A mixed methods investigation of athletes' smartphone usage and its impact on sport experiences and key psychosocial variables

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Abstract

Smartphones are omnipresent and indispensable in today's society. Research in psychology and education points to both helpful and detrimental implications of smartphone usage for performance and well-being. Competitive and high-performance athletes represent a subsection of a demographic deeply intrenched in smartphone usage, yet few studies have shed light on the impact of smartphones usage in athletes' lives. The overarching aim of this research was to advance knowledge on athletes' use of smartphones. The mixed methods research program, with sequential pacing and qualitative priority, was informed by a critical realist paradigm. Data were collected through focus groups, remote tracking and surveys, and individual interviews with competitive and high-performance athletes. The research culminated in four distinct but related studies and four articles.

The purpose of Study 1 was to qualitatively investigate varsity athletes' lived experiences with smartphones. Five focus groups were conducted with a sample of 21 varsity athletes (9 men, 12 women) representing nine different sports (i.e., track and field, basketball, rowing, fencing, Nordic ski, rugby, swimming, lacrosse, and soccer). The inductive and reflexive thematic analysis led to the creation of three main themes. The first theme pertained to general usage experiences (i.e., characteristics of usage, awareness and nature of usage, restrictions of usage), revealing that social media is a focal point of athletes' usage. The other two themes concerned athletes' concurrent experiences of negative (i.e., stress, distraction, disengagement) and positive (i.e., self-regulation, social connectedness) smartphone usage. The majority of varsity athletes (81%) self-identified as moderate or heavy smartphone users, and relied on their devices throughout the day for communication and self-management. Findings suggest that smartphone usage exists along a continuum of negative/unhelpful to positive/helpful usage rather

than as distinct “good” or “bad” usage. Usage is complex and often paradoxical for sport preparation, performance, recovery, and well-being.

The purpose of Study 2 was to develop and pilot test a novel research application designed to examine, in an ecologically valid way, the prevalence and features of smartphone usage among a sample of athletes, in tandem with a selection of psychosocial variables. An interdisciplinary research team was formed to create the mobile research application and measure its tracking ability and accuracy to inform Study 3. The smartphone usage of five (n = 5) student-athletes was tracked in real-time over a 15-day period. Participants also completed a mobile self-report survey on psychosocial variables deemed important to athletes’ performance and well-being (i.e., mindfulness, mental health, and self-regulation). Results of the pilot study demonstrated a sizable range in total hours of smartphone usage, with an average of 31.1 hours per week, predominantly for social media. Real-time smartphone usage averages surpassed athletes’ self-reported time spent studying (20h per week) and training for sport (11.4h per week). All participants reported moderate-to-high self-regulation capacity, mindfulness, and mental health. The pilot study provided proof of feasibility for a longitudinal study using the research application and methods. It afforded the opportunity to make technical adjustments based on participant feedback, enhance usability and ecological validity, and subject the data to preliminary algorithms to extract detailed information from a large data pool.

Building on Study 2, the purpose of Study 3 was to investigate the prevalence and features of competitive student-athletes’ smartphone usage and psychosocial outcomes using a longitudinal in vivo design. Over the course of one year, student-athletes’ smartphone usage was automatically tracked via the mobile app they installed on their phone and they also completed a self-report survey through the app on a monthly basis to assess self-regulation, mindfulness,

mental health, stress, loneliness, and perfectionistic self-presentation. Although 20 participants volunteered to complete the study, only 10 participants consistently completed the survey and were retained in the final dataset. Descriptive analyses showed that the student-athletes used their smartphones for an average of 24.15 hours per week, predominantly for social media, and they formed two distinct user groups (i.e., heavy and light usage). Psychosocial profiles revealed they had moderate-to-high psychosocial functioning and highly nuanced changes in psychosocial outcomes and usage over time. There were no significant relationships between amount of smartphone usage and psychosocial outcomes, except for one positive relationship between usage and mental health in the winter. Findings support a new wave of literature deemphasizing a simple negative relationship between smartphone usage and psychosocial outcomes, and encourage further study of individual characteristics, such as purpose of usage. This study illustrates that although it is resource intensive, it is feasible to leverage the smartphone as an in vivo research tool to collect complex, ecologically valid usage data in tandem with psychosocial self-reports. It lays a foundation for larger-scale studies to assess the impact of athletes' usage on their psychosocial functioning.

The purpose of Study 4 was to qualitatively examine the self-regulatory processes, conditions, and outcomes related to the smartphone usage of competitive and high-performance athletes, and to postulate a model to inform research and applied practice in this area. Guided by the results of the previous studies showing prevalent social media usage among athletes, Study 4 also furthered explored athletes' use of social media. Twenty-four (n = 24) competitive and high-performance athletes from eight different sports participated in individual, in-depth interviews. A directed content analysis, informed by the models of self-regulated learning and self-regulatory strength, was performed to analyze the data. While many themes aligned with components of

both or either self-regulation models, new themes were generated. To account for all the data and explain athletes' smartphone usage in and around the sport setting, the "Self-regulation and Smartphone Usage Model" (SSUM) was created. The SSUM includes five broad components: (a) self-regulation capacity, (b) self-regulation processes, (c) conditions (i.e., context of usage, type of usage, awareness of usage, autonomy of usage, and concurrence of usage), (d) outcomes, and (e) self-regulation competencies. Findings support a paradoxical relationship between smartphone usage and self-regulation. On the one hand, athletes use their smartphones to engage and master helpful self-regulation processes and on the other, they face increased self-regulatory demands because of their smartphones—particularly social media—which can lead to self-regulatory depletion.

Overall, the current research sheds light on a new facet of competitive athletes' lives—the smartphone. It underscores a deeply individualized, nuanced relationship between athletes and their phones, regardless of age, sex, type of sport, or competitive level. These devices can both inhibit and facilitate self-regulation and influence performance and well-being. Regardless of the purpose of usage, smartphones must be effectively managed. Thus, athletes must develop self-regulatory competencies specifically for this tool. This research shows the value of tracking real-time usage of phones and provides a conceptual map for working with athletes to leverage the benefits of smartphone technology.

Keywords: smartphone usage, social media, athletes, sport psychology, well-being, performance, app, self-regulation, critical realism

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Statement of Contribution

I, Poppy DesClouds, was responsible for (a) co-conceptualizing this doctoral research, (b) co-creating the mobile research application, (c) collecting and analyzing the data, and (d) writing the four articles that comprise this dissertation. Dr. Natalie Durand-Bush, my thesis supervisor, was involved in (a) co-conceptualizing this doctoral research, (b) co-creating the mobile research application, and (c) revising the four articles and this doctoral dissertation. Dr. Durand-Bush provided critical feedback and encouraged reflection and revision throughout the entire doctoral process. Given the contributions of Dr. Durand-Bush, she is a co-author on the four articles within this dissertation. Dr. Fedwa Laamarti, School of Electrical Engineering and Computer Science at the University of Ottawa, was responsible for (a) co-creating the mobile research application, (b) managing data storage and extraction, and (c) contributing to app descriptions and statistical analysis for Studies 2 and 3. Dr. Lamaarti's doctoral supervisor and lab director, Dr. Abdulmotaleb Ed Saddik, contributed to the creation of the research application and provided high-level expertise related to application development, data storage, and data extraction for Studies 2 and 3. Given the contributions of Drs. Laamarti and El Saddik, they are co-authors on Articles 1 and 3. Michael Del Bel, PhD Candidate in the School of Rehabilitation Sciences at the University of Ottawa, provided guidance with the statistical analyses and interpretation of results in Study 3. Dr. Bradley Young provided guidance on the analysis and interpretation of results in Study 3, and contributed to the manuscript written for Study 3. Given the contributions of Mr. Del Bel and Dr. Young, they have been included as co-authors on Article 3. Ms. Darien Wrona contributed valuable time helping the researcher transcribe interview data from Study 4. Thesis committee members, Dr. Bradley Young and Dr. Pierre-Nicolas Lemyre, provided feedback during the proposal stage of this research; their insights were

instrumental in navigating challenges that arose throughout the research program. Informed consent was obtained from all human research participants in this study (Appendix A). This research was examined and approved by the University of Ottawa Research Ethics Board, Office of Research Ethics and Integrity, which operates in accordance with the Tri-Council Policy Statement and other applicable laws and regulations in Ontario (see Appendix B for Certificate of Ethics Approval).

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PART I

Introduction

"A lot of people I go to school with think of their phone as part of them. Like if it's not with them, then they're not a complete person" (Athlete, Study 4)

Smartphones have become facets of our everyday lives—extensions of our brains and our bodies. We carry these devices with us everywhere we go; we take them to dinner, to work, to the gym, and to bed. We check them without thinking (Oulasvirta et al., 2012) and we feel them ring when they are not there (Deb, 2014). We rely on them to hold our appointments, passwords, sense of direction, sense of time, conversations, memories, and social identity. Media as an extension of the human being is not a new concept. Marshall McLuhan (1964) infamously proposed "media as the extension of man" to illustrate how various communication mediums throughout history have shaped human affairs. Indeed, this has carried into the modern age, where the medium—the smartphone—continues to shape how we think, feel, and act as human beings. In the world of sport psychology, where primacy is placed on the interaction between mind, body, and environment, a medium that can influence how we think, feel, and act anywhere, any time is of utmost importance. Smartphones are complex components of the sport environment that hold great potential to both optimize performance and well-being and cause significant pitfalls, particularly for athletes, who face a multitude of social, physical, emotional, and cognitive demands. Nevertheless, there is limited research (i.e., less than 10 known studies) explicitly dedicated to athlete *smartphone* usage. Research on athletes' use of these devices is needed to guide further inquiry and applied practice.

Upon the conception of this project, the researcher acknowledged the continued, rapid evolution of smartphone technology and its broader implications, and so it seemed pertinent to

provide a brief overview of technological advances since the beginning of the project. The field has indeed evolved in exciting ways since this research began. In an applied sense, smartphone technology has continued to bloom, and in tandem, the uptake of these devices in Canada and worldwide has been steady (Deloitte, 2019; Silver, 2019). Alongside technical advances (e.g., 17 new iterations of the iPhone since 2017), both Android and Apple have acknowledged potential drawbacks of their technology on performance variables (e.g., attention) and well-being, and have introduced new, user-controlled options to aid screen time awareness and focus (Apple, 2021; Austin, 2018; Google, n.d.; Lynley, 2018; Perez, 2018). As well, Instagram has acknowledged the potential psychosocial dangers of its applications and introduced features that are meant to support mental health awareness and reduce online bullying (Clark, 2016; Instagram, n.d.; Steinmetz, 2019). Over the past few years, we have witnessed numerous social-political events and a global pandemic, which garnered a resurgence of attention on the impact of screen time on child and youth mental health (Pinder & Brown, 2021), and the ability for social media to foster great misinformation (Volkmer, 2021). These events also exposed the power and potential of social media in aiding communication, support, activism, and public health campaigns (e.g., Auxier, 2020; Breza et al., 2021; Cox et al., 2021; Dimaling-Cruz et al., 2021). For athletes in particular, it appears that smartphone features that were used to support athlete communities, team cohesion, and athletic identity helped to protect mental health during the pandemic (Graupensperger et al., 2020). These events shine light on how essential smartphone technology can be for maintaining connection and community. Nevertheless, social media has continued to undergo intense scrutiny, especially as Facebook has monopolized the social media space. Facebook is confronting tremendous censure for hiding data, which illustrates the detrimental impact of its platforms (i.e., Instagram and Facebook) on the well-being of users,

particularly young females (Wells et al., 2021; see The Wall Street Journal, 2021 for full investigation). These rapid changes and advancements underscore the dynamic uses of smartphones and implications of usage. As well, they highlight interactions between social and political events and usage patterns that emerge over time. While research has been dedicated to studying these uses and implications in other domains (e.g., psychology, education, marketing, communications), there is little empirical evidence to provide a foundation for understanding athlete smartphone usage and how the sport context impacts their experiences with smartphones. Research is needed to fill this gap.

With regards to smartphone and social media research, a new wave of literature shows that the intense focus on negative implications of smartphone and social media usage may not be an accurate representation of reality (Coyne et al., 2020; Ellis, 2019; Flora, 2018; Odgers & Jensen, 2020; Orben & Przybylski, 2019; Panova & Carbonell, 2018). Nevertheless, this focus on negative outcomes has been disseminated in mainstream media (e.g., Andrew-Gee, 2018; Fradera, 2018; Twenge, 2017). A call has been put forward for more longitudinal research that reaches beyond classic screen time arguments, and pays heed to the systems of usage, the moderators and confounders of usage, and the dynamic capabilities of smartphone technology (Coyne et al., 2020; Ellis, 2019; Odgers & Jensen, 2020; Orben & Przybylski, 2019; Panova & Carbonell, 2018). With regards to research methods, despite a range of research capabilities afforded by smartphones and a call for smartphone research to move beyond self-reports (Ellis, 2019), few empirical studies have made use of the smartphone features that are available to objectively track usage and engage participants remotely (Boase & Ling, 2013; Deng et al., 2019; Elhai et al., 2017c). Smartphone usage is not a static but rather a complex phenomenon to research. Yet, the limited research on athlete smartphone usage has been focused on negative

outcomes, cross-sectional data, and controlled studies. Creative, novel forms of research and inquiry are required to adequately study this phenomenon, particularly methods that can capture nuanced, ecologically valid, longitudinal data.

In the world of sport, specifically, we have witnessed tremendous technological developments using mobile applications to collect data related to movement and biomechanics (i.e., physical indicators of performance such as heart rate, respiration, anthropometry, range of motion, strength, distance, and speed; Peart et al., 2018). There has also been a push for athletes to invest in their online presence and identity via social media (Dart, 2014; David et al., 2018; Rahikainen & Toffoletti, 2021; Sanderson & Hull, 2015) while continually monitoring and restricting their usage because of security concerns as well as image and sponsorship control (e.g., Canadian Olympic Committee, 2019; Dart, 2014; David et al., 2018; Sanderson, 2018; Tarabay & Zheng, 2022). Overall, despite the continued and widespread adoption of performance-related and social media mobile applications in sport, there are only a handful of studies on smartphone usage among athletes.

There are six core psychosocial variables examined in this research project: self-regulation, mindfulness/attention, mental health, stress, social connectedness, and self-presentation. These variables are those that are prevalently studied and referenced in the smartphone literature at large, and have also been deemed important for athletes' performance and well-being. Self-regulation refers to purposeful control and management of thoughts, feelings, and actions in the interest of achieving a desired state or attaining a goal (Bauer & Baumeister, 2010; Zimmerman, 2000). Mindfulness refers to purposeful and present regulation of attention and a non-judgmental approach to one's experience (Feldman et al., 2007). Mental health refers to a state of subjective psychological, social, and emotional well-being, contributing

to positive and productive functioning in life (Keyes, 2002). Stress is mental, emotional, or physical strain that arises when one's perceived demands outweigh available coping resources (Cohen et al., 1983; Uldry & Andersen, 2008). Social connectedness refers to belongingness and engagement with a close, cohesive network. This is opposed to loneliness, which leaves people feeling disconnected from others (Bowins, 2021; Lee & Robbins, 1995). Self-presentation is a goal-driven process by which people monitor and control how others perceive them (Leary, 1992). Focus was given to perfectionistic self-presentation in the current research, which is more a specific, maladaptive interpersonal expression of flawlessness (Flett & Hewitt, 2005; 2014).

Together, the aforementioned variables and gaps in the literature shaped the rationale for conducting the current research. The overall aim was to investigate athletes' experience of smartphone usage in and around the sport context, and uncover the impact of this usage on psychosocial variables that have important implications for the performance and well-being of athletes.

Review of Literature

The following section presents an overview of the concepts and the two theoretical models that guided the four studies comprising this dissertation. As research pertaining to athletes' smartphone usage is quite scarce, this review draws on literature from other related domains (i.e., psychology, medicine, communications, and education). Additional in-depth reviews of the literature are provided in Articles 1 through 4 in Part III.

Smartphone Usage

Smartphones are electronic devices used for interpersonal communication, media exploration, and entertainment. They are enabled with technology allowing for internet browsing, e-mail, and the use of downloadable applications with a wide range of functions

(Steeves, 2014). Most notably, the smartphone is a mobile device that allows all of these features and functions to be accessed remotely—anytime, anywhere. We have witnessed an explosive growth in the use of smartphones in contemporary society. The 'iGeneration' (iGen)[1], or those born in the 1990s and beyond (Rosen, 2011; Twenge, 2017), are a cohort who have grown up in a digital environment and are significant users of smartphones for interpersonal communication, self-expression, and media multitasking (Magen, 2017; Rosen et al., 2013; Steeves, 2014). This group also uses smartphone technology to build essential digital and media skills to support the tasks and demands of their everyday lives (Odgers & Jensen, 2020). In every area of modern life, this generation has been privy to the presence of mobile media and mobile access to the internet (Collins & Ellis, 2015; Lookout, 2012; Steeves, 2014). Current and many former Canadian competitive athletes are part of this iGen (Gould et al., 2019).

Several reports have shed light on the prevalent use of mobile technology in Canada and globally (Deloitte, 2019; Meeker, 2019; Pew Research Center, 2021a; 2021b; Sangalli & Lewis, 2020; Smith, 2015; Statistics Canada, 2019; Steeves, 2014). These reports show a global average of 4.2 hours of smartphone usage per day (Perez, 2021), a number that continues to rise (Sangalli & Lewis, 2020). Statistics Canada (2019) found that 98% of 15-24-year-olds own a smartphone. Among Canadians, social networking has become a dominant form of interpersonal communication and motive for using smartphones (Schimmele et al., 2021; Steeves, 2014). There has been a growing trend in the use of visual-based platforms via the smartphone, such as Instagram, TikTok, and YouTube, and video communication platforms (Meeker, 2019; Sangalli & Lewis, 2020). There is also evidence of increased online activity among young people (15-34 years) during the COVID-19 pandemic, particularly for maintaining connection and

[1] The younger portion of the iGen, who are also deeply rooted in this digital environment are part of Generation Z or "Gen-Z"—those born from 1996 on (Gould et al., 2019).

communication (Bilodeau et al., 2021; Sangalli & Lewis, 2020). During the pandemic, users 18-24 years of age were spending more than half of their digital time using mobile apps (Sangalli & Lewis, 2020), which underscores the prominent place of smartphones in the lives of these young adults. A study by Bentley et al. (2015) showed that young people interacted with their smartphones for an average of three hours per day and were drawn to use their phones in 'any spare second', especially during waiting or unscheduled time. Other reports have shown that young people check their phones when they wake up in the middle of the night, while going to the washroom, during meals with others, and while driving (Lookout, 2012). Moreover, the iGen represents a group of heavy 'media-multitaskers', that is, they use their devices to perform multiple tasks at once (Rosen & Samuel, 2015). A study by Rosen, Carrier, and Cheever (2013) showed that in a 15-minute study period, a sample of students switched tasks due to a technological distraction (i.e., social media and texting) every six minutes, on average.

Positive and Negative Implications of Usage

In a breadth of disciplines (i.e., psychology, sociology, communications, and education), research related to the relationships between smartphone/social media usage and various psychosocial outcomes is ongoing. Based on the available research, it is not possible to draw a clear consensus on whether smartphone usage is definitively good or bad. A brief overview of the positive and negative implications of usage corroborated by sources from the literature from a variety of domains is presented in Table 1. These results underscore an interplay of negative and positive implications of smartphone usage. It is noteworthy that less than 10 studies from the sport psychology domain are included in this table and pertain to athlete smartphone usage specifically. This demonstrates that the field of sport psychology is behind most other domains when it comes to research on athlete smartphone usage.

Social Media

Given the prevalent use of social media in the general population (Auxier & Anderson, 2021; Schimmele et al., 2021), and among Canadians in the iGen and Gen Z cohorts specifically (Schimmele et al., 2021), literature on social media was considered in this review and in Articles 1 to 4. Of particular interest are studies related to social media usage and psychosocial variables also known to be pertinent to athlete well-being and performance (e.g., self-regulation, self-presentation, mindfulness and attention, mental health, communication, social connectedness, stress). While this dissertation is not about social media, it is an important element of smartphone usage that warrants consideration and attention. Smartphones are a medium providing access to social media, along with a multitude of other features and functions. As such, social media was one aspect of usage studied and discussed within the project.

To give an overview, the prevalent use of social media platforms on smartphones is undeniable (Schimmele et al., 2021) and the two are inextricably linked. In fact, many studies focus on social media without considering how or where these platforms are accessed. The literature on smartphone usage is fragmented and disorganized because of this, and while distinctions are occasionally made, so too are assumptions about the relationship between the medium (smartphones), the media (social media), and the content (the specific things that users are seeing/accessing). As can be seen in Table 1, both positive and negative implications of social media usage have been uncovered, but examinations have focused mostly on negative outcomes (Ellis, 2019; Schimmele et al., 2021). Notably, research on social media shows that the way individuals use social media is a factor in the outcome of their usage. It appears that “active” and “social” usage (e.g., creating, engaging, posting, exchanging content) has a less detrimental effect on the mental health of users than “passive” usage (e.g., scrolling, browsing without direct,

Table 1.

Positive and Negative Implications of Smartphone Usage

Positive implications of usage	
Increased/enhanced/supported	
Prosocial behavior and social connectedness	Best et al., 2014; David et al., 2018; Dunn et al., 2021; Gardner & Davis, 2014; Hayes, 2019; Ryan et al., 2017; Skierkowski & Wood, 2012; Wright, 2012
Communication	Bentley et al., 2015; Browning & Sanderson, 2012; David et al., 2018; Dunn et al., 2021; Gardner & Davis, 2014
Identity and image management	Browning & Sanderson, 2012; Chan et al., 2015; David et al., 2018; Gardner & Davis, 2014; Park et al., 2020; Sanderson & Hull, 2015; Toffoletti & Thorpe, 2018
Social and emotional support	Best et al., 2014; David et al., 2018; Dunn et al., 2021; Ehrlén & Villi, 2020; Frison & Eggermont, 2015; Hayes, 2019; Oh et al., 2014; Pierce, 2009; Wright, 2012
Well-being	Best et al., 2014; Wright, 2012
Learning	Chan et al., 2015; George & DeCristofaro, 2016; Hartley & Bendixen, 2019; Zheng et al., 2018
Advocacy and activism	Auxier, 2020; Sanderson & Hull, 2015; Toffoletti & Thorpe, 2018
Self-regulatory learning processes (e.g., preparation, self-monitoring)	Hartley & Bendixen, 2019; Lau et al., 2011; Lee et al., 2021; Ling, 2005; Peart et al., 2018; Quelly et al., 2016; Zheng et al., 2018
Negative Implications of Usage	
Decreased/hindered/inhibited	
Cognitive capacity, attention, analytic thinking, and working memory	Abramson et al., 2009; Encel et al., 2017; Fortes et al., 2019; 2020a; 2020b; 2021; Greco et al., 2017; Marty-Dugas et al., 2018; Stothart et al., 2015; Ward et al., 2017
Sleep	Jones et al., 2019; Lanaj et al., 2014; Rosen et al., 2016; Schaefer, 2018; Schimmele et al., 2021; Thomée et al., 2010
Task performance	Carrier et al., 2018; Fortes et al., 2019; 2020a; 2020b; 2021; Greco et al., 2017; Jones et al., 2019; Lau, 2017; Stothart et al., 2015

Negative Implications of Usage	
Decreased/hindered/inhibited	
Productivity and efficiency	Carrier et al., 2018; Rosen et al., 2013
Social engagement	Chotpitayasunondh & Douglas, 2016; McDaniel & Coyne, 2016
Self-control	Abramson et al., 2009; Carrier et al., 2018; Fortes et al., 2019; 2020a; 2020b; Greco et al., 2017; Lanaj et al., 2014; Rosen et al., 2013
Well-being	Best et al., 2014; David et al., 2018; Rosen et al., 2014; Schaefer, 2018; Twenge et al., 2018; Twenge & Martin, 2020
Increased/exacerbated	
Stress/anxiety	Clayton et al., 2015; Elhai et al., 2019; 2017a; Hayes, 2019; Rosen et al., 2013a; Rosen & Samuel, 2015; Schimmele et al., 2021; Skierkowski & Wood, 2012; Thomée et al., 2010; Vahedi & Saiphoo, 2018
Mental health concerns	Kim et al., 2020; Schimmele et al., 2021; Twenge & Martin, 2020; Twenge et al., 2018; Twenge, 2017; Vahedi & Saiphoo, 2018
Mental fatigue and cognitive load	Fortes et al., 2019; 2020a; 2020b; Greco et al., 2017; Thomée et al., 2010
Isolation and loneliness	Best et al., 2014; Gardner & Davis, 2014; Ryan et al., 2017; Thomée et al., 2010; Twenge et al., 2019
Problematic/addictive usage	Elhai et al.; 2017b; Roberts et al., 2014; Tzavela & Macromati, 2013
Bullying	Browning & Sanderson, 2012; Chan et al., 2021; David et al., 2018; Sanderson & Truax, 2014

Note. Adapted from original version in "Smartphones and varsity athletes: A complicated relationship" by P. DesClouds and N. Durand-Bush, 2021, *Frontiers in Sports and Active Living, 2,* p. 3. (https://doi.org/10.3389/fspor.2020.560031).

purposeful exchanges; Chen et al., 2016; Elhai et al., 2017b; Verduyn et al., 2017; Wang et al., 2017). This is largely because active usage contributes to gains in social capital and connectedness, while passive usage can lead to unhelpful comparisons (Verduyn et al., 2017) and leaves users vulnerable to habitual behaviors and unexpected content. Findings related to the detriments of passive usage are not limited to social media, but are seen across studies on screen

time as well (e.g., Kim et al., 2020; Sanders et al., 2019). Additionally, social media usage can lead to social comparison (Boers et al., 2019; Wang et al., 2017) and displacement of healthy activities such as physical activity and social interaction (Boers et al., 2019; Oberle et al., 2020; Twenge et al., 2018). Social media content also has potential to reinforce triggers of depression and depressive symptoms (Boers et al., 2019).

Media Multitasking

Together, smartphone and social media usage creates a perfect environment for media multitasking (i.e., using more than one medium at the same time), especially since smartphone usage tends to be short and sporadic (Bentley et al., 2015; Deng et al., 2019). An example of media multitasking includes doing homework on a computer while also scrolling social media on a smartphone. While the presence of a smartphone is distracting enough to cause detriments to attention and performance (Thornton et al., 2014; Ward et al., 2017), media multitasking can cause additional detriments to executive functions such as self-control and goal-directed behavior (Magen, 2017), which are essential components of self-regulation (Bauer & Baumeister, 2010; Zimmerman, 2000). Unsurprisingly, both social media and smartphone usage have been found to be a detriment to academic and cognitive performance (e.g., Abramson et al., 2009; Carrier et al., 2015; 2018; Lau, 2017; Rosen et al., 2013; Ward et al., 2017). Concentration impediment appears to be a main negative outcome of media multitasking, as well as social media and smartphone usage respectively (Carrier et al., 2015; 2018; Marty-Dugas et al., 2018; Rosen, 2011; Rosen et al., 2013; Stothart et al., 2015; Schimmele et al., 2021). These findings have been considered within the sport psychology domain (e.g., Encel et al., 2017; Fortes et al., 2019; 2020a; 2020b; 2021; Greco et al., 2017), likely due to the importance of attentional selectivity and capacity to achieve optimal sport performance (Boutcher, 2008). Nonetheless,

research on social media, smartphones, and media multitasking in sport, particularly the implications on performance and psychosocial functioning, remain limited compared to that carried out in other domains.

Screen Time

Aside from smartphones and social media, research attention has been paid to general 'screen time' (particularly among children and young adults; e.g., Kim et al., 2020; Oberle et al., 2020; Sanders et al., 2019; Twenge et al., 2018; Tang et al., 2021), which pertains to the amount of time spent in front of a variety of screens including television, computer, tablets, and smartphones. The literature on this subject is also divided in terms of negative and positive implications (Pinder & Brown, 2021; Tang et al., 2021). Smartphones are distinct entities that do not operate nor influence in the same way as TV or computers, namely because smartphones compound screen time media into a singular, remote space. Odgers and Jensen (2020) have called for a shift away from focusing on screen time to instead consider the range of capabilities afforded by smartphones, which can facilitate a number of different interactions, uses, and implications. It is the mobile nature of smartphones that makes them so unique, ubiquitous, and impactful across life contexts, including sport. This was a key motive to focus the current research on smartphones instead of broader screen time.

Athlete Smartphone Usage

Much of the literature on smartphone and social media usage within the general population focuses on the iGen. Presently, this includes adults, young adults, and adolescents—those approximately 12 to 32 years old. This is important because many current and former Canadian competitive athletes are part of this iGen demographic. They have grown up with smartphones and they have brought them into the sport context. Despite this, ecologically valid

research on athletes' use of smartphones is limited, leaving sport scholars and stakeholders without an empirical foundation for research and applied usage guidelines. The literature pertaining to athletes' use of smartphones that does exist is largely focused on athletes outside of Canada. This literature is dispersed in terms of age (ranges from adolescent to adult) and competitive level (ranges from provincial to professional), leaving a gap in our understanding of the smartphone usage of Canadian competitive and high-performance athletes as defined within the context of the Canadian High Performance Sport Strategy (2019). Furthermore, there is research on athletes' use of social media, without consideration of smartphones, and most studies do not consider or mirror the real-world smartphone usage behaviors of athletes.

Li and colleagues (2021) were the first to study the psychological predictors of smartphone overuse (i.e., problematic levels of smartphone usage) of university athletes in China. Specifically, the authors sought to gain more understanding of the relationship between ADHD, mindfulness, basic psychological needs, and smartphone overuse. Results point to a relationship between higher mindfulness, greater needs satisfaction, and less smartphone overuse, but the results are nuanced in that higher mindfulness did not predict needs satisfaction in those with higher risk of ADHD. ADHD symptoms were also related to higher smartphone overuse. As with most studies in other domains on smartphone usage, the authors employed a cross-sectional method using a battery of surveys, and type, purpose, and context of usage were not considered. Moreover, the meaning of "overuse" in this study was unclear. A self-report survey for smartphone addiction was used to measure the overuse construct. Overuse connotes *amount* of usage, while the items of the smartphone addictions scale pertain to experiences of usage in line with addictions criteria such as compulsive behavior, functional impairment, withdrawal, and tolerance (Lin et al., 2015).

Fortes et al. (2019; 2020a; 2020b; 2021) have studied the impact of smartphone app exposure on the cognitive load and decision-making of athletes prior to performance activities. In controlled study environments, the researchers were able to determine that just 30 minutes of exposure to social media apps via a smartphone prior to performance could negatively impact cognitive load and optimal decision-making in soccer players (Fortes et al., 2019; 2020a). They also found that repeated use of social media via smartphones could inhibit optimal decision-making and performance gains among volleyball players (Fortes et al., 2021), as well as swimming performance improvement, in part due to increased perceptions of training duration and intensity (Fortes et al., 2020b). These are some of the only studies to address smartphone usage as it relates to sport performance outcomes. Notably, the experiments were carried out in controlled environments where participants' usage was supervised and restricted, and smartphone usage pertained to social media apps only. The duration of usage was long and focused, and participants were to use their phones without engaging with those around them, which does not necessarily mirror reality.

In another study, Greco et al. (2017) found that smartphone usage could induce mental fatigue among young athletes, negatively impacting physical and technical aspects of their sport performance. While results point to inhibited executive function (specifically, decision-making) and reduced physical self-control, this was also a controlled study in which the type and amount of smartphone usage was dictated by the researchers. Participants used a pre-determined 'brain game' application for a set duration prior to performance. This does not mirror the more prevalent characteristics of young people's smartphone usage. It appears that studying smartphone usage in controlled experiments poses obstacles for ecological validity, in that athletes are not allowed to use many features and functions available to them, and usage is

controlled rather than sporadic, as reported in real-life contexts (Bentley et al., 2015; Deng et al., 2019; Gorrell, 2018).

In a related bank of literature pertaining to athlete social media usage, Encel et al. (2017) found that athletes accessed Facebook prior to and during sport competition and the use of this platform was significantly associated with a disruption in their concentration. Results are in line with the aforementioned experiments, however, the variables in this study, including Facebook use, were measured using retrospective self-reports. Importantly, none of these studies considered existing characteristics and competencies of the athlete participants.

Attention has also been paid to the effects of social media usage on athletes' sleep. Using publicly available game statistics and Tweets of professional NBA players, Jones et al. (2019) discovered an association between late-night tweeting and diminished next-day game performance. However, in another study of elite judo athletes, Dunican et al. (2019) found no significant difference in sleep or next day performance when electronic devices were removed prior to bed. As well, Schaefer (2018) noted that student-athletes' perceived smartphone usage was a relevant stressor and a potential detriment to both sleep and mental health. Taken together, these findings suggest that smartphone usage may impact sleep and other variables such as performance and mental health. However, more research is warranted to support this.

With regards to features of usage, a range of novel smartphone applications are available to provide athletes physical self-monitoring and self-recording functions that may improve awareness and performance (Lee et al., 2021; Peart et al., 2018). Lee and colleagues (2021) recently found that performance outcomes were associated with the type of smartphone application used by professional golfers. The use of relevant applications (e.g., to support aspects of self-regulation such as self-monitoring and organization) appeared to have a positive

relationship with performance. However, prolonged use of smartphone entertainment apps worsened performance outcomes. This shows that a variety of variables related to smartphone usage should be considered in research.

In their qualitative study, Dunn et al. (2021) illustrated the prevalent and important role of social media and electronic communication in young female athletes' sport experiences. Athletes self-reported between 3 and 10 hours of social media usage per day, and a great deal of their electronic communication was for organization, team and community building, social development, and curation of athletic identity. Notably, the young athletes' perceptions of their media usage were far more favorable than the perceptions of their coaches and parents. This study provides important insights into the perceptions of young athletes around social media usage, the discrepancies among their views and the views of parents and coaches, as well as the psychosocial variables that are impacted by usage (communication, socialization, identity formation). Nevertheless, this study did not pertain to smartphones, specifically, and encompassed all forms of social media and electronic communication, including the use of non-remote technology such as computers.

There is a separate but related series of studies in the sport domain, particularly in the fields of sport marketing and sport communication, that pertain to athletes' use of social media. While the literature is not as extensive as in domains outside of sport such as education, health, and psychology, this research is more developed than that pertaining to athlete smartphone usage. Sanderson and colleagues (e.g., Browning & Sanderson, 2012; Sanderson & Hull, 2015; Smith & Sanderson, 2015) explored the self-presentation of athletes across a range of social media platforms, as well as the concurrent positive functions (e.g., identity management and expression, self- and fan-advocacy, activism, communication and community, access to

information, marketing, team cohesion) and negative outcomes (e.g., maladaptive interactions, mocking, sarcasm, belittling, threats, pressure, anxiety, criticism and comparison) of using social media. Likewise, David et al. (2018) qualitatively studied the psychological impact of Twitter usage among NCAA athletes and uncovered advantages and disadvantages. Athletes reported using the platform for support, cohesion, advocacy, feedback, marketing, and filling time, but also experienced feelings of obligation, a lack of autonomy, low self-confidence and self-efficacy, high pressure, and criticism.

More recently, Park et al. (2020) qualitatively illustrated the benefits, challenges, and negative outcomes for student-athletes' when using social media for personal branding. Benefits included convenience, career networking, and display of skill and achievement. The athletes used various social media apps to carefully self-present athletic identities and authentic elements of their personalities. Nonetheless, negative consequences of usage were front-of-mind for athletes who actively controlled their social media usage to avoid potential negative effects on their public image. Notably, Sanderson and Hull (2015) underscored that a negative focus "overshadow[s] the notion that the majority of athletes who use social media do so in a positive manner" (p. 23). By and large, the literature surrounding social media usage among athletes points to both increased opportunity *and* demand, as well as both increased connection *and* comparison.

Sport Demands, Psychosocial Skills, and Smartphones

Athletes are required to perform at a high-level while navigating a multitude of peripheral demands such as careers, sponsorships, employment, academics, relationships, family obligations, and typical daily life tasks. They must often maintain strong dual-roles (e.g., student and athlete, employee and athlete, mother and athlete), while coping with strenuous physical and

mental demands and expectations (Foster & Chow, 2020; Humphrey et al., 2013). Smartphones, which are an undeniable new facet of the sport environment, have the potential to both help and hinder athletes' abilities to manage these demands. There are several psychosocial skills that are important for athletes to prioritize in order to optimize sport experiences and performance. Many of the same variables have been discussed in the literature in relation to smartphone and social media usage. Table 2, which has been adapted from Article 3 (DesClouds et al., 2022), provides an executive summary of the psychosocial variables of interest in the current research: self-regulation, mindfulness/attention, mental health, stress, social connectedness, and self-presentation. Taken together, the studies in Table 2 show that these variables have implications for the contexts of both sport and smartphone usage. These variables can facilitate or impede performance experiences and well-being in sport, and they may also be enhanced or hindered by smartphones.

The literature regarding the impact of smartphone usage on psychosocial skills is ever-growing, however, it is quite fragmented in terms of methodology and theoretical underpinnings. It leans heavily on the contention that smartphone and social media usage is problematic to psychosocial functioning (Ellis, 2019; Odgers & Jensen, 2020). Despite the presence of both positive and negative functions of smartphone usage, a negative focus has dominated the research with express interest in problematic usage and smartphone addiction (Elhai et al., 2019; Ellis, 2019; Panova & Carbonell, 2018). Researchers also continue to fervently expose the pitfalls of smartphone and social media usage (e.g., Boers et al., 2019; Twenge, 2017; Twenge & Campbell, 2018; Twenge & Martin, 2020; Vahedi & Saiphoo, 2018), which has influenced media and public attention to more exclusively focus on the detriments of usage. Problematic smartphone usage has been indeed defined and studied (Elhai et al., 2017a; Kim, 2017) and

Table 2.

Psychosocial Variables Relevant to Athletes and Smartphone Usage

Psychosocial Variable	Relevance to Athlete Performance/Well-being	Relevance to Smartphone Usage	Potential Interplay Based on Evidence
Self-Regulation (SR) *Purposeful control and management of thoughts, feelings, and actions in the interest of achieving a desired state or attaining a goal (Bauer & Baumeister, 2010; Zimmerman, 2000)*	• Supports learning and performance in sport (Cleary & Zimmerman, 2001), and psychosocial functioning of athletes (Dubuc-Charbonneau & Durand-Bush, 2015) • Self-control is required for motor control, emotional regulation, and persistence in sport training and competition (Englert, 2016)	• SR and executive function can buffer negative effects of smartphone usage such as goal conflict and mindless usage (Carrier et al., 2015; Hofmann et al., 2017; Khang et al., 2013; Rosen et al., 2018; Szumowska et al., 2018; van Deursen et al., 2015; Wu, 2015) • Smartphone usage can support SR learning processes and skills (e.g., Hartley et al., 2020; Hartley & Bendixen, 2019; Palalas & Wark, 2020; Quelly et al., 2016; Zheng et al., 2018). • Smartphone usage can lead to self-regulatory depletion (Lanaj et al., 2014) • Media-multitasking, often afforded by smartphone usage, is related to executive function and SR processes such as self-monitoring, planning, and self-control (Carrier et al., 2015; Magen, 2017)	• Smartphones may support SR processes that could enhance the performance, learning, and well-being of athletes. In the same regard, smartphones may equally impede key SR processes, induce SR depletion, and limit performance and well-being.
Mental Health (MH) *A state of subjective psychological, social, and emotional well-being, contributing to positive and productive functioning in life (Keyes, 2002)*	• Complex and excessive demands can compromise athletes' well-being (Gould & Whitley, 2009; Van Slingerland et al., 2018; 2019) • Performance and functioning can be impacted by athletes' mental health (Van Slingerland et al., 2019)	• There are both positive and negative relationships between smartphone usage and MH (Best et al., 2014; Elhai et al., 2019; Wright, 2012; Vahedi & Saiphoo, 2018) • Adolescents' use of digital media can negatively impact psychological well-being (e.g., Boers et al., 2019; Twenge & Campbell, 2018) • Negative implications of smartphone usage on well-being are more nuanced than research suggests (Coyne et al., 2020; Ellis, 2019; Orben & Przybylski, 2019; Odgers & Jensens, 2020) • Smartphone features can support MH interventions and gratify MH needs (Ellis, 2019)	• Smartphones may exacerbate mental health concerns and compromise well-being. However, smartphones may equally provide athletes with access to support and MH interventions to satisfy MH needs.

Psychosocial Variable	Relevance to Athlete Performance/Well-being	Relevance to Smartphone Usage	Potential Interplay Based on Evidence
Stress *Mental, emotional, or physical strain that arises when one's perceived demands outweigh available coping resources (Cohen et al.,1983; Uldry & Andersen, 2008).*	• Unmanaged stress can negatively impact athletes' performance, well-being, and mental health (Dubuc-Charbonneau & Durand-Bush, 2015; Gould & Whitley, 2009; Van Slingerland et al., 2018)	• Smartphone usage can contribute to fear of missing out (FoMo), personal and social stress, as well as anticipatory, separation, state, and somatic anxiety (Clayton et al., 2015; David et al., 2018) • High perceived stress is related to higher smartphone usage (Dissing et al., 2019; Vahedi & Saiphoo, 2018)	• Smartphones may add to the stress faced by athletes and impact performance and well-being. Athletes facing high demands and high stress might be at risk for increased or problematic smartphone usage.
Social Connectedness (SC) *Interpersonal closeness derived from belonging to and engaging with a close, cohesive network (Lee & Robbins, 1995)*	• Perceived social support can enhance performance, coping, motivation, and well-being (Rees & Hardy, 2000) • Relatedness is a basic psychological need affecting athletes' motivation and well-being (Ryan & Deci, 2017)	• Smartphone features can facilitate and improve SC, sense of belonging, and support (Best et al., 2014; Ryan et al., 2017; Wright, 2012). • Non-social features (e.g., passively scrolling through social media) of smartphone usage may be most detrimental to psychosocial functioning (Elhai et al., 2019) • Athletes use smartphones to foster social connection (David et al., 2018; Dunn et al., 2021) • Those high in loneliness may be at risk of smartphone reliance and problematic smartphone usage (Kim, 2017)	• Smartphones may facilitate both sport-specific and general social support, thus enhancing performance, coping, motivation, and well-being. However, athletes on the periphery of their team (i.e., new players, rookies), or those experiencing loneliness (i.e., away from home), may be at risk of increased or problematic smartphone usage.
Mindfulness & Attention *Purposeful and present regulation of attention and a non-judgmental approach to one's experience. (Feldman et al., 2007).*	• Mindfulness interventions in sport have benefitted athletes through improved flow, mindfulness, emotion regulation, and well-being (Baltzell & Akhtar, 2014; Josefsson et al., 2019; Noetel et al., 2019) • Attentional capacity and selectivity are essential for optimal sport performance (Boutcher, 2008; Perry, 2005)	• Smartphone usage can disrupt attention, cognitive capacity, and working memory (Marty-Dugas et al., 2018; Stothart et al., 2015; Ward et al., 2017) • Metacognition and mindfulness strategies can help task performance, executive function, and well-being while using digital technology (Bauer et al., 2017; Carrier et al., 2015; Li et al., 2021)	• Smartphones can disrupt attention in key performance situations and through multitasking, they can impede mindfulness as well. However, athletes with enhanced attentional and mindfulness skills may use these competencies to buffer the negative effects of smartphones and enhance positive aspects such as self-management.

Psychosocial variable	Relevance to Athlete Performance/Well-being	Relevance to Smartphone Usage	Potential Interplay Based on Evidence
Perfectionistic Self-Presentation (PSP) *Maladaptive interpersonal expression of flawlessness (Flett & Hewitt, 2005; 2014).*	• Smartphones provide features that allow individuals to self-present in controlled, purposeful, and personal ways (Smith & Sanderson, 2015) • PSP is associated with negative MH and sport performance outcomes (Flett & Hewitt, 2005; 2014; Hewitt et al., 2003). • Athletes high in PSP may be skilled at hiding psychological pain, and at increased risk of harm to physical and MH (Flett & Hewitt, 2014)	• PSP can be facilitated and exacerbated by social media usage (Hellmann, 2016)	• Smartphones provide access to features—particularly social media—that allow athletes to carefully curate self-presentations, including athletic self-presentations, which could lead to perfectionistic self-presentation and disguising psychological pain and MH needs.

Note. Adapted from Article 3, DesClouds et al. (2022).

warrants investigation. However, problematic smartphone usage is not a recognized disorder and there are no standard criteria for smartphone addiction (Ellis, 2019; Panova & Carbonell, 2018). As such, it is easy to conflate regular usage with terms like ‘addiction’ and ‘overuse’. Elhai and colleagues (2019) cautioned readers not to “over-pathologize” normal usage, which does not impair normal, day-to-day functioning.

Calls have been made for more context-specific research that examines layers deeper than screen time including context, purpose, intent, type, and timing of usage, as well as user characteristics (Ellis, 2019; Marty-Dugas et al., 2018; Odgers & Jensen, 2020; Twenge & Martin, 2020). Further, Odgers and Jensen (2020) suggested that smartphone technology be acknowledged for its value for functioning and thriving in modern society. Consideration of these elements will arguably lead to a more nuanced and accurate understanding of the impact of smartphones. Furthermore, given the lack of research on athlete smartphone usage, it is important to remain open to all aspects of smartphone capabilities as well as positive, negative, and null effects of smartphones usage among athletes.

Self-Regulation and Smartphones

One of the main benefits of smartphones is their ability to support self-regulation through a multitude of organization, scheduling, reminder, reflection, goal-setting, self-monitoring, and self-observation features. Also, it is well established that athletes must effectively self-regulate in order to excel in their sport pursuits (e.g., Cleary & Zimmerman, 2001; Collins & Durand-Bush, 2010; Englert, 2016; Goudas et al., 2013; Jonker et al., 2010; Kitsantas et al., 2017) and maintain their well-being (Balk & Englert, 2020; Dubuc-Charbonneau & Durand-Bush, 2015; Durand-Bush et al., 2015). It is possible then that athletes may use smartphones to support this context-specific self-regulation as smartphones can improve self-regulatory behaviors such as self-

monitoring and self- observation (Lee et al., 2021; Ling, 2005; Peart et al., 2018; Quelly et al., 2016). However, athletes would arguably require a certain level of self-regulation to use smartphones in facilitative ways. For instance, they would need self-regulatory competencies to override the temptation, obligation, or habit of using these devices in and around the sport setting (e.g., Bauer et al., 2017; Hofmann et al., 2017; Rosen et al., 2018; Szumowska et al., 2018; van Deursen et al., 2015; Wu, 2015). Based on research from other domains, it is also plausible that smartphones could create additional self-regulatory demands stemming from other life contexts that may not be relevant to sport (e.g., reminders for school work, notifications for social outing with friends). Thus, smartphones should be regarded for both facilitative and disruptive functions in studies involving athletes and the sport context. This was considered in the current research.

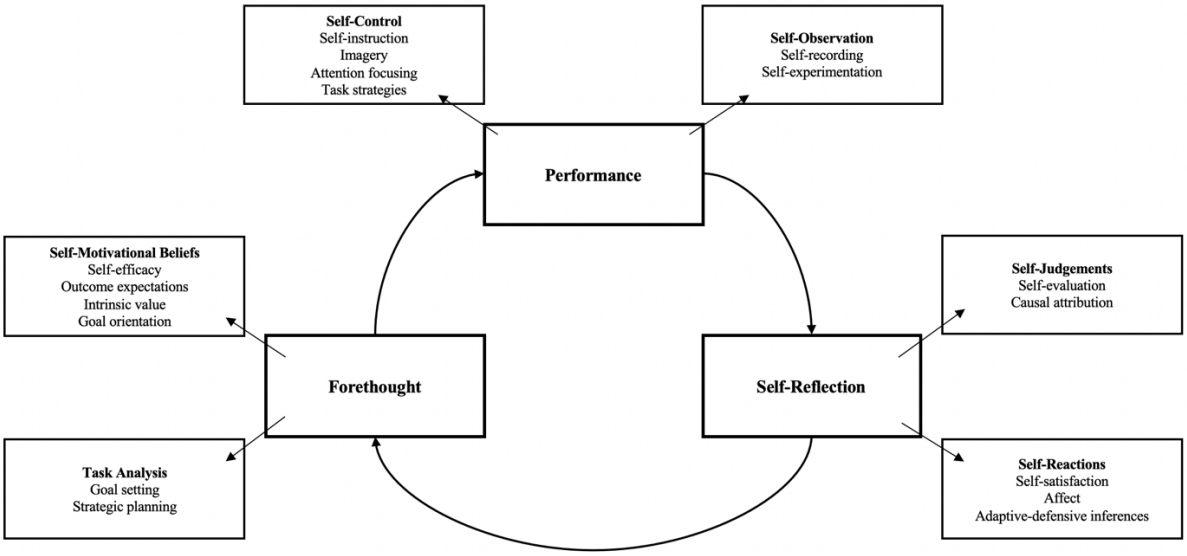
To guide the study of smartphone usage in sport and consider a wide range of functions, experiences, and impacts, the current research project was informed by two widely accepted models in the literature: the model of self-regulated learning (Zimmerman, 2000) and the model of self-regulatory strength (Baumeister et al., 2007). Both models have been applied extensively in the sport psychology domain (e.g., Chan et al., 2015; Cleary & Zimmerman, 2001; Collins & Durand-Bush, 2010; Dorris et al., 2012; Dubuc-Charbonneau & Durand-Bush, 2015; Englert, 2016; Englert et al., 2015; Furley et al., 2013; Goudas et al., 2013; Jonker et al., 2010; Kitsantas et al., 2017), and both have been used to orient and focus the study of smartphone usage in other domains (e.g., Hartley et al., 2020; Hartley & Bendixen, 2019; Lanaj et al., 2014; Palalas & Wark, 2020; Zheng et al., 2018). However, neither model appears to have been used to inform the study of smartphone usage within the sport context, and the models have not been used together, in a complementary way, to inform the holistic study of smartphone usage.

Model of Self-Regulated Learning

According to Zimmerman (2000), self-regulation involves the dynamic occurrence of several cognitive processes, which are depicted in the model of self-regulated learning (Figure 1). This pro-active and goal-centered model involves three cyclical phases of forethought, performance, and self-reflection, which in turn encompass both covert self-regulatory processes and self-beliefs that influence learning and performance. In Zimmerman's (2000) view, beliefs and motivations are fundamental to self-regulated learning in that the quality of processes imbedded within the model are entirely dependent upon being self-aware and exerting personal agency. The self-regulated learning model is performance-focused and is concerned with continuous performance improvement in pursuit of high-order goals (Zimmerman, 2000). The model also relies on a triad of interdependent influences (i.e., social, environment, and self) as well as resources available within this triad to support self-regulation (Zimmerman, 2000). Studies in the sport domain show that self-regulatory processes such as planning, self-monitoring, and self-reflection are associated with learning, well-being, and performance in sport (Collins & Durand-Bush, 2010; Jonker et al., 2010; Kitsantas et al., 2017). Furthermore, highly skilled athletes employ more self-regulatory processes more frequently than less-elite athletes (Bartulovic et al., 2017; Cleary & Zimmerman, 2001; Durand-Bush et al., 2022; Kitsantas & Zimmerman, 2002; Zimmerman, 2002). In a controlled experiment, Cleary et al. (2006) implemented the self-regulatory learning model to provide self-regulatory instructions on goal setting, self-recording, and strategic self-reflection with novice basketball players. The authors demonstrated that quality self-regulation training and practice resulted in greater task performance and adaptations (Cleary et al., 2006). In other words, the more individuals learned

Figure 1.

Model of Self-Regulated Learning (Zimmerman, 2000)



Note. Figure based on Zimmerman (2000).

and effectively applied self-regulation processes, the more they achieved their athletic performance goals. With a focus on performance and learning, Zimmerman's (2000) framework lends itself well to examining how smartphones may help athletes' performance and development. The three cyclical phases of the model give insight into various processes and attributes (e.g., self-efficacy, motivation, goal setting, planning, attention and arousal control, self-monitoring, self-reflection, satisfaction, affect) required to learn and successfully perform in sport (Collins & Durand-Bush, 2010; Durand-Bush, et al., 2015; Goudas et al., 2013; Jonker et al., 2010; Kitsantas et al., 2017). Of relevance in the current research, they also provide insight into the same processes and attributes supporting various smartphone features (e.g., self-efficacy,

social support, goal-setting, feedback, self-monitoring; Lau et al., 2011; Lee et al., 2021; Ling, 2005; Peart et al., 2018; Quelly et al., 2016).

In sum, the model of self-regulated learning is designed to account for and nurture context- and goal-specific self-regulatory learning and performance. It is thus is well-suited to (a) support the study of smartphones as a tool for self-regulatory learning, (b) explain how smartphone usage can cause deficiencies and/or gains in self-regulation processes and attributes, and (c) emphasize the relationship between smartphone usage and the sport environment. However, Zimmerman's (2000) model does not take into consideration the potential for self-regulatory 'overload', or a peak threshold at which self-regulatory demands become too much for an individual to handle successfully. Furthermore, it does not consider that self-regulation processes may be required across life domains within a given period. Due to the model's performance- and context-specificity, it does not provide the means for understanding convergence between self-regulatory attempts in different and potentially overlapping domains (e.g., work and sport). As such, the self-regulated learning model does not include explicit considerations for self-regulation failure due to depletion or overload from too many self-control demands. For this reason, it is important to consider the model of self-regulatory strength to address these gaps.

Model of Self-Regulatory Strength

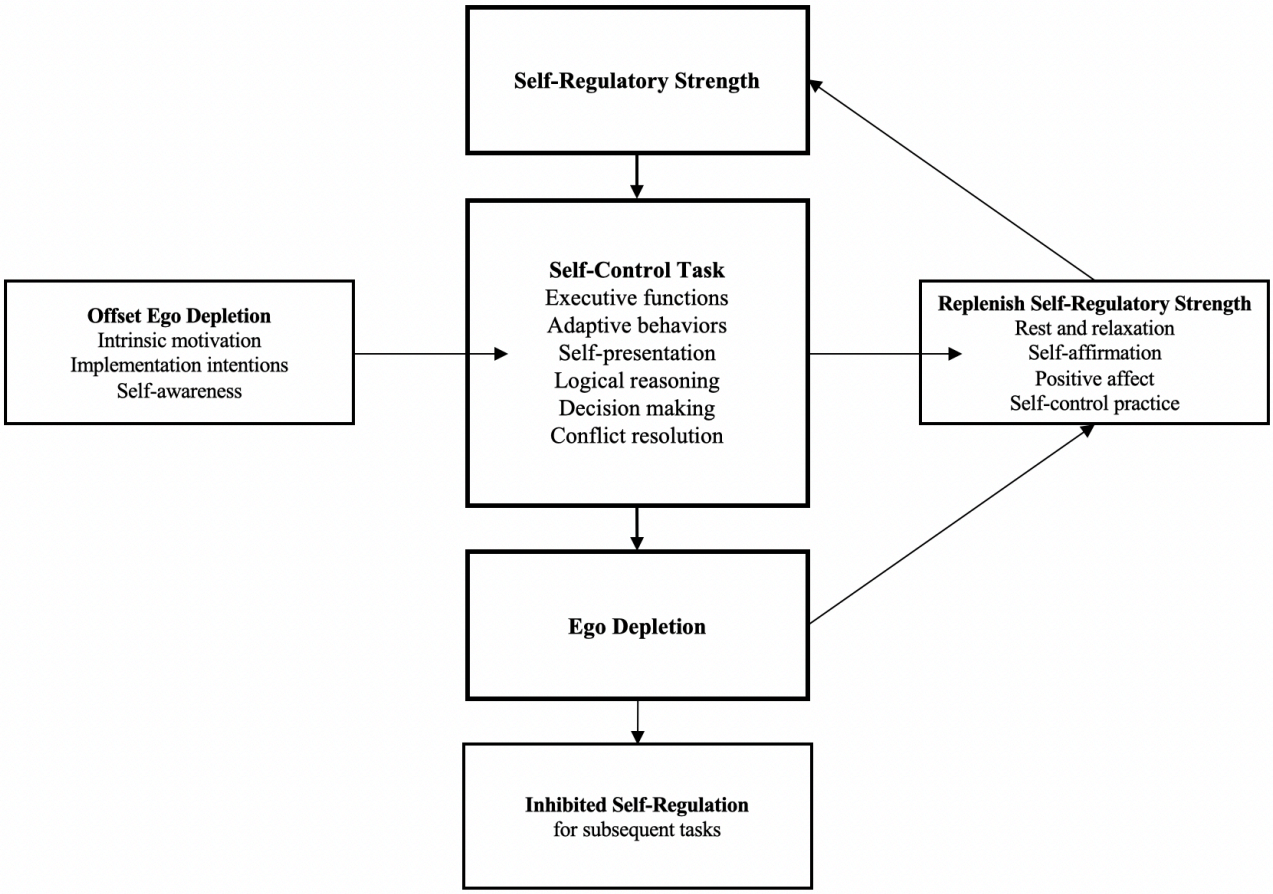
Baumeister and colleagues' (Bauer & Baumeister, 2010; Baumeister et al., 2007; 1998; Heatherton & Baumeister, 1996) model of self-regulatory strength (Figure 2) focuses on self-regulation capacity, self-control, and self-regulation failure. Three core tenets underpin this model: (a) self-regulation is a finite resource, (b) self-regulation is a domain-general, common resource, and (c) self-regulatory strength can be enhanced. According to Bauer and Baumeister

(2010), successful self-regulation allows individuals to control short-term temptations for the return of long-term goals, whether this takes the shape of controlling emotions, thoughts, behaviors, impulses, or challenges. Acts of self-control are executed by drawing from a limited supply of self-regulation capacity (i.e., the self-regulatory resource), making less of it available for subsequent acts of self-control, and eventually leading to complete depletion. Baumeister and colleagues (1998) coined the term 'ego depletion' to represent the state in which the self-regulatory resource becomes exhausted and subsequent acts of self-control begin to fail. Additionally, self-regulatory resource depletion occurs regardless of the domain that demands regulation (e.g., whether the task is sport or school related). Thus, self-regulatory exertion in one domain can impair subsequent performance in another domain and the resource will remain depleted across domains until it has been adequately replenished. Rest, relaxation, positive thinking, self-control practice, self-affirmations, and planning can help rebuild self-regulatory strength (Bauer & Baumeister, 2010). The model also dictates that domain-general self-regulatory strength can be fortified through routine practice to strengthen the resource to meet self-control demands (Muraven et al., 1999).

The model of self-regulatory strength has been tested in several controlled studies (see Baumeister et al., 1998 for overview), which have brought to light subordinate processes that moderate the strength of self-regulation (e.g., motivation, self-efficacy, affect, feedback, reflection, goal hierarchy, decision-making, personality, interpersonal processes). The self-regulatory strength model has also been applied in the sport domain (see Englert, 2016 for review). Englert (2016) found that, regardless of the sport task or athlete, sufficient self-control is necessary for motor impulse control, anxiety and attention regulation, and persistence in strenuous training and competition situations. Moreover, self-regulatory strength is required at

Figure 2.

Model of Self-Regulatory Strength



Note. Figure based on Bauer and Baumeister (2010), Baumeister et al. (2007), Baumeister et al. (1998), and Heatherton and Baumeister (1996).

both inter- and intra-individual levels in distracting and high-pressure sport situations (Furley et al., 2013).

Overall, the self-regulatory strength model fulfills gaps not accounted for by the model of self-regulated learning such as self-regulation failure, the depletion of self-regulatory capacity, and pan-domain and dual-task self-regulation demands. Given its predominant focus on self-control (or the absence thereof), the model of self-regulatory strength may help to understand individuals' self-regulation in the face of smartphone temptation (e.g., caused by notifications,

calls, or the presence of the device). The model can also shed light on how smartphones contribute to the depletion and replenishment of self-regulatory strength, and help understand the impact on important performance variables such as attention and motivation.

Purpose and Rationale of Research Project

Despite the attention drawn to smartphone usage in broader society and in some aspects of sport (e.g., marketing, communication, and psychology), there are considerable gaps in the literature:

a) There is limited empirical evidence on athletes' use of smartphones. Specifically, there is a lack of objective data on the usage prevalence and features within this population, and little research on the implications of smartphone usage for athletes' performance and well-being.
b) There is little research on the interplay between smartphone usage and key psychosocial variables deemed important to optimize athletes' performance and well-being (i.e., self-regulation, mental health, stress, social connectedness, mindfulness, self-presentation).
c) There are limited ecologically valid longitudinal studies on smartphone usage in general, and none in the sport psychology domain.
d) There are limited studies that leverage the full range of features and functions available via the smartphone to inform research and best practices.
e) Studies rely heavily on cross-sectional, self-report data related to smartphone usage, which pose problems such as recall bias and social desirability and do not account for fluctuations in usage over time.
f) There has been a call for more studies on smartphone usage (outside of problematic usage) that consider contextual, personal, and temporal nuances of usage.

g) Few studies pertaining to implications of social media on athlete functioning consider how, why, and where social media is being accessed by athletes.
h) There is a deficit of studies driven by frameworks that can inform a wider range of smartphone usage experiences.

In light of these gaps, the overarching aim of this research project was to advance knowledge surrounding athletes' use of smartphones by examining athletes' smartphone usage experiences and the implications of this usage on psychosocial variables that are imperative to both performance and well-being in sport. Due to the scarcity of studies in this area, as well as the deficit of studies driven by comprehensive frameworks that can account for an inclusive view of smartphone usage, the models of self-regulated learning (Zimmerman, 2000) and self-regulatory strength (Bauer & Baumeister, 2010) were selected to inform this research. Taken together, these two models offer a holistic lens through which to explore athletes' use of smartphones.

A sequential mixed methods research project (Creswell, 2014) was employed to meet the following research objectives:

a) Qualitatively investigate athletes' experiences with smartphones in the sport context (Study 1);
b) Quantitatively assess athletes' smartphone usage prevalence and features, and key psychosocial variables over time using a novel, in vivo research method (Studies 2 and 3);
c) Qualitatively examine the interplay between athletes' smartphone usage and self-regulation and propose a model to inform research and applied work in this area (Study 4).

Table 3 provides an overview of the studies, objectives, and corresponding research questions. Each study was designed to target different questions and methods to uncover various

layers and elements associated with the topic of investigation and collectively provide a comprehensive account of athletes' smartphone usage.

Table 3.

Overview of Objectives, Research Questions, and Methods by Study

Objective(s)	Research Question(s)
Study 1: Qualitative (Focus Groups) *Inductive, exploratory*	
Investigate varsity athletes' lived experiences with smartphones in the sport context.	How are varsity athletes using their smartphones, and how is their usage impacting their experience of being a varsity athlete?
Study 2: Quantitative (Pilot Study) *Method-focused, proof-of-concept*	
Pilot test the functionality of a mobile application as a remote, efficient, and objective data collection tool. Collect and analyze preliminary data related to student-athlete smartphone usage, and key psychosocial outcomes.	Can a novel mobile application be used and optimized to capture objective, longitudinal, ecologically valid usage data of athletes, in real-time time? How might these data be collected, stored, extracted, and analyzed to shed light on relationships between athlete smartphone usage and key psychosocial outcomes?
Study 3: Quantitative (Usage Data Tracking and Mobile Survey) *Ecologically valid, longitudinal, descriptive*	
Create a novel data capture system that can be used, in vivo—imbedded within the smartphone itself—to collect complex, longitudinal smartphone usage and psychosocial data from a sample of student-athletes. Investigate the prevalence and features of athlete smartphone usage alongside psychosocial outcomes.	Prevalence: What is the prevalence of smartphone usage among student-athletes and are there differences in usage within the sample? Features: What are the main features of usage within this sample? (i.e., When do athletes use their phones most? Which apps do they use most often?) Profiles: How do the psychosocial profiles differ among those who are heavier and lighter users within this cohort of student-athletes? Impact: Over time, how might smartphone usage be associated with athletes' self-reported psychosocial and sport experience outcomes?

Objective(s)	Research Question(s)
Study 4: Qualitative (Individual Interviews) *In-depth, theoretical re-description*	
Examine the self-regulatory processes, conditions, and outcomes related to the smartphone usage of athletes using the models of self-regulated learning and self-regulatory strength.	What self-regulatory processes, conditions, and outcomes are related to the smartphone usage of a sample of Canadian athletes, based on the models of self-regulated learning and self-regulatory strength?
Determine a model that can inform research and applied practice pertaining to athlete smartphone usage.	What model can be used to inform research and applied practice to optimize athletes' smartphone usage?

PART II

Supplemental Methods

The following section serves as a supplement to the methods sections included in the four articles in Part III of the dissertation. Specifically, the purpose is to provide a more comprehensive understanding of the use of critical realism as a philosophical stance for the mixed methods research project, and explain how this approach informed each study and provided a framework for the integration of results. Additional details on the structure of the mixed methods research design are included, as well as specific information pertaining to the design and execution of the mobile app studies (Studies 2 and 3). This supplemental material was not included in the four articles given the journal page limits and the focus of each manuscript.

Background

The literature pertaining to research paradigms in the social sciences continues to be driven by debates over superior philosophical approaches and their respective differences (Creswell & Plano Clark, 2007; Hall, 2013; Morgan, 2007; Sparkes, 2015; Teddlie & Tashakkori, 2010). There is a dominant view that accepting any one paradigm from a positivist, interpretivist, or critical school of thought, requires rejecting all the others. This divide has restricted the acceptance of mixing methods, philosophies, and disciplines. Mixed methods researchers have proposed new philosophical approaches including a-paradigmatic, dialectical, and multiple-paradigm models (Teddlie & Tashakkori, 2010). Through this, an appreciation of strengths, limitations, and complementarity has begun to emerge. Nonetheless, as researchers continue to seek single-paradigm stances with which they can align their research, there remains a need for philosophical foundations that guide research that is more inclusive of both qualitative and quantitative methods, classical and interpretivist assumptions, and mental and physical

realities. The critical realist paradigm provides this inclusive approach by offering a 'middle-ground' between positivism and constructivism, while simultaneously serving as a strong single-paradigm guided by its own unique core ontological, epistemological, and methodological tenets (DeForge & Shaw, 2012).

Critical Realism

Critical realism is a theory of science that draws together ontological realism and epistemological interpretivism (Bhaskar, 1995; 2008)[2]. Critical realism allows researchers the opportunity to study emergent processes and context-specific phenomena. It is a fluid theory of science that does not seek 'truth' claims or 'universal laws', but instead acknowledges fallibility, emergent progress, reflexivity, and the importance of context in influencing a phenomenon (Byers, 2013). Critical realism focuses on generative causation, which is about reaching beyond what is simply observable and theorizing about the mechanisms that shape what can be observed (Connelly, 2001; Ryba et al., 2020). Critical realism is by no means a deterministic framework for science, but instead a framework for constant reformation, dialogue, re-iteration and improvement.

Critical realism has been applied only minimally in the domain of sport psychology, and those who have conducted research through a critical realist lens have done so because it afforded a strong foundation for qualitative and mixed methods research (Ryba et al., 2020). Critical realism is applicable to the domain of sport psychology because its ontological and epistemological stance can guide examination of different psychosocial and physical systems at play within a phenomenon.

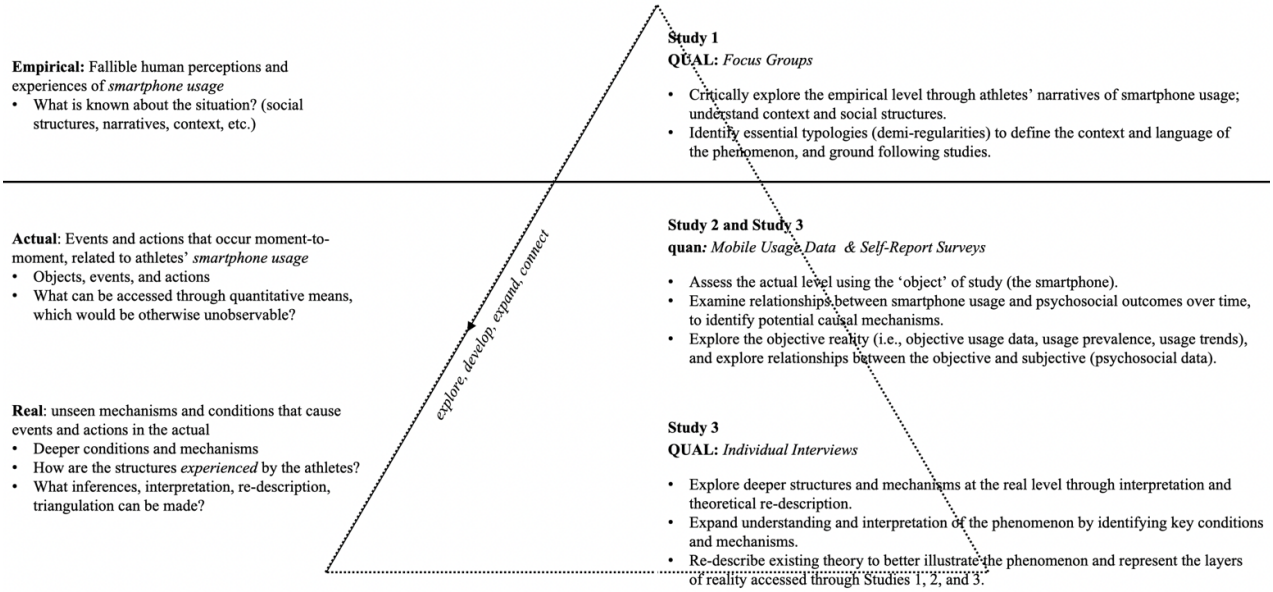
[2] The critical realist epistemological stance has been likened to constructivism (e.g., Fletcher, 2016; Ryba, 2020), interpretivism (e.g., Byers, 2013; Bygstad et al., 2016), and relativism (e.g., Stutchbury, 2021). Most important is the contention that critical realist ontology cannot be reduced to epistemology, that is: "human knowledge captures only a small part of a deeper and vaster reality" (Fletcher, 2016, p. 2).

The ontological perspective of critical realism is characterized by a three-layered, stratified conception of reality: (1) the empirical domain, constituted by fallible human perceptions and experiences, (2) the actual domain, constituted by moment-to-moment events and actions, and (3) the real domain, constituted of unseen or overlooked mechanisms and conditions (DeForge & Shaw, 2012). Neither of the three layers are considered to be more or less real or impactful than the other, but each merely represents a different manifestation of reality that can impact the other two. The ontological assumptions of critical realism are often presented in an 'iceberg model' (DeForge and Shaw, 2012; Fletcher, 2016; Stutchbury, 2021) to help researchers comprehend the notion that only a single layer of reality is accessible at the level of human knowing (i.e., the empirical; Fletcher, 2016). Figure 3 depicts the current research project's layers of reality based on the iceberg model and provides insight into how the methods address each layer. According to critical realism, we can only detect a certain level of reality via events and experiences and there are deeper underlying mechanisms that exist regardless of our knowledge of them (DeForge & Shaw, 2012). Researchers seek to produce a composite understanding of a social phenomenon, including various interacting perspectives, structures, and mechanisms. Critical realism is less concerned with truth and more concerned with uncovering the conditions that give rise to particular social phenomenon (Fletcher, 2016).

The epistemological assumptions of critical realism uphold appreciation for multiple perspectives of reality, multiple players in a social phenomenon, and ongoing, critical dialogue between participants, researchers, theories, and existing empirical data. This dialogic characteristic is essential to understanding from a critical realism vantage point, where a central goal of the approach is eventual consolidation of multiple interpretations and sources into new meaning (DeForge & Shaw, 2012).

Figure 3.

Critical Realism Ontological Layers of the Current Research Project: The Iceberg Analogy



Note. Figure informed by Stutchbury (2021).

Critical realists maintain that while varying perceptions are important and legitimate interpretations of reality, all explanations of reality should be treated as fallible, including the explanations provided by research participants, theorists, and scientists (Clark et al., 2008).

Critical realism has gained traction in the social sciences because the stance allows for connection between objective and subjective reality (Ryba et al., 2020). It is not surprising then, that under critical realist tenets, there is no choice to be made between qualitative or quantitative methodologies (Putnam, 1992). Connelly (2001) asserted that this is what allowed critical realism to emerge as a significant force in the social sciences, providing a deeper, realistic account of causation. It is an approach that values the use of multiple sources of data to espouse inconsistencies and to resolve various perspectives (Ormston et al., 2014). Critical realism also proposes that causality occurs in "open systems" that are not stagnant, and are ever-changing

(Ryba, 2020, p. 11). Participants' experiences and understanding can be used to challenge existing scientific knowledge and theory.

The aforementioned features of the critical realist paradigm were important in the current research to examine nuances pertaining to the prevalence, role, and impact of smartphones in the lives of athletes. It was essential to remain open to elements of an objective and subjective reality at play, as well as physical and mental domains. Moreover, an objective of this research was to re-describe existing empirical data and theory to accommodate the knowledge gained about smartphone usage within the particular context of sport. The smartphone offers a complex mixture of features and functions, and many relationships between the smartphone (object) and athletes (actors) can occur on a variety of levels. As Bygstad et al. (2016) noted when discussing the application of critical realism in information systems research, technical objects can be decomposed into many components "which have their own set of relationships and mechanisms" (p. 87). Oftentimes, the mechanisms of smartphone usage are not immediately straightforward or observable. Thus, it was imperative to adopt a philosophical stance that appreciated fluid, interactive, subjective, and objective parts (Bygstad et al., 2016). Furthermore, trends in smartphone usage are ephemeral; usage rapidly changes and evolves as new features and functions are introduced and the wants and needs of users change. It was deemed necessary to capture the variable use of smartphones through a longitudinal in-vivo research design as well as qualitative studies drawing from both individuals and group interview methods to explore athletes' experiences and perspectives. For further information, see Appendix G, which provides an overview of the core tenets of critical realism, as well as how choices throughout this research were informed and supported by critical realist assumptions.

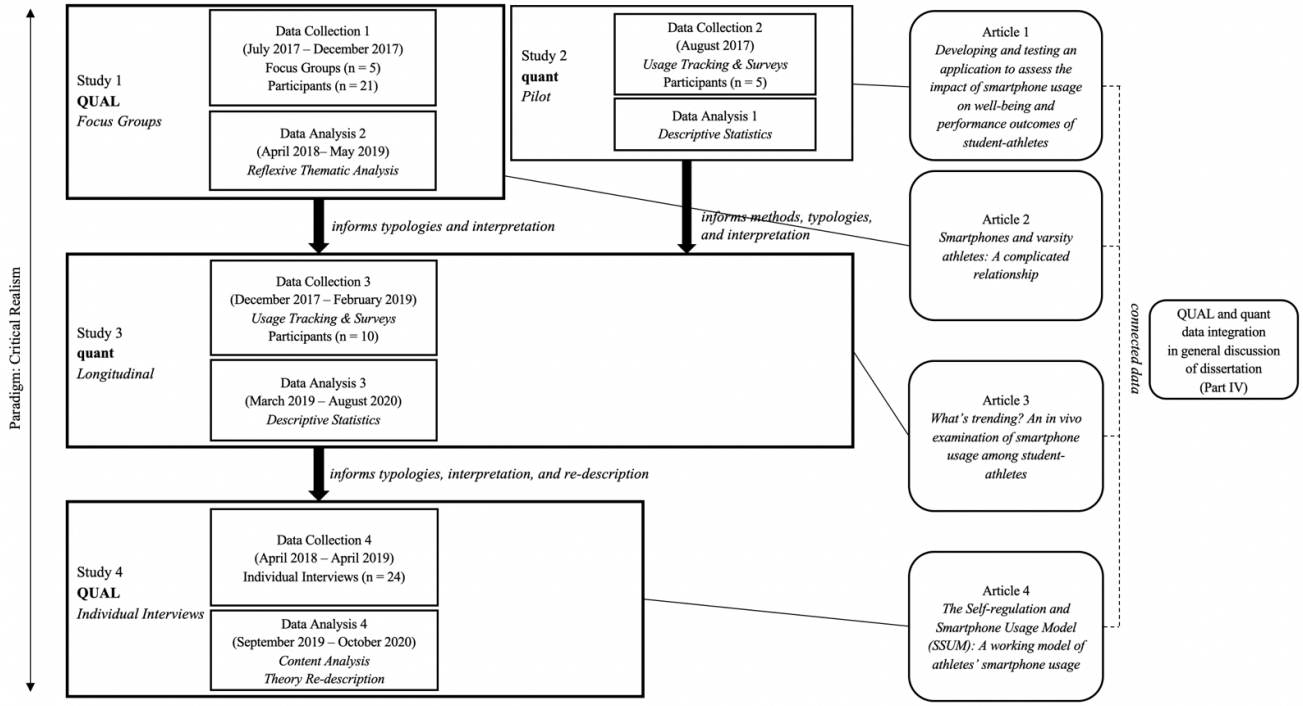
Mixed Methods Research Design

Mixed methods research incorporates qualitative and quantitative tools and strategies to produce data. The purpose of mixing methods is to employ one method to corroborate, complement, enhance, clarify, develop, inform, contrast, or expand on the results of another method (Creswell, 2014; Greene et al., 1989; Teddlie & Tashakkori, 2010). The use of both qualitative and quantitative approaches, if integrated wisely, fortify the research design and data collection, and deepen data analysis and inferences. From a critical realist perspective, mixed methods also allow researchers to access different perspectives and layers of reality and deepen understanding of the phenomenon being studied.

A mixed method design with a qualitative priority and sequential pacing was employed to carry out four stand-alone studies (Creswell, 2014). Both qualitative (focus group and individual interviews; see Appendices C and D for interview guides) and quantitative (longitudinal tracking of phone usage data and self-report psychosocial data; see Appendix E for mobile survey questions) data were collected in order to gain a rich and deep understanding of the relationship between athletes and their smartphone usage. In line with a critical realist approach, these methods were also used to gain the best possible sense of the whole phenomenon by accessing various objective, subjective, personal, and contextual layers of reality. Studies 1 and 4 were qualitative, whereas Studies 2 and 3 were quantitative (i.e., ([QUAL → quant] → quant) → QUAL). Figure 4 depicts the research timeline combined with (a) the methodology—the approach taken to study the topic and meet the purposes, (b) the methods—the specific tools and techniques used to collect and analyze the data (Sparkes, 2015), (c) the outcomes (Articles 1 through 4), and (d) the relationships between the studies to underscore points of integration, connection, and triangulation.

Figure 4.

Sequential Mixed Methods Research Timeline



Based on the use of a sequential design (Creswell, 2014), results from Study 1 informed the typologies for Study 2 and Study 3, and the results, together, informed the selection of participants, research approach, interpretation, and theoretical re-description in Study 4. Likewise, the process and results of Study 2 informed the methods and interpretation of Study 3. The data from each study were connected in each manuscript through the literature review and discussion, and they were integrated at various points to best capture the nuances and complexities of this novel topic of investigation.

Participants

The population of focus in the current research included Canadian competitive and high-performance athletes. Competitive athletes are "Canadians [who] have the opportunity to systematically improve and measure their performance against others in competition in a safe and ethical manner" (Canadian High Performance Sport Strategy, 2019, p. 3). Competitive

athletes typically refer to competitive club, provincial, and varsity athletes. High-performance athletes are “Canadians [who] are systematically achieving world-class results at the highest levels of international competition” (Canadian High Performance Sport Strategy, 2019, p. 3) and include national, Olympic, and professional athletes. Competitive and high-performance athletes were prioritized because of the mental and physical demands they face in sport and because many of the psychosocial skills they rely on to optimize their performance and well-being (i.e., self-regulation, mindfulness/attention, mental health, stress, social connectedness, self-presentation, communication) have been shown to be impacted by smartphone usage.

The exploration of athletes’ smartphone usage began in Study 1 with a focus on varsity athletes (i.e., competitive athletes who play for a varsity sanctioned university team). The population in Studies 2 and 3 was expanded to include competitive athletes attending school on a full-time basis and competing at a club, provincial, CEGEP, and/or varsity level. Finally, the population was further expanded in Study 4 to include athletes performing at both competitive (i.e., provincial and varsity) and high-performance (i.e., national, Olympic, professional) levels. This afforded the examination of a variety of perspectives and experiences to provide a holistic account of smartphone usage within this population.

Mobile Application

Studies 2 and 3 involved the use of a mobile application developed specifically for this research project. Details regarding the application were provided in Articles 1 and 3 in Part IV of the dissertation. The purpose of this section is to share some of the unforeseeable challenges associated with the app, which influenced the research process. The novel technological nature of Studies 2 and 3 led to uncontrollable hurdles that required methodological adjustments. The biggest challenge was developing a research application that fit the creative vision and research

requirements of the project, and was also feasible from a computer engineering and data collection perspective. A related hurdle was navigating the privacy, data collection, and data availability restrictions of Android and Apple smartphone platforms. A timeline of events, hurdles, and methodological adaptations are described in Table 4 followed by a description of the application and research challenges that accompanied it.

Table 4.

Timeline of Events for Mobile Application Development

September 2016	The project is conceptualized and the target sample size is projected at 500 participants.
	Funding is not available for the development of the mobile research app, which can run thousands of dollars.
	The Algonquin College Mobile Application Design and Development program and Computer Programming departments are contacted to discuss the project and recruit app developers.
October 2016	After a series of meetings, the current research team partners with the Algonquin College Computer Programming Co-Op team to develop the preliminary app.
	Many concept and design meetings follow over the next six months, with few deliverables.
March 2017	The Algonquin College team develops a basic application framework. The app is missing 90% of the capabilities for the project. This experience enlightens the research team to the difficulties inherent in developing and maintaining the 'back end' of the app, particularly collecting objective usage data in real time. The research team saves the Algonquin College framework for future use and reference.
	The primary researcher contacts the University of Ottawa School of Electrical Engineering and Computer Science to discuss the project and ask if they are interested in contributing to it. A personalized letter is sent to the Co-op Coordinator in the Faculty of Engineering. The Co-op Coordinator sees the project as an opportunity for students to gain mobile software development experience and schedules a meeting with the research team.
	The research team meets with the Co-op Coordinator who agrees to send the project summary (Appendix F) to his colleagues.
	Dr. Abdulmotaleb El Saddik (Director of MRC Lab) contacts the research team expressing interest in the project.
	The research team meets Professor El Saddik and his PhD student, Fedwa Laamarti. They discuss the project and opportunities for interdisciplinary work, including presentations and publications. The MRC Lab already has an extensive resume of joint projects within sport and biomechanics, and as a result, has specific interest in sport psychology collaborations.

	Fedwa Laamarti agrees to develop the application with Dr. El Saddik's oversight, and collaborate on publications and presentations related to the app.
April - July 2017	The primary researcher works closely with the MRC team to develop the research app (including concept, interface, functionality, usability, etc.).
May 2017	Recruitment commences for Study 2. It becomes clear that, among interested participants, there are more iPhone users than Android users.
July 2017	An initial Android version of the application is completed and tested by the research team and adjustments are made.
	The MRC team agrees to develop an Apple/iPhone version of the app. After securing all of the tools necessary for this development, the team verifies that the app can be created. However, making it available for use and extracting the necessary data for the research project is impossible without approval from Apple.
August 2017	A pilot iteration of the Android application is launched for the 15-day pilot study (Study 2).
August – December 2017	The primary researcher contacts Apple Headquarters to figure out how to obtain permission for the Apple research application. The researcher is put in contact with Apple Research Kit, the health research special projects department at Apple.
September 2017	Algorithms are developed by the MRC team to extract data from the massive dataset collected during the pilot study. The research team recognizes that data extraction will be a significant, labor-intensive challenge during the longitudinal study.
	The pilot study data are extracted, analyzed, reported, and accepted for publication.
	The research application is revised based on the pilot study. Adjustments are made to the survey questions, interface, notifications, data collection tools, and coding bugs.
December 2017	Study 3 commences with Android users only since approval for the Apple app is still ongoing.
January 2018	Back and forth conversations between the research team and Apple Research Kit continue over many weeks. The research team hosts several meetings with Apple Health Special Projects to have the application approved and be able to access the research data.
	Apple remains steadfast that no one is given access to the usage data of iPhone users. However, some health research teams have been able to gain access through partnerships with Apple.
March 2018	The research team proposes a research partnership to Apple Research Kit and Health Special Projects. Initially, they accept.
	University of Ottawa Research Ethics Board is contacted to make necessary adjustments and put the correct approvals in place.
April 2018	Apple Health Special Projects returns to the research team and says the partnership and application approval will not be possible for "many months". Eventually, the partnership is taken off the table altogether. No reason is provided.
April 2018	Many other possibilities for studying iPhone users are considered (i.e., screenshots of the "usage" screen on a weekly basis, retrospective reporting, etc.). However, no options can provide real time objective data, which are the basis of the study.

	Furthermore, no other options reduce participant burden or reporting bias in the same way as the Android application, rendering the two approaches staggeringly different. The Android study (Study 3) is in full swing. It is clear that there are no viable iPhone options, so the University of Ottawa Research Ethics Board is consulted and study eligibility is opened up to recruit a larger pool of competitive student-athletes across Canada. A few more Android users are successfully recruited. The primary researcher consults with her Thesis Supervisory Committee to modify the sample for Study 4 so that it no longer relies on the sample of Study 3 and can commence independently of the Study 3 timeline. Competitive and high-performance athletes of various ages, sex, sports, and levels are independently recruited and asked to self-screen into Study 4 by identifying themselves as heavy or light users. These categories are defined based on typologies from Study 1 and data from Study 2. The goal is to keep research moving without changing the research questions or study purpose. These changes are approved by the Thesis Supervisory Committee and the Research Ethics Board.
February 2019	Access to the research application is closed one month following the last data collection point. Although 133 participants were initially recruited, only 20 were Android users who provided sufficient data to be considered for Study 3. In order to report the richest and most comprehensive data possible, the primary researcher gets approval from her Thesis Supervisory Committee to focus on the longitudinal quality of the project and adjusts the selection criteria to include 10 participants in the final sample of Study 3.

As is detailed more extensively in Articles 1 and 3, the mobile research application (Figure 5) that was designed and developed for Studies 2 and 3 of this research project was a result of interdisciplinary collaboration at the University of Ottawa, between researchers in the SEWP Lab in the School of Human Kinetics and the MRC Lab in the School of Electrical Engineering and Computer Science.

The app was capable of capturing both self-report survey data and real-time smartphone usage data. Based on these features, it remains unique in the domains of sport psychology and computer engineering and within smartphone research at large. There were benefits and challenges inherent to creating a novel research application. The app facilitated the collection of objective usage data to capture accurate nuances of smartphone usage among participants, and thus allowed the research team to use the smartphone to its full potential, not only as an object of the research but also as a research tool.

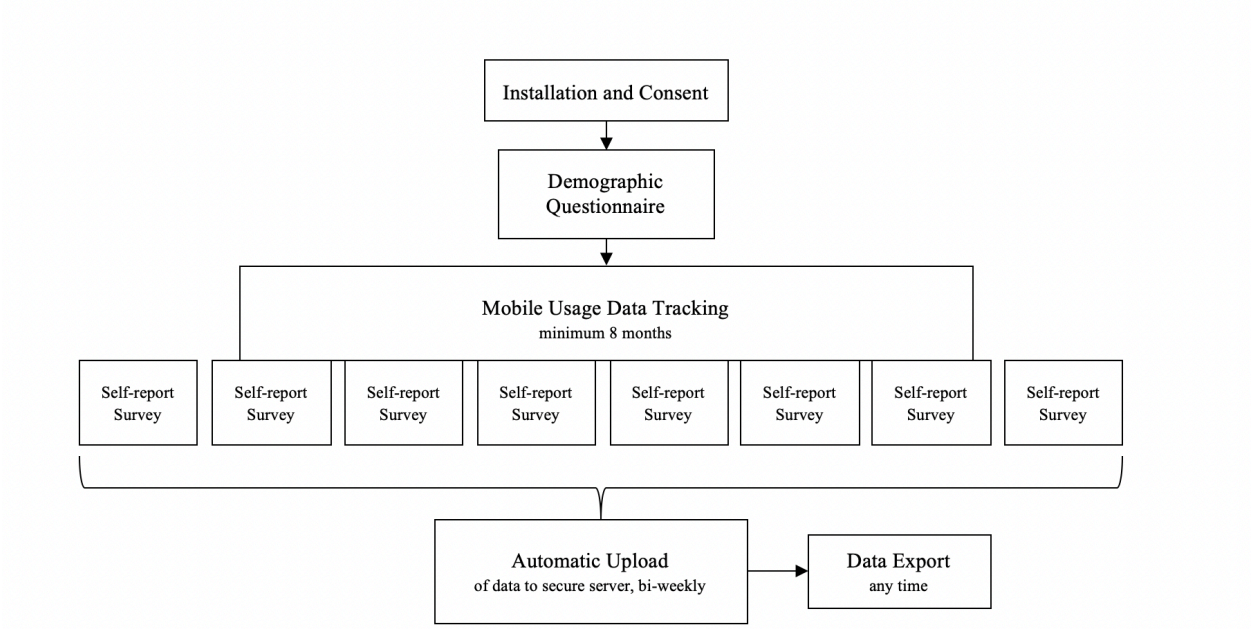
Figure 5.

Research Application Interface

The application was user-friendly, with a simple interface, so as not to unduly increase participants' usage. It allowed participants to complete a self-report psychosocial survey on a monthly basis. Participants could complete the survey in sections, so it was possible to start and stop in more convenient, sporadic intervals without losing data. This was to ease participant burden, match usage trends suggested in the literature (Bentley et al., 2015; Deng et al., 2019), and enhance the ecological validity of the research. The survey was also made available in a different order each month to reduce the risk of response bias among participants who would be answering the same questions multiple times during the year. The automatic tracking feature of the application reduced the risk of recall bias and over/under-reporting of usage, which remains a concern in smartphone research (Ellis, 2019) because it is near impossible to accurately recall prevalent and sporadic usage (Bentley et al., 2015; Deng et al., 2019). Article 1 more extensively details the development and testing of the application while Article 3 focuses on the self-report survey measures and longitudinal outcomes. Figure 6 provides a visual overview of the data collection process via the mobile application.

Figure 6.

Data Collection Process via the Mobile Application



Privacy

As with all mobile applications, the collection of user data is a common privacy concern, especially when aiming to collect data in a covert and non-invasive manner. It was challenging to determine how to engage participants in an ethical and transparent way, without unduly influencing their usage. The research team had to consistently ensure they were building an application with a clear research purpose that did not appear to be intrusive like spyware. To respect the privacy of participants, content from their applications was not collected. The team also made sure the research application could function with all of the same features as a regular smartphone app, including full user control to turn off notifications, as well as to silence, remove, exit, and/or close the application at any time to cease data tracking entirely. In addition, participants were assigned a study ID and were never identified by name on the research servers; all data were encrypted to protect it during transfers, and the data were only decrypted for

analysis. Despite being unequivocally clear about the research purpose, privacy restrictions caused the most significant challenges in this project.

Hawthorne Effect

A key consideration when creating the research app was to optimally support research needs without unduly influencing study results. When using a smartphone as an automatic tracking research tool, it is essential to consider whether participants are aware that their usage is being tracked. The mere knowledge of this automatic tracking feature has the potential to act as a motivator of behavior change. In studies of health behavior change, this is often referred to as the Hawthorne Effect (Leonard & Masatu, 2006; McCambridge et al., 2014) and this potential influence was considered when designing the app and study. The research application was developed to be as covert as possible and to run unobtrusively in the background of athletes' regular phone usage. The only times the application became evident was twice per month when participants were automatically prompted and then reminded to complete the monthly survey. The longitudinal nature of this study was a strength, as the Hawthorne effect is generally short and tends to dissipate over time (Leonard & Masatu, 2006; McCambridge et al., 2014). While participants might have initially adjusted their usage, it is likely that the novelty of the research wore off over time and participants resumed with their regular usage patterns.

Data Management

Data management was a notable hurdle to overcome throughout Studies 2 and 3, as the sheer amount of encrypted data that were collected, stored, cleaned, and analyzed was enormous (e.g., data from every moment of every day for an entire year in Study 3). Interdisciplinary collaboration was essential and the MRC Lab team was able to securely store the research data

on University of Ottawa servers, develop back-end entry points to access the data, and develop an algorithm to sort and extract the necessary data for analysis.

Trustworthiness

Smith and McGannon (2018) and Sparke (2015) suggest that validity and trustworthiness checks should be specific to the guiding paradigm. The following section describes several steps that were taken to enhance integration, coherency, and trustworthiness of each study and the research project overall. Many of these steps are congruent with the tenets of the critical realist paradigm. In-depth description of the connection between these elements and critical realism can be found in Appendix H.

In Studies 1 and 4, the interview guides and interview process were pilot tested and reviewed by the thesis supervisor and thesis committee. Further, the thematic (Study 1) and content (Study 4) analyses and outcomes were subjected to an iterative process of reviewing, critiquing, reflecting, and adjusting with the help of critical friends (Smith & McGannon, 2018). Continued, cyclical re-examination of study themes and outcomes also helped to ensure consistency and coherency within and across each of the four studies as a form of 'ongoing data verification' (Onwuegbuzie & Teddlie, 2003). As well, verified transcripts were imported into NVivo software for organization, coding, and analysis, which allowed the primary researcher to perform complex searches and keep an audit trail. The mobile application, survey, and web server used for Study 3 were pilot tested with five athletes during a one-month period (Study 2). Moreover, the primary researcher arranged regular debriefs with the thesis supervisor and app development team, and was able to speak with participants to address methodological, ethical, and technical concerns, ensuring the research method was efficacious.

The primary researcher also ensured that she acquired the requisite knowledge, skills, and academic and professional experience to carry out the research project by completing relevant graduate courses pertaining to research methods, interventions, and counselling. Additionally, she completed undergraduate level courses in communications theory, communications and media history, critical media theory, communications research methods, and mass communication. The researcher also gained valuable experience working as a clinical research coordinator, managing a range of medical research and pharmaceutical trials. She has worked for over 9 years as an independent Mental Performance Consultant and 3 years as a Care Coordinator for the Canadian Centre for Mental Health and Sport, honing her interviewing skills and sensitivity to the population under study. The researcher continued to enhance her research competencies and applied experience throughout her doctoral studies through collaborative research projects, research coordinator work, private practice, and professional development opportunities (i.e., workshops, courses, and one-on-one consultation).

Finally, the researcher followed guiding tenets from the literature surrounding integration and coherency of mixed methods research to further enhance the trustworthiness of the project. These tenets included:

- Development and re-examination of a specific and coherent design framework (Creswell, 2014; Creswell & Plano Clark, 2007; Morse, 2010);
- The development and use of strong typologies (i.e., consistent, common project-specific themes and language carried throughout each study to enforce coherence and integration across methods, datasets, and writing; Caracelli & Green, 1993; Yin, 2006);
- Completion of a scoping review at the outset of the project, followed by multiple literature reviews throughout the project (Leech et al, 2010);

- Consideration of convergent and dissonant perspectives;
- Triangulation through methods (i.e., using multiple methods to assess for consistency of findings), data (i.e., comparing the data acquired from different sources at different times), and theory (i.e., using multiple theories to interpret the data; Patton, 1999).

Finally, the limitations of each study were clearly delineated and the findings were critically appraised against existing empirical work and theory throughout the research (Patton, 1999).

PART III

Results

The following section presents the results of the research project, organized into four separate articles (see Figure 4 in Part II). Article 1 (i.e., Study 2) focuses on the concept and feasibility of a mobile research app imbedded into the regular smartphone usage of athletes. The study provides preliminary objective data on the nuances of athletes' smartphone usage and the relationships between key psychosocial variables and smartphone usage. Article 2 (i.e., Study 1) uncovers the positive and negative lived experiences of varsity athletes using their smartphones in the sport context. Article 3 (i.e., Study 3) covers the findings pertaining to the longitudinal tracking of objective data to demonstrate the prevalence and features of athlete smartphone usage. This study details the psychosocial profiles of athlete smartphone users and highlights changes over time. Article 4 (i.e., Study 4) examines the self-regulatory processes, conditions, and outcomes related to athlete smartphone usage and introduces a new model to illustrate these variables. Articles 1 and 2 are structured and formatted according to the specifications of the peer-reviewed journal in which they were published. Articles 3 and 4, which were submitted to peer-reviewed journals and are currently under review, are structured and formatted according to APA specifications.

Article 1: Developing and testing an application to assess the impact of smartphone usage on well-being and performance outcomes of student-athletes

DesClouds, P., Laamarti, F., Durand-Bush, N., & El Saddik, E. (2018). Developing and testing an application to assess the impact of smartphone usage on well-being and performance outcomes of student-athletes. *Advances in Intelligent Systems and Computing, 721*, 883-896. https://doi.org/10.1007/978-3-319-73450-7_84[3]

[3] References are based on IEEE style guidelines, as per ICITS 2018 requirements

Abstract

This paper outlines the development and testing of a novel mobile research application, which was specifically conceptualized and produced for sport psychology research assessing the prevalence and impact of student-athletes' smartphone usage. Research examining athletes' use of smartphones within and related to sport is scarce. As well, the research pertaining to smartphone usage in similar domains (i.e., physical activity and exercise), has relied heavily on retrospective, self-report data to determine smartphone usage prevalence. This study takes a step toward leveraging the smartphone as a sport psychology research tool, and toward recognizing the potential impact of smartphone usage in the sport domain. Sport psychology and computer science researchers collaborated to conceptualize, develop, and test a specialized mobile application that remotely tracks objective, detailed, smartphone usage, in real-time, via the personal smartphones of five (n=5) student-athlete participants. The application also allows for efficient administration, completion, and storage of demographic and self-report surveys on key psychosocial, behavioral, and performance variables in student athletics. The results of this pilot study highlight preliminary smartphone usage trends of student-athletes and some key psychosocial variables related to their well-being. As well, the results underscore the capabilities of the research app to be used as a sport psychology assessment tool in an upcoming longitudinal prospective study with 500 varsity athletes.

Keywords: smartphones, mobile application, sport psychology, student-athletes

Introduction

We have witnessed an explosive growth in the use of smartphones in contemporary society. The 'iGeneration' (iGen), or those born in the 1990s and beyond [1], are significant users of these technologies for interpersonal communication, self-expression, and media multitasking [2, 3, 4]. In every area of modern life, this generation has been privy to the presence of mobile media and mobile access to the Internet [4,5,6]. Among Canadian youth, e-mail, text messaging, and social networking have become dominant forms of interpersonal communication and motives for using smartphones. A recent study by Bentley, Church, Harrison, Lyons, and Rafalow [7] showed that young people interacted with their smartphones for an average of three hours per day and were drawn to use their phones in 'any spare second', especially during waiting or 'unscheduled' time. Many in the 18-to-34-year demographic report going no more than one hour without checking their cellphones, and they engage in this sporadic checking in practically any environment, including when they wake up in the middle of the night, during meals with others, and while going to the washroom [6]. Moreover, the iGen represents a group of heavy 'media-multitaskers', that is, they use several devices as well as features of those devices to perform multiple tasks at once [1].

Athletes are important and unique members of the iGen. Despite the overall research interest in the use of smartphones and social media, there are only a handful of studies in which athletes' use of smartphones have been examined. Athletes' use of these devices is of interest because they must consistently perform at a high level under pressure and rely on well-refined psychosocial skills that can be impacted by smartphone usage. However, their capacity to self-manage optimally may be directly impacted by the presence and prevalent use of smartphones. Of particular interest are varsity athletes, who must play the dual role of student and athlete while coping with strenuous

physical and mental demands and expectations [8,9]. The demands put on student-athletes have the potential to induce stress, burnout, and illness [10,11,13,14]. However, some researchers have found that stress and burnout may be buffered by sound self-regulation skills [8,12,15,16].

Research has shown that there is potential for smartphones to facilitate a range of self-regulatory behaviours [17,18,19,20,21]. This may be regarded as a positive implication of smartphone usage, particularly because self-regulatory behaviors have also been positively associated with learning, development, and performance in sport [22,23,24,25,26,27]. However, the literature also exposes the potential for smartphones to promote addictive and problematic behaviours [28,29,30], disrupt attention and executive function [1,2,31,32], cause anxiety [1,33,34], induce mental health concerns [35,36,37], and cause deficits in task performance [38,33]. The mere presence of a smartphone is distracting enough to thwart self-regulation capacity for some individuals and cause detriments to attention and performance [32]. The potential for distractions and setbacks is high if athletes' self-control becomes hindered in some way (e.g., cannot resist temptation to check phone) [8]. Furthermore, there is potential for well-being to be hindered if athletes cannot maintain an optimal capacity to self-regulate and perceive growth and development toward their performance goals.

Drawing on the literature that is available, it is clear that there are both benefits and drawbacks of smartphone usage. Unfortunately, evidence regarding the impact of mobile technology in the context of sport is scarce. However, based on the various aforementioned effects of smartphones identified in other domains, one could hypothesize that varsity athletes' use of smartphones could equally help or hinder their capacity to self-regulate and maintain optimal levels of well-being and performance. Given the deficit of research related to the use of

smartphones in the athlete population, and given the important influence usage may have on their performance and development, studies in this field are warranted.

Another important topic to address in relation to smartphone usage is social media, which is a significant motive of the iGen's use of smartphones. In a recent study, 16% of Ontario students reported spending more than five hours per day on social media [39]. It is no wonder then, that there is research interest in the ways social media is impacting the psychosocial functioning and development of young people [33,34,37,38]. Although empirical studies regarding social media tend to focus specifically on the platform itself (i.e., Facebook, Instagram, Tinder), without explicitly referring to where or how the social media was accessed (i.e., via smartphone), results show that young people are increasingly using smartphones for social media purposes [30]. Notably, a recent study [40] showed that Facebook use was significantly correlated with concentration disruption in athletes. Thus, the literature also points to the importance of understanding the particular impact of social media usage via smartphones. It is pertinent to achieve clearer understanding of which applications have the most significant impact in the sport environment, and why.

To better and more accurately understand athletes' smartphone usage, researchers from the University of Ottawa's SEWP (Self-Regulation for the Enhancement of Well-Being) Laboratory and MCRLab (Multimedia Communications Research) Laboratory collaborated to create a novel mobile application. The use of apps in research has been shown to be valid, reliable, and feasible [41]. Therefore, together, these researchers are taking the first step toward filling an important knowledge gap and leveraging the use of smartphones in sport psychology research and assessment.

Method

Purpose

This paper addresses the development and testing of a mobile research application, and the preliminary results emerging from the data collected during a one-month pilot study carried out with five student-athletes. There were two main objectives of the pilot study: (1) to test the functionality of the mobile application as a remote, efficient, and objective data collection tool; and (2) to collect and analyze preliminary data related to student-athlete smartphone usage, and key psychosocial variables related to attention, awareness, mental health, and well-being. The pilot study also afforded us the opportunity to subject the data to preliminary algorithms, which were created to extract detailed statistical information from a large pool of data.

The mobile application was conceptualized for a prospective longitudinal study with 500 Canadian varsity athletes. Although this longitudinal study has not yet commenced, the purpose of the large-scale project is to (1) understand athletes' lived experiences with smartphones, (2) assess trends in athletes' usage and determine if usage impacts sport performance and development, and (3) examine how athletes employ social media to self-manage and self-present in their sport. Results of this large-scale study will provide evidence regarding the effectiveness and feasibility of using a mobile app to carry out sport psychology research. Most importantly, this project will lay the groundwork for developing more sophisticated research programs addressing emerging technologies in sport.

Seven participants initially took part in the pilot study. Two of them dropped out, thus, five participants (1=male, 4=female) are included in the pilot study results. All five participants were student-athletes from the University of Ottawa, competing at various competitive levels in basketball, ultimate Frisbee, track and field, and flag football.

The Mobile Application

The mobile application, of which the system architecture is depicted in Figure 1, was purposefully developed to automatically track varsity athletes' actual and perceived smartphone usage, as well as their perceived level of sport performance and development. Athletes interested in participating in the study were given a password by the researchers, allowing them to download and access the app on their smartphone and complete a consent form. Once they provided their consent, the app automatically began to covertly collect usage data in the background of their regular smartphone activity. It periodically uploaded this data to a secure web server, with minimal impact on battery and data usage, when the participant was securely connected to Wi-Fi. The app also automatically prompted the athletes to complete a self-report survey, with reminders, as necessary. The protocol for the pilot study mirrored that of the anticipated 8-month longitudinal study, but was condensed to be implemented over the span of one-month.

The researchers aimed to create a minimally invasive app that did not constrain or influence athletes' regular smartphone usage. The app thus runs covertly, in the 'background' of participants' regular smartphone usage, and can be silenced, deleted, and re-installed, just like any other mobile application. Several steps were followed to ensure that participants' self-reported perception of usage would not unduly influence their actual regular usage trends. First, participants were asked to self-report on both their positive and negative perceptions of smartphone usage, so as to not inadvertently sway their focus toward one or the other. Second, social desirability items were included within the self-report survey in order to assess and control for this characteristic in the participant sample. Third, usage data was not provided to participants during the research period.

The fact that the app captures both self-report and real-time data is indeed a unique feature and benefit [42]. It was surprising to find that most of the studies on the impact of smartphone

usage rely solely on self-report data [43]. Self-report data are retrospective and subject to over-reporting. Since youth and young adults' use of smartphones is sporadic and nuanced [7], it is highly unlikely that they can accurately remember to what extent they use their mobile device throughout the day. Additional benefits of the app are that it reduces participant burden and optimizes response rates by providing all surveys remotely, allowing immediate upload of responses to a secure server, and mirroring the sporadic nature of smartphone usage by allowing participants to complete surveys at their own pace.

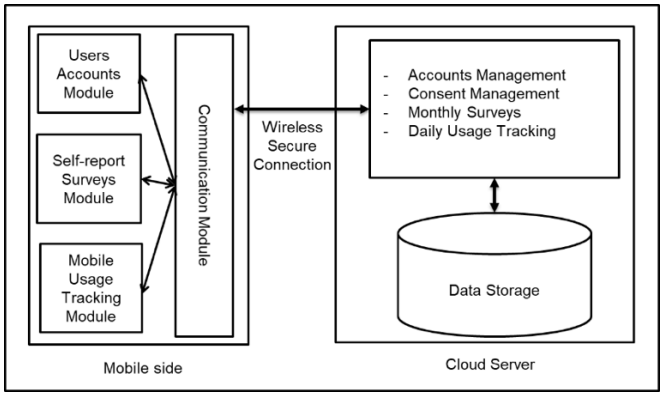


Fig. 1. System Architecture

Measures

Data collected via the Mobile App. The mobile application captures usage (i.e., types, frequency, duration of usage of all features and applications on an individual's smartphone, including those related to text messages, emails, phone calls, video games, social media, photos, videos, music). Of note, the application does *not* track the content within applications so as to not violate participant privacy. Once athletes upload the app to their phone (accessed with a study-specific password) and provide consent via the application, they are prompted, at one time-point only, to complete a demographic questionnaire. Using the mobile app, this questionnaire asks them to provide personal (e.g., age, gender, ethnicity), academic and sport-specific information (e.g.,

institution, type of sport, year of eligibility), and basic smartphone usage information (e.g., imposed time restrictions, contexts in which smartphones are used, perceptions of personal smartphone usage). Once participants consent, automatic tracking commences and access to a monthly self-report survey becomes available. The self-report survey assesses psychosocial, behavioral, and sport performance variables that are important in competitive sport and possibly impacted by smartphone usage. The following measures are included in the mobile survey: (1) the Self-Regulation for the Enhancement of Performance and Well-Being Scale (SEWP-S) [44]; (2) the Cognitive Affective Mindfulness Scale-Revised (CAMS-R) [45]; (3) the Perfectionistic Self-Presentation Scale (PSPS) [46]; (4) The Modified Self-Presentation Tactics Scale (social-media specific) [47]; (5) the Perceived Stress Scale [49]; (6) the New General Self-Efficacy Scale [50]; (7) the Mental Health Continuum – Short Form (MHC-SF) [51]; (8) the 6-Item De Jong Gierveld Loneliness Scale [52]; and (9) the Communications Skills Assessment (COMSA-R2) [53].

The participants complete the survey within the last two weeks of every month. Although the survey requires approximately 15 to 20 minutes to complete, athletes can do this at their own leisure and respond to the questions in multiple sittings. Although items are the same across the eight surveys, the order varies from survey to survey to reduce a potential learning effect over time. Each athlete's usage and self-report survey data is automatically uploaded to a secure web server that was designed for this study.

Data reported for the Pilot Study. The pilot study focused on testing the range of tracking ability and accuracy of the mobile app, and was used to glean preliminary results from the small participant pool. From the significant amount of usage data collected during the pilot period, the researchers focused on reporting total smartphone usage, usage based on time of day, the most frequently used apps, and mean scores related to athlete well-being.

Automatic Objective Tracking Measures. The total smartphone usage for each participant throughout a 15-day period during which all five participants responded to the survey was assessed, as well as the percentage of usage that took place during the following 4 time points: morning (6am-12pm), afternoon (12pm – 6pm), evening (6pm – 12am), and overnight (12am – 6am). The top 3 applications, used for the greatest amount of time were identified, as well as the total usage time for each application.

Mindfulness. The CAMS-R [45] is a 12-item measure used to evaluate four domains of mindfulness: attention, present-focus, awareness, and acceptance. The CAMS-R shows convergent and discriminant validity, and has been replicated in student, community, and clinical samples [45]. For the purposes of this study, one additional item was added: "I pay attention to sensations in my body". This item targets participants' awareness of bodily sensations - an important element of sport performance [15].

Mental Health. The MHC-SF [51] is a 14-item measure of mental health used to assess three subscales of emotional, psychological, and social well-being. The MHC-SF is a psychometrically sound measure [54].

Self-Regulation. The SEWP-S [44] is a 16-item measure of self-regulation capacity informed by Zimmerman's model of self-regulated learning [48]. It aims to evaluate three subscales of self-regulation: preparation, performance, and evaluation. As the SEWP-S is a new scale, basic psychometric properties have yet to be assessed.

Results

Participants' total smartphone usage over 15 days ranged from 20.5 hours to 119.4 hours, with an average usage of 4.5 hours per day and 31.7 hours per week. Average smartphone usage

among participants (31.7 hours per week) far surpassed their average self-reported time spent studying (20 hours per week) and training for sport (11.4 hours per week). The participants' perceived smartphone usage varied in accuracy, but 4 out of 5 participants' self-reports were lower than their actual usage. Notably, the participant with the highest real-time usage (55.7 hours per week), accurately reported his smartphone usage as being approximately 50 hours per week.

The participants' usage was spread throughout the day, peaking either in the morning (between 6 am and 12 pm) or overnight (between 12 pm and 6 am). Four of the participants' peak usage period accounted for more than 40% of their total usage (see Fig. 2). One participant's peak usage period was overnight (47.8 hours; 45% of total usage). Coincidentally, this athlete was the only one who reported a mental illness diagnosis.

Four out of the five participants' most frequently used application involved social media (i.e., Snapchat, Instagram, and Facebook). These participants spent at least 7 hours more on their social media application than their next-most-used application. One participant's social media usage time was 19 hours more than his next-most-used application. All participants had at least one social media application in their top three most used apps. Moreover, each participant's top three most-used applications accounted for the majority of their usage per week (see Fig. 3). Table 1 provides a summary of the usage percentages of each participant's top three most-used apps versus other applications, as well as total smartphone usage per week (across all apps) for each participant.

In general, the five participants reported moderate to high self-regulation capacity, mindfulness, and mental health. All but one of them was categorized as 'flourishing' based on the mental health scale. Although nuances can be observed across five participants, one in particular exhibited lower scores on all three measures (see Fig. 4).

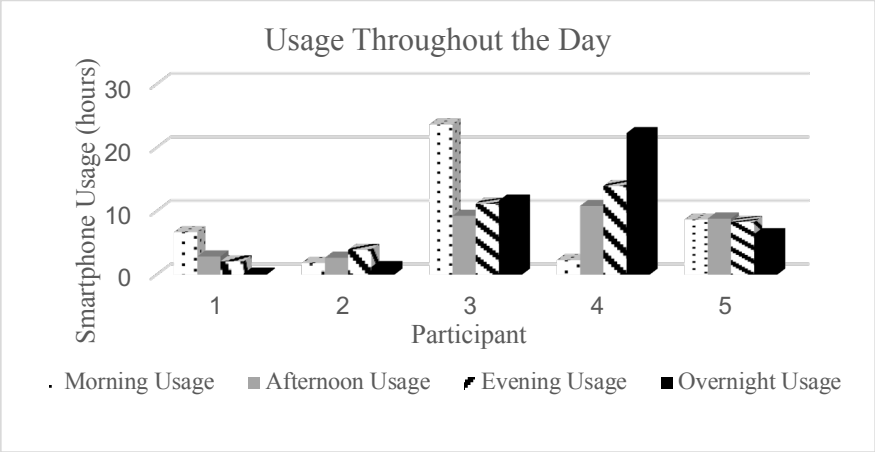


Fig. 2. Prevalence of smartphone usage throughout four periods of the day, morning (6am-12pm), afternoon (12pm-6pm), evening (6pm-12am), and overnight (12am-6am).

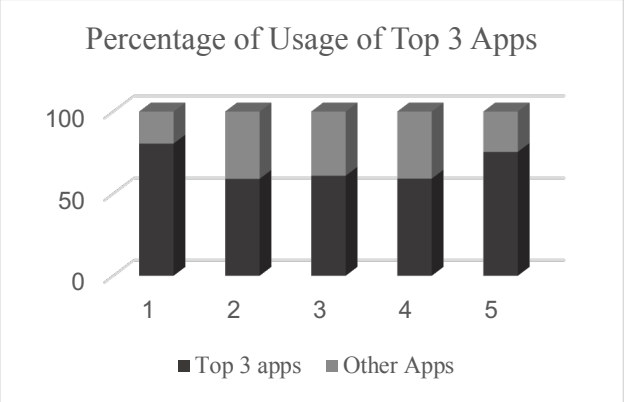


Fig. 3. Percentage of usage of top 3 apps (per week).

Scores for self-regulation capacity, mindfulness, and mental health followed a similar pattern for each participant, respectively, showing that if one of the three scores were low, moderate, or high, the other two scores followed suit. The two participants with the highest smartphone usage reported elevated scores for mental health, mindfulness, and self-regulation capacity, while the participant with the lowest scores on these thee measures also had the lowest smartphone usage.

Table 1. App Usage Distribution

Student	% Top 3 Apps	% Other Apps	Total hours/week
1	80.50	19.50	11.79
2	59.04	40.96	9.56
3	60.95	39.05	55.7
4	59.16	40.84	49.32
5	75.44	24.56	32.12

In terms of results pertaining to the mobile app itself, technical modifications were made as a result of the pilot testing process. The researchers were able to flag technical glitches and optimize usability according to participant feedback (e.g., minimize keyboard after use, re-install the app when get a new phone, modify registration screen to easily register and provide consent). Participants did not report any significant time burdens or usability concerns with the mobile survey.

The mobile survey is meant to uncover changes in capacity, perception, and experience over time. As such, the app was tweaked so that participants cannot complete two self-report surveys for two different time points back-to-back. The app now restricts survey availability so that it is only accessible for a period of 15 days at the end of each month, after which participants have a 2-week break before being prompted to report again.

Furthermore, results showed that the app generates a significant amount of data requiring many calculations to assess phone usage. As such, the researchers have developed algorithms to analyze the data and will merge two different Android tracking usage Application Programming Interfaces (APIs) to extract data.

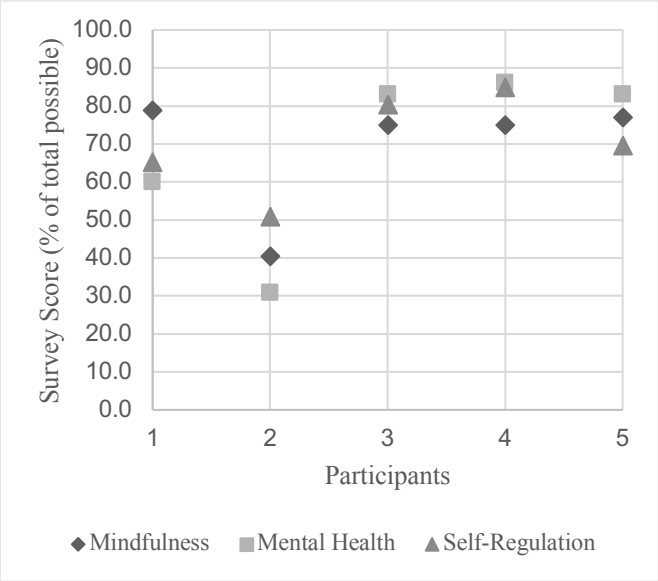


Fig. 4. Individual survey scores (reported as % of total possible survey score for comparisons) for mindfulness (CAMS-R), self-regulation (SEWP-S), and mental health (MHC-SF).

Discussion

The purpose of this study was to test a sport psychology mobile application and report preliminary results emerging from the one-month pilot phase carried out with five university student-athletes. Overall, smartphone usage among the five student-athletes was high but individualized, as depicted in Figure 1. Furthermore, social media apps accounted for a staggering percentage of the participants' usage. These findings are in line with the literature in other domains demonstrating the prevalent use of smartphones in the 18-to-34-year demographic and the overwhelming presence of social media [3,4,7,30]. When examining differences between participants' perceived and actual smartphone usage, results suggest varying levels of awareness. This supports the notion that actual usage among iGen members may be under-reported in self-report research [43] and underscores the importance of measuring real-time data.

It is compelling to note that the five student-athletes' average usage per week was equivalent to more than one full day (31.7 hours). This is interesting to observe among a group of

individuals who are performing multiple time-consuming demands, including training for sport, attending university, and holding a part-time job. This weekly average of 31.7 hours far surpassed the average self-reported time studying per week (20 hours) and training for sport (11.4 hours). This finding is in line with literature that proposes the iGen has a propensity for multitasking [3], as there are not enough hours in the day to engage in this much activity without relying on multitasking. Research on media- and social media-multitasking has shown that engagement in these types of behaviours can cause detriments to self-control, task performance, and goal achievement [2,3,38]. However, four out of the five participants in the pilot study reported moderate to high self-regulation capacity, mindfulness, and mental health, which contradicts previous findings. Nonetheless, the fifth participant's excessive overnight smartphone usage, lower scores on the three psychosocial measures, and self-reported mental illness diagnosis raise concern. This finding does fit with previous findings that suggest smartphone usage is linked to mental health concerns [33,35,36]. However, more research is necessary to confirm the interrelationships between the aforementioned variables, which are all important in the context of competitive sport.

There were indeed challenges in developing and testing the sport psychology research app, which required fixing technical glitches and providing options to respect ethical research guidelines (i.e., allow participants to turn off notifications and close the app completely). Future researchers endeavouring to develop similar mobile applications stand to learn from the results of this pilot study. There is a fine line between essential research data and breach of privacy. In spite of the difficulties encountered, it has afforded the researchers many benefits. The study demonstrates that it is possible to successfully collect objective, nuanced, real-time usage data, which can differ from self-reported usage. It shows the smartphone's potential as a research tool

that not only appeals to the iGen, but also reduces participant burden and optimizes response rates. The pilot study also provided the opportunity to subject the smartphone usage data to preliminary algorithms, which were created to extract detailed statistical information from a large pool of data. Overall, results will enhance the efficiency, accuracy, trustworthiness, and focus of the large-scale longitudinal study that will be carried out in the near future.

Moving forward, researchers in the sport and computer science domains are encouraged to investigate the prevalence and trends of athletes' smartphone usage, and build a database depicting the variety of smartphone features and functions that may be leveraged to facilitate positive sport and well-being outcomes for athletes. Considering that smartphone usage and social media appear to go hand-in-hand, it is necessary to study both together to gain a full and rich understanding of the psychosocial impact of smartphone usage. If researchers do not consider how athletes' access and use social media, it becomes difficult to draw clear, evidence-based guidelines around optimal smartphone usage.

Limitations

This study provided noteworthy findings to inform further research. Nonetheless, some limitations must be acknowledged. First, the sample was small and precluded the researchers from running statistical analyses to determine the significance of relationships between measures. As such, the study only provides a descriptive 'snap shot' of athletes' smartphone usage and level of well-being. Secondly, the research app is only available for Android phones at the moment, so participants with iOS devices, who could potentially exhibit very different usage profiles, were excluded from participating.

Conclusion

Smartphones, particularly social media apps, were highly used by this sample of university student-athletes. Usage was most prevalent during the morning and overnight. Participants generally under-reported usage, when compared to the real-time data collected. Benefits of the mobile app developed for this research include the automatic, non-invasive, longitudinal tracking of objective usage data and the administration of a user-friendly mobile survey. The mobile app shows great promise as it limits participant burden and mirrors the sporadic usage patterns of the iGen.

This is the first known study to track and explore the use of smartphones in a sample of athletes. It will inform a forthcoming large-scale study with 500 athletes that will: (a) fill a gap in the literature pertaining to the use of mobile technology in sport, (b) fulfill the growing need for robust remote data collection methods (apps, mobile surveys, web servers), and (c) propose avenues for new collaborations and further interdisciplinary research. From a practical perspective, findings from this research will help to inform strategies to leverage the use of smartphones to optimize performance in sport.

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Article 2: Smartphones and varsity athletes: A complicated relationship

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Abstract

Varsity athletes are a group of high performers situated within a demographic notable for smartphone usage and media-multitasking. Surprisingly, little research has examined the impact of smartphones in the lives of varsity athletes. The purpose of this exploratory, qualitative study was to begin addressing this gap by investigating varsity athletes' experiences with smartphones. Varsity athletes (n = 21) from nine different sports participated in one of five focus groups, and data emerging from these discussions were subjected to an inductive thematic analysis. Results indicate that smartphones are a mainstay of varsity athletes' experiences, as the athletes regularly use their smartphones to manage roles and demands across multiple contexts (e.g., sport, school, home). Themes pertained to concurrent negative (e.g., stress, distraction, disengagement) and positive (e.g., self-regulation, social connectedness) implications of smartphone usage, making it clear that athletes' relationship with their smartphone is a complicated one. Findings contribute to the limited studies of smartphone usage among athletes, and support the notion that implications of usage exist along a continuum, rather than in distinct categories of "good" and "bad". Results can inform practical guidelines for optimizing athletes' use of smartphones in and around the sport context.

Keywords: athlete, varsity, sport, smartphone, technology, social media, focus groups

Introduction

Smartphones are omnipresent in modern society, particularly among young users. In Canada, 98% of 15 to 24-year-olds own a smartphone (Statistics Canada, 2019), and the number of smartphone users has continued to climb despite slowing trends in other areas of the world (Deloitte, 2019). There is no doubt that smartphones can be both "good" and "bad", as they allow us to stay connected to the world, but can also lead us to feel distracted and frustrated (Smith, 2015). Not surprisingly, there is a great deal of health, psychology, communications, and education research related to the impact of smartphone usage. However, there is a deficit of literature in the sport psychology domain pertaining to the ways in which smartphones are changing and impacting the experiences of athletes (Durand-Bush and DesClouds, 2018). Athletes, like the rest of the population, face the task of negotiating their smartphone usage on a day-to-day basis. This is particularly true for varsity athletes, a young subset of high-performance athletes, who have grown up training, living, and learning with mobile devices at their sides. Anecdotal evidence shows that varsity athletes are using smartphones (e.g., Gregory, 2019), but the question remains: How are varsity athletes using their smartphones, and does their usage positively or negatively impact their experience of being a varsity athlete?

Smartphone Usage

The literature surrounding smartphone usage is rapidly evolving, as are the features and functions of smartphone technology. Reports on various cohorts show smartphone usage averaging over 2.5 hours per day (e.g., Smith, 2015; Deng et al., 2019) accumulated through extremely short and sporadic periods of usage (Bentley et al., 2015; Deng et al., 2019). Young users are particularly smartphone savvy and deeply intrenched in usage (Bentley et al., 2015; Smith 2015; Twenge, 2017). The 'iGeneration' (iGen; those born in the 1990s onward)

comprises individuals who have been privy to mobile access to the internet since adolescence (Rosen, 2011; Twenge, 2017). Members of this cohort are notable for media consumption, social media usage, electronic communication and socialization, media multitasking, fear of missing out (FOMO), and digital distraction (Rosen, 2011; Przybylski et al., 2013; Rosen et al., 2013; Twenge, 2017). Prone to separation anxiety when they are without their devices (Cheever et al., 2014), many in this demographic turn to their phones in any spare second, especially when bored and in waiting times (Bentley et al., 2015; Smith, 2015).

Impact of Smartphone Usage

In a breadth of disciplines, research related to the impact of smartphones is ongoing. The literature surrounding the impact of smartphones is largely unsystematic and a uniform definition of smartphone usage is not employed. Moreover, many studies pertain generally to screen time, with the smartphone as only one component of media usage, or they pertain only to a specific feature of usage (e.g., social media, mobile health interventions), without clarifying whether a smartphone was used to access this feature. In order to gain a broad understanding of the positive and negative psychosocial implications of smartphone usage, while also acknowledging the prevalent use of smartphones to access social media (Smith, 2015), this review of literature includes research related not only to smartphone usage, but also specific features such as health intervention and social media applications.

Research from other domains shows us that smartphone usage can be both positive and negative, and accumulating evidence is beginning to suggest an interplay of negative and positive effects. Table 1 summarizes these effects.

Table 1. Positive and negative implications of smartphone usage.

Positive implications of usage	Negative implications of usage
Increased / Enhanced	Decreased / Hindered
• Social connectedness (Best et al., 2014; Gardner and Davis, 2014; Ryan et al., 2017) • Communication (Gardner and Davis, 2014; Bentley et al., 2015) • Identity and image management (Gardner and Davis, 2014; Chan et al., 2015; Park et al., 2020) • Self-disclosure (Best et al., 2014; Gardner and Davis, 2014) • Social and emotional support (Wright, 2012; Best et al., 2014; Frison and Eggermont, 2015) • Well-being (Wright, 2012; Best et al., 2014) • Learning (e.g., Chan et al., 2015; George and DeCristofaro, 2016) • Self-regulatory behaviours (e.g., Quelly et al., 2016)	• Cognitive capacity, attention, analytic thinking, and working memory (Abramson et al., 2009; Stothart et al., 2015; Ward et al., 2017; Marty-Dugas et al., 2018) • Sleep (Thomée et al., 2010) • Task performance and information processing (Stothart et al., 2015; Carrier et al., 2018; Fortes et al., 2019) • Productivity and efficiency (Rosen et al., 2013; Carrier et al., 2018) • Social presence (Chotpitayasunondh and Douglas, 2016; McDaniel and Coyne, 2016) • Self-control (Abramson et al., 2009; Rosen et al., 2013; Carrier et al., 2018) • Well-being (Best et al., 2014; Rosen et al., 2014)
	Increased / Exacerbated
	• Stress / anxiety (Thomée et al., 2010; Clayton et al., 2015; Elhai et al., 2017; Vahedi and Saiphoo, 2018) • Mental health concerns (Elhai et al., 2017; 2019; Vahedi and Saiphoo, 2018) • Mental fatigue and cognitive load (Thomée et al., 2010; Greco et al., 2017; Fortes et al., 2019) • Isolation and loneliness (Thomée et al., 2010; Best et al., 2014; Gardner and Davis, 2014; Ryan et al., 2017)

An important distinction can be made between debilitative and facilitative (i.e., normal) smartphone usage, based on the type, purpose, and intent of usage (Marty-Dugas et al., 2018; Elhai et al., 2019; Ellis, 2019). Facilitative usage tends to be productive, purposeful, and

intentional, and it does not impede regular functioning or cause distress (Elhai et al., 2019). An important focus, then, beyond the amount of usage, is the intent and impact of smartphone usage in one's daily life. Emerging reviews of smartphone research recommend the acceptance of smartphones and consideration of the broader purpose, type, and context of usage when researching smartphone technology (e.g., Ellis, 2019).

Smartphones and Sport

There are only a handful of studies in which athletes' use of smartphones and accompanying features (e.g., social media, training apps) have been examined. Some have started to address the potential implications of smartphone usage on athletes' performance. These studies suggest that athletes' use of smartphones and/or social media at various stages prior to sport performance can disrupt concentration (Encel et al., 2017), inhibit decision-making (Fortes et al., 2019), induce mental fatigue (Greco et al., 2017; Fortes et al., 2019), and delay sleep (Jones et al., 2019), in some instances, leading to performance decrements (Greco et al., 2017; Fortes et al., 2019; Jones et al., 2019). A distinct, but related stream of research has focused on competitive athletes' self-presentation and sharing behaviours on social media (e.g., Smith & Sanderson, 2015; Nankervis et al., 2018), as well as experiences and implications of using various platforms, particularly Twitter (David et al., 2018; Sanderson, 2018; Park et al., 2020). Ever-evolving social media usage continues to introduce new complexities to the varsity sport context, as these platforms provide athletes with great autonomy for identity management, communication, and public sharing. However, they equally pose risk to athletes' performances and experiences, and the curated public image of athletes and post-secondary sport programs. Taken together, these studies pertaining to the social media usage of athletes point to both positive (e.g., team support, motivation, image management, and connection), and negative (e.g.,

criticism, obligation, and anxiety) experiences and implications. Importantly, these studies focus explicitly on social media, which is only one aspect of smartphone usage. Thus, while this stream of research provides valuable insights, it overlooks the technology used to access social media, and accounts for only a small portion of the possible smartphone usage behaviours and implications.

Athletes' lived experiences with smartphones, and the positive and negative impact of using these devices in and around the sport context remains unclear. This is concerning, considering that many high-performance athletes are part of the iGen, known for outstanding and nuanced smartphone usage. A preliminary study by DesClouds et al. (2018) showed that a group of Canadian varsity athletes were using their phones for an average of 32 hours per week. This is more than one full day per week dedicated to smartphone usage alone. The athletes' most used applications pertained to social media. In fact, the weekly usage time for social media exceeded the use of any other application by seven hours on average. This study suggests that varsity athletes are using smartphones a great deal in their day-to-day lives. More evidence is required, as the impact of smartphone usage on athletes has rarely been empirically investigated. In an attempt to address this gap, the purpose of this exploratory study was to investigate varsity athletes' lived experiences with smartphones. More specifically, the aim was to gain an in-depth understanding of varsity athletes' positive and negative smartphone experiences by investigating the core research question "How are varsity athletes using their smartphones, and how is their usage impacting their experience of being a varsity athlete"?

Materials and Methods

There is a paucity of research related to the smartphone usage behaviours of varsity athletes, as well as the implications of smartphone usage in these athletes' lives. Therefore, an

exploratory, qualitative study was employed to uncover the pertinent elements of smartphone usage within Canadian varsity athlete cohorts. This study was guided by the critical realist paradigm. A critical realist approach promotes the use of dialogic methods, and assumes that an unknowable reality is partially accessible only through the perceptions and interpretations of individuals (DeForge and Shaw, 2012; Fletcher, 2016). It also recognizes the importance of participants' interpretations of the subject being studied, and leaves it to the researcher to use existing theory and empirical work to negotiate and eventually consolidate multiple perspectives into the best possible understanding of reality (DeForge and Shaw, 2012; Fletcher, 2016).

Focus Groups

In line with a critical realist approach, the data for this study were collected through focus groups. Focus groups encouraged dialogue and discussion among participants, and allowed the researchers to access the participants' interpretations of the phenomenon under study (i.e., smartphones) in a specific context (i.e., varsity athletes). The focus groups helped the researchers to gain a broad understanding of varsity athletes' experiences, while drawing attention to specific examples and nuances within their shared world. Both breadth and depth of data were deemed important in this exploratory study to lay a foundation for inquiry, as well as to inform future studies. Focus groups are often used as a preliminary step in exploratory research programs, and can also stand alone as a research method in order to explore a novel or unfamiliar research topic (Wilkinson, 1998). Given the novelty of the investigation of smartphones in the context of varsity sport, focus groups were deemed to be the most acceptable method to allow for the identification of both individual and collective perspectives and experiences, in an interactive and efficient manner. In line with a critical realist approach, the typologies developed from the

data analysis were based on negotiation and consolidation of the language of the participants, the researchers' interpretation of the data, as well as the existing literature (Fletcher, 2016).

Context

The varsity sport context is arguably an ideal one in which to examine the impact of smartphone usage. Varsity athletes represent not only a demographic deeply situated within the iGen, but also a unique group of athletes required to perform and self-regulate at a high-level in both sport and school (Dubuc-Charbonneau and Durand-Bush, 2015). For example, Canadian varsity athletes are required to maintain a high academic standing alongside strong sport performance outcomes, particularly if they are seeking or holding scholarships. This can create added demands and pressure that could impact athletes' behaviours. Indeed, the literature points to both benefits and drawbacks of participating in varsity sport. Positive outcomes include the development of self-esteem, discipline, social networks, teamwork, and leadership (Watt and Moore, 2001). On the other hand, drawbacks include the management of complex, conflicting roles and schedules, feelings of isolation and frustration, and pressure to maintain performance standards (Watt and Moore, 2001; Gould and Whitley, 2009).

It is no surprise, then, that the demands put on student-athletes can induce stress, burnout, and illness (Gould and Whitley, 2009; Dubuc-Charbonneau and Durand-Bush, 2015). The potential for distractions, setbacks, and compromised well-being is high if athletes cannot effectively self-regulate (Dubuc-Charbonneau and Durand-Bush, 2015). Given the benefits and drawbacks of smartphone usage that have been identified in other domains, one could hypothesize that the use of smartphones in the varsity sport context could both facilitate and hinder athletes' capacity to self-manage multiple roles and demands, maintain well-being, and

achieve goals across school, sport, and social contexts. For all these reasons, varsity sport was deemed an ideal context in which to carry out the proposed project.

Participants

Participants were recruited from two Universities in Canada, each with an established varsity sport program including various individual and team sports. Using a purposive sampling technique (Patton, 2002), participants were recruited through social media, as well as through informational emails sent to university sport services departments, which were then distributed to athletes at the discretion of sport service directors and coaches. Snowball sampling also occurred, through word-of-mouth from other focus group participants. Participants had to be current student-athletes competing in a Canadian varsity-sanctioned sport. Ethics approval was granted from both universities involved. Consent of the athletic directors at each institution was obtained prior to recruitment activities, and all study participants signed a consent form and were provided with a copy for their own records. A total of 21 athletes (9 men, 12 women) from nine different sports (i.e., track and field, basketball, rowing, fencing, Nordic ski, rugby, swimming, lacrosse, and soccer) took part in the study. Their year of varsity eligibility ranged from first to fifth year. It is noteworthy that at the time of the study, both institutions' sport departments had policies accounting for the social media usage of their varsity athletes, but not the use of smartphones. These policies pertained to respecting and representing the ethics, values, and integrity of the institution. Only one policy made clear that athletes would be subject to sanctions if they did not abide by regulations. These policies were presented only once to participants during their varsity sport orientation at the beginning of the school year.

Procedure

Five focus groups each comprising three to five participants (M = 4.2) were conducted in-person at the host institution, in a private room. The duration of the focus group discussions ranged from 64 to 109 minutes (M = 85.2). The number of participants in each group allowed the exploration of a variety of perceptions and opinions (i.e., breadth), and the identification of both individual and collective perspectives and experiences in an interactive and efficient manner (i.e., depth; Rio-Roberts, 2011). Athletes were recruited for focus groups until the researchers could make a strong case that an acceptable level of saturation had been reached. Saturation was reached in the fifth focus group, insofar that the research question could be appropriately answered, the story regarding athletes' experiences had taken shape, topics of discussion were becoming repetitive and familiar, and further inquiry might have been counter-productive to the research objective (Mason, 2010).

Focus groups were held during the Fall and Winter semesters, so participants would be actively involved in both school and sport at the time of the interviews, as well as in both training and competition periods. The focus groups were guided by an in-depth, semi-structured interview guide, and were led by the lead researcher who is a Mental Performance Consultant and well-versed in interviewing. Steps were taken to reduce effects of social desirability, which included assuring participants that their responses would be anonymized and any information linking to their name, sport, or institution would be removed. It was also emphasized that all responses should remain confidential within the group. Participants were informed that the researchers were inquiring about both negative and positive experiences, so there would be no 'right' or 'wrong' answers, nor a systematized order of responses. At the beginning of each focus

group, athletes were reminded that they could choose to answer or not answer questions at their own discretion, and discussion among participants was encouraged.

Interview Guide

A multi-section interview guide was used to direct the semi-structured focus groups. The guide was flexible and promoted 'responsive interviewing' (Rubin and Rubin, 2012), whereby a continuous give-and-take between the interviewer and respondents was encouraged to maintain direction without overbearing structure. Participants were encouraged to embark on discussion with one another, and to give concrete examples of experiences with their smartphones.

The first and second sections of the guide pertained to introductions and motivations to participate, so members of the focus group could build rapport and become comfortable with one another, and the interviewer (e.g., "When did you start playing your sport?"). The third section pertained to participants' experiences and perceptions of varsity athletics (e.g., "What does it mean to be a varsity athlete?"), and the fourth section dealt with participants' preference and priorities when it came to smartphones (e.g., "Do you consider your smartphone to be an essential tool? Can you live without it? Explain."). These sections were used to set the stage for an in-depth, context-specific discussion.

The fifth section honed in on participants' smartphone usage, including perceptions of usage, prevalence, and context of usage. This was first established generally (e.g., "Primarily, what do you use your smartphone for?"), and then in-depth with questions related to usage for sport, academics, and communication, respectively (e.g., "What smartphone features do you use most often when you are at training, practice and/or competition? Explain."). In the sixth section, participants focused in on domains of sport, school, and social life, as they discussed questions such as, "What role does your smartphone have in your life?" and, "What smartphone rules or

restrictions do you have to abide by?" The final section provided the athletes an opportunity to reflect on the focus group discussion, share additional experiences, and make final comments.

Data Analysis

Guided by critical realist assumptions, it was important that participants' perspectives and interpretations were emphasized first, and then compared and consolidated by the researcher with existing empirical data. As such, an inductive, reflexive thematic analysis of the focus group data was performed. This method was chosen in order to thoroughly describe and understand the data, while also emphasizing the context of the phenomenon under study. In line with a critical realist approach, reflexive thematic analysis is a method that relies on researchers to engage in continued reflexive practice and re-negotiate their analyses of the data in order to consolidate the best possible interpretation of reality. Researcher subjectivity is deemed to be a "resource" for informing data analysis, and transparency is paramount (Braun and Clarke, 2019). Therefore, based on existing literature in other domains, the lead researcher approached this dataset with the assumption that polarized terms of 'negative versus positive' were appropriate initial organizing concepts to navigate the phenomenon of smartphone usage among athletes.

In addition to the inductive, reflexive component, a data-driven coding process was undertaken to stay true to the exploratory goals of the research (Braun et al., 2016). The analysis was guided by Braun and Clarke's (2006; 2019) recommendations. The lead researcher first immersed herself in the data by listening to the focus group audio recordings and by reading through the transcripts for deep familiarization. She recorded initial ideas, comparisons, and reactions, and noted inter-group dynamics describing emphasis, emotion, or unique qualities. This aided her in understanding group characteristics when discussing helpful/positive and debilitative/negative smartphone usage experiences. Verified transcripts and researcher notes

were then imported into NVivo software for organization, coding, and analysis, which allowed the researcher to perform complex searches and keep an audit trail.

The researcher parsed the raw interview transcripts into initial descriptive codes representing patterns of shared meaning among the athletes. After coding all of the data, she meaningfully grouped the initial codes into high-order themes related to the central organizing concepts of positive versus negative implications. These themes represented the experiences and perceptions of smartphone usage that were common or shared among the athletes, as well as any outlying or contrasting perspectives and experiences. The researcher worked reflexively throughout her development and organization of themes in order to question and re-negotiate her own definitions and interpretations of the dataset. Cyclically, the researcher reflected on and reworked several iterations of the thematic structure so as to best represent the data as it related to the core research question. To enforce qualitative rigor, the thematic structure was checked by 'critical friends' (Smith and McGannon, 2018), through a series of formal meetings with the second author and research peers. The second author (the first author's PhD supervisor) critically explored the coding tree and high-order themes from the perspective of someone with in-depth knowledge of the competitive sport community, but at arm's length from the focus groups and raw research data. This process of critical friends helped with interpretation of the data and consideration of alternative perspectives and feedback. In the end, three high-order themes were constructed by the researcher, with eight sub-themes representing patterns of meaning among the varsity athletes related to positive and negative implications of smartphone usage.

Results

The results are presented in three sections: general usage, negative usage, and positive usage. All three sections pertain to varsity athletes' perceptions of the positive and negative

experiences of smartphone usage in and around the sport context. Participant identification codes are provided with each citation (F = Female, M = Male; T = Track and Field, B = Basketball, Rw = Rowing, X = Nordic Ski, R = Rugby, Sw = Swimming, L = Lacrosse, S = Soccer, F = Fencing), and numbers indicate the focus group in which the athlete participated. For example, a female rugby player from the third focus group was coded as RF-3.

General Usage

General usage pertains to athletes' usage preferences, behaviours, and experiences that describe the nature and context of smartphone usage in the varsity sport setting.

Characteristics of Usage

The athletes most frequently reported using their smartphones to access Facebook, Messenger, Instagram, Snapchat, YouTube, music, and organizational tools such as calendar, alarm, and e-mail applications. There was a divide between Android and iPhone users; out of the 21 athletes, 10 used an Android device, predominantly due to affordability. Participants were asked to classify themselves as heavy, moderate, or light smartphone users and then to provide an explanation of their self-classification. Overall, athletes self-identified as heavy, moderate, or light smartphone users, with the majority of participants referring to themselves as moderate or heavy users (n = 17; 81%). Heavy users reported having their smartphone on them or near them at all times, and using their device for "everything" throughout the day. They described the need to check and respond to notifications constantly and with immediacy. Moderate users identified themselves in terms similar to that of heavy smartphone users, with the caveat that they regularly tried to monitor their smartphone usage, and reduce unhelpful smartphone habits. Conversely, light users (n = 4; 19%) identified only feeling the need to use their phone for essential tasks, and

otherwise, felt able to separate from and ignore their device, feeling no pressure to answer texts, calls, or notifications.

Athletes also discussed using their smartphones to occupy themselves when bored, filling in time, or procrastinating from completing uninteresting tasks: “During competitions, in between events, I'll usually just text people so I have something to do” (TF-1). They attributed much of their usage to the physical habit of picking up their phone, simply because it is always there: “It’s in your sports bra. It’s [with you] every time you work out. The only place it’s not [with you] is in the shower, really. And even then!” (RF-2). The athletes found themselves to be using their smartphones most in the “to and from” and “waiting” times in the sport context (e.g., in transit to and from training or competition, waiting for the next heat or game).

Awareness and Nature of Usage

The athletes showed an acute awareness of their own smartphone usage, as well as others’ smartphone usage, particularly the negative implications of usage across the various contexts of their lives (i.e., sport, school, and social). The athletes were in-tune with their internal dialogue warning them of their own “bad” media habits and negotiating self-control. Athletes consistently returned to social media during the focus group conversations. They passionately discussed the nature of social media in their sporting lives, and reported using social media for purposes of entertainment, self-promotion, motivation, comparison, and self-presentation, particularly ‘authentic’ and ‘athletic’” self-presentations. One athlete described, “People can put up two faces…You could portray that you’re the greatest athlete out there, but you’re not… that you’re doing great, but realistically not” (TM-2a). The athletes also commented on specific smartphone functions they used in the sport context (predominantly music, video, social media, and team sport applications). The athletes were particular about smartphone features used in

competition, practice, and dry-land training (i.e., gym). Generally, the athletes described more productive and controlled smartphone usage in the sport context, as compared to other contexts such as in class: "[My phone] is certainly on me the majority of times. The only time it's not is if I'm at practice and at the gym, because I want to focus… You know, I wish I was that focused in class" (TM-2b).

Restrictions of Usage

Generally, no team-wide, formal regulations existed to dictate the control of smartphone usage in the sport context, and experiences of smartphone rules were not uniform among the athletes. The majority of restrictions that athletes faced were self-imposed, coach-imposed, or based on unwritten rules to maintain respect and live up to social norms: "On our team…about an hour before games, there are no phones. Like, it's not written anywhere" (BF-1). One athlete elaborated on the intensity of these social norms among his teammates:

> I've gotten mad at people for having their phones out in the room. If you come in at halftime there's no reason to be on your phone checking Facebook… But, we don't have strict rules. Once, I saw a guy check his phone to see a football score after we had just lost – this was 30 seconds after we got in the room – and somebody just lost it [on him]. (LM-5)

Some athletes described self-imposed smartphone restrictions that helped them with preparation and optimal focus in the sport context.

> I basically cut out all social aspects of my phone's use about 20 minutes before I start warming up, just cut all conversations and say, 'I'm going. I'm competing. I'm focused in.' I'll put my headphones in, and then focus my usage solely on my training and competition. (TM-2a)

Interestingly, for some athletes, environmental conditions such as extreme cold and water dictated whether they could use their smartphones at training and competition. Many athletes said they controlled their usage in the sport context simply due to the fact that their phone would be far away in a bag, locker, or change room. In this respect, sport created a natural separation from the smartphone.

The greatest paradox expressed by the athletes pertained to the experience of being separated from their smartphone. Many identified deliberately taking a 'break' from their phone as a source of relief. However, this relief was only present if athletes were not expecting or anticipating any important information via their phone. If smartphone separation was forced upon them (e.g., forgetting their phone, phone crashing), this could induce a state of anxiety and/or panic. One athlete explained her dichotomous position:

> I think I'm calmer when I know I don't need it. Because I know if I need it, then I'm waiting up checking on it, getting anxious… It's a cross between freedom and anxiety. It's freedom of 'I just don't have my phone'. And then anxiety, obviously, if you are expecting something. (RF-2)

Negative Usage

Negative usage pertained to any experience of smartphone usage deemed debilitative to self-management, optimal functioning, performance, and/or well-being. The three main subthemes pertaining to negative usage were (a) stress, (b) distraction, and (c) disengagement.

Stress

The athletes experienced smartphones as a source stress induced by feelings of obligation, pressure, and FOMO, which all appeared to be intertwined. Stress was induced both by features of the smartphone and obligations associated with the smartphone. FOMO was a

major component of stress induced by smartphones. Athletes reported feeling more comfortable when their phones were easily accessible: “I guess it’s just a comfort thing, to have it there” (LM-5). Uniquely, athletes reported stress when separated from their phone, for fear of missing out on essential information or updates from their team and coach. One athlete mentioned, “Quite often we’ll have to look at our phone to see when our event is, or to double check 500 times to make sure that it still says the same thing, always double checking” (TM-1). The athletes also discussed feeling disappointed about missing out, induced by the social scarifies they have to make as varsity athletes. This feeling was easily exacerbated by their smartphones, which allowed non-athlete peers to put pressure on the athletes to disregard their sport commitments for social events. Athletes commented that their smartphones allowed pressure from the outside world to be brought into various performance situations (e.g., messages from professors during practice), and conversely, pressure from the sporting world intruding in personal situations (e.g., messages from coaches during down time). As one athlete explained:

> I find I can’t handle the social media at competitions, when I’m already stressed out. I just find texting people and messages to be way too stressful for me. None of my friends who are not at the track care about how my events are going... To me, that’s like the outside world at that point, and I don’t really want to deal with that. I just want to deal with what’s happening at the competition. (TM-1)

A major catalyst of stress was obligation—a pervasive and often overwhelming negative feeling of urgent responsibility. Participants revealed that smartphone usage, and even the mere presence of a smartphone, fostered a feeling of obligation to be accessible at all times, to provide immediate responses, and to provide continuous updates, including on performance outcomes.

> I find it stressful sometimes, on messenger and in a [text] conversation, if I don't want to reply, but have already seen it, it's like: Oh my god! It says I've seen it, I HAVE to reply now. Then, you get stressed out. (TF-1)

Participants noted that while this feeling of obligation is likely not unique to athletes, it is intensified for varsity athletes, due to the demands of their coaches in particular. The athletes felt that communication from their coaches was something they could not ignore or save for later. Thus, the athletes agreed that the smartphone communication habits of their coaches would directly implicate their own smartphone habits and sense of obligation to stay connected. One athlete explained, "[As an athlete], I think the requirements of how often you should check your phone are higher… more serious. You don't have a choice if your coach is emailing you; he's not going to wait" (BF-1).

Moreover, several athletes felt that a unique aspect of social media in their lives was the pressure to properly represent their institution. As one athlete explained:

> Every team has started an Insta[gram] or Twitter. I think everybody's trying to push that on us…and that differs from the regular student body. We don't even have a choice, really. We're just already implicated… Public space is a public space. So, we're implicated whether we want it or not. (RF-2)

Obligation to the university made a number of athletes feel that they had to be active on social media, even if they preferred not to be. The athletes also discussed their obligation to be ever-aware of their social media presence, modeling respectable behaviour. Notably, some athletes felt their university's representation of them on social media was a direct reflection of the institution's support (or lack of support) for their sport. Some athletes described how the

university's social media made them feel disregarded and overlooked by the institution. One athlete described being "bumped" out of the way by more popular sports:

> We got double banners, beat [our rivals] ... We got one post [on social media], which was then bumped 5 mins later by a men's game [happening] in 3 weeks… We just did something huge; we creamed them. And we get bumped. (XF-3)

Distraction

Participants also discussed their smartphones as a source of distraction that could consume their attention and lead them to engage in absent-minded, non-task-specific thinking or behaviour. They explained that distraction could be related to features of the phone, the mere presence of the phone, and even thoughts about the phone. Athletes' experiences of distraction led to time-wasting, usage regret, and idleness.

> I find it gets so easy to just kick back and be like, "Oh, Instagram. Cool picture of windsurfing. Cool picture of kayaking. Cool thing fencing. Cool thing skiing", and then two hours go by and I'm like, "I haven't written any of my thesis and it's due tomorrow!" That sucks. (FM-3)

Many athletes also reported that their smartphones distracted them from their ideal sleep routine. It was before bed that athletes felt the least control over their phone usage. One athlete gave an example, "Last night, I was in bed at 10:30pm and a friend texted me, and it turned into a deep conversation. Two hours later I'm like, "Wow, that smartphone just robbed me of two hours of very precious sleep" (TM-1). The athletes noted several similar experiences of becoming 'trapped' by the constant influx of content on their phones: "Before I go to bed, usually I go on social media. And I think at that point [my smartphone] kind of controls me, because I'm so tired, but I'm still scrolling… even though I really want to go to bed" (SwW-4).

In the sport context, some athletes repeatedly checked phones during short breaks at training instead of staying focused on the task at hand. They explained that during these short breaks, they would become distracted by their phone notifications (both real and anticipated), and would focus on negotiating to the urgency and importance of checking and responding to them. For example, "During that break, you know you'll go get water. So, if I know someone is needing an answer, I'll go run and check it [my smartphone]" (FM-3). Another commented, "It really depends what the message is about, or if I was messaging someone previously, I would message them back. Sometimes, I realize, "Will this help me? Or not?" (XF-1). Moreover, several athletes allowed themselves to be distracted by re-negotiating their self-imposed usage restrictions at training or competition if they were expecting an important e-mail or message, or continuing an important conversation from outside of the sport context.

> Once [we] get to the venue and we're in our suits and everything, I usually just put my phone in my bag… Unless I'm waiting for an email back or waiting for a text back or something… I'm pretty bad for that; then I'll usually check my phone. (SwF-4)

Disengagement

The athletes also discussed smartphones as a source of disengagement, whereby they were preoccupied with the smartphone to the extent that they were no longer fully participating in the task at hand: "So many times, I'll check [my phone] one second and [then] look up, and it's like, 'Whoa! It's been five minutes and I didn't hear anything they said" (XF-4). Athletes admitted to experiencing disengagement themselves, and being impacted by the disengagement of those around them. Specifically, athletes divulged several instances in which parents, coaches, and teammates were disengaged from competition—not cheering or watching an event—because they were preoccupied with their smartphone screen.

> It is really hard when you are having a shitty meet or something, and you come back from a race, and you see a bunch of people on their phone. Like, they didn't even watch you race… That can be really frustrating. When other people are zoning out and doing their own thing, it's really hard. (SwF-2)

Some athletes proposed that the disengagement they were noticing was influenced by smartphone temptation, along with a lack of self-awareness and self-control. A few athletes speculated that disengagement at training or competition was not beneficial to performance "I think a lot of people who are on their social media during a swim meet aren't really into the meet, and then they don't perform as well" (SwF-4). One athlete described a perceived link between disengagement and a lack of intensity, which he attributed to excessive smartphone and social media usage:

> It's almost like there's no intensity with them [rookies] when they're practicing. Like if it's not funny or comical, or doesn't send them a notification that something's going to happen, then they're not concerned about it at all… They're just not there ever, ever'. (LM-5)

These experiences of disengagement led some athletes to perceive isolation at competition, as well as low team cohesion and support. Two athletes discussed this experience post-performance, "You come up to someone and they're like, "Oh how did it go?" … Well, why weren't you watching? You were literally sitting right here!" (SwF-2). "They devalue what you just did. Why would you ask that? ... Why didn't you just take the time to pay attention if you really care?" (RF-2). There was a consensus among participants that many people in the sport arena, including athletes and spectators, were more concerned with posting than experiencing the

event at hand. Some of the athletes' sentiments included, "Everything now is about showing off to people that you've done shit instead of doing it" (SwM-4), and, "They'll only want to go there so they can get a good picture" (RF-3).

Positive Usage

Positive usage pertained to any experience of smartphone usage deemed facilitative to self-management, optimal functioning, performance, and/or well-being. The two main subthemes identified were (a) self-regulation and (b) social connectedness.

Self-Regulation

For all athletes, the smartphone functioned as an accessible, efficient multitool that allowed them to self-regulate (i.e., plan, self-monitor, perform tasks, and reflect) in a variety of domains. As one athlete described, "I think [the smartphone] can be very, very useful because it's basically like a super swiss army knife in your pocket" (SwM-3). The majority of participants reported that their phones were an essential tool, and described using the smartphone to successfully manage various aspects of their learning, performance, and day-to-day functioning:

> One of the biggest things about being a student athlete is being organized… and [the smartphone] is just a great tool, because it takes less time. And we're already so pressed for time.... we all see how it helps, and how it enhances our productivity. (RF-3)

Importantly, smartphones allowed athletes to do this immediately, in any setting, and often remotely, so they felt more in control of their learning and workload when dealing with multiple demands. As one athlete explained:

> I used to be a teacher's assistant, and I would get emails [about] my thesis and other projects. After my shower, I would sit down for 20 minutes in the locker room and just

> answer every single one…. The smartphone was really, really useful for that, so I could just get through it. (SwM-3)

Participants widely reported the use of smartphones for self-regulation in sport, particularly during independent training and preparation: "I use [my smartphone] every day. I schedule everything. I use it for practice, I log my weights, and my distances in my approaches, and stuff like that" (TM-2b). For example, they talked about using notes and music during sport preparation to increase focus, motivation, and mental readiness. One athlete noted, "For mental preparation, I think all of us use [smartphones] for music, to block sounds from around us… I use music to prepare myself to get focused and list the things I need to focus on while I race" (SwM-4). Another athlete explained:

> In my warmup, I heavily use my phone. I'll always have music... I have in my notes who we're playing and people to look out for, their tendencies and points. Then, if it's a bus ride, I'm usually watching a game film of a previous game they played, and looking at their stats. I want to know which hand they're going to shoot with, and who's going to shoot on the power plays. The phone's huge for that, and so accessible. (LM-5)

Some athletes reported using social media to facilitate motivation and goal setting, while video and photo features were used to facilitate self-reflection and evaluation. One athlete explained, "In the summer, I use my phone all the time. I'll video myself doing a movement and then I'll watch it on my phone, see how it went, put it in slow-motion. And then keep practicing, doing it again." (LM-5).

Social Connectedness

Although participants reported that constant connection with others could be a driving source of stress, they also noted the importance of their smartphone for providing meaningful

connection with others and fostering a sense of community. The athletes distinguished the importance of genuine versus disingenuous connection, and reported that helpful and positive connection came from those they perceived to be genuinely interested in their well-being, development, and performance.

Parents were reported to be some of the most important, genuine connections for the athletes, particularly for those who lived away from home. In several cases, being able to remotely connect with a parent was essential to the athlete's preparation for an event, or for a debrief following it. As one athlete explained, "Sometimes I phone my mum. Sometimes quite a bit, depending on the competition and how stressed out I am. I appreciate phoning my mum or messaging her; it can just bring me back down to fairly steady" (XF-1). Another athlete commented, "Staying in contact is huge… Especially away games, when I walk out of the room, I'll take my phone out and usually I'll call my parents before getting on the bus" (LM-5). Furthermore, one athlete explained the positive way his social media fostered mass, remote communication and support from his family: "It's fun for my family to see. They look at the photos and they're like "Oh, cool! You did this!" (FM-3). Many athletes reported the necessity of their smartphones in fostering this connection to feel adequately supported in their sport pursuits.

The majority of athletes explained that they used smartphones to foster ongoing team communication: "Communication with the rest of the team, and the coaching staff, and everything – [the smartphone] is vital, and I say that truly understanding the meaning of the word vital tool for that" (RF-2). They also used their smartphones to enhance cohesion, fun, and a sense of community among their team members, as well as among other varsity athletes, and

athletes from the same sport across the nation. They described that this connection could occur through group chats, team apps, and social media posts.

Although the athletes reported mixed feelings related to social media presentations, they articulated an understanding of how social media posts could foster a sense of connection and community for athletes who don't play. One athlete commented on how social media allowed rookies and benched players to feel engaged and proud to be part of the team, even if they did not play: "[Rookies] might have played; maybe they didn't. But, they were dressed for the game, and they'll take a picture and post it after and say, "So happy to be a [name of team]!" It's good! It's good that you want to show that off, and you're proud, and you're still happy, even though you didn't play… Even if you didn't get picked, it doesn't mean you didn't help us get here" (RF-3).

A few athletes explained how positive presentations on social media could serve as a tool for athletes to derive positive gains from a difficult outcome: "But, we do that [positive social media posts] because we're trying to be positive. Our coach always says, 'It was a good meet! It was hard!' … People are just trying to be positive and hype it up a bit more" (SF-3). One athlete commented her fellow athletes will often use social media platforms to candidly share about losses and difficult performance outcomes, in order to seek support and connection from their sport community.

> Because it's such a small sport, people are constantly saying, "Oh I didn't perform, but this is why…". So often you'll see photos of, "Rough weekend of racing; didn't have my legs" … You know people are saying it to make themselves feel better, because [it] was a great race but you didn't like your results. (XF-3)

Discussion

The aim of this study was to explore varsity athletes' positive and negative smartphone experiences, with the intent of providing insight into how they are using their smartphones and how their usage is impacting their experience of being a varsity athlete. Results show that smartphones were highly used by the sample of varsity athletes, with 81% of them self-identifying as being moderate or heavy users, relying on their device throughout the day. Moreover, smartphones were largely used for social media, communication, and organization. This is congruent with characteristics of the general population, and particularly the iGen (Smith, 2015; Bentley et al., 2015). Furthermore, varsity athletes' experiences in sport were perceived to be influenced by their smartphone usage. Positive and negative implications of usage were shared by the athletes and will be addressed in the following three sections: (a) negative and positive smartphone usage, (b) continuum of smartphone usage, and (c) applied considerations.

Negative Usage

Athletes perceived their smartphones to be a source of stress when their phone was both available and unavailable to them. This is consistent with the literature that points to mobile phones causing increased stress, pressure, and overload particularly through constant access to information, connection, and demands (Thomée et al., 2010). Participants reported feelings of anxiety when separated from their smartphones, and several studies have shown that stress and anxiety can result from being separated from smartphones after only a short period of time, particularly within the iGen, and among heavy smartphone users (e.g., Thomée et al., 2010; Rosen et al., 2013; Cheever et al., 2014; Clayton et al., 2015). This could help explain the athletes' reports of constant checking behaviours at competition and practice. Clayton et al. (2015) have studied psychophysiological outcomes of smartphone separation, and found that

when participants were unable to answer their phone while performing another cognitive task, "heart rate and blood pressure increased, as well as feelings of anxiety and unpleasantness" (p. 123). If anxiety, psychological intensity, and physiological arousal are heightened by smartphone separation, it warrants keen attention from the sport community. Smartphone separation anxiety could inhibit optimal performance states by unnecessarily raising athletes' anxiety and arousal, particularly among those who are heavy users and have developed dependence on their phones (Cheever et al., 2014).

Specific feelings of being obligated to communicate with coaches and to positively represent the university online appear to be unique additional stressors for varsity athletes, which can be exacerbated by their constant connection to smartphones. These findings are in line with literature highlighting varsity athletes' perceived obligation to maintain a curated image online (David et al., 2018; Sanderson, 2018; Park et al., 2020). The athletes in this study experienced unique, sport-specific FOMO based on the stress of missing essential information from coaches or information that could potentially impact their sport performance or success (e.g., starting lines, different race times). Research indicates FOMO can drive increased social media and smartphone usage, thus compounding demands, incurring detriments to self-control, and influencing distracted and multitasking behaviors (Przybylski et al., 2013; Clayton et al., 2015). This added pressure from fear of missing essential sport information, could be influencing varsity athletes to use their phones more than they otherwise would. Additionally, researchers have proposed that habitual checking and fear of missing important information can lead to the development of problematic smartphone usage (Elhai et al., 2017; 2019). This suggests that through added demands and obligations in the varsity sport context, athletes may face unique, additional risk factors for problematic smartphone usage.

Smartphones were also a distraction for participants, leading to absent-minded usage among the athletes, particularly before bed and in 'waiting times'. This aligns with literature pointing to smartphones (and accompanying features) as catalysts of internal and external distraction, absent-minded usage, inattention, sleep disruption, and media multitasking, which can be debilitative to performance and well-being (e.g., Thomée et al., 2010; Clayton et al., 2015; Stothart et al., 2015; Carrier et al., 2018; Marty-Dugas et al., 2018). Results also show that in the sport context, some athletes sporadically put energy and attention toward negotiating the importance of smartphone checking and notifications. Stothart et al. (2015) found that just the receipt of a phone notification can be detrimental to attention and performance, likely by influencing task-irrelevant thoughts. Further, Ward et al. (2017) argue that cognitive capacity can be depleted by the presence of a smartphone, even when people control their attention and are not consciously tempted to check their phones. This suggests that the cognitive capacity of athletes could be at risk, even if they are actively choosing not to engage with their phones. This is also salient because smartphone and social media usage prior to competition and training has been found to incur concentration disruption and inhibited decision-making in athletes (Encel et al., 2017; Fortes et al., 2019). It appears that if unmanaged, internal and external smartphone distraction has the potential to be cognitively depleting, and disruptive to athletes' concentration and performance (Encel et al., 2017; Fortes et al., 2019).

Notably, athletes did not report experiences of smartphone distraction within their own sport performances (e.g., when running on the track, swimming in the pool, or playing on the field). This is likely because in active training and competition situations, athletes are naturally. physically separated from their smartphones, a characteristic of the sport setting that was highlighted by participants. Ward et al. (2017) have shown that those with full separation from

their smartphone had better cognitive task performance, even compared to those who had their smartphone on their desk or in their bag on 'silent'. These findings suggest that distraction may be further influenced by the vicinity or 'salience' of the smartphone (Ward et al., 2017). Sport may well provide a unique arena where smartphone distraction could be managed by the natural separation of athletes from their phones. However, in order to fully benefit from this, athletes would need to train and utilize strategies to maintain task-focus and reduce smartphone dependence, including anticipation of notifications or future usage (Clayton et al., 2015; Stothart et al., 2015; Ward et al., 2017).

Results also point to smartphones as a source of disengagement in the sport context. Athletes reported that the disengaged behaviour of friends, family, coaches, and teammates, due to their use of smartphones during training and competitions (i.e., not being present or attentive to the situation at hand and concentrating on one's phone instead), caused detriments to athletes' sense of team cohesion and support. In line with this, research suggests that smartphones are influencing interference and disengagement in social situations (Chotpitayasunondh and Douglas, 2016; McDaniel and Coyne, 2016). Interestingly, research has shown that FOMO and lack of self-control—two characteristics that emerged from our results—may be predictive of smartphone addiction and lead to preoccupation with smartphones instead of attending to the present social situation (Chotpitayasunondh and Douglas, 2016). Some athletes commented that self-control is lacking among their teammates, and a few blamed the disengagement and diminished performance of rookie players on smartphone usage. It seems that the athletes' perceptions may be founded, as studies have uncovered that those who use their phones more exhibit poorer self-control and efficiency, more impulsive decision making, less analytical thinking, and inattention (Abramson et al., 2009; Marty-Dugas et al., 2018). Strengthening self-

control, self-confidence and self-determination (to reduce fear), and attentional control may be important strategies to improve athlete engagement.

Positive Usage

Aside from negative implications of usage, results point to the benefit of using smartphones to build team cohesion, as well as a sense of community and support, particularly through ongoing connection with peers and family. This is in line with literature that points to young people using a variety of smartphone applications for relationship building, connection, social interaction, and coordination (Gardner and Davis, 2014; Bentley et al., 2015). Connection was particularly important to the varsity athletes, who found themselves at a distance from their team and core social supports (e.g., when on the road, not playing due to injury, or being benched as a rookie athlete). This is congruent with Frison and Eggermont's (2015) assertion that social media is an important means of social and emotional support among young people, specifically when the needs of the support seekers are adequately met by the support network. Furthermore, Wright (2012) found that emotional support through Facebook predicted lower perceived stress among college students, suggesting that social media support among athletes could also have a positive buffering effect on their perceptions of daily stressors. This may be particularly relevant for varsity athletes, as Wright (2012) determined that homophily (i.e., similar attitudes and backgrounds) among users increased their perceptions of support through social media. The results from our study show that social media may provide a unique space for athletes to debrief, reframe, and seek support following difficult sport events and outcomes. Taken together, the use of smartphones and social media for connection, community-building, and social support among varsity athletes could foster opportunities for enhanced well-being, and

help to mitigate pitfalls of varsity athletics such as increased stress and isolation (Dubuc-Charbonneau and Durand-Bush, 2015).

Another positive outcome of smartphone usage was augmented capacity to self-regulate in the face of multiple demands and contexts (e.g., sport, school, personal life). This is in line with other literature highlighting the multi-faceted use of smartphones among young people (Gardner and Davis, 2014; Bentley et al., 2015; Smith, 2015). The athletes' smartphones supported the optimization of self-regulated learning processes, particularly planning, self-reflection, and self-presentation in the sport setting. This is not surprising given that a number of interventions in health settings have shown the benefits of smartphones as self-regulatory tools for self-monitoring, goal setting, and self-reflection (e.g., Quelly et al., 2016). A great deal of literature has focused on the detriments of smartphone usage, but much less has focused on the potential of smartphones to support self-regulatory learning processes, which are essential components of athlete functioning, development, and performance (Cleary and Zimmerman, 2001; Dubuc-Charbonneau and Durand-Bush, 2015). The varsity athletes in this study found their smartphones to be essential tools to fulfill multiple roles and responsibilities. In this sense, self-regulatory smartphone usage could act as a buffer to the unique demands of being a student-athlete by supporting self-regulation within and outside of the sport context.

Continuum of Usage

Results of this study suggest that a complicated, paradoxical relationship exists between athletes and their smartphones. While all athletes felt that their smartphones were essential tools, they identified a dichotomous or 'torn' feeling about their usage that was heavily dependent on context, purpose, and time of usage. For example, smartphones may have been helpful for self-regulation, but they concurrently interfered with self-control and cognitive capacity. The devices

also fostered community building and social support, but equally led to distraction and disengagement, inhibiting team cohesion and perceptions of support. Equally, smartphones may have given student-athletes a sense of control over the multiple demands they faced (e.g., sport, school, personal life), all the while fostering stress, FOMO, and a sense of obligation. While there are both positive and negative implications of smartphone usage for varsity athletes, these implications may exist along a continuum, rather than within succinct, polarized categories. Although the athletes shared common experiences and perspectives of smartphone usage, their personal preferences, habits, and outcomes of usage were nuanced and idiosyncratic across contexts and situations. Similarly, Chan and colleagues (2015) reported a dichotomy in the lived experiences of students' smartphone usage for learning purposes. The authors also introduced the notion of a continuum of "serendipitous and purposive" mobile learning, shaped by time and intent of usage (p. 101). A similar continuum appears to be applicable to this cohort of varsity athletes, pointing to helpful and unhelpful aspects of usage that fluidly coexist. According to student-athletes in this study, context of usage is another important dimension to consider within this continuum of usage. A few other studies examining how social media and smartphone usage impact well-being underscore similar convoluted areas (e.g., Best et al., 2014; Ryan et al., 2017; Elhai et al., 2019; Ellis, 2019). This suggests that the use of smartphones should not categorically be deemed as good or bad. Instead, these devices offer a double-edged value for varsity athletes that is highly dependent on time, purpose, and context of usage.

Applied Considerations

It is clear that varsity athletes use their smartphones to manage roles and demands across multiple contexts (e.g., sport, school, home), and so, simply focusing on the negative implications of usage does not acknowledge the full range of athletes' interactions with their

phones. Building on this, and in line with Durand-Bush and DesClouds' (2018) suggestions for smartphone usage in the sport context, it is recommended that sport psychology practitioners, coaches, and athletes avoid a one-size-fits-all approach to smartphone rules and regulations. Instead, athlete autonomy and accountability for smartphone usage should be promoted through consistent, open dialogue about how smartphones can help and hinder sport performance and experiences. These discussions can inform the creation of individualized guidelines for smartphone usage that carefully consider the context (e.g., training, competition, school, home), purpose (e.g., planning, self-presentation, entertainment), time (e.g., morning of competition, bedtime) of usage, as well as individual goals, needs, preferences, and self-regulation skills. Through such guidelines, the benefits of smartphone technology (e.g., to support self-regulated learning) could be carefully leveraged, and restrictions could be put in place in areas where phones tend to have a negative impact.

Results of this study show that athletes had a high level of self-awareness and were deeply in tune with the various facilitative and debilitative implications of their smartphone usage, as well as their internal dialogue cautioning them about their media habits. However, they appeared to lack self-control in certain situations. In line with research showing young user's acute awareness of usage, and inclination to use their phone in unscheduled times (e.g., between tasks, when bored, and while waiting; Bentley et al., 2015), the athletes in this study reported using their phones when bored, procrastinating, and between tasks. The athletes specified engaging in passive, absent-minded usage during these times, arguably leading to attentional deficits and cognitive depletion. Research is pointing to mindfulness, meta-cognition, and self-regulation as positive coping strategies to mitigate the negative effects of smartphone usage (Carrier et al., 2015; Bauer et al., 2017). Sport psychology practitioners are uniquely positioned

to help athletes and coaches develop such skills and gain insight into the effects of passive (absent-minded) versus active (purposeful) usage. Establishing mindful, purpose-driven smartphone usage plans to optimize performance and well-being appears to be a worthwhile endeavor when working with varsity athletes. Furthermore, given that many varsity sport departments now have policies regarding the use of social media, it would be important to inform them of relevant research findings to support and adapt their policies to optimize both social media and smartphone usage.

Strengths, Limitations and Future Research

There is a paucity of studies on the impact of athletes' smartphone usage. While this study is the first to explore smartphone usage within the context of Canadian varsity sport, it is time-limited by rapidly evolving technology and literature. The sample is limited both in terms of the number of participants and the contexts from which athletes were recruited. It is possible that some athletes' perspectives (e.g., across different sports, genders, and years of eligibility) were not represented in the focus groups. Consequently, broad generalizations should not be made. Nonetheless, the results of this study give insight into the complex and nuanced experiences that varsity athletes may have with their smartphones. It is clear that there are both benefits and drawbacks from using these devices in and around the sport context, leading athletes to perceive a complex relationship with their smartphones. This manuscript constitutes a first step in research on the impact of smartphone usage in athletes' lives, and can inform a breadth of future studies in this area. This study also provides a foundation for the development of evidence-based guidelines for smartphone usage in sport, which consider the full range of helpful and unhelpful uses of this technology.

Findings can inform future research in a number of ways. For example, studies should aim to investigate the longitudinal impact of smartphone usage on athletes, considering variables such as time, purpose, and context of usage. Researchers should also examine specific characteristics (e.g., frequency and types of features being used on the smartphone) and outcomes of usage, including sport performance and well-being. Moreover, social media was a prevalent feature of the athletes' smartphone experiences, used for sport-specific purposes such as self-monitoring, reflection, comparisons, and self-presentation. As such, research should continue to explore the role of social media in athletes' lives, including the role of social media within the self-regulatory processes of athletes. Given the dichotomous findings regarding self-regulation and self-control, scholars should look at the interplay between smartphone usage and these variables. Finally, studies should focus on the potential of smartphones to foster self-regulatory learning in the sport context, to better understand whether and how purpose-driven usage might enhance sport learning, performance, and overall mental health.

Conclusion

Smartphones are powerful, omnipresent devices capable of generating both negative and positive experiences in the sport context. Negative implications of usage in this study included stress, distraction, and disengagement, while positive influences involved self-regulation and social connectedness. Smartphones concurrently offer challenges and opportunities for varsity athletes, underscoring the importance of effective self-regulation and self-control to leverage the benefits and mitigate the risks of these devices. Athletes' relationship with their smartphone is complicated and nuanced, suggesting that usage is best viewed on a continuum, rather than through two polarized ends. Time, purpose, and context of usage are important variables to consider when exploring the impact of smartphones on varsity athletes.

Data Availability Statement

The datasets generated for this article are not readily available because approval from the Research Ethics Board is required in order to release any data from this project. Requests to access the datasets should be directed to Poppy DesClouds, [email address].

Ethics Statement

The studies involving human participants were reviewed and approved by The Health Sciences and Science Research Ethics Board, Office of Research Ethics and Integrity, University of Ottawa. The patients/participants provided their written informed consent to participate in this study.

Author Contributions

PD conceived and carried out the research project in consultation with ND-B, and wrote the manuscript. ND-B supervised the project, provided critical feedback, and edited the manuscript. All authors contributed to the article and approved the submitted version.

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Article 3: What's trending? An in vivo examination of smartphone usage among student-athletes

DesClouds, P., Durand-Bush, N., Del Bel, M., Laamarti, F., Young, B. W., & El Saddik, A. (2022). What's trending? An in vivo examination of smartphone usage among student-athletes. *Journal for the Study of Sports and Athletes in Education.*

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Abstract

This exploratory study is the first to present an in vivo method to capture rich, longitudinal data on the prevalence and features of student-athletes' smartphone usage and concurrent psychosocial outcomes. Ten competitive Canadian student-athletes were meticulously tracked through the collection of monthly self-report surveys and real-time smartphone usage data over the course of a full academic year. Half of them exhibited heavy while the other half exhibited light usage trends. The athletes predominantly used their smartphone for social media. Changes in their moderate-to-high level of psychosocial functioning was highly nuanced over time, similar to their amount of usage. Findings support a new wave of literature deemphasizing a simple relationship between smartphone usage and negative psychosocial outcomes, and encourage further study of individual characteristics, such as purpose of usage. This research lays the foundation for larger-scale studies to assess the impact of student-athletes' smartphone usage.

Keywords: sport psychology, smartphones, social media, mobile technology, self-regulation, student-athletes, longitudinal design, ecological validity

Introduction

In 2019, Time magazine published a story about Texas Tech Red Raiders making an unexpected comeback to advance to the NCAA men's Final Four. The article attributed the team's success to a decision to ban smartphones (Gregory, 2019). The piece mirrors a current media and research trend showcasing negative implications of smartphone usage (Ellis, 2019), particularly for mental health (i.e., wellbeing), attention, and performance. Despite active media attention, very little research has focused on the smartphone usage trends and behaviors of athletes. The empirical foundation for decisions around the use of smartphones in the sport context is scarce, even though student-athletes have clearly not been exempted from the influx of smartphone technology.

There is a clear deficit of studies examining usage data in vivo (i.e., actual real time or real-world usage), as researchers continue to rely on retrospective self-report estimates from participants (Ellis, 2019). Self-reports are uniquely problematic in this context of study because the quick, sporadic, multifaceted, habitual, and automatic usage inherent to smartphones (Bentley et al., 2015; Deng et al., 2019) makes it near impossible for participants to reliably recount smartphone usage over the course of a day, let alone a week or several months (Ellis, 2019). In vivo research can rectify the pitfalls of self-report studies by capturing the fine details of usage which can be easily overlooked, forgotten, and over or under-estimated in the latter type of research. Real-world usage patterns of athletes have likely been neglected because the labor intensity involved in creating an ecologically valid research tracking method is enormous. Further, no longitudinal studies have examined usage trends and changes in student-athletes over time, which is particularly important in seasonally-driven contexts like sport and academia. The current study aimed to fulfill these important gaps in the literature.

Characteristics and Impact of Smartphone Usage

The iGen (also known as Gen Z, born in the 1990s) has been of particular research interest, as it encompasses a cohort who has grown up in a digital environment with mobile access to the internet (Rosen, 2011; Twenge et al., 2018). In Canada, the majority of this demographic owns a smartphone (98% of 15–24-year-olds; Statistics Canada, 2019). This cohort is marked by extensive media consumption, media multitasking, and digital distraction (Rosen, 2011), as well as highly sporadic and fragmented usage throughout the day, predominantly for social media purposes (Bentley et al., 2015; Deng et al., 2019; Smith, 2015; Twenge et al., 2018). Many Canadian competitive student-athletes are situated within the iGen demographic. The use of smartphones within this cohort requires attention because student-athletes must consistently perform at a high-level, under significant stress and pressure (Humphrey et al., 2013; Neal et al., 2013). They rely on well-refined psychosocial skills to meet complex and conflicting demands related to academic and sport performance, social life, well-being, and family obligations (Foster & Chow, 2020; Humphrey et al., 2013). Smartphones have the potential to augment the benefits (e.g., communication, cohesion, identity formation, self-regulation) and exacerbate the drawbacks (e.g., complex identity management, added stress and pressure, feelings of isolation) of being a student-athlete (DesClouds & Durand-Bush, 2021). Table 1 provides an executive summary of the psychosocial variables of interest in the current study that have implications for the contexts of sport and smartphone usage. Altogether, the studies show that self-regulation, mental health, stress, social connectedness, mindfulness, attention, and perfectionistic self-presentation can facilitate or impede performance and well-being in the sport context. The table also underscores that the smartphone—as an ever-present

source of demand and connection—may enhance or hinder the psychosocial variables that are imperative to student-athletes' optimal performance experiences and well-being.

Smartphones and Athletes

Empirical evidence regarding athlete smartphone use is accruing, although the literature is limited compared to that found in other domains. Greco et al. (2017) suggested that smartphone usage among young football players could induce mental fatigue and negatively impact sport performance. However, their experimental study did not closely mirror the real-world smartphone usage habits of young athletes. Similarly, Fortes et al. (2019, 2020) suggested that just 30 minutes of social media exposure via smartphone prior to sport performance can lead to a cognitive load and inhibit optimal decision making. In terms of the impact of social media on sport performance, Encel et al. (2017) found that accessing Facebook both prior to and at sport competitions was significantly associated with concentration disruption in athletes. Additionally, Jones et al. (2019) analyzed publicly available game statistics and uncovered an association between late-night tweeting and diminished next-day game performance among professional NBA players. Contrary to this finding, the removal of electronic devices before bed among a cohort of elite judo athletes led to no significant difference in sleep or next day performance (Dunican et al., 2017), pointing to potential individual differences in usage behaviors. Other research has suggested that perceived smartphone usage was a relevant stressor among NCAA athletes, potentially causing detriments to their sleep and mental health (Schaefer, 2018).

Regarding athletes' use of social media – including self-presentation and sharing behaviors – researchers have uncovered both negative and positive uses and interactions afforded

Table 1.

Psychosocial Variables Relevant to Athletes and Smartphone Usage

Psychosocial Variable	Relevance to Athlete Performance/Well-being	Relevance to Smartphone Usage
Self-Regulation (SR) *Purposeful control and management of thoughts, feelings, and actions in the interest of achieving a goal (Bauer & Baumeister, 2010; Zimmerman, 2000)*	• SR supports learning and performance in sport (Cleary & Zimmerman, 2001), and psychosocial functioning of athletes (Dubuc-Charbonneau & Durand-Bush, 2015) • Self-control is required for motor control, emotional regulation, and persistence in sport training and competition (Englert, 2016)	• SR can buffer negative effects of media multitasking, goal conflict, and mindless usage (Hofmann et al., 2017; Khang et al., 2013; Szumowska et al., 2018) • Smartphone usage can support SR learning processes and skills (e.g., Quelly et al., 2016; Zheng et al., 2018). • Media multitasking, often afforded by smartphone usage, is related to executive function, self-monitoring, planning, and self-control limitations (Carrier et al., 2015; Magen, 2017)
Mental Health *A state of psychological, social, and emotional well-being, contributing to positive and productive functioning in life (Keyes, 2002)*	• Complex and excessive demands can compromise athletes' well-being (Gould & Whitley, 2009; Van Slingerland et al., 2018; 2019) • Performance and functioning can be impacted by athletes' mental health (Van Slingerland et al., 2019)	• There are both positive and negative relationships between smartphone usage and mental health (Best et al., 2014). • Adolescents' use of digital media can negatively impact psychological well-being (e.g., Boers et al., 2019; Twenge & Campbell, 2018) • Negative implications of smartphone usage on well-being are nuanced (Coyne et al., 2020; Ellis, 2019; Odgers & Jensen, 2020; Orben & Przybylski, 2019) • Smartphone features can support mental health interventions and gratify mental health needs (Ellis, 2019)
Stress *Mental, emotional, or physical strain that arises when one's perceived demands outweigh available coping resources (Cohen et al.,1983; Uldry & Andersen, 2008)*	• Unmanaged stress can negatively impact athletes' performance, well-being, and mental health (Dubuc-Charbonneau & Durand-Bush, 2015; Gould & Whitley, 2009; Van Slingerland et al., 2018)	• Smartphone usage can contribute to fear of missing out, personal and social stress, as well as anticipatory, separation, state, and somatic anxiety (Clayton et al., 2015; David et al., 2018) • High perceived stress is related to higher smartphone usage (Dissing et al., 2019; Vahedi & Saiphoo, 2018)

Psychosocial Variable	Relevance to Athlete Performance/Well-being	Relevance to Smartphone Usage
Social Connectedness (SC) *Interpersonal closeness derived from belonging to and engaging with a close, cohesive network (Lee & Robbins, 1995)*	• Perceived social support can enhance performance, coping, motivation, and well-being (Rees & Hardy, 2000) • Relatedness is a basic psychological need affecting athletes' motivation and well-being (Ryan & Deci, 2017)	• Smartphone features can facilitate and improve SC, sense of belonging, and support (Best et al., 2014; Wright, 2012). • Non-social features (e.g., passively scrolling through social media) of smartphone usage may be most detrimental to psychosocial functioning (Elhai et al., 2019) • Athletes use smartphones to foster SC (David et al., 2018; DesClouds & Durand-Bush, 2021) • Those high in loneliness may be at risk of smartphone reliance and problematic smartphone usage (Kim, 2017)
Mindfulness & Attention *Purposeful and present regulation of attention and a non-judgmental approach to one's experience (Feldman et al., 2007)*	• Mindfulness interventions in sport have benefitted athletes through improved flow, mindfulness, and regulation (Noetel et al., 2019) • Attentional capacity and selectivity are imperative to optimal sport performance (Perry, 2005)	• Smartphone usage can disrupt attention, cognitive capacity, and working memory (Marty-Dugas et al., 2018; Stothart et al., 2015; Ward et al., 2017) • Metacognition and mindfulness strategies can help task performance, executive function, and well-being with using digital technology (Bauer et al., 2017; Carrier et al., 2015)
Perfectionistic Self-Presentation (PSP) *Maladaptive interpersonal expression of flawlessness (Flett & Hewitt, 2005; 2014)*	• PSP is associated with negative mental health and performance outcomes (Flett & Hewitt, 2005; 2014; Hewitt et al., 2003) • Athletes high in PSP may be skilled at hiding psychological pain, and at increased risk of harm to physical and mental health (Flett & Hewitt, 2014) • Smartphones provide space to control self-monitoring and self-presentation in purposeful and personal ways (Smith & Sanderson, 2015)	• PSP can be facilitated and exacerbated by social media usage (Hellmann, 2016)

Note. Studies related to social media usage are included, as smartphone usage among the iGen is largely for social media purposes.

by various platforms (e.g., Browning & Sanderson, 2012; David et al., 2018; Dunn et al., 2021; Ehrlén & Villi, 2020; Gorrell, 2018; Sanderson & Hull, 2015; Sanderson & Truax, 2014). For example, David et al. (2018) studied the psychological impact of Twitter usage among NCAA athletes and found that while it could increase perceptions of team cohesion, usage could also lead to anticipatory anxiety as well as decreased concentration and confidence. Similarly, Gorrell (2018) uncovered that social media usage could hinder the self-efficacy of combat athletes, however, this was largely dependent on the individual and the nature of their usage. These findings parallel those of DesClouds and Durand-Bush (2021), who qualitatively examined negative (e.g., stress, distraction) and positive (e.g., self-regulation, social connectedness) implications of smartphone usage among Canadian varsity athletes. The authors suggested that smartphone usage may be better considered along a continuum of facilitative to debilitative usage that largely depends on the context and purpose of use.

The pilot study conducted for the current project equally demonstrated that smartphone usage among student-athletes is not straightforward (DesClouds et al., 2018), as it can help and hinder athletes' abilities to manage demands in and around their sport environment. This study served to test a novel mobile research application (app) and, to our knowledge, it was the first to examine objective, real-world smartphone usage data among student-athletes. The five cases in the pilot study showed significant smartphone usage (an average of 4.5 hours per day) over a 15-day period and a proclivity for the use of social media apps (DesClouds et al., 2018). However, the pilot sample was small and the duration of the study was brief. More research is required to examine the prevalence and variability of smartphone usage over time, and to more deeply explore the psychosocial profiles of student-athletes in conjunction with their usage behaviors.

Purpose and Rationale

This study was undertaken because there is reason to believe that psychosocial variables essential to athletes' optimal performance experiences and well-being are impacted by smartphone usage (David et al., 2018; DesClouds & Durand-Bush, 2021; Encel et al., 2017; Fortes et al., 2019; 2020). Athletes are using smartphones, yet empirical evidence regarding their usage prevalence and trends is non-existent. In sum, there is a gap in knowledge surrounding athlete smartphone usage, as well as the relationship between athletes' smartphone usage behaviors and psychosocial variables that are essential to their sport experiences and well-being, and how these relationships might change over time. Thus, the overall purpose of this study was to begin filling these gaps by creating a novel data capture system that could be used, in vivo imbedded within the smartphone itself – to collect complex, longitudinal smartphone usage and psychosocial data from a sample of student-athletes. This was deemed necessary to advance research, which has been limited by self-report and cross-sectional methodological approaches. While the study did incorporate self-reported psychosocial data, the approach mirrored an Experience Sampling Method – to create a self-reported "archival file of daily experience" (Larson & Csikszentmihalyi, 2014, p. 21) – whereby self-report questionnaires were considered in concert with in an ecologically valid real-time tracking method to generate rich data and answer the following research questions.

Research Questions and Hypotheses

- **Research Question (RQ) 1**: **Prevalence -** What is the prevalence of smartphone usage among student-athletes and are there differences in usage within the sample? Our hypothesis was that smartphone usage would be prevalent and multifaceted among the athletes across three seasonal periods, mirroring that of the general population (Deloitte,

2019; Smith, 2015; Statistics Canada, 2019), and there would be distinguishable heavy and light user groups (Deng et al., 2019).

- **RQ2**: **Features -** What are the main features of usage within this sample? (i.e., When do athletes use their phones most? Which apps do they use most often?) Our hypothesis was that the greatest proportion of athletes' usage would take place in the afternoon and evening, particularly just prior to bed (i.e., Andrews et al., 2015; Bentley et al., 2015; Statistics Canada, 2019), and the most used apps among athletes would be social media (Browning & Sanderson, 2012; Smith, 2015).
- **RQ3**: **Profiles -** How do psychosocial profiles differ among those who are heavier and lighter users within this cohort of student-athletes? Our hypothesis was that heavy users would have lower mindfulness and self-regulation scores (Carrier et al., 2015; Magen, 2017), as well as higher perceived stress (Dissing et al., 2019; Vahedi & Saiphoo, 2018) and loneliness scores (Kim, 2017). Moreover, those with higher social media usage would report higher perfectionistic self-presentation (Hellmann, 2016). We expected the relationship between smartphone usage and mental health to be highly variable (Coyne et al., 2020; Orben & Przybylski, 2019).
- **RQ4**: **Impact –** Over time, how might smartphone usage be associated with athletes' self-reported psychosocial and sport experience outcomes? Our hypothesis was that, similar to varying usage across seasons, there would be both favourable and unfavourable seasonal changes in athletes' psychosocial and sport experience outcomes (DesClouds & Durand-Bush, 2021).

Method

Exploratory studies in the social sciences are used to explore novel topics, produce new ideas and hypothesis related to an existing topic, use methods that pose challenges and risks, and/or to look at a phenomenon more in-depth (Swedberg, 2020). The current study can be characterized as exploratory as it served to investigate a novel topic, develop new ideas and questions for future research, and employ a challenging research method. Previous studies on athlete smartphone usage have focused on controlled environments and we endeavored to take a risk and conduct the research in a real-world setting. We aimed to advance knowledge using data that would allow us to uncover the intricacies of usage and the unique psychosocial profiles of athletes involved. As is the case with exploratory research, results are considered tentative and additional studies are warranted before more definite conclusions can be drawn (Swedberg, 2020).

Participants

Participants were recruited from across Canada using a purposive sampling technique (Patton, 2002) and a social media strategy. The research team shared a study infographic on Twitter, Instagram, and Facebook, which included basic study information and the research team's contact information. The infographic was then shared publicly by colleagues, friends, sport service departments, and sport organizations, and re-shared by any additional interested parties. Additionally, informational emails were sent to sport services departments and distributed to coaches and athletes at the department's direction. Snowball sampling also occurred through word-of-mouth. Interested participants emailed the lead researcher, who screened for eligibility. To participate, athletes had to (a) be a competitive student-athlete in Canada, (b) own a smartphone equipped with Google's Android operating system, and (c) be 13

years of age or older, representing entry into high school and the "train to train" stage of the long-term athlete development framework when increased commitment to sport performance, sport specialization, and heightened competition intensity begin (MacNeill et al., 2014). Participants meeting eligibility were sent a link to download the research app to their smartphone. An attempt was made to recruit a wide range of competitive athletes with varying ages, sexes, competitive levels, and contexts.

Final Sample Selection

Participants who were included in the final sample were required to meet strict inclusion criteria. These criteria ensured that purposeful selection would not impede the ecological validity of participants' usage behaviors. Each participant had to display: (a) a minimum of three consecutive months of tracked usage data (illustrating that they had not closed the application and periodically "left" the study), (b) a minimum of five months of tracked usage data across the academic year, and (c) psychosocial survey response data at a minimum of three different time points, pertaining to at least two of the three seasons (i.e. fall, winter, summer) spanning the academic year. With respect to the latter criterion, this ensured that the study could be categorized as longitudinal. A total of ten (n = 10) participants met these criteria.

The 10 participants included five male (n = 5) and five female (n = 5) athletes from 10 different competitive sports (i.e. lacrosse, Nordic ski, ultimate frisbee, swimming, volleyball, rowing, curling, football, track and field, CrossFit). The mean age of participants was 20.2 years (min = 16, max = 24). All participants were competitive student-athletes, either part of a sport-specialized high school or CEGEP college program (n = 3), or they were a varsity or competitive club athlete attending a Canadian university (n = 7).

Data Collection

To carry out this project, sport psychology and computer science researchers collaborated to create a novel mobile app that could track the "real-life" smartphone usage patterns of participants, while also collecting self-report survey data on a monthly basis (see DesClouds et al. (2018) for an in-depth description). Upon their first log-in to the app, participants were prompted to provide consent (using the form approved by the university ethics review board at the host institution) and create a personalized account for the study using a study ID and personal password. Participants were then asked to complete a one-time demographic questionnaire, after which, automatic tracking of smartphone usage commenced. At this first timepoint, athletes were also prompted to complete the self-report survey via the research application, and were subsequently notified to complete it once per month throughout the study. In order to reduce participant burden, and to collect data at varying monthly timepoints, the app made the self-report survey available from the 15th to the 30th of each month and participants could submit the survey in sections throughout the two-week period. The participants received two push notifications, reminding them to complete the survey before closure each month. They were able to begin the study at any point over the course of the academic year and encouraged to complete a full eight months of participation, with the opportunity to complete extra months before study closure.

Measures

Smartphone Usage Data

The mobile app captured objective smartphone usage data in real time (i.e., every moment of the day). With participant privacy as a foremost concern, the research application did not track any content within apps and only the time of usage, duration of usage, and name of the

application used. For the purposes of this study, smartphone usage pertained to the duration of usage, which included any time the phone was unlocked and a participant interacted with an app (whether actively or passively).

Survey

The mobile survey included demographic questions (completed at the first time point only) and a series of psychosocial and sport experience measures described below.

Demographics. This component of the survey included basic demographic (e.g., age, sex, ethnicity), academic (e.g., institution, time spent studying, major stressors), employment (e.g., time spent working), sport (e.g., sport type, time spent training), smartphone usage (e.g., imposed time restrictions, contexts), and health (e.g., concussion history, mental illness diagnosis) information.

Psychosocial measures. The following scales were included in the self-report survey to measure the psychosocial profiles of participants. Some scales were modified to limit the number of items to reduce participant burden.

- **Self-Regulation**: The Self-Regulation for the Enhancement of Performance and Well-Being Scale (SEWP-S) is a novel 16-item measure of self-regulation capacity for performance and well-being, informed by Zimmerman's (2000) model of Self-Regulated Learning. It evaluates three subscales of self-regulation: preparation, performance, and evaluation, using a five-point Likert scale ranging from *strongly agree* to *strongly disagree*. A Cronbach's alpha value of 0.712 indicated acceptable internal consistency for this scale (Tavakol & Dennick, 2011).
- **Mindfulness and Attention:** The Cognitive and Affective Mindfulness Scale-Revised (CAMS-R) is a 12-item measure of mindfulness used to evaluate four domains: attention,

present-focus, awareness, and acceptance, using a four-point Likert scale ranging from *rarely/not at all* to *almost always*. The CAMS-R shows convergent and discriminant validity and has been replicated in student, community, and clinical samples (Feldman et al., 2007). For the purposes of this study, one additional item was added to the CAMS-R ("I pay attention to sensations in my body") to assess participants' attention to physical sensations, which are important in sport.

- **Mental Health:** The Mental Health Continuum-Short Form (MHC-SF) is a 14-item self-report measure used to assess mental health. It includes three subscales of emotional, psychological, and social well-being and respondents can be categorized as having flourishing, languishing, or moderate mental health. The MHC-SF is a psychometrically sound assessment tool (Lamers et al., 2011).
- **Stress:** The Perceived Stress Scale (PSS) is a 14-item measure of global perceived stress designed to assess the degree to which individuals appraise their situation as stressful. The measure employs a 5-point Likert scale ranging from *never* to *very often*. The PSS is both valid and reliable in community samples (Cohen et al., 1983). To reduce participant burden, the scale was reduced from 14 to 10 items.
- **Loneliness and Social Connectedness:** The 6-Item De Jong Gierveld Loneliness Scale comprises two subscales assessing emotional loneliness and social loneliness. It uses a five-point Likert scale ranging from *yes* to *no* and has been shown to be psychometrically sound (De Jong Gierveld & van Tilburg, 2006).
- **Perfectionistic Self-Presentation:** The 27-item Perfectionistic Self-Presentation Scale (PSPS) measures striving to either present perfection or avoid presenting imperfections. It is used to evaluate three sub-scales: perfectionistic self-promotion, nondisclosure of

imperfection, and nondisplay of imperfection, using a seven-point Likert scale ranging from *strongly disagree* to *strongly agree*. The PSPS has demonstrated acceptable psychometric properties (Hewitt et al., 2003). To reduce participant burden, the scale was reduced from 27 to 11 items (three nondisclosure items, four nondisplay items, and four self-promotion items).

Sport experiences. Sport experiences were assessed via a 7-day recall questionnaire that was developed specifically for this study, as no scales meeting the project's needs were available. Participants rated their participation in sport activities, judging their own sport development (i.e., the extent to which they learned and stretched limits in training and/or competition), success (i.e., accomplishment in training and/or competitive activities), and sport satisfaction (i.e., self-satisfaction in ability to perform training and/or competitive activities) each using a three-point Likert scale anchored at *extremely*, *moderately*, and *not at all*.

Perception of smartphone usage. Two additional questions assessed participants' perceived helpfulness and unhelpfulness of their smartphone usage (e.g., Over the last month, to what extent has your smartphone usage been helpful to you?), each using an 8-point Likert scale ranging from *not at all* to *extremely*.

Data Analysis

Due to the novelty of this research and limited sample size, descriptive statistics were prioritized. A variety of methods were used to capture the richness and complementarity of the data to best answer the research questions. Visual representations delineating each individual participant were given priority in order to highlight trends and changes in individual experience over time. Descriptive matrixes and charts were created to depict relationships and make inferences to inform future research and professional practice. Data were examined both within

and across three seasonal periods: fall (September-December), winter (January-April), and summer (May-August), which mirrored the semester-based and school-break calendar followed by the majority of participants.

Prevalence and Features of Usage (RQ1 and RQ2)

Basic descriptive statistics (e.g., means, medians, ranges, and standard deviations) were examined as a whole and for specific subgroups (e.g., amount of usage, age, sex, season, type of sport) in order to uncover any group differences in usage and features of usage among the cohort (e.g., time of day of usage, apps used). Independent sample *t*-tests were performed to confirm any significant differences among male and female athletes, as well as heavy and light user groups each season. Additionally, an ANOVA was performed to determine whether a significant seasonal difference in usage could be observed among participants (Field, 2013).

Profiles and Impact (RQ3 and RQ4)

The athletes' mean scores for each scale within the three seasonal periods were calculated, providing a total score for each psychosocial variable during each of the three seasons (fall, winter, and summer). A heat map was created to display the psychosocial profiles of all users within this study, relative to one another as well as across the heavy versus light user groups. Heat maps are visual representations of data matrices that use a color-coding system to provide macro and micro views of data and draw attention to areas of pertinence (Wilkinson & Friendly, 2009). They have been used in previous smartphone research to illustrate usage data (e.g., Bentley et al., 2015; Böhmer et al., 2011). The green (favorable) to red (unfavorable) color-conditions of the heat map were derived from the minimum and maximum scores among all ten participants on each scale. The participants and scores were arranged individually and seasonally, as well as based on the heavy and light user groups. This allowed us to visualize

nuanced trends and changes over time, as well as possible associations within the cohort and for each individual. The brightest green indicates the maximally favorable psychosocial score on the particular scale within the cohort, and the brightest red indicates the maximally unfavorable score on that scale within the cohort. All gradients from red to green indicate movement between these extremes. Movement from green to red is indicative of an unfavorable change, while a change from red to green is indicative of a favorable change. Favorability is based on the commonly known functional impact of each variable (e.g., a decrease in mental health is regarded as unfavorable, while a decrease in stress is regarded as favorable). To further underline possible associations and trends over time, we calculated the standard deviation for each scale within the whole cohort, and marked any changes that were equal to or greater than one standard deviation from the mean ($\geq$ 1.0 SD) to indicate a significant seasonal change for that participant. Finally, as the heat map was used to display individual scores of each athlete, we were able to assess absolute values of psychosocial functioning, relative to the total scores possible on each scale.

Additional Analyses

Based on the outcomes of the aforementioned visual analyses, we performed supplementary statistical analyses to explore associations over time among the heavy and light user groups. While the sample was too small to produce generalizable findings or confirm our hypotheses, these analyses were carried out to help us fulfill exploratory goals. We saw value in investigating any relationships that could point to important considerations for future work. Since the total scores on the questionnaires ranged from 30 to 80, all scores were normalized to percentages out of the maximum possible score for each questionnaire. Spearman's rho

correlation coefficients (r_s) were then calculated for each of the three seasons of the year to determine relationships between all variables of interest related to smartphone usage.

Following these analyses, noting both high self-regulation scores among our sample and a lack of clear support for our hypotheses, we elected to conduct an a-posteriori analysis controlling for self-regulation. We believed this further investigation would contribute to our purpose of uncovering psychosocial profiles of student-athletes in relation to their smartphone usage. We deemed this to be an important next step, as based on previous research and a review of literature, it seems that enhanced self-regulation capacity may function as a buffer to the ill-effects of smartphone usage. Moreover, self-regulation is known to be an essential, highly developed skill among high-performing athletes. As such, repeated Spearman's rho correlation coefficients were calculated to determine the influence of self-regulation on the relationships between all psychosocial metrics and smartphone usage for each of the three seasons. Spearman's rho correlation coefficients were interpreted as weak (± .10), medium (± .30), or strong (± .50) relationships (Field, 2013). All statistical analyses were performed using SPSS Statistics 26.0 (IBM Corp., Armonk, NY, USA) with a significance level set at $p < .05$, unless otherwise stated.

Results

Prevalence and Features of Usage (RQ1 and RQ2)

Prevalence

Participants' total smartphone usage over the course of the study ranged from 20.0 hours (min) to 318.4 hours (max) per month, or approximately 5 hours per week (min) and 79.6 hours per week (max). Average monthly usage was 96.9 hours (~24.15 hours per week; $SD = 66.9$ hours). Both objective (24.15 hours weekly) and self-reported (18.8 hours) measures of average

smartphone usage slightly surpassed participants' average self-reported time spent studying (17.9 hours), and training for sport (14.9 hours) per week. Notably, the average weekly usage of the three heaviest users surpassed their self-reported weekly sport training by 12.75, 22.75, and 44.5 hours, respectively, and their perceived weekly school work by 14.5, 22.75, and 25.75 hours, respectively. Six of the participants reported "never" using their phone at sport training or competition venues, while three indicated "rarely" using their phone at these venues. One athlete mentioned using the smartphone "often" at training and competition.

Average usage based on identified demographics (i.e., sex, sport type, school level, seasonal period) were plotted on bar graphs with whiskers set at 95% confidence interval. This revealed that there were no significant differences between average usage among male and female athletes, team and individual sport athletes, nor for high school/CEGEP and university athletes. Moreover, an ANOVA confirmed that there was no significant difference in seasonal usage among participants. Taken together, this suggests that neither sex, sport type, school level, nor seasonal period had an impact on amount of usage.

Features

Based on the average monthly hours spent using various apps, it was observed that participants used their smartphones predominantly for social media, text communication, and internet browsing. Table 2 provides a breakdown of the top apps used per participant.

All participants had a social media app in their top three most used apps over the course of the study. The social media platforms on which participants cumulatively spent the most hours were Instagram (16.3 hours per month, ~4 hours per week, on average), followed by Snapchat (13.1 hours per month, ~2.5 hours per week, on average). The app that had the highest total

usage hours among participants was YouTube. Outstandingly, 51% of this usage was attributed to one participant (647 hours throughout five months; 129.4 hours per month on average).

Table 2.

Top Three Apps Used with Average Monthly Hours

Participant	Mean Monthly Hours of Usage	User Group	Top 3 Apps Used	Average Monthly Hours Using App
1M Lacrosse	34.4	Light	Twitter Facebook Snapchat	2.6 3.0 2.4
2F Nordic Ski	42.1	Light	Web Toons Web Browser Instagram	10.5 8.3 5.7
3F Ult. Frisbee	37.2	Light	Instagram Web Browser YouTube	8.0 2.1 1.3
4F Swimming	50.7	Light	Text Snapchat Instagram	9.6 9.3 8.5
5F Volleyball	57.1	Light	Instagram Text Web Browser	13.9 8.6 5.4
6F Swimming	132.3	Heavy	Instagram Snapchat Facebook	37.0 25.7 14.3
7M Rowing, CrossFit	117.9	Heavy	YouTube Grindr Web Browser	49.0 11.8 11.1
8M Curling	122.5	Heavy	Snapchat Text Instagram	17.3 13.3 11.7
9M Swimming	166.8	Heavy	Web Browser Video Game YouTube	50.6 30.8 27.5
10M Football, Track	217.9	Heavy	YouTube Web Browser Facebook	129.4 36.4 25.6

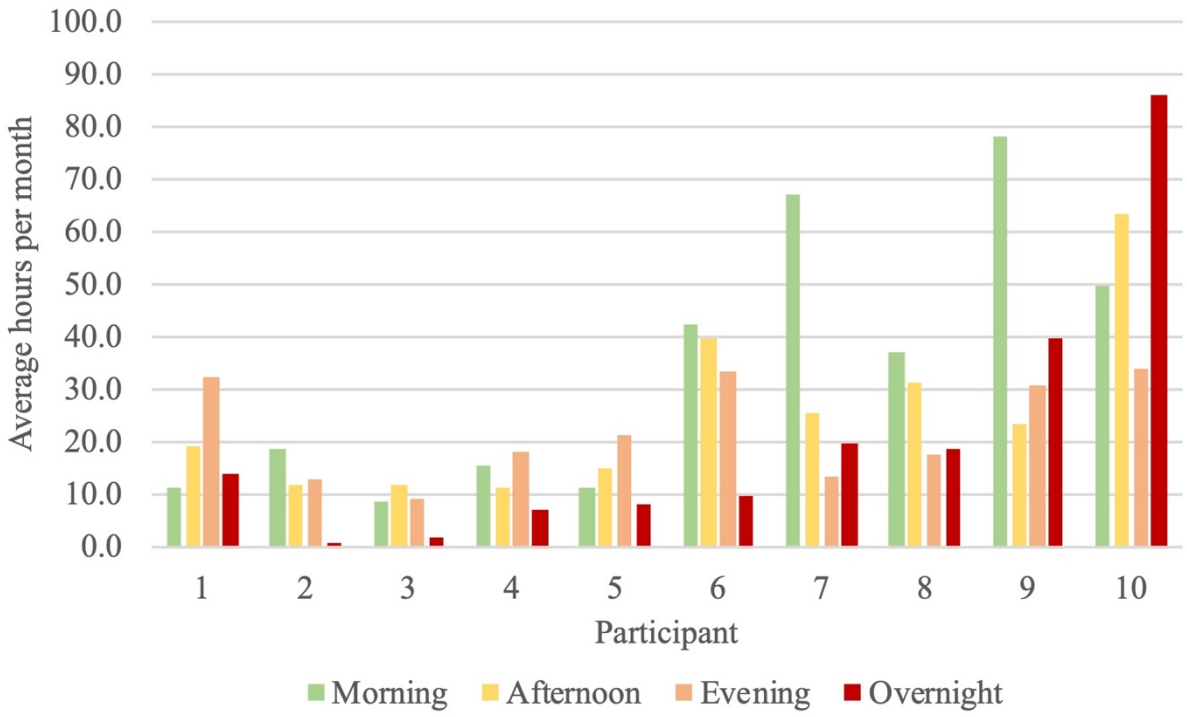
Note. M indicates a male and F indicates a female athlete.

Less this participant, the remaining participants spent 30.2 hours per month (~7.6 hours per week, on average) on YouTube.

Participants used their phones to varying intensities throughout the day (Figure 1). For 50% of participants, the most usage on average each month was in the morning (6am – 12pm). Only one participant had average peak usage during the overnight period (12am – 6am).

Figure 1.

Peak Usage Times



Note. Prevalence of smartphone usage throughout four periods of the day, based on average hours per month. Time periods are as follows: morning (6am – 12pm), afternoon (12pm-6pm), evening (6pm-12am), and overnight (12am-6am).

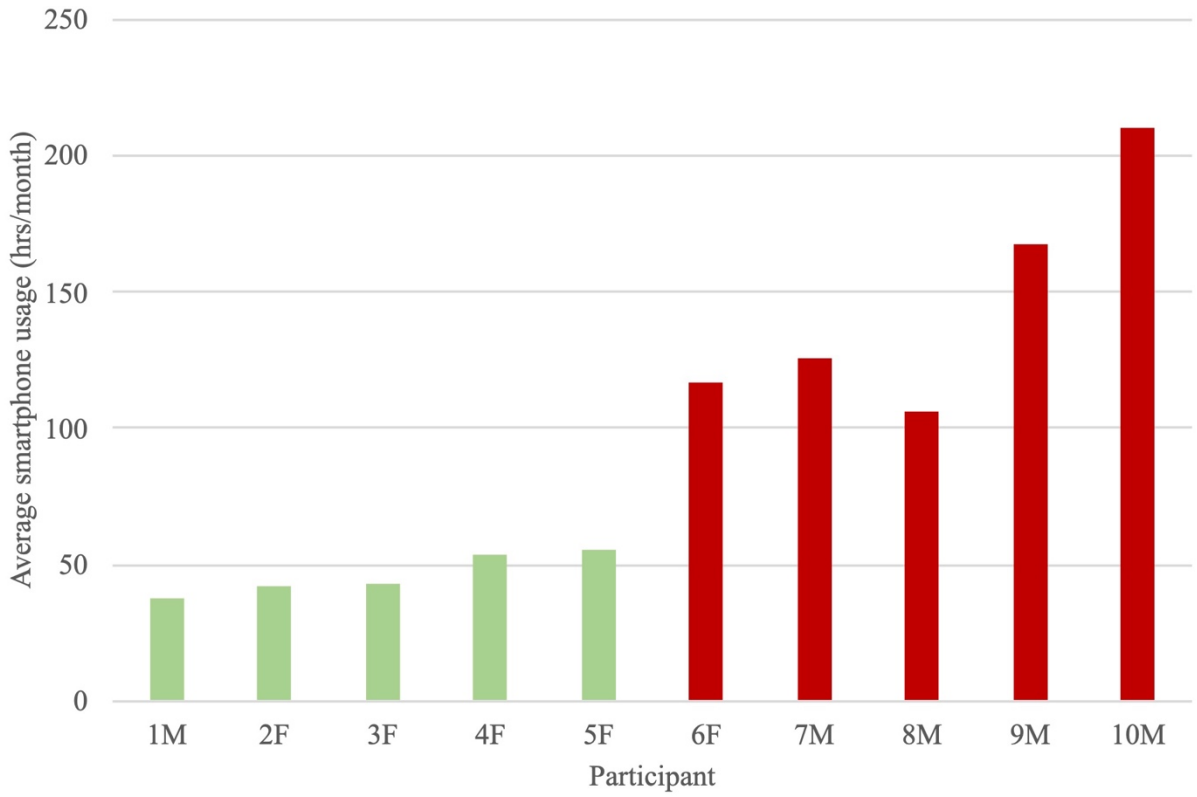
Profiles and Impact (RQ3 and RQ4)

As the standard deviation pertaining to usage was high, and almost three times the mean value, we examined the possibility of distinct user groups, particularly heavy and light users. In

visualizing the data (Figure 2), a natural split between light and heavy users could be observed, with five participants in each group.

Figure 2.

Average Monthly Smartphone Usage



Note. Average monthly smartphone usage per participant; M indicates a male and F indicates a female athlete.

A median split of participants' usage data allowed us to distinguish heavy and light user groups (light = 20.0-76.8 hours, *SD* = 14.28; heavy = 76.9-318.4 hours, *SD* = 56.89) that precisely mirrored the natural split in Figure 1. The average usage of each group was plotted as a bar graph, with whiskers added at a 95% confidence interval, and confirmed a meaningful difference between the average usage of heavy and light groups, with a very large effect size of *d* = 1.65. A series of independent sample *t*-tests revealed that mean usage was significantly higher

among heavy users compared to light users in each of the three seasonal periods: summer (p = .002), fall (p = .011), and winter (p = .029). All three significant findings had a large effect size ($d \geq 0.8$). Figure 3 is a heat map representation of these high and low usage groups, with an overview of participants' individualized nuances in usage and their psychosocial scores.

In the heat map, smartphone usage is coded as green from lightest usage (e.g., participant 3F during the summer at 31.7 hours) to red for heaviest usage (e.g., participant 10M during the winter at 268.3 hours). All other variables are coded as brightest green for a maximally favorable score on that scale among the cohort (e.g., participant 10M has a mindfulness score of 43.0 during the fall), and brightest red for maximally unfavorable score among the cohort (e.g., participant 6F has a mindfulness score of 28.0 during the winter). Significant seasonal within-group changes (more than one standard deviation from the mean) are bolded and underlined. For example, in the winter, participant 1M scored unfavorably high loneliness (28.5) relative to the rest of the cohort, but in the fall, significantly decreased his loneliness score (19.0) by more than one SD from the group mean.

The heat map illustrates individual differences, including exceptional individual changes in amount of usage and psychosocial scores over time. Examining the map vertically, within each psychosocial variable, intra- and inter-individual differences and changes can be observed. Examining the map horizontally, within each participant, intra-individual relationships between variables can be observed, as well as inter-individual profile differences. For example, participant 3F shows low self-regulation, mental health and perceived sport experiences relative to the rest of her light user group, while participant 5F shows consistent high psychosocial scores. Moreover, in the fall season, participant 3F shows a significant increase in smartphone usage, in tandem with significant increases in five psychosocial variables and perceived sport

experiences, indicating higher psychosocial functioning during this season. However, this participant is the only one exhibiting this notable profile. The heat map reveals that regardless of amount of usage, there is considerable variety in athletes' profiles.

When comparing individual scores of mindfulness, loneliness, stress, and self-regulation to the total possible of each scale respectively, moderate-to-high levels of functioning can be observed within the entire sample. Some consistent lower functioning can be observed in relation to perfectionistic self-presentation and mental health scores for three individuals, representing both heavy and light users. In sum, Figure 3 highlights that psychosocial functioning and usage appear to be individually and seasonally driven, and this sample of athletes appears to be moderate-to-high functioning regardless of whether they are heavy or light smartphone users. In terms of seasonal differences within the heavy and light user groups, a series of independent sample t-tests confirmed only one significant finding: Perfectionistic self-presentation was significantly higher among heavy users during the summer season ($p = .025$, $d \geq .80$).

Additional Analyses

In terms of associations between usage and the nine variables for each season, only one significant Spearman's rho correlation coefficient was observed between smartphone usage and mental health ($r_s = .584$, $p = .038$) during the winter season. Descriptive statistics show that self-regulation scores were consistently high among this group of athletes. A matrix of Spearman's rho correlation coefficients for each of the three seasons was produced and additional relationships between variables across seasons became evident, suggesting that self-regulation impacts the level of these criterion variables. There was a significant positive correlation between loneliness and stress ($r_s = .742$, $p = .046$) for the fall season. Significant positive

Figure 3.

Heat Map of Variables of Interest

Participant	Season	Average Smartphone Usage (hrs/month)	Mindfulness (52)	Self-Regulation (80)	Mental Health (70)	Loneliness (42)	Percieved Stress (80)	Perfectionistic Self-Presentation (77)	Percieved Sport Development (3)	Percieved Sport Success (3)	Percieved Sport Satisfaction (3)
Light Users											
1M	Winter	49.1	35.0	63.5	41.5	28.5	38.5	45.5	2.0	2.3	2.3
Lacrosse	Fall	42.5	39.0	63.0	**53.0**	**19.0**	46.0	48.0	2.0	2.0	2.0
2F	Winter	46.2	34.0	58.0	21.0	**19.0**	48.5	44.5	2.0	2.0	1.7
Nordic Ski	Summer	38.0	34.0	-	-	18.0	48.0	40.0	-	-	-
	Fall	41.7	32.0	45.0	28.0	14.0	52.0	**51.0**	2.0	2.0	2.0
3F	Winter	37.2	36.0	46.0	35.0	14.7	36.0	50.3	1.5	1.5	1.2
Ultimate Frisbee	Summer	31.7	**29.8**	41.3	24.5	**21.8**	**45.5**	50.0	**1.0**	1.3	1.3
	Fall	**58.9**	**38.0**	**51.0**	**40.0**	**10.0**	**36.0**	48.0	**2.0**	**2.0**	1.0
4F	Winter	52.0	40.0	67.5	48.5	22.5	35.0	29.0	2.6	2.2	2.2
Swimming	Summer	60.3	39.0	63.5	46.0	21.5	31.5	26.0	**1.8**	2.0	1.8
	Fall	**48.7**	38.0	-	-	20.0	35.0	**37.0**	-	-	-
5F	Winter	45.9	43.0	64.0	46.0	14.0	27.0	26.0	2.0	2.7	2.0
Volleyball	Summer	53.4	41.3	70.0	56.8	16.8	22.0	27.8	2.2	2.8	**2.8**
	Fall	**66.0**	38.8	66.5	49.0	17.5	**32.8**	28.8	**2.7**	2.6	2.6
Heavy Users											
6F	Winter	83.3	28.0	54.0	54.0	18.0	41.0	42.0	3.0	2.0	3.0
Swimming	Summer	**143.8**	29.5	53.0	**42.5**	19.3	**52.5**	45.3	**1.7**	**2.5**	**2.2**
	Fall	122.6	30.3	53.0	40.5	19.7	48.0	48.7	**2.2**	2.0	2.6
7M	Winter	125.6	31.3	60.0	62.7	11.3	48.3	56.7	1.7	2.1	2.1
Rowing/Crossfit	Summer	110.2	33.0	**72.0**	69.0	10.0	**40.5**	57.0	**3.0**	**3.0**	**3.0**
	Fall	140.5	31.0	**48.0**	**41.0**	**17.0**	44.0	55.0	**1.0**	**2.0**	**2.0**
8M	Winter	86.4	41.0	64.0	46.0	23.0	41.0	55.0	2.0	3.0	2.0
Curling	Summer	**121.2**	**32.8**	62.0	42.5	20.5	46.0	59.3	2.3	**2.3**	**1.5**
9M	Winter	117.3	35.0	64.0	34.0	22.0	35.0	44.0	2.3	2.7	2.0
Swimming	Summer	**218.3**	36.5	61.0	35.0	23.0	33.5	49.0	2.4	**2.0**	2.0
10M	Fall	177.4	43.0	65.0	51.0	23.0	43.0	44.0	3.0	2.0	2.0
Football/Track	Winter	**268.3**	40.3	61.5	56.0	**16.7**	37.0	51.5	**2.3**	2.0	2.0
Group Averages											
Average Score of Light Users		48.0	37.0	58.3	40.8	18.4	38.1	39.4	2.0	2.1	1.9
Average Score of Heavy Users		142.9	34.3	59.8	47.8	18.6	42.5	50.6	2.2	2.3	2.2

correlations were observed between smartphone usage and perfectionistic self-presentation (r_s = .622, p = .037), and stress and perfectionistic self-presentation (r_s = .623, p = .037), and a negative significant correlation between mindfulness and stress (r_s = -.613, p = .039) for the winter season. Lastly, in relation to the summer season, a significant positive correlation was observed between mindfulness and perfectionistic self-presentation (r_s = .821, p = .022), and significant negative correlations were observed between stress and mindfulness (r_s = -.947, p = .002), and loneliness and mental health (r_s = -.936, p = .003). No statistically significant relationships between smartphone usage and perceptions of sport experience (i.e., development, success, satisfaction), nor perceived phone helpfulness were observed. Notably, however, self-regulation was significantly negatively correlated with athletes' perceptions of smartphone unhelpfulness for both the fall (r_s = -.739, p = .029) and winter (r_s = -.828, p = .003) seasons, suggesting that this skill impacts users' perceptions of how their smartphone helps them to function in their day-to-day lives.

Discussion

The objective of this exploratory study was to begin addressing gaps in the literature regarding smartphone usage among student-athletes. We sought to provide real-time data on the prevalence and features of smartphone usage within this cohort, and make preliminary inferences about the potential for smartphones to impact athletes' psychosocial functioning and sport experiences.

Prevalence of Usage

Results appear to support Hypothesis 1 that smartphone usage is prevalent and multifaceted among student-athletes over time. The average usage per week among the athletes (∼24.15 hours) was equivalent to more than one full day, which supports the results of

DesClouds et al. (2018) pilot study. However, among this group, there was a more outstanding range of usage (20.0–318.4 hours). Furthermore, usage trends were similar to that of the general population in terms of the amount of time athletes used their smartphones (over 3 hours per day; Deng et al., 2019; Smith, 2015).

Nevertheless, the heavy user group displayed hours of usage that suggest the need for multitasking. Simply put, there are not enough hours in a day to accommodate the time spent on the smartphone and the time spent fulfilling all other demands without multitasking and using the phone to assist with completing tasks. There is a propensity for multitasking among the iGen, which can have unfavorable relationships with attention, performance, self-monitoring, and learning (Carrier et al., 2015; Magen, 2017). These are all important processes for student-athletes, and if heavy users are engaging in multitasking in order to fit in smartphone usage hours, this may have potential negative effects on learning and performance. Moreover, Ellis (2019) suggested that one of the biggest concerns facing regular smartphone users is that smartphone interactions take up time that displaces other activities – a sentiment originating from the displacement hypothesis in the screen time literature (Boers et al., 2019; Oberle et al., 2020). It is important to consider whether usage among certain athletes is at odds with time spent working, studying, training, or sleeping, particularly since our results illustrate some consistent overnight usage (between 12 am and 6 am). Since student-athletes have complex and conflicting roles, which can lead to stress, burnout, and illness (Dubuc-Charbonneau & Durand-Bush, 2015; Gould & Whitley, 2009; Neal et al., 2013; Van Slingerland et al., 2019), it is worrisome if smartphones are taking up time that otherwise could be spent on activities for optimal recovery, such as sleep. Schaefer (2018) has shown some associations between athletes' perceived smartphone usage and sleep disturbance, and suggested that younger student-athletes are more

likely to delay sleep by staying up later on their smartphone. Additionally, Jones et al. (2019) showed a relationship between tweeting late at night prior to a basketball game and decreased next-day performance. In considering these results, we can reasonably assume that prevalent overnight users might be putting next-day performance at risk, simply due to less and displaced sleep, regardless of the purpose or nature of their usage.

Peak smartphone usage during the day varied from athlete to athlete. Half of the athletes showed peak usage in the morning while others mainly used their phone in the afternoon and evening. While other studies show an increased number of smartphone users in the afternoon and evening (Andrews et al., 2015; Bentley et al., 2015), and peaks in usage just prior to bed (Bentley et al., 2015; Statistics Canada, 2019), our results more closely align with findings that show varying peaks in individual usage throughout the day (Deng et al., 2019; DesClouds et al., 2018). The athlete population is one that has set training schedules and it is not unusual for athletes to get up early in the morning for sport and school, which could help to explain heavy usage in the morning. One athlete, categorized as a heavy user, also had significant overnight usage. DesClouds et al. (2018) highlighted a similar athlete usage profile with diminished psychosocial scores, however, the athlete in the current study showed a stable and high psychosocial functioning profile over time. While we cannot overlook literature showing that heavy digital media usage – particularly social media usage – can decrease psychological wellbeing (Boers et al., 2019; Oberle et al., 2020; Twenge & Campbell, 2018; Twenge et al., 2018), our results are in line with research suggesting that the psychosocial impact of smartphones should not be solely based on the amount and time of usage, but also how the media is used (Elhai et al., 2019; Ellis, 2019; Odgers & Jensen, 2020).

Features of Usage

Results appear to support Hypothesis 2, as the most used apps within this athlete cohort pertained to social media. A social media app was consistently in the top three apps used by each of the participants across seasons. This is congruent with studies demonstrating the prevalent use of smartphones to access social media, particularly among the iGen (Bentley et al., 2015; Smith, 2015), including athletes (e.g., Gorrell, 2018; Sanderson & Hull, 2015). While Sanderson and Truax (2014) deemed Twitter to be the choice social media platform for college athletes, participants in the current study preferred other apps. This is not surprising given the changes in social media trends from year to year, including a recent increase in the use of visual-based platforms like Instagram and YouTube (Deloitte, 2019; Meeker, 2019). Results of our study support these findings; the most used apps among participants were visual-based apps such as Instagram, YouTube, and Snapchat. A study by Ehrlén and Villi (2020) showed that Instagram usage among recreational Finnish athletes fostered community, inspiration, and motivation, which is corroborated by Canadian varsity athletes in a study by DesClouds and Durand-Bush (2021). Such findings are also in line with the moderate-to-low loneliness scores and the overall high-functioning psychosocial profiles exemplified in the current study.

It is notable that while many studies problematize social media usage, Coyne et al. (2020) have shown that individual changes in social media usage over time did not predict changes in mental health indices, suggesting that other processes may be at play in the relationship between social media usage and well-being. Our results parallel this finding. Moreover, a great deal of research problematizes social media without considering *how* the media is accessed, which could be an important factor influencing whether the use of social media is helpful or unhelpful in a given situation. Smartphones, as portable devices, make social media available to athletes

anywhere and anytime, unless there are established limitations. Studies have shown that social media can impede cognitive capacity and concentration when used just prior to sport tasks (Encel et al., 2017; Fortes et al., 2019), and can have negative psychosocial effects on athletes' sport performance (Browning & Sanderson, 2012; David et al., 2018; Gorrell, 2018). Interestingly, 9 of the 10 athletes in the current study reported rarely-to-never using their phones *during* training and competition. While this seems positive, it does not preclude athletes from bringing their phone to the sport venue, where the device can instigate unplanned distractions (Stothart et al., 2015; Ward et al., 2017), including a range of notifications just prior to and after performance tasks. Participants' self-reports of not using their phones at training or competition mirror results from DesClouds and Durand-Bush's (2021) study, who proposed that sport might provide a natural break from devices, simply due to the physical separation imposed by the context. Similarly, previous studies have found that extracurricular activities, such as sport, can enhance psychological wellbeing and can function to displace young peoples' screen time activity (Oberle et al., 2020; Twenge et al., 2018). Nevertheless, usage prior to sport events remains an area that should be further investigated due to studies showing negative effects on performance.

Profiles and Impact

While Hypotheses 3 and 4 could not be confirmed based on our data, results suggest that they do warrant further investigation. Even though our sample size was small, results illustrate more nuances in psychosocial profiles and the impact of smartphones than the existing literature suggests. The amount of smartphone usage did not appear to be significantly linked to psychosocial outcomes over time within our sample of athletes. Furthermore, profiles did not vary distinctly between heavy and light user groups. Findings indicated fairly consistent and stable psychosocial profiles and usage across participants, regardless of the sport or season. More

specifically, the student-athletes exhibited moderate-to-high psychosocial functioning (i.e. self-regulation, mental health, and mindfulness) regardless of the amount of smartphone usage. This aligns with literature suggesting that we may be generalizing the negative psychological outcomes as a result of amount of usage and that heavy usage is inherently problematic (Andrews et al., 2015; Elhai et al., 2019; Ellis, 2019; Odgers & Jensen, 2020). Instead, purpose, type, and intent of usage, as well as individual differences (e.g. biological, cognitive, situational) may be more significant indicators of the impact of smartphone technology (Coyne et al., 2020; DesClouds et al., 2018; Ellis, 2019; Marty-Dugas et al., 2018). Furthermore, as mental training is a specific component of athlete development (MacNeill et al., 2014), many athletes are given the opportunity to learn and practice a variety of psychosocial skills (e.g. self-regulation, self-reflection, mindfulness) that may potentially contribute to their ability to navigate smartphone usage in more functional ways than the general population.

There were no notable group differences between heavy and light users aside from amount of usage. However, individual nuances were observed across participants, with some heavy users exhibiting lower mindfulness and self-regulation and higher perfectionistic self-presentation than the rest of the group. Specifically, perfectionistic self-presentation was high among two heavy smartphone users and it significantly increased in tandem with their usage. This variable has been linked to negative mental health (Hewitt et al., 2003) and sport performance outcomes (Flett & Hewitt, 2005). Flett and Hewitt (2014) proposed that athletes high in perfectionistic self-presentation may be expert at hiding psychological pain. This warrants further study as this characteristic could be a risk factor for competitive athletes who use social media to support perfectionistic behaviors.

Additional Analyses

Although our sample size did not allow for generalizable statistical analyses, we found it valuable to explore potential relationships that would be pertinent to examine more in-depth in the future. Results showed no significant difference in usage from season to season, suggesting consistent usage throughout the year. However, matrices and statistical analyses point to seasonally-based correlations, which underscore the potential that the ebb and flow of an academic and sport training/competition year could impact the functioning of athletes. This parallels literature showing athletes' fluctuating levels of well-being throughout a training season (DeFreese & Smith, 2014) and between in- and out-of-seasons (Morris et al., 2020). This may be exposing a different set of needs for athletes, particularly during vulnerable periods when well-being is lower. However, the literature pertaining to psychosocial outcomes of student-athletes' academic year or degree cycle is extremely limited (Morris et al., 2020). Psychosocial profiles highlight a number of significant changes in the fall, which could reflect the adjustment required as athletes transition back into school and sport after the summer period. Moreover, a statistically significant correlation was observed between mental health and smartphone usage during the winter, suggesting that during this time, increased smartphone use aided mental health. For many Canadian students-athletes, the winter semester is marked by increased isolation and time spent indoors, and so this result might be pointing to participants' use of their smartphone to fulfill a need for self-regulation, social connection, and coping. This would represent a gratification of needs, which may be an important function of smartphone usage (Elhai et al., 2019; Ellis, 2019; Gorrell, 2018), particularly as athletic and academic demands change across time.

Significant relationships between psychosocial variables across the three seasons were uncovered when controlling for self-regulation. Moreover, significant changes in athletes'

perceptions of their sport experience (i.e., satisfaction, development, and success) appeared to have more to do with athletes' self-regulation than their amount of smartphone usage. Additionally, self-regulation scores were outstandingly high among this sample. This is not surprising given athletes' propensity for high self-regulation capacity (Dubuc-Charbonneau & Durand-Bush, 2015) typically required for optimal performance (e.g. Cleary & Zimmerman, 2001; Englert, 2016). DesClouds and Durand-Bush (2021) highlighted self-regulation as a positive implication of smartphone usage, helping athletes to manage multiple and conflicting demands through technology-enabled preparation and self-reflection. Interestingly, Khang et al. (2013) reported that individuals with higher self-control may engage in more voluntary and purposeful smartphone usage, and Hofmann et al. (2017) proposed that self-control can moderate the ill-effects of media use on wellbeing. Furthermore, self-regulation ability may help to buffer negative effects of media multitasking (Szumowska et al., 2018). While we cannot definitively determine whether self-regulation is buffering negative implications of smartphone usage or facilitating positive self-regulation functional capabilities, we can begin to consider that both factors are at play. The fact that self-regulation was significantly negatively correlated with athletes' perceptions of smartphone unhelpfulness in the fall and winter semesters suggests that when self-regulation is high, unhelpful qualities of smartphones are less prominent. Again, in line with gratification of needs, if athletes require enhanced self-regulation capacity to meet multiple demands, this could be precisely what they expect their smartphones to fulfill (Elhai et al., 2019; Ellis, 2019).

Applied Considerations

From a practical standpoint, sport psychology practitioners and coaches should bear in mind that contrary to popular belief, the prevalent use of smartphones and social media among

athletes is not all bad. Smartphones are an inherent aspect of athletes' lives; thus it is pertinent to plan for usage in and around the sport context to leverage benefits and mitigate drawbacks throughout the athletic season and school year. In addition to helping athletes pay attention to when and how often they use their smartphone, coaches and practitioners should encourage athletes to reflect on how and why they use various smartphone features, including social media (DesClouds & Durand-Bush, 2021; Durand-Bush & DesClouds, 2018; Elhai et al., 2019; Ellis, 2019). Discussions on the usefulness and uselessness of smartphones in different contexts (e.g. sport, school, home) and at different essential timepoints (e.g. in training, post-competition, before bed, in-season, off-season) could help athletes learn to effectively manage the use of their device. Given that student-athletes were avid users of Instagram, YouTube, and Snapchat, it would make sense for sport leaders to leverage the use of these apps to build a supportive community (DesClouds & Durand-Bush, 2021; Ehrlén & Villi, 2020), and enhance athletes' media literacy. The sport context may lend itself well to encouraging athletes to take regular breaks from using their smartphone, especially to foster mental and emotional recovery. Having said this, given the high number of hours of usage exhibited by heavy users in this study, it is likely that some athletes will always be on their device regardless of time of year and context; as such, they should be asked to monitor for potential negative effects of their usage on their functioning and performance (e.g. decreased attention and self-regulation, perfectionistic self-presentation). Since self-regulation may foster a facilitative relationship between athletes and their smartphones, it is pertinent for coaches and sport psychology practitioners to support athletes in their continued development of self-regulation skills both generally and specifically in relation to smartphone usage.

Strengths, Limitations and Future Research

There is a deficit of ecologically valid studies related to the impact of smartphones on student-athletes. A major strength of this study is that it is the first of its kind to longitudinally examine real-time smartphone usage within a student-athlete population, while simultaneously leveraging the smartphone as a tool for in vivo data collection (DesClouds et al., 2018). It is important to recognize that smartphone research is limited by rapidly evolving technology and literature, as well as technology privacy restrictions. The research app developed for this study was applicable to Android smartphones only, as we were unable to develop and distribute an iPhone version due to Apple restrictions. This constrained the recruitment of athletes who identified as iPhone users and resulted in a small sample. In light of the small sample size, the results of this study should be read with caution and should not be generalized. Nonetheless, with strict inclusion criteria, we trust that the results provide valuable initial insight into the complex and nuanced usage trends and psychosocial profiles of student-athletes enrolled in this study. Moreover, we believe the methodological approach provides ecologically valid assessments of usage trends and psychosocial profiles. Future researcher should continue investing the same time- and labor-intensity required to carry out similar studies, while enhancing methods of recruitment and retention over time.

Athlete smartphone usage is a phenomenon worthy of further exploration and this study provides a starting point for future research in this area. There remains a deficit of conceptual frameworks to guide research on smartphone usage among athletes; the applicability of existing or new theory to this phenomenon has not been examined. Thus, future research should investigate the applicability of relevant sport psychology theories to study, describe, and guide athletes' smartphone usage. Future studies should also include larger samples of athletes using

both Android and Apple smartphones. They should expand smartphone-afforded research capabilities, and examine not only time and place of usage, but also specific patterns of usage in the sport context. It would be pertinent to question how various sport environments influence smartphone behaviors and to investigate multiple perspectives (e.g., athletes, coaches, mental performance consultants). Further, while this study provides a high-level overview of the applications used by competitive athletes, future research should explore, in more depth, the specific platforms that are most used by athletes across sports, levels, ages, and sexes. Finally, the relationships between smartphone usage, self-regulation, perfectionistic self-representation, and sport experiences and outcomes should be more thoroughly investigated.

Conclusion

The purpose of this exploratory study was to provide real-world, longitudinal data on the prevalence and features of student-athletes' smartphone usage, illustrate the psychosocial profiles of heavy and light users, and examine concurrent psychosocial functioning indices. This study constituted a first step in collecting detailed data on smartphone usage trends and testing a complex app to inform future research. All in all, athletes used their phones in predominant and multifaceted ways across all three seasons, mirroring that of the general population. The most used apps were social media, which confirm iGen trends. Usage was spread throughout the day, with the greatest proportion taking place in the morning, which partially supports literature in other domains. Athletes reported moderate-to-high psychosocial functioning, irrespective of being categorized as a heavy or light user. This contradicts studies showing a relationship between heavy smartphone/social media usage, and reduced functioning (e.g. low mindfulness/attention and self-regulation, and high loneliness). While nuances were observed within and across the psychosocial profiles of athletes, their profiles remained fairly stable across

the three seasons, as did their smartphone usage. Overall, this study supports the new wave of research suggesting that the negative associations between smartphone usage and psychosocial outcomes may not be as prevalent or straightforward as they were originally hypothesized to be (Ellis, 2019; Odgers & Jensen, 2020). Sport may be a unique context in which athletes' highly-developed psychosocial skills help them to regulate and leverage their smartphone usage in beneficial ways (DesClouds & Durand-Bush, 2021). The research application developed for this study shows the tremendous value of leveraging the smartphone as a research tool for collecting ecologically valid usage and self-report data.

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Article 4: The Self-Regulation and Smartphone Usage Model (SSUM): A working model of athletes' smartphone usage

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Abstract

Self-regulation is essential for optimal development, performance, and well-being in sport, and smartphones may support and hinder this self-regulation. The relationship between smartphones and self-regulation has seldom been investigated in sport. Thus, the purpose of this study was to examine self-regulatory processes, conditions, and outcomes related to athletes' smartphone usage. Twenty-four competitive and high-performance athletes from eight sports participated in individual interviews informed by the models of self-regulated learning (Zimmerman, 2000) and self-regulatory strength (Baumeister et al., 2007). Themes created from a directed content analysis aligned with components of both models and were integrated with new themes to form the "Self-regulation and Smartphone Usage Model" (SSUM). The SSUM illustrates a cyclical model of self-regulation and smartphone usage across five components: self-regulation capacity, processes, conditions, outcomes, and competencies. While self-regulation demands can be increased because of smartphones and lead to depletion, smartphones can be powerful vehicles to strengthen self-regulation competencies.

Keywords: self-control, smartphones, athletes, self-regulated learning, self-regulatory strength, performance, depletion

Introduction

Self-regulated learning (SRL) refers to "self-generated thoughts, feelings, and actions that are planned and cyclically adapted to the attainment of personal goals" (Zimmerman, 2000, p.14). Effective SRL processes such as strategic planning, self-monitoring, and self-reflection have been associated with enhanced performance and well-being in sport (Kitsantas et al., 2017; Dubuc-Charbonneau & Durand-Bush, 2015; Englert, 2016). Self-regulatory strength (SRS), a global energy resource used to exert volitional control (Englert, 2016), is also important for optimal athletic performance, particularly motor impulse control, anxiety and attention regulation under pressure, and persistence in strenuous training and competition situations (Englert, 2016; Furley et al., 2013).

Smartphone Usage

A complex and novel variable that athletes now have to regulate in the sport context is the smartphone. Research in the sport psychology domain is predominantly focused on athletes' use of social media (e.g., David et al., 2018; Dunn et al., 2021; Fortes et al., 2019; Encel et al., 2017; Sanderson & Hull, 2015). Only a few studies explicitly pertain to the smartphone usage of athletes (DesClouds & Durand-Bush, 2021; DesClouds et al., 2018; 2022; Fortes et al., 2019; Greco et al., 2017). This work has shown that athletes use their phones for a variety of purposes, including to supplement self-regulatory behaviors (e.g., to enhance self-observation through video, to support strategic planning through notes and leaderboard apps) in and around the sport context (DesClouds & Durand-Bush, 2021). In a study examining relationships between smartphone usage and psychosocial variables, DesClouds et al. (2022) suggested that self-regulation might buffer the negative implications of smartphone usage and facilitate positive capabilities through the supplementation of self-regulation processes. Other studies have shown

that such processes may be essential for using smartphones in facilitative ways (e.g., Carrier et al., 2015; Hofmann et al., 2017; Khang et al., 2013).

There are also drawbacks to using smartphones in the sport context, such as concentration disruption (Encel et al., 2017), increased cognitive load (Fortes et al., 2019), and mental fatigue (Fortes et al., 2019; Greco et al., 2017). To gain more insight into the nuanced relationship between athletes' smartphone usage and self-regulation skills like attentional control, scholars have expressed a need to look at the intricacies of usage including the context, purpose, and time of usage as well as characteristics of individual users (DesClouds & Durand-Bush, 2021; Ellis, 2019; Odgers & Jensen, 2020; Twenge & Martin, 2020). There is need for studies to integrate frameworks that can account for the continuum of smartphone usage. To date, there are no empirical investigations incorporating self-regulation frameworks to study smartphone usage in sport, nor empirically-informed guidelines to help athletes optimize the use of smartphones (Durand-Bush & DesClouds, 2018).

Self-Regulation Frameworks

There are two widely supported self-regulation frameworks that shed light on self-regulatory processes to either control impulses (i.e., model of SRS, Baumeister et al., 2007) or to accomplish tasks (i.e., model of SRL, Zimmerman, 2000).

Model of SRL

Zimmerman's (2000) model of SRL is a proactive and goal-centered model that presents self-regulation as a dynamic, cyclical occurrence of several cognitive processes. The model involves three phases of forethought, performance, and self-reflection. These phases encompass both covert self-regulation processes (e.g., strategic planning, self-recording, attentional control, self-evaluation) and self-beliefs that guide planning and adaptation and impact overall self-

regulation capacity. With a focus on performance and learning, and applications in sport (e.g., Kitsantas et al., 2017; Dubuc-Charbonneau & Durand-Bush, 2015), the SRL framework lends itself well to examining how usage might support athletes' performance and development. However, Zimmerman's (2000) model does not take into consideration the potential for self-regulation overload or a peak threshold at which self-regulation demands may become too excessive for an individual to handle. Equally, the SRL model does not consider convergence between self-regulation attempts in differing and potentially overlapping domains (e.g., home and sport), which is a fundamental feature of smartphone usage. For these reasons, it is important to also consider Baumeister and colleagues' (2007) SRS model.

Model of SRS

The model of SRS (Baumeister et al., 2007) focuses on self-regulation capacity and self-control. It involves a primary resource of self-regulatory strength, which becomes depleted as individuals complete a self-control task (e.g., executive functions, adaptive behaviors, self-presentation). The main tenet of the model is that acts of self-control at a particular moment in time will reduce self-control performance at a subsequent moment in time. As self-regulatory strength diminishes, individuals can enter a state of ego depletion, whereby subsequent self-control processes are inhibited until an adequate level of strength is replenished. In this model, self-regulation is regarded as a finite, domain-general resource used to exercise self-control and implement other executive functions including focus, persistence, decision-making, and emotional regulation. Furthermore, self-regulatory strength can be built over time, and replenished once it is depleted (Bauer & Baumeister, 2010). Notably, the SRS model differs from models of attention and cognitive load by focusing on a subsequent reduction in self-regulation, rather than a concurrent inhibition to attention or working memory (Schmeichel &

Baumeister, 2004). This is imperative in the sport context in which smartphone usage is often regarded for its ability to negatively impact subsequent performance outcomes (e.g., Encel et al., Fortes et al., 2019). The SRS model has been studied in the context of sport and used to explain diminished performance, choking, negative anxiety effects, diminished impulse control, and defeat (see Englert, 2016 for overview). The SRS model makes it possible to unearth conditions that contribute to self-regulation depletion and failure, and discover potential for smartphones to overload self-regulation capacity due to multiple demands.

Summary and Purpose

The model of SRL is a valuable framework to guide the study of smartphones as a context-specific self-regulatory tool and examine how various self-regulation processes are developed and supported by smartphones. Complementary to this, the model of SRS is well-suited to explore cross-domain self-regulation demands as well as global self-regulation capacity and failure. Both models have been commonly referenced in sport psychology research, illuminating the importance of athletes' well-developed self-regulation capacity to attain optimal performance and well-being (e.g., Kitsantas et al., 2017; Dubuc-Charbonneau & Durand-Bush, 2015; Englert, 2016). For these reasons, the models of SRL and SRS were used to guide this current study of Canadian athletes' smartphone usage.

The study aimed to answer the following research question: What self-regulatory processes, conditions, and outcomes are related to the smartphone usage of a sample of Canadian athletes, based on the SRL and SRS models? A secondary aim was to put forth a model that could inform research and applied practice pertaining to athletes' use of smartphones. Given that so few studies have explicitly focused on the use of smartphones in sport and no framework exists to guide empirical work in this area, this study fills an important gap in the literature.

Methods

This study is the fourth study within a larger mixed methods research project. The previous three independent studies (i.e., Study 1, DesClouds & Durand-Bush, 2021; Study 2, DesClouds et al., 2018; Study 3, DesClouds et al., 2022) explored the prevalence, patterns, experiences, and outcomes of smartphone usage among different cohorts of athletes. Findings provided the rationale and context for this study and informed typologies used to guide the analysis and interpretation of results. The current study aims to continue advancing knowledge by specifically focusing on the interplay between self-regulation and smartphone usage.

Paradigm

This study was guided by the critical realist paradigm, which promotes the use of dialogic methods such as interviewing (Fletcher, 2016). Critical realists assume that reality is partially accessible through the perceptions and interpretations of researchers and participants. Multiple perspectives are negotiated and consolidated with existing theory and empirical work to achieve a deeper understanding of reality (Fletcher, 2016). A critical realist approach was deemed appropriate for this study given the research question and the use of theory (e.g., SRL and SRS) and existing data to guide the research process.

Context and Participants

In order to examine a range of perspectives and experiences, athletes from competitive (i.e., provincial and varsity) and high-performance (i.e., national, Olympic, and professional) sport (Canadian High-Performance Sport Strategy, 2019) were recruited. The sample represented diverse and inclusive demographics (e.g., age, sex, sport, competitive level), psychosocial profiles, and smartphone usage dynamics. This allowed the researchers to parse similarities and

differences and find a framework to inform smartphone usage within the larger competitive sport context.

Participants were recruited from across Canada through social media and informational emails, using a purposive sampling technique (Patton, 2002). Snowball sampling also occurred through word-of-mouth from participants and other community members who were aware of the larger research project. Participants had to be 13 years of age or older; this age limit was implemented to represent entry into high school and the "train to train" stage of the long-term athlete development framework, when increased commitment to sport performance, sport specialization, and heightened competition intensity begin (Sport for Life, 2019). Also, at this age, participants could independently consent to study participation. Ethics approval was granted from the ethics board of the research institution, and all study participants signed a consent form prior to data collection.

A total of 24 athletes (9 male, 15 female) from eight different sports (i.e., sailing, curling, track and field, hockey, football, Ultimate Frisbee, volleyball, and snowboard) took part in an individual interview. Participants ranged from 13 to 39 years of age (M = 23) and competed at competitive (n = 12) and high-performance (n = 12) levels. Participants estimated that on average, they were using their smartphone 19 hours per week (approximately 2-3 hours per day).

Interviews

Each of the 24 individual interviews were conducted by the first author either in-person at a mutually convenient location, or over videoconference or telephone. Interviews were held throughout the recruitment year and ranged from 37 to 92 minutes (M = 62.1 minutes). Recruitment occurred until the researchers could make a strong case that a diverse sample of athletes had been included and an acceptable level of saturation had been reached. Saturation

was reached by the final two interviews. The researchers could suitably answer the research question and identify repetition and familiarity in the topics being discussed. It was deemed that further inquiry would be counter-productive to the research objectives and efficiency (Mason, 2010).

Congruent with the critical realist approach, a multi-section, theory-driven interview guide was used to direct the in-depth, semi-structured interviews (Smith & Elger, 2014). The guide targeted the models of SRL and SRS but was flexible and prompted active, collaborative interviewing, whereby a critical dialogue was undertaken between the first author and each participant. The researcher aimed to draw on participants' experiences and critically evaluate their accounts against existing empirical knowledge in order to access multiple layers of reality (Smith & Elger, 2014).

The first section of the interview guide included a screening question, where participants self-identified as a heavy or light smartphone user based on provided definitions of heavy (i.e., you feel pressure to have your phone on you, feel that you have to check/respond all the time, and use your phone all/most of the day) and light usage (i.e., you rarely/never feel pressure to have your phone on you, you often/always feel that you can ignore your phone, and you seldom/sometimes use it throughout the day). The second section pertained to demographic questions such as age, sport, level of competition, years of sport involvement, academic and work status, and basic perceptions of time spent studying, training, competing, working, and using the smartphone.

The third section of the guide was informed by the models of SRL and SRS. First, participants were asked more general questions pertaining to their smartphone usage for self-regulation purposes (e.g., Does using your smartphone help you to function on a daily basis and

if so, how? Overall, does using your smartphone lead you to have more or less control over your life? Please explain and give examples.). Following this, participants were asked questions pertaining to specific phases of SRL (e.g., Forethought: How does using your smartphone help you to prepare or get ready to learn and perform? Does using it ever prevent you from preparing to perform? Self-reflection: Does using your smartphone ever help you to reflect on or evaluate your learning or performance? Explain), and elements of SRS (e.g., Has using your smartphone ever led you to become emotional to the point where you felt energized or on the contrary, depleted? How does this impact your learning and performance?).

The fourth section of the guide pertained to smartphone usage for social media purposes, and the relationship between social media, self-regulation, and image management (e.g., What do your social media profiles say or reveal about you? Do you spend a lot of time building and managing this identity? Explain). The fifth section prompted participants to reflect on their use of smartphones to optimize self-regulation, with a particular emphasis on the impact of their environment (e.g., Are there ways in which you could start or stop using your smartphone to optimize your performance and well-being as a student-athlete? Does your coach model acceptable smartphone usage at training and competition?). The sixth and final section of the guide provided space for the researcher and participant to collectively summarize the interview, reflect on the discussion, and share additional experiences, questions, or comments.

Data Analysis

A qualitative directed content analysis was performed. Directed content analysis is an analytical approach well-suited to the critical realist stance as analysis procedures help to bring to light both supporting and countering evidence for a theory, using various levels of codes (i.e., respondent-driven, researcher-driven, and theory-driven; Hsieh & Shannon, 2005). Moreover,

this approach allows researchers to systematically identify trends and patterns in the data (i.e., demi-regularities; Fletcher, 2016). The goal was to search for both supporting and non-supporting evidence of the theories guiding the study. The data analysis steps undertaken allowed for continuous, iterative processes of deduction and induction so that participant accounts could be emphasized first and then compared to existing data, consolidated, and critically examined (Fletcher, 2016).

The data analysis was largely informed by Hsieh and Shannon's (2005) systematic process to code data and identify hierarchical themes and patterns. First, the interview recordings were transcribed verbatim and the raw data (i.e., 650 pages of single-spaced transcribed text) was reviewed for familiarization. Using NVivo 12 software, the first author deductively coded the transcripts into meaning units informed by the models of SRL and SRS as well as typologies identified from the previous three studies within the broader research project. Data that could not be categorized according to theory nor prior typologies were assigned a novel in vivo code. Each meaning unit was then reexamined for specific examples of self-regulation processes, conditions, and outcomes. A synthesis of high-order themes was then performed in order to draw together a single set of conclusions and derive a model of best fit to describe the phenomenon. The researcher cyclically reflected on the thematic structure several times to best represent the data as it related to participants' accounts, the core research question, and the two models informing the study. The thematic structure and generated model were shared and checked with "critical friends" (Smith & McGannon, 2018) through a series of formal meetings with the second author and research peers. This process helped with interpretation of the data and consideration of alternative perspectives and feedback. The coding tree was revised seven times and the new model more than five times as a result of reflection and critical feedback sessions.

Results

Results are presented in six sections. The first section introduces a conceptualization of the results as a novel model titled the "Self-Regulation and Smartphone Usage Model" (SSUM; Figure 1). The subsequent five sections (Self-regulation Capacity, Self-Regulation Tasks, Conditions of Usage, Outcomes, and Self-Regulation Competencies) pertain to the processes, conditions, and outcomes outlined in the SSUM. Results are presented according to the model from left to right. A definition of each component—based on existing literature, previous study typologies, and participants' accounts—is provided at the beginning of each section. Participant identification codes are provided with each citation (VB = Volleyball, SN = Snowboard, SO = Soccer, H = Hockey, U = Ultimate Frisbee, B = Basketball, SW = Swimming, T = Track and Field, F = Football, SA = Sailing, C = Curling, SK = Skiing; M = competitor in a male designated sport, F = competitor in a female designated sport). For example, an athlete competing in men's soccer was coded as (SOM1).

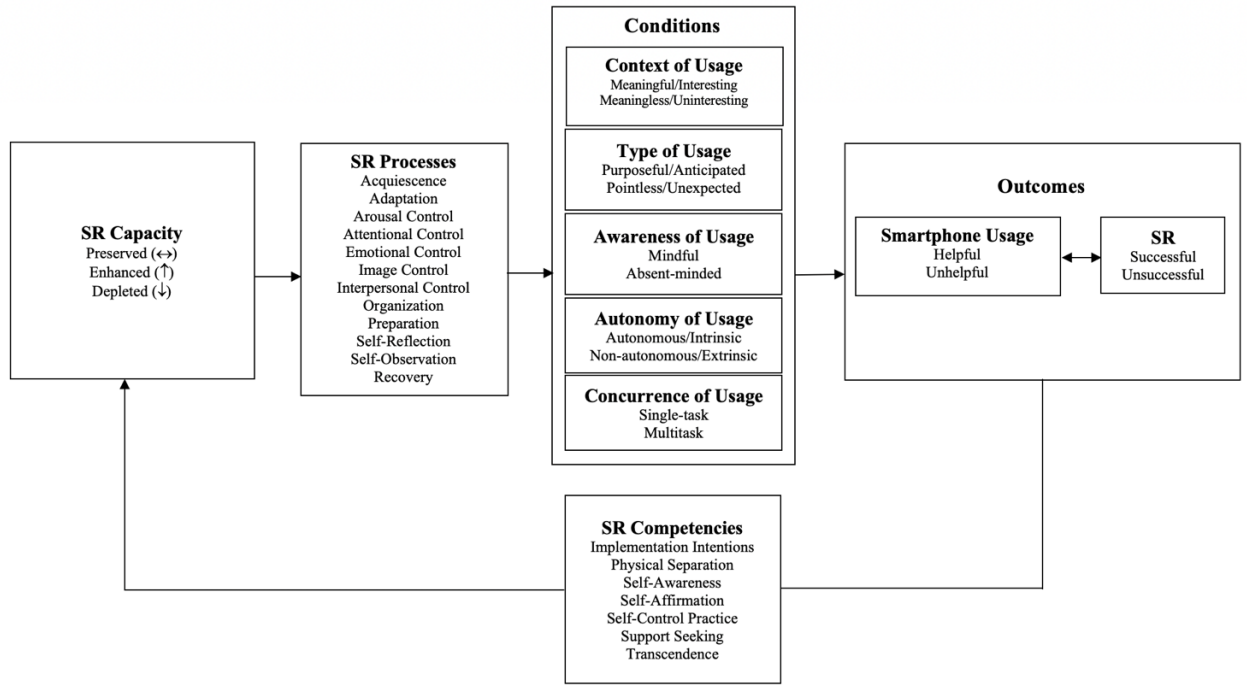
The Self-Regulation and Smartphone Usage Model

Neither the model of SRL or SRS on their own accounted for the full range of processes, conditions, and outcomes discussed by participants, which provided the rationale for developing the SSUM, a flexible model with applied focus that reflects nuanced and layered self-regulation processes and conditions related to smartphone usage among athletes (see Figure 1). The SSUM depicts 12 processes, 5 conditions, and 7 competencies that are interrelated. While some existing components of the SRL and SRS models have remained intact in the SSUM (e.g., self-observation, attentional control, self-control practice), other components were shifted and/or renamed to (a) account for the different types of experiences reported by athletes, (b) align with typologies established in previous studies, and (c) use accessible language for applied settings.

The SSUM also includes new sub-components derived from the data (e.g., support seeking, conditions of usage).

Figure 1.

The Self-Regulation and Smartphone Usage Model (SSUM)



The SSUM represents both conceptualizations of self-regulation, that is forethought, self-control, and self-reflection (SRL; Zimmerman, 2000), as well as finite self-regulation capacity, which can be depleted and restored (SRS; Baumeister et al., 2007). The cyclical flow of the SSUM mirrors that of the model of SRL and is meant to demonstrate continuity between one self-regulation task and the next.

Self-Regulation Capacity

The first component of the SSUM is self-regulation capacity, which is defined as *athletes' self-regulatory strength (available self-regulatory resource) when facing a new self-regulation cycle involving the use of their smartphone.* Athletes gave examples of how self-

regulation capacity could be preserved, enhanced, or depleted as they faced a new task, depending on the preceding cycle and their personal self-regulation competencies. They described preserved and enhanced self-regulation capacity as a feeling of being ready, alert, focused, energized, and/or motivated. For example, one athlete shared how using her smartphone prior to a performance task helped her to enhance her capacity to complete the task, "It'll really motivate me. The playlist just puts me into a zone. It will get me ready for what's about to happen" (BBF1). On the other hand, depleted self-regulation capacity was associated with a feeling of being fatigued, distracted, stressed, overwhelmed, trapped, or disengaged. This reduced capacity occurred when a preceding self-regulation cycle (i.e., task completion) led to depletion rather than rejuvenation. One athlete said, "I'd say, [my phone] has never made me energized, more really, really depleted" (VBF1) and another mentioned, "I would pull [my phone] out right before bed and just get sucked into the vortex, and then it'd be hard to sleep" (SAM1). Athletes reported that when facing a new cycle in a depleted state, it is more difficult to successfully complete a task.

Self-Regulation Processes

The next component of the SSUM pertains to self-regulation processes, which are defined as *athletes' actions with their smartphones, taken to achieve a specific outcome when completing a task*. Self-regulation processes are thus actions related to or supplemented by smartphone usage wherein usage refers to using the smartphone or restricting its usage. The athletes described a total of 12 processes related to smartphone usage in and around the sport context. Ten of these processes could be linked to the models of SRS and SRL (i.e., adaptation, acquiescence, arousal control, attentional control, emotional control, image control, interpersonal control, preparation, self-observation, and self-evaluation). The other two were novel processes

(i.e., recovery and organization). The 12 self-regulation processes are defined, with examples, in Table 1 and an example is provided for each process.

Interestingly, all athletes shared an example of using social media in relation to these 12 self-regulation processes. Image control stood out amongst the list as a particularly cumbersome process for athletes, especially for high-performance female athletes and those working with sponsors:

> As females, I think there's a big pressure to post on social media in order to advertise our events. If you play in the NHL, you don't need to go on social media before the Stanley Cup first round and let people know that playoffs are coming. Whereas in female sports, you do. People don't know where to watch you or where to see you so we are told to go on social media and let people know. That's added pressure. (HF2)

Conditions of Usage

The third component of the SSUM pertains to conditions of smartphone usage during a self-regulation cycle. Conditions of usage are defined as *circumstances that mediate smartphone usage and outcomes.* Athletes discussed five conditions of usage (i.e., context of usage, type of usage, awareness of usage, autonomy of usage, and concurrence of usage), which were perceived as either positive/helpful or negative/unhelpful in their self-regulation efforts.

Context of Usage

Context of usage refers to *situations in which athletes use their smartphone, which can be meaningful/interesting or meaningless/uninteresting.* Athletes discussed different sport-related situations (i.e., training and competition) that were engaging and important to them in which they used their smartphone, as illustrated in the following example: "As track athletes, most people are in the zone to the point where they won't even talk to their best friend. Phone usage—

Table 1.

SSUM Self-Regulation Processes

SR Process	Definition of SR process in the context of athlete smartphone usage	Contextual example
Acquiescence	Actions taken to reluctantly accept or perform a task	An athlete reluctantly posts on social media about their competition, conveying inauthentic feelings about their experience, to please a sponsor.
Adaptation	Actions taken to modify thoughts, emotions, or behaviours	A team's competition venue is moved at the last minute so the team captain uses the team's social media chat to alert all team members of the change in real-time.
Arousal Control	Actions taken to manage activation or intensity	An athlete uses a pump-up playlist to help them build intensity and activate their body.
Attentional Control	Actions taken to manage focus and distractions	An athlete puts their phone on 'airplane mode' an hour prior to competition to enhance task-specific focus.
Emotional Control	Actions taken to manage emotions	An athlete tempers low mood and frustration from a text message conversation in order to stay present and productive at a competition.
Image Control	Actions taken to manage the way self-image is conveyed and perceived by others (i.e., self-presentation, impression management, identity management)	An athlete selects and edits photographs and carefully composes a caption to portray a desired athletic image over social media.
Interpersonal Control	Actions taken to manage interactions with others (e.g., teammates, coaches, fans)	An athlete responds to a fan belittling their performance on social media.
Organization	Actions taken to manage daily tasks and obligations	An athlete sets reminders for tasks throughout the day using their 'reminders' application.
Preparation	Actions taken to analyze upcoming tasks and establish goals, strategic plans, and outcome expectations	An athlete uses their 'notes' application to establish a mental preparation routine prior to performance including goals, self-talk phrases, and a debrief plan.
Self-Reflection	Actions taken to evaluate performance including seeking feedback, analyzing performance data to explain outcomes, and reviewing reactions	An athlete turns off their phone for a period of time following performance to focus on the debrief.
Self-Observation	Actions taken to pay attention to performance by collecting and experimenting with personal data	An athlete uses their phone camera to video record their performance to then review this with their coach.
Recovery	Actions taken to return to a normal or desired physical, psychological, and/or emotional state	An athlete silences all notifications on their phone to take a break.

Note. SR processes are actions related to or supplemented by smartphone usage. Thus, usage can refer to both the use or the restriction of use of the smartphone.

at that time, at our level—you don't see it much, because the competition is fierce" (TM2). Conversely, there were situations related to school, work, team meetings, and family that were perceived as less important than training and competitive situations: "What's happening on Instagram is a lot more interesting than what's happening in my anatomy notes!" (VB2). In general, situations that were perceived as meaningful/interesting were associated with heightened self-regulation in comparison to those perceived as meaningless/uninteresting.

Type of Usage

Type of usage refers to *the nature of athletes' smartphone usage, which can be purposeful/anticipated or pointless/unexpected.* Athletes described purposeful/anticipated smartphone usage as usage that they planned for, relied on, and integrated in their routines: "The morning of a game day, I'll go on the notes in my phone and write out my three goals for that game coming up—three quick hits I want to focus on. It grounds me" (HF2). Athletes also reported pointless usage and mentioned that it occurred mostly when they were already depleted (e.g., following performance): "When I'm lazy or tired, I'll just go on my phone for half an hour and then start my work. Then, half an hour passes, then ten more minutes pass; it just keeps going until it's eight o'clock" (VBF1). Unexpected usage was often a result of not having a smartphone regulation plan in place: "We were going to a tournament and an [unexpected] situation came up over text. [The conversation] threw me off and the whole ride I was upset. The whole night I was down. The next morning, I didn't perform how I should have (BF1). In sum, purposeful/anticipated smartphone usage was linked to more positive experiences and outcomes than pointless/unexpected usage.

Awareness of Usage

Awareness of usage refers to *athletes' level of consciousness of their smartphone usage*, *which can be either mindful or absent-minded.* Athletes described mindful smartphone usage as being fully engaged with and attentive to the purpose of their usage as it related to the task they were performing: "I'm very mindful, because in a game, I would never have my cell phone on the ice. I want to practice how I play and that's why in practice I don't have my phone on the ice (CF3). Mindful usage was also associated with attentional and arousal control, as one athlete described: "Sometimes, if I'm waiting around on game day, I'll go use my phone for Sudoku or something, to just stimulate my mind in a way that's not social media, but still not letting me focus on the game (HF2). Conversely, absent-minded usage—particularly unplanned social media scrolling—was associated with loss of time and distraction from the task at hand: "I pick up the phone and do something, and then I've totally forgotten what I was going to do. I get pulled down the rabbit hole of this and that, and 20 minutes later I go, 'What am I doing!" (VF1). In general, mindful usage was more favorably perceived by the athletes in comparison to mindless usage, which was typically associated with unhelpful/unsuccessful outcomes (e.g., depletion).

Autonomy of Usage

Autonomy of usage refers to *athletes' level of self-determined smartphone usage, which can be either autonomous/intrinsic (stemming from personally meaningful motives) or non-autonomous/extrinsic (stemming from external motives such as rules or rewards).* Athletes described instances when they felt a high level of autonomy when using their phone. One athlete described a time when she was able to make strong personal choices about her phone usage:

> When we went to [the Olympics] we had a different phone number, so I didn't give that phone number to anyone back home. The only people who could contact me were the people I gave that number to. I even let my family know that the group chat goes off, so I wasn't constantly getting messages. I was proud of the way I handled it! (HF2)

Athletes also shared feeling obligated by coaches, administration, or sponsors to sometimes use their phones in a way that did not resonate with their personal values or goals: "I think [mandatory usage] entices players to rebel. It makes me think my coach doesn't trust me. I think it takes away a lot of accountability and trust … It's overwhelming (HM1). Another athlete described how restricted usage imposed by others is counterproductive to resilience: "It feels like an invasion of privacy. If you don't ever expose yourself to anything [that's on your phone], then when something [bad] does happen, it's going to hit you that much harder (CF3). Overall, autonomous usage was perceived to lead to more helpful and successful outcomes while extrinsically motivated usage was associated with resentment, frustration, and depletion.

Concurrence of Usage

Concurrence of usage refers to *the number of self-regulation processes occurring at the time of athletes' smartphone usage, which can be characterized as single-tasking or multi-tasking.* Athletes described several examples of engaging in self-regulation processes to accomplish a single or specific task while using their smartphone. The following is an illustration of using the phone to facilitate focus on single-tasks at training: "I'm pretty much tied to my phone for my workouts because they have the progressions, the reps, and the sets right there—demo videos and everything" (UF4). However, sometimes athletes activated multiple self-regulation processes while using their phone, which led to multitasking. An example is provided by the same aforementioned athlete: "Sometimes, when I'm doing a heavy lifting set and the

program asks for a three-minute break, I end up texting with friends or checking email, and I'm like, 'I just can't leave this alone! Just focus!'" (UF4). Overall, multitasking was perceived to more likely deplete athletes and cause mis-regulation or self-regulation failure than single-tasking.

Outcomes

The fourth component of the SSUM pertains to outcomes—*the results of self-regulation and smartphone usage, which can be characterized by different dimensions (i.e., cognitive, behavioral, social, emotional).* Athletes discussed positive and negative outcomes of self-regulation (i.e., successful or unsuccessful) and smartphone usage (i.e., helpful or unhelpful), which could impact one another. On the one hand, helpful smartphone usage was generally associated with successful self-regulation and favorable outcomes, as described by one athlete who purposefully used their smartphone to engage in self-observation during recovery, leading to desired results (i.e., validation and support): "During my rehab recovery, I kept track of where I was at relative to other people. There are tons of people posting their own rehab journeys. Validation from other people and the support from other people is nice!" (UF1). On the other hand, unhelpful smartphone usage was typically associated with unsuccessful self-regulation and unfavorable outcomes. For example, one athlete described how a lack of interpersonal control via the smartphone led to poor social comparisons and reduced self-confidence: "I see things on my phone, and it's like, 'Why can't I have that? Why can't I do this? If she's doing that, I can't do it'. It's not motivation that it really impacts, it's self-confidence" (BF1). Another athlete described the interplay between the lack of arousal and attentional control and negative cognitive outcomes: "My mental energy was not spent 100% on the game. There was some mental energy that was wasted thinking about what these random people were saying [on social media]" (CF3).

The outcome of a self-regulation cycle ultimately impacted the self-regulation competencies that athletes had to implement in order to replenish their self-regulation capacity for the subsequent cycle.

Self-Regulation Competencies

The final component of the SSUM pertains to self-regulation competencies, which are *the personal characteristics, knowledge, skills, abilities, behaviors, and attitudes that athletes have learned and developed to preserve or enhance self-regulation capacity*. Competencies derived from the models of SRS and SRL included self-awareness, self-affirmation, self-control practice, implementation intentions, and transcendence. Athletes also reported novel competencies pertaining to support-seeking and physical separation from the smartphone. Self-regulation competencies contributed to the availability of self-regulation capacity for a subsequent cycle (e.g., new task). In particular, self-regulation capacity could remain in a state of depletion based on inadequate availability or use of competencies. One athlete, who used her phone to debrief and reflect on performances, described how she favourably used self-awareness to enhance her recovery and her ability to exert emotional control and self-reflection after a hard performance: "If I have a really bad game and I'm not ready to look at the stats yet, or I'm not ready to re-watch game film, I give myself some time to digest what happened. I know that if I engage with it too early, I'm just going to beat myself up about it" (VBF2).

Athletes described that self-regulation competencies often began as deliberate self-regulatory processes such as putting their phone away as part of a readiness routine, or managing social media expectations through exposure and practice. However, through routine practice over time, these processes became automated skills. Some athletes even described transferrable competencies developed in the sport setting. For example, one athlete attributed his task-

switching ability with his phone to his self-control practice in ski training, "[In] skiing, so many things happen like delays and bad weather; you have to learn to be on, then off, then on, then off, all the time. It's something I'm just really used to at this point" (SKM1). Other athletes discussed their experience developing self-regulation competencies with the help of a mental performance consultant, who facilitated smartphone and social media practice in the form of exposure, physical separation, disconnection, forethought, and awareness, as illustrated in the following example:

> I had a mental training plan to tackle not caring as much about social media and what people say. The harder work—the exposures—I tried to do right after the season was done, so I had time to digest it. By the time the season was starting, it was about maintaining and self-reflection. Now it's just not as much of a weight on my shoulders as it used to be. I can balance how much I'm on my phone. If something bad happens, I have the tools to be able to fight off the feelings from that. (CF3)

Discussion

The purpose of this study was to examine self-regulation processes, conditions, and outcomes related to athletes' smartphone usage. A secondary purpose was to put forth a model that could inform research and applied practice for the optimization of smartphone usage in the sport context. Results supported a paradoxical two-fold relationship between smartphone usage and self-regulation. On the one hand, athletes face increased self-regulation demands because of their use of smartphones, which can lead to depletion. On the other hand, athletes use their smartphones to facilitate the execution of tasks and master self-regulation competencies. The self-regulation processes, conditions, and competencies included in the SSUM are addressed in light of existing theory and literature.

Self-Regulation Processes

Athletes in this study engaged in numerous self-regulation processes that involved the use or restriction of use of their smartphone, which led to a variety of outcomes. Several processes were linked to the SRL model (e.g., preparation, self-monitoring, self-observation; Zimmerman, 2000) and the SRS model (e.g., attentional control, image control, acquiescence; Bauer & Baumeister, 2010). It was evident that smartphone usage could contribute to both self-regulation success and failure in various situations in and out of the sport context.

Several processes paralleled those identified by DesClouds and Durand-Bush (2021) in their study of varsity athletes' smartphone usage experiences (e.g., organization, planning, self-observation, attentional control), which suggests these are important elements to address as athletes strive to determine out how to best use their phones. Current findings also support the notion that smartphone usage exists along a continuum of helpful to unhelpful usage, illustrating the potential for each self-regulation process to be aided or disrupted by the use of phones. Thus, self-regulation processes should not be regarded as being inherently positive or negative, but instead considered in relation to conditions of usage to produce specific outcomes.

This study supports the notion that self-regulation processes represent actions that require self-regulatory strength or capacity. This substantiates Baumeister et al.'s (2007) view that any self-regulatory action—successful or unsuccessful—can have a depleting effect, except for actions or processes that have become innate or automatic. While athletes can work with smartphones to manage performance and daily tasks, results show that they require self-regulation capacity to do this and this capacity must be continually replenished. Failure to do this could impact athletes' performance. For instance, studies have shown that athletes' capacity to self-regulate influences their focus and decision-making ability (Furley et al., 2013). As well,

negative effects of performance anxiety on attention might be more significant in athletes whose self-regulation is depleted from a previous task (Englert, 2016).

Athletes' accounts corroborated other research showing that social media can disrupt concentration (David et al., 2018; Encel et al., 2017) and increase cognitive load (Fortes et al., 2019; Greco et al., 2017) through depleted self-regulation capacity. However, a number of self-regulation processes (e.g., use social media to focus attention on motivational content, vicariously learn from elite athletes, control image to role model for younger athletes, seek support from family and friends) can be supported by social media and positively impact performance, learning, and well-being depending on the conditions of usage. Effective self-regulation processes may therefore buffer negative implications of smartphone usage and facilitate more positive, functional uses of these devices (Carrier et al., 2015; DesClouds & Durand-Bush, 2021; Hofmann et al., 2017; Khang et al., 2013).

Athletes' discussion of image management demands incurred by social media usage was significant. In particular, all athletes reported that image management over social media was costly to their time and energy, and on occasion, their emotions and self-control. Rahikainen and Toffoletti (2021) examined the concept of 'digital labor' shouldered by female climbers in order to yield and maintain sponsorship opportunities. A key component of this labor was image management. Results point to similar digital labour and depletion effect felt among the athletes in this study, particularly female athletes performing at a professional or Olympic level. It appears that digital presence is a necessary part of being an athlete, particularly for vocational success (David et al., 2018; Rahikainen & Toffoletti, 2021; Sanderson & Hull, 2015). However, the burden imposed by this new set of media demands has been largely overlooked. Given that

self-regulation capacity can be depleted by image management demands (Baumeister et al., 2007), more attention must be paid to this in the future.

Conditions of Usage

Results show that the interplay between self-regulation processes and conditions of usage may lead to a variety of outcomes, as depicted in the SSUM. Such findings are in line with previous work highlighting that usage outcomes are driven more by context and purpose of usage, rather than amount (DesClouds et al., 2022; Ellis, 2019; Odgers & Jensen, 2020). Findings also suggest that disconnecting from smartphones entirely is not the only (and often not the best) strategy for mitigating negative effects of smartphone usage (Durand-Bush & DesClouds, 2018). Instead, awareness and management of usage conditions may dictate whether or not smartphones are helpful or unhelpful and whether or not they facilitate or hinder athletes' self-regulation.

Context of Usage

Athletes described many instances of successful self-regulation in contexts that were meaningful and interesting to them. This finding supports the SRL model's social cognitive approach, which highlights the vital role of the environment in self-regulation (Zimmerman, 2000). Furthermore, in both the SRL and SRS models, boredom, apathy, and disinterest are presented as inhibitors of self-regulation (Baumeister et al., 2007; Zimmerman, 2000). Results affirm these contentions as athletes provided several accounts of unsuccessful self-regulation (e.g., distraction, multitasking, and succumbing to smartphone temptation) in contexts that were uninteresting, boring, or unimportant to them (e.g., class, work, team meetings, and social situations). Zimmerman (2000) suggested that this is because self-regulation processes require effort that is typically only deployed when the outcome or skill is highly valued. Thus, if athletes

are disinterested or disengaged in a particular situation or context, they may not be able to or want to invest the effort required to effectively self-regulate.

Type of Usage

Athletes reported various types of usage (i.e., purposeful and planned; purposeless and reactive). Purposeful and planned usage led to helpful and successful outcomes, which is supported by both the model of SRL and SRS. Both models dictate the importance of intent, purpose, planning, and forethought in successful self-regulation (Bauer & Baumeister, 2010; Zimmerman, 2000). In the sport context, planning has been shown to be an important action to prevent depletion of self-regulatory strength, as intentions for behavior can activate automatic processes that do not draw on the self-regulatory resource (Englert, 2016). Likewise, Zimmerman (2000) contended that dysfunctional self-regulation is reactive and lacks goal structure, strategic planning, and personal agency. This is supported by current results wherein athletes described reactive, unplanned, purposeless, and extrinsically motivated usage as the most significant catalysts of unfavorable outcomes.

Awareness of Usage

This study shows that mindful use of smartphones facilitates other helpful conditions such as purposeful, planned, and task-specific usage. Mindful usage can curtail many negative cognitive, behavioral, and emotional effects of usage, thus preserving self-regulation capacity and lessening the potential for self-regulatory failure. These findings are in line with literature pointing to metacognition and mindfulness strategies as helpful to task performance, executive function, and well-being in digital environments (Bauer et al., 2017; Carrier et al., 2015). Athletes appeared to have a heighted capacity for mindful usage in the sport context, which is not entirely surprising given that attentional capacity and selectivity are imperative to optimal

sport performance (Perry, 2005). Also, athletes were especially mindful of their smartphone usage just prior to performance. Interestingly, not all athletes reported that social media usage around performance was debilitative or unproductive. In many instances, purposeful, mindful social media use was perceived to aid motivation and self-concept—benefits that have been noted in the literature (David et al., 2018; Sanderson & Hull, 2015).

Athletes' absent-minded usage appeared to be the most detrimental to their self-regulation, in general. This parallels findings by Marty-Dugas et al. (2018) who found that absent-minded smartphone usage (as opposed to usage in general) was consistently related to inattention. Furthermore, athletes' mindless usage occurred more after performance when they gave little attention to the process of reconnecting with their phone and could find themselves depleted and misregulating in post-performance scenarios requiring recovery (Balk & Englert, 2020). 'Internal process prioritization' is a concept from the SRS model showing that self-regulation failure can occur despite clear standards and monitoring because one gives into and acts on habitual processes (Heatherton & Baumeister, 1996). This phenomenon may help explain the abundance of absent-minded usage that was reported in situations where athletes had been exerting significant self-control during their sport performance but subsequently failed to effectively control their smartphone usage after performance when they should have been prioritizing self-evaluation and recovery.

Autonomy of Usage

According to the athletes, they were more likely to achieve helpful or successful outcomes when they perceived autonomy over their usage, and when their usage was in line with their values and goals. Baumeister et al. (2007) reported that "self-control refers to the capacity for altering one's own responses, especially to bring them into line with standards such as ideals,

values, morals, and social expectations, and to support the pursuit of long-term goals" (p. 351). It appears that, for athletes, intrinsically aligning smartphone usage with their values and goals is imperative for successful self-regulation. This supports the findings of Muraven (2008) who showed that when someone perceives to have a high level of autonomy over a self-control task, it is less depleting than if the task was externally dictated.

Results pertaining to the autonomy of usage condition illuminated that smartphone usage was not solely dependent on individual choice, but was influenced by the environment including social pressures and norms (i.e., "social expectations"; Baumeister et al., 2007; Zimmerman, 2000). In line with the SRL model (Zimmerman, 2000), these findings illustrate a bidirectional relationship between environmental, social, and self-processes. The influence of the environment was extremely prevalent in the athletes' accounts and was deeply linked to the behaviors and choices of others in that environment. As originally proposed by Zimmerman (2000) and by DesClouds and Durand-Bush (2021), the environment may function as a self-regulation resource for athletes, allowing for practiced, purposeful, and meaningful smartphone usage control.

Concurrence of Usage

All athletes provided examples of facing a myriad of self-regulation processes as well as simultaneous cross-domain demands because of their smartphones. This included the completion of processes on their smartphone alongside the completion of processes in their sport setting. Findings underscore the potential for smartphones to elicit multitasking behaviors, which have been associated with depletion that limits executive function, planning, self-monitoring, and self-control (Carrier et al., 2015; Magen, 2017). Multitasking was generally unhelpful to athletes in this study and led to unsuccessful outcomes, particularly when the smartphone introduced an unplanned interruption and the athlete would rapidly and mindlessly react. In line with the tenets

of the SRS model, self-regulation processes in one context could be impacted by *prior* demands from another context (Baumeister et al., 2007; Englert, 2016). Athletes used smartphones to switch between tasks, which could be useful for managing multiple demands (e.g., staying connected with work while training on a high-intensity schedule). However, this could also be depleting (e.g., causing cognitive overload or overwhelming demands) if competencies were not used to manage and replenish the executive resources used. Single-tasking was generally associated with more practiced, planned, purposeful, and mindful usage in that athletes described taking focus away from or toward their smartphone to deliberately complete a task, even if very quickly (e.g., checking work notifications during set breaks in training). Taken together, these results mirror literature showing the iGen's propensity for task-switching due to technological distractions, which can be more detrimental to the performance of those who rapidly respond to interruptions and do not have metacognitive strategies in place to guide their awareness or ability to stop and refocus on a new task (Carrier et al., 2015).

Self-Regulation Competencies

All athletes described the use and mastery of self-regulation competencies to help optimize their self-regulation and smartphone usage. This shows that self-regulation is not a static but rather a malleable capacity that can be developed through various competencies (Bauer & Baumeister, 2010; Zimmerman, 2000). Both models of SRS and SRL (Bauer & Baumeister, 2010; Zimmerman, 2000) and related research (Englert, 2016) have shown that self-regulation capacity can be fortified through routine practice. Likewise, many of the competencies discussed by the athletes (e.g., implementation intentions, transcendence, practice) have been noted in both the models of SRL and SRS for their ability to enhance self-regulation from either a resource or learning perspective. In the SRL model, these are discussed as task competencies that can

facilitate the development of self-regulatory skill (Zimmerman, 2000) and can become engrained in performers' actions through practice. Baumeister et al. (2007) referred to this same phenomenon as forming a resistance to depletion wherein self-control is depleted at a slower rate because self-regulation competencies have been thoroughly practiced to the point of automation.

Athletes mentioned that support-seeking (e.g., from a mental performance consultant) to learn to manage smartphones was an important self-regulation competency. Durand-Bush and DesClouds (2018) equally reported that mental performance consultants play a role in helping athletes optimize smartphone usage in and around the sport context. Further, athletes in the current study commented that their self-regulation competencies were influenced by how usage was modeled at home and/or among their teammates and peers. Zimmerman (2000) noted that interpersonal relationships can be a resource for self-regulation, and those without exposure to communities where successful self-regulation is taught, modeled, and rewarded may have lower capacity. Taken together, this suggests that athletes' sport community could act as an essential resource for motivating and fostering helpful, successful smartphone usage.

Applied Considerations

The SSUM shows that regardless of negative or positive outcomes of self-regulation and smartphone usage, a self-regulation cycle is depleting. It takes effort to restrict usage and it also takes effort to use smartphones wisely thus capacity is required for athletes to flourish, particularly when presented with new or unexpected demands (Englert, 2016). It also takes time and dedication to develop self-regulation capacity and practice is essential to success (Bauer & Baumeister, 2010; Englert, 2016; Zimmerman, 2000). When it comes to smartphone usage, athletes cannot be expected to change behaviors overnight. New usage patterns to supplement self-regulation or restrictions to lessen demands should be implemented over time and modeled

in the sport environment (Zimmerman, 2000). It is important that athletes are given the space and time to work on nurturing self-regulation processes, conditions, and competencies.

Coaches and mental performance consultants can help athletes by having conversations early and often about the role of smartphones and how various elements can impact the management of these devices (e.g., planning, attention, recovery). In these conversations, it is imperative to foster athlete autonomy and intrinsic motivation (Bauer & Baumeister, 2010; Englert, 2016; Zimmerman, 2000) by eliciting and connecting with athletes' experiences, values, and goals, rather than making assumptions and ascribing general rules (Durand-Bush & DesClouds, 2018). Coaches should avoid controlling usage and instead help athletes to understand and make usage decisions for themselves.

Since recovery was identified as a key self-regulation competency (Balk & Englert, 2020), coaches and mental performance consultants should help athletes develop routines for smartphone usage that include opportunities to recover and replenish capacity. This involves paying close attention to phone connection and disconnection periods, as well as readiness signals for social media interaction. Smartphone usage plans should also help athletes remain aware of how contextual factors influence their usage and self-regulation, and how they can stay accountable to themselves when capacity is low. This involves helping athletes discuss and monitor their helpful and unhelpful usage patterns across different facets of their life (e.g., school, work, sport; Durand-Bush & DesClouds, 2018). Given the prominent role of social media in athletes' lives, mental performance consultants should help athletes manage their self-image, particularly in marketing, role modelling, and sponsorship situations. All of these activities inevitably place additional demands on athletes thus costs versus benefits must be taken into consideration when optimizing efforts.

Strengths, Limitations, and Future Directions

This is the first study to propose a model related to athlete self-regulation and smartphone usage. As such, more research on the SSUM should be conducted and include the perspectives of other athletes. A strength of this study was the inclusion of athletes with diverse profiles and experiences, however, the sample was limited to Canadian athletes and included more women than men. Future research should continue aiming for diverse backgrounds but target more genders across competitive levels. This study also corroborates previous work showing individuals' complex and nuanced experiences with smartphones. Yet, it specifically demonstrated that smartphones can be used to supplant and support athletes' self-regulation and suggests that there are conditions of usage for effective use of smartphones and self-regulation. While more studies are needed to substantiate this, this research begins to provide a foundation for the development of evidence-based guidelines for smartphone usage in sport. For instance, the SSUM can be used as a tool to help coaches, mental performance consultants, and athletes explore different smartphone usage behaviors and establish effective plans. Intervention or case studies to test the efficacy of the SSUM in guiding facilitative smartphone usage would be valuable. As social media continues to impact all facets of society, researchers should further investigate its impact on athlete self-regulation and what is required for optimal recovery.

Conclusion

The aim of this study was to uncover self-regulation processes, conditions, and outcomes related to athletes' smartphone usage and to create a comprehensive model that may guide research and applied practice in this area. The SSUM depicts 12 processes, 5 conditions, and 7 competencies that help understand why and how smartphone usage can facilitate or hinder athletes' self-regulation. As smartphones are deeply connected to athletes' lives and perceived to

be essential to many components of their functioning, acceptance of these devices in the sport domain are important. This study constitutes an important first step in developing a working model to guide leaders and practitioners by integrating the most applicable components of two commonly referenced self-regulation models (i.e., SRL and SRS). It is hoped that the SSUM will be further examined and applied in real-world settings to help optimally train smartphone usage much like any other sport-related skill.

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PART IV

General Discussion

In this general discussion, integrated findings are presented and significant theoretical, methodological, and applied contributions of the research are highlighted. Limitations of the project, as well as recommendations for future research are reviewed at the end of the section. Research aims will first be revisited to serve as a foundation for this discussion.

Research Aims Revisited

The overarching aim of this research was to advance knowledge of athletes' smartphone usage. The objectives were to derive both subjective and objective understanding of usage prevalence and trends among this population, and uncover how this usage impacts athletes' experiences and psychosocial variables that are key to their performance and well-being. Using a sequential mixed methods design informed by the critical realist paradigm, the following purposes were addressed in four separate studies:

Study 1 (Article 2) – Qualitative (Focus Groups).

- Investigate athletes' experiences with smartphone usage in the sport context.
    - *Paradigmatic purpose: Critically explore the empirical level through athletes' narratives of smartphone usage; understand context and social structures.*

Study 2 (Article 1) – Quantitative (Pilot Data Tracking and Self-Reports).

- Pilot test the functionality of a novel research application to collect objective usage data and examine the interplay between this usage and key psychosocial outcomes.
    - *Paradigmatic purpose: Better understand the actual level, the 'object' of study (the smartphone), and psychosocial variables through quantitative means.*

Study 3 (Article 3) – Quantitative (Longitudinal Data Tracking and Self-Reports).

- Utilize an in vivo research method to collect complex, longitudinal data on the prevalence and features of athlete smartphone usage and explore the interplay between this usage and psychosocial variables pertinent to performance, well-being, and smartphone usage.
    - *Paradigmatic purpose: Deepen understanding of the actual level by examining relationships between smartphone usage and psychosocial outcomes over time, to identify potential causal mechanisms.*

Study 4 (Article 4) – Qualitative (Individual Interviews)

- Examine the self-regulatory processes, conditions, and outcomes related to the smartphone usage of athletes; determine a model that can inform research and applied practice pertaining to athlete smartphone usage.
    - *Paradigmatic purpose: Explore deeper structures and mechanisms at the real level through interpretation and theoretical re-description.*

Interpretation and Integration of Research Findings

As this was a sequential mixed methods project, each study informed the next. The literature review and typologies derived from Study 1 were carried forward and built upon in each additional study, literature review, and discussion. Congruent with the critical realist paradigm, each study was designed to dive deeper through ontological layers and uncover a greater breadth of perspectives (i.e., epistemological knowing). In the following section, two main themes spanning the integrated findings are reviewed: continuum of usage and context of usage.

Continuum of Usage

The findings of this dissertation suggest that a continuum of positive/helpful to negative/unhelpful athlete smartphone usage exists, which is mediated by various mechanisms and conditions of usage. Results of Study 1 point to both negative and positive experiences of smartphone usage among athletes. They corroborate that there are indeed pitfalls of smartphone usage (e.g., David et al., 2018; Fortes et al., 2019; 2020a; 2020b; 2021; Greco et al., 2017; Park et al., 2020; Sanderson & Truax, 2014) related to experiences within sport (e.g., reduced sense of support, team cohesion, and spectator engagement; increased pressure and sense of obligation) and outside of sport (e.g., increased stress, anxiety, fear of missing out, distraction, time-wasting, sleep disruption). Moreover, results underscore that negative experiences such as stress and anxiety can be experienced as a result of smartphone usage (Elhai et al., 2017b; Vahedi & Saiphoo, 2018), *and* as a result of separation from the smartphone, which is in line with other literature (Cheever et al., 2014; Clayton et al., 2015; Rosen et al., 2013; Thomée et al., 2010). Nevertheless, athletes also delineated benefits of smartphone usage (e.g., increased capacity to organize and manage tasks and communicate with others). They perceived their smartphone to be essential to their functioning as student-athletes for management of several cross-domain demands and sport-specific preparation and learning. These results illustrate that athletes' relationship with their smartphones is not straightforward, as these devices lead to mixed emotions, uses, and outcomes that are personal, fluid, and paradoxical.

A continuum of mobile learning shaped by time and intent of usage has been discussed in the education domain (Chan et al., 2015). As well, researchers have recognized the dynamic and multifaceted potential of smartphone technology and the importance of personal agency and competencies of users as they navigate the helpful and unhelpful aspects of smartphone usage

(Chan et al., 2015; Hartley & Bendixen, 2019; Palalas & Wark, 2020). Hartley & Bendixen (2019) describe that self-regulated learning processes (e.g., self-monitoring, goal setting, planning, information management, self-awareness) can equally be supported or deterred by smartphone usage, depending on the users' self-knowledge (e.g., cognition, learning abilities) and ability to recognize and act upon that knowledge (i.e., personal agency, goals, values, beliefs). Results of Study 1 provide an illustration of experiences and outcomes of usage along this continuum, and point to important psychosocial variables (e.g., stress, attention, mindfulness, social connection, self-regulation) and contexts of usage (e.g., sport, school, work, social life) at play in the movement along the continuum.

Results from Studies 2 and 3 expand understanding of this dynamic continuum by challenging expectations that negative and positive psychosocial outcomes would have a clear relationship with athletes' smartphone usage. Instead, these two studies provide a glimpse into favourable psychosocial profiles of athletes across amounts of usage. Specifically, results of Study 2 demonstrate that all participants reported moderate-to-high self-regulation capacity, mindfulness, and mental health. Results of Study 3 enhance these findings and suggest that the one-to-one relationship between smartphone usage and negative psychosocial outcomes was not present. Through statistical analyses, no significant relationships between amount of usage and psychosocial outcomes were found, aside from a positive relationship between mental health and usage in the winter season. This aligns with literature suggesting a nuanced relationship between smartphone/social media usage and psychosocial outcomes based on a matrix of factors (Coyne et al., 2020; Ellis, 2019). While negative aspects of usage might exist, they co-exist with positive uses and outcomes. Study 3 also revealed individual changes in usage, psychosocial relationships, and psychosocial outcomes over time. Studies have shown that athlete well-being

can fluctuate throughout a season (Cresswell & Eklund, 2006; DeFreese & Smith, 2014) thus more research is warranted to examine to what extent changes in well-being could be linked to the interplay between positive and negative smartphone/social media usage.

Finally, results of Study 4 deepen understanding by illustrating the processes, conditions, and competencies related to usage that contribute to movement in one direction or another along the continuum. Self-regulation success appears to exist along a continuum similar to that of smartphone usage whereby outcomes of self-regulation follow a gradient of success to failure as smartphones are used in tandem in facilitative or debilitative ways. Study 4 uncovered that meaningful contexts (such as sport), purposeful usage (that aligned with athletes' goals and values), self-awareness of usage (leading athletes to remain engaged and present), autonomous usage (allowing athletes to feel intrinsically motivated and have a sense of personal agency in their usage choices), and task-specific usage (whereby athletes were using their phones for a purpose aligned with the task at hand) moved athletes toward the helpful/successful end of the smartphone usage and self-regulation continuum. These results mirror Lee et al.'s (2021) findings who reported that golfers use mobile applications that support aspects of self-regulation such as self-monitoring and organization, which appear to have a positive relationship with performance. Notably, however, results of Study 4 suggest that there are countless interactions across usage conditions that can influence the continuum of smartphone usage and self-regulation, as conceptualized in the SSUM model.

Taken together, it can be discerned from this research project that not all athletes use their phones in the same ways or for the same purposes to reach similar outcomes; instead, they shift back and forth along a continuum of usage. Also, it cannot be concluded that heavy users and light users are situated at each end of the unhelpful/unsuccessful to helpful/successful

continuum, respectively. Rather, even the most heavy and light users can have both positive and negative experiences with smartphones, which may change over time based on a variety of factors captured in the SSUM. There are also other factors at play that should be addressed in future research (e.g., environment, complexity of tasks, technology literacy).

Context of Usage

Findings from this dissertation also show the importance of the context of smartphone usage and the impact it can have on athletes. Specifically, being an athlete and using a smartphone in and around the sport setting appears to have a direct impact on how and why athletes use their phones, and how they traverse the usage continuum. The context of usage (e.g., sport, school, home) also points to unique social, environmental, and power structures at play in the relationship between athletes and their smartphones.

Invisible Load

First, there appears to be a unique invisible load shouldered by athletes due to their smartphones. As illustrated in Studies 1 and 4, this invisible load is accumulated through athletes' perceived obligations to self-present, carefully manage their image, and communicate with coaches, family, friends, and fans. In Study 1, athletes revealed perceived obligations to their academic institution and their coaches. In Study 4, more examples of similar perceived obligations were reported such as having to turn on GPS trackers so coaches could track athletes' whereabouts prior to major competitions, filling in 'health check' applications every morning in order to avoid repercussions at practice, fielding excessive messages from family and friends during major competitions, self-presenting inauthentic sentiments in order to please sponsors, and spending undue time planning how to respond to fans. These two qualitative studies made it especially clear that athletes felt obligations to self-present (through words, images, and

interactions) in ways that pleased peers, teammates, sponsors, recruiters, coaches, and sport and academic institutions.

Fundamentally, increased stress, pressure and overload as a result of constant accessibility through smartphones is not unique to athletes (e.g., Thomée et al., 2010). However, it appears this load might be intensified for competitive and high-performance athletes who must fulfill obligations related to their sport context. These findings are in line with work by David et al. (2018) who demonstrated that NCAA athletes felt they were not only being constantly monitored, but they had to carefully and intentionally curate Twitter posts because of "the great responsibility that came with their student-athlete status" (p. 176). In the current research, obligation was described by athletes from all sports, competitive and academic levels, and age groups. However, results of Study 4 clarified that the invisible load acquired due to marketing and sponsorship demands was unique to high-performance athletes and high-performance hopefuls, who found it necessary to self-manage and self-present to bolster their career as an athlete. This was especially the case for female athletes who felt tasked with making their sport visible in a male-dominated, highly-aestheticized space. Odgers and Jensen (2020) have put forward the idea that smartphones and social media are technologies that should be embraced and utilized because they are imperative to young people's success in 'economies of the future' (p. 346). It seems that this may be an expectation for success for high-performance athletes in Canada. However, it begs the question: Are athletes sufficiently literate in this area and trained to effectively employ smartphones and social media to reap the full benefits and protect themselves from existing pitfalls? Park et al. (2020) have preliminarily investigated challenges and benefits of athletes using social media as a branding tool, but more attention must be paid to this so that athletes get appropriate support to meet expectations and fulfill obligations.

Rahikainen and Toffoletti (2021) described the digital labor taken on by athletes, and particularly female athletes, to yield and maintain sponsorship opportunities. This digital presence that appears to be increasingly necessary for athletes' career success in sport (Dart, 2014; Dumont, 2017) warrants serious scoping as we have been quick to overlook the burden that it arguably adds in an already stressful environment (Evers, 2019). Further, this invisible load of obligation and self-presentation has not yet been understood in terms of self-regulatory depletion. Study 4 served to contextualize smartphone experiences within an integrated self-regulation framework showing how contextually-driven obligations may be costly to athletes' time, energy, and overall functioning.

Furthermore, Study 1 and Study 4 revealed that when coaches and/or sport administrators removed athletes' autonomy of usage and forced them to use their smartphones to self-monitor and self-present in particular ways, the smartphone quickly became *unhelpful* for athletes. A sense of personal agency appears to be imperative for athletes to perceive the smartphone as a *helpful* tool rather than a burden. These findings support Deci and Ryan's (2012) concepts of autonomous versus controlled motivation, which are deeply intertwined with behavioral regulation. Results of this research point to the importance of autonomous motivation to regulate smartphone usage in the sport context, suggesting that "the more fully a regulation is internalized, such that the behavior is more autonomous, the more likely people are to change and maintain behaviors" to support well-being (Deci & Ryan, 2012, p. 422). Additional studies with athletes, coaches, and sport stakeholders are warranted to identify an acceptable range of obligations imposed on athletes that respects their autonomy, individuality, privacy, and self-regulation competencies.

Sport-Specific Social Media Usage

Another key finding specific to the sport context pertains to social media usage. Aside from the aforementioned findings regarding the use of social media to fulfill communication and self-presentation obligations, results of Studies 2 and 3 confirm that athletes predominantly use their phones for social media. In fact, real-time tracking metrics showed that their use of social media applications largely exceeded their use of other applications across an academic year. Visual-based social media applications were some of the most popular, including Instagram, YouTube, and Snapchat. The qualitative nature of Study 4 helped to further understand that athletes' constant curation of their athletic identity over social media may be intensifying the value they are placing on their athletic identity, thus taking focus away from other identities they could be developing (Brewer et al., 1993). This suggests that social media usage among athletes might be reinforcing a hyper focus on athletic identity and driving attention toward externally reinforced attributions, rather than an internal locus of control (Hanrahan & Biddle, 2008). Intense focus on athletic identity over social media could lead athletes to attach their self-evaluations, self-worth, and competence to social media feedback and content. Based on findings regarding the continuum of smartphone usage, this feedback could be highly positive or highly negative and either close or far from athletes' real attributes. This leaves athletes' self-evaluations vulnerable to external sources, making adaptive self-reactions and accurate attributions of performance outcomes difficult, particularly when self-regulatory capacity is depleted (Baumeister et al., 2007; Zimmerman, 2000).

By engaging in context-driven social media activities, athletes are also opening themselves up to harassment inherent to social media celebrity (Sanderson & Truax, 2014). Several athletes in Study 4 recounted positive experiences with fan feedback and support while at major

competitions. While some found this uptick in social media celebrity motivating, others found it pressure-inducing. Only a few instances of online harassment were noted by high-performance female athletes in Study 4. Interestingly, a study by World Athletics (2021) showed that female athletes were the target of 87% of all online abuse during the 2020 Tokyo Olympics, which suggests that women in sport may be more at risk of social media abuse. Female athletes should receive additional support and training to mitigate this. Such opportunities could also help them shift prevailing discourses regarding women's presence and value in sport and provide a space for activism and role modeling (Rahikainen & Toffoletti, 2021; Sanderson & Hull, 2015; Toffoletti & Thorpe, 2018). Several female athletes in Studies 1 and 4 described highly valuing their ability to present as a role model for other young female athletes over social media.

Essential Tool for Athletes

Building on the positive aspects of mobile technology, the smartphone appears to be an essential tool to support self-regulation in the sport context. In Study 1, participants shared how their smartphones helped them meet the multifaceted demands of student-athlete life and optimize performance preparation and debriefs. Studies 1, 3, and 4 revealed how athletes' smartphone usage was more productive and facilitative in the sport setting than in other domains of their lives. Sport is therefore a favourable context in which to leverage the use of phones to optimize performance, well-being, and learning. As seen in this dissertation, phones may be used to support self-regulation processes such as planning, self-monitoring, and reflection (Hartley & Bendixen, 2019; Lee et al., 2021; Zheng et al., 2018; Zimmerman, 2000). Furthermore, findings point to the power of environmental and social influences in the sport context for facilitating smartphone usage through self-regulation. Sport offers a physical boundary for athletes to inadvertently train their ability to be contently separated from their phones and experience more

face-to-face social interactions with positive role models (e.g., coaches, teammates, mental performance consultants, other support staff) in a natural environment. Previous studies have found that extracurricular activities, such as sport, can function to displace young peoples' screen time activity (Oberle et al., 2020; Twenge et al., 2018). The current research uncovered added benefits that sport participation may present when attempting to use and regulate smartphones to optimize the functioning, performance, and learning of athletes.

Contributions

The research findings from Studies 1 to 4 advance the body of knowledge on athlete smartphone usage and the impact of this technology in the sport context. Theoretical/conceptual, methodological, and applied contributions of this research are discussed in the following section.

Theoretical/Conceptual Contributions

The current research provides a conceptual foundation for the study of athlete smartphone usage and it also contributes to the literature pertaining to athlete self-regulation. Specifically, the models of self-regulated learning and self-regulatory strength have not been used in tandem, in a complementary fashion, to study a phenomenon within sport psychology. This dissertation foregrounded theory triangulation (Patton, 1999) so that the two theories were used together, to inform the research and assess the data. Globally, findings reveal a unique consolidation of two seminal self-regulation theories and helped to uncover points of complementarity and dissonance among them. Further, there are no known frameworks pertaining to the study of athlete smartphone usage and no studies have sought to integrate self-regulation models to understand a full continuum of usage.

In terms of progression across the four studies, Study 1 first provided evidence that the smartphone functions as a self-regulatory tool for varsity athletes, while also causing

impediments to self-control (i.e., distraction and disengagement). The results helped to corroborate that a self-regulation model would be highly relevant for the study of athlete smartphone usage, and underscored that it would be necessary for this model to account for the broad range of facilitative and debilitative smartphone functions highlighted by participants. Studies 2 and 3 furthered knowledge about athletes' self-regulation capacity through longitudinal data tracking and monthly mobile surveys. They led to preliminary logical inferences about the relationship between athlete smartphone usage and self-regulation. Study 4 provided evidence that both concepts of self-regulated learning and self-regulatory strength can be used, in complementary ways, to study and explain aspects of smartphone usage among athletes.

Specifically, results of Study 4 support that, together, the models of self-regulated learning and self-regulatory strength allow for a more holistic account of usage, including aspects that are unique to the sport context and the experiences of athletes. Components of each model help to understand elements of athlete smartphone usage. Zimmerman's (2000) model is helpful for explaining context-specific usage (i.e., usage specific to sport) for the purpose of improving or maintaining desirable outcomes, supplementing self-regulated learning via smartphones, and developing self-regulation competencies with or for smartphone usage. On the other hand, the model of self-regulatory strength (Baumeister et al., 2007) is useful for defining self-regulation tasks and self-regulation capacity, understanding and explaining unhelpful, automatic smartphone usage behaviors, self-regulation depletion, self-regulation failure as an outcome of usage, and specific methods of enhancing self-regulation. It seems that when it comes to athlete smartphone usage, unsuccessful self-regulation is due to both ineffective proactive techniques (Zimmerman, 2000) and self-regulatory depletion (i.e., overloaded SR demands due to the smartphone introducing cross-domain access at any given time; Baumeister

et al., 2007). This is an important consideration, as up to this point, we have been largely *reactive* to the negative effects of smartphone usage (e.g., banning phones), instead of *proactively* planning for productive usage and enhanced self-regulation capacity.

However, the current research also demonstrated that even though the two aforementioned models could be used in a complementary fashion to investigate the variables of interest, they could not comprehensively account for the full continuum of smartphone usage and self-regulation processes and competencies at play in the specific context of sport. As such, Study 4 contributes a novel conceptualization of self-regulation and smartphone usage among athletes. The Self-regulation and Smartphone Usage Model (SSUM) illustrates the nuanced, flexible continuum of smartphone usage and outcomes for athletes. The SSUM draws together a comprehensive list of existing processes and sub-processes from both the model of self-regulated learning and self-regulatory strength as well as new ones. It introduces five main components (self-regulation capacity, self-regulation tasks, conditions, outcomes, and self-regulation competencies) including 12 self-regulation processes, five conditions of usage (i.e., context, type, awareness, autonomy, and concurrence of usage), and seven self-regulation competencies that influence helpful to unhelpful smartphone usage and successful to unsuccessful self-regulation related to smartphone usage. The SSUM was developed to represent the smartphone usage of competitive and high-performance athletes specifically, and so it is context-specific. There are unique social and psychological characteristics of this population that contributed to how the model functions, including unique motivators of smartphone usage among athletes (e.g., sponsorship, role modeling, performance outcomes, team cohesion), and the importance for athletes to have well-developed self-regulation capacity to attain optimal performance and well-being (e.g., Clearly et al., 2006; Dubuc-Charbonneau & Durand-Bush, 2015; Durand-Bush et al.,

2022; Englert, 2016; Furley et al., 2013). Even though the SSUM is context-specific, and the general population may have different competencies and usage motivations than athletes, the conditions presented in the model do parallel findings in other domains (e.g., negative mental health outcomes as a result of passive social media usage (Verduyn et al., 2015; 2017), metacognition and mindfulness aiding more functional use of digital technology (Bauer et al., 2017; Carrier et al., 2017), inattention due to absent-minded usage (Marty-Dugas et al., 2018)). As studies are designed in the future, such parallels should be further examined to determine the applicability of the SSUM to other performance contexts.

Methodological Contributions

This mixed methods research informed by the critical realist paradigm makes several methodological contributions. Although mixed methods research is gaining traction in the sport psychology domain (Ryba et al., 2020), projects of this nature that are firmly grounded in paradigmatic choices and carried out with rigorous considerations of trustworthiness, integration, and coherency are still developing (Bryman, 2006). This dissertation contributes a mixed methods approach with clear, purposeful decisions behind the use of qualitative and quantitative methods (i.e., focus groups to encourage critical dialogue, mobile tracking to capture objective, ecologically valid data, and individual interviews to achieve depth, perspective, and individual insight). A call has been made for mixed methods research that is carried for the purpose of showing richer, deeper understanding of phenomena that can only be achieved with the sum of multiple methods (Fetters & Freshwater, 2015). The qualitative and quantitative results of this dissertation, together, provide an otherwise unachievable, holistic description of smartphone usage among athletes (i.e., prevalence, features, context, interactions, experiences, mechanisms,

structures), which is absent from the sport psychology literature, and rare in the study of smartphones at large.

Studies 2 and 3 took on a strong methodological focus, in that novel methods were developed and implemented to capture real-time longitudinal data. It is noteworthy that Studies 2 and 3 leveraged the object of study (i.e., the smartphone) as an in vivo research tool. This was done by creating and embedding the mobile survey within the app that was developed for the research. As such, these two studies provide knowledge on the development and use of the smartphone as an ecologically valid research tool that can complement and mirror the usage behaviors of athletes. Previous research has relied on cross-sectional studies and self-reports of usage (Boase & Ling, 2013; Deng et al., 2019), which are vulnerable to reporting biases and overlook the purpose and context of usage (Ellis, 2019). Study 3 fills in a void of longitudinal studies in the area of smartphone research and sheds light on the variability of usage within and across individuals (DeFreese, 2014). Furthermore, creative data analysis techniques were used to examine the results of Study 3 in order to keep focus on the rich, longitudinal data. To keep the mixed methods goals and paradigmatic stance at the forefront of choices, visual representations and descriptive statistics were prioritized. Specifically, a heat map was generated to visualize individualized data over time (Wilkinson & Friendly, 2009). This is not a common approach to present results in the sport psychology domain, but it has been used previously to illustrate smartphone usage (e.g., Bentley et al., 2015; Böhmer et al., 2011) and supports a novel mechanism for comparing, contrasting, and drawing preliminary inferences about a small sample.

Finally, this mixed methods research project is one of only few in the domain of sport psychology that are informed by the critical realist paradigm (see Ryba et al., 2020 for

overview). Furthermore, few studies have discussed how to apply critical realism in a concrete way to guide method and analysis choices (e.g., Bygstad et al., 2016; Fletcher, 2016; Stutchbury, 2021). This dissertation advances knowledge not only on critical realism as a useful, applicable paradigm for mixed methods research in sport psychology, but also on how to apply critical realism through methodological choices such as data collection, analysis, and integration. Critical realism informed every step of this mixed methods project. In Study 4, the approach was crucial to identify the context and conditions that influenced athletes' usage and self-regulation (i.e., retroduction). It also served to support, reject, and modify elements of existing theory, create a new conceptual model, and provide the most accurate possible explanation for the data (i.e., abduction; Fletcher, 2016).

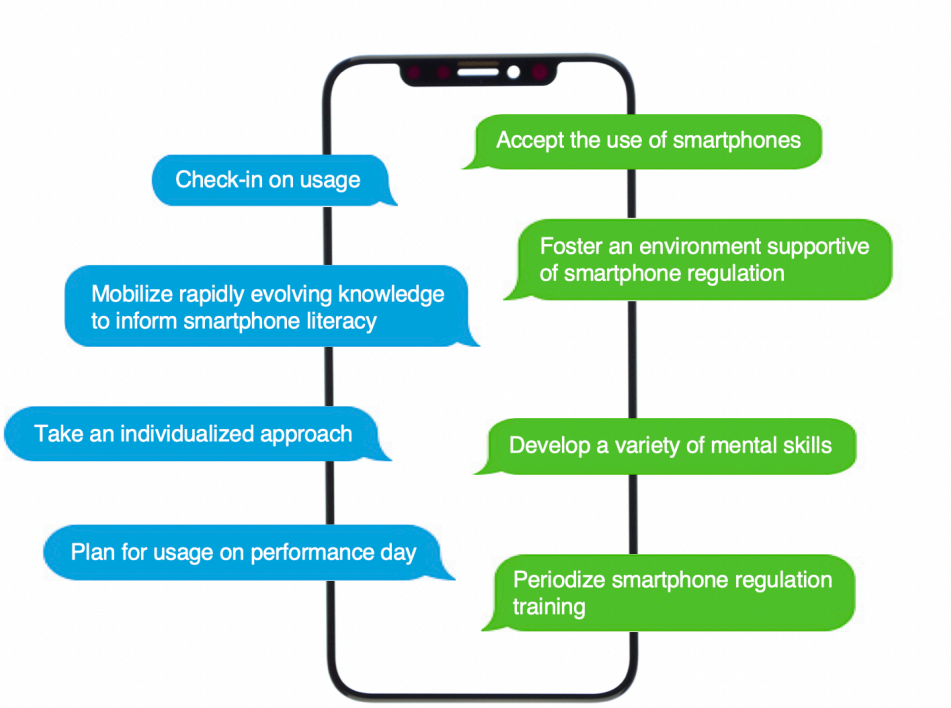
Contributions to Applied Practice

The current research also makes significant contributions to applied practice. Several practice recommendations can be drawn from the four studies to help athletes, practitioners, and sport leaders leverage and optimize smartphone usage in and around the sport setting. Of importance, these recommendations were derived throughout the project as each study was completed and some of the recommendations were implemented in workshops with the sport community. Figure 7 summarizes the eight recommendations that can guide professional practice.

Applied Recommendation 1 – Accept the use of smartphones. Findings from Studies 1, 2, 3, and 4 underscore that not only is smartphone usage prevalent among competitive and high-performance athletes, it is also deemed an essential component of their functioning. Whether smartphones are used to support psychosocial functioning, performance, or both, there are benefits of using these devices, particularly given the increased demands for communication,

connectivity, and organization in athletes' lives. The prevalence of usage among athletes' mirrors that of the general population (Deng et al., 2019; ComScore, 2017; Smith, 2015) while the necessity of usage corroborates that smartphones are integral in many aspects of modern life (e.g., Smith, 2015). As such, a productive approach for athletes, coaches, and sport stakeholders Figure 7.

Recommendations for Athletes, Practitioners, and Sport Leaders to Optimize the Use of Smartphones



is to accept and learn how to work with the technology in the sport context, rather than against it (Sanderson, 2018).

Applied Recommendation 2 – Take an individualized approach. Studies 2 and 3 show that the impact of smartphone usage extends far beyond the amount of time that athletes use their phone. Findings from all four studies provide support that individual nuances of usage must be considered to fully understand how smartphones function in athletes' lives. Individual

competencies, characteristics, motivations, and dispositions play a role in moderating the effects of smartphone usage (e.g., Coyne et al., 2020; Elhai et al., 2019; 2017b; 2017c; Hartley & Bendixen, 2019; Twenge & Martin, 2020; Palalas & Wark, 2020; Zheng et al., 2018). They support the notion that blanket- and all-or-nothing approaches to smartphone regulation in the sport setting do not attend to the continuum of usage among athletes (Durand-Bush & DesClouds, 2018; Sanderson, 2018). Further, findings from Study 4 highlight the imperativeness of athletes' sense of autonomy and personal agency over their smartphone usage choices and the connection of these choices to core goals and values, in order to facilitate productive usage and successful self-regulation. In general, mental performance consulting interventions should be tailored to the individual and/or specific team expectations and norms for optimal effectiveness (Collins & Durand-Bush 2016; Sharp & Hodge, 2011). Considerations of an athlete's smartphone usage appears to be no different. Durand-Bush and DesClouds (2018) shared a list of key questions that may be posed to athletes by practitioners to guide reflection and practice for the optimization of usage. Appendix I also provides reflection prompts to produce team- or individual-specific smartphone usage standards that are context and time sensitive, and aligned with team or individual values and goals.

Applied Recommendation 3 – Plan for usage on performance day. Studies 1 and 4 show that disconnecting from smartphones prior to performance could be beneficial to prevent depletion. However, there are situations in which athletes find it helpful to use their phones to get ready to perform (e.g., use music and video for activation; re-read goals and reminders to focus on task-relevant cues). After performance, athletes can face both positive and negative interactions via their smartphone, which can impact self-reflection, evaluation, and recovery. These findings point to a dire need for flexible smartphone usage interventions to target the pre-

and post-competition period so that self-regulation, well-being, and particularly recovery, can be supported rather than thwarted (Eccles et al., 2021). It is common practice for mental performance consultants to assist athletes in developing plans and routines to manage thoughts, feelings and actions to achieve peak performance and respond to obstacles (Blumenstein & Orbach, 2020; Cotterill et al., 2010; Wang & Zhang, 2015). Since Study 4 revealed that purposeful, mindful, anticipated, autonomous, and single-tasked smartphone usage is ideal, mental performance consultants should address these conditions of usage when assisting athletes in establishing pre- and post-competition plans. As with any aspect of performance enhancement, deliberate practice is essential (Baker et al., 2020) thus opportunities to practice smartphone regulation and mitigate anxiety caused by separation should be provided on a regular basis (Cheever et al., 2014; Clayton et al., 2015).

Applied recommendation 4 – Periodize smartphone regulation training. Study 3 results point to a balancing act between perceived helpfulness and unhelpfulness of smartphones that is mediated by athletes' self-regulation competencies and seasonal changes. Athletes should remain aware of how benefits and stressors inherent to their own smartphone usage change throughout the year based on factors such as contextual demands, personal needs, vulnerabilities, and recovery. Interestingly, there was mention in Study 4 that periodized exposure training for social media took place during the off season due to the intensity of the work required paid off during competition season. These findings suggest that a periodized approach to smartphone usage training would be pertinent to complement the ebb and flow of mental and physical training intensity and recovery. Practitioners should explore the best time to increase smartphone and social media literacy with athletes (Blumenstein & Orbach, 2020).

Applied recommendation 5 – Foster an environment supportive of smartphone regulation. Results from Studies 1 and 4 demonstrate the significant influence of social and environmental factors in supporting optimal smartphone usage and self-regulation. The physical and social environments of particular sports can influence athletes' use and regulation of smartphones (e.g., keeping the phone in the car because it is too cold to check outside; using the phone during team meetings because everyone else is doing the same). Moreover, athletes feel obliged to use their smartphone and face a variety of demands related to smartphone and social media usage because of their dedication to the sport context. These findings suggest that mental performance consulatnts, coaches, and integrated sport team members should take care to review and consider the demands they place on athletes. They should consider whether they are contributing to an environment of helpful usage or perpetuating undue control and media obligations for connectivity during inopportune times. Furthermore, based on Study 1 in which athletes keenly recognized the negative impact of other individuals' use of phones in the sport context, those interacting with athletes in the sport environment should be aware of and strive to model appropriate smartphone usage behaviours.

Applied recommendation 6 – Develop a variety of mental skills. Findings from Study 4 show that athletes can develop several competencies to manage and use smartphones and social media in ways that benefit performance, day-to-day functioning, and well-being. These competencies—such as transcendence (i.e., goal setting and mastery orientation; Weiss & Amorose, 2008), implementation intentions (i.e., planning; Cotterill et al., 2010; Englert, 2016), recovery (Balk & Englert, 2020; Eccles et al., 2021), self-awareness (Ravizza, 2010); self-affirmation (Van Raalte et al., 2017), and practice (Baker et al., 2020)—are well known in the sport psychology domain. The SSUM in Study 4 can serve as a valuable map for guiding athletes

in developing mental/self-regulation competencies for the use of smartphones. This model illustrates how athletes can use a variety of strategies to engage or not engage with their phones and social media in meaningful and facilitative ways, and mitigate the cognitive load and self-regulatory demands that these devices introduce. Smartphone usage is a habit-forming behavior that can cascade into increased use (Oulasvirta et al., 2012) and problematic usage (Elhai et al., 2017; 2019). As such, developing sound mental skills to prevent this from occurring is salient for athletes.

Applied recommendation 7 – Check-in on usage. Findings from Studies 1 and 4 show that awareness and purpose of usage influence the positive/helpful to negative/unhelpful continuum of usage. Both of these conditions rely on athletes' ability to be mindful, achieve a present focus, and assess thoughts and feelings in-the-moment to connect with *why* they are using their phone. Metacognition and mindfulness can also help to buffer the negative impacts of digital technologies on attention and well-being (Bauer et al., 2017; Carrier et al., 2015; Li et al., 2021). In considering this evidence, regular check-ins throughout the day are suggested to help athletes kickstart mindful usage. Appendix J provides examples of questions athletes can routinely ask themselves to remain aware and prompt mindful, purposeful usage.

Applied Recommendation 8 – Mobilize rapidly evolving knowledge to inform smartphone literacy. The pervasive question in the literature has been whether or not smartphone and social media usage is detrimental to athletes and their performance (Encel et al., 2017; Fortes et al., 2019; 2020; Greco et al., 2017). However, findings from Studies 1 to 4 suggest that this is not the ideal question to ask. The better questions to consider pertain to smartphone literacy: *Are athletes aware of the different reasons they use their phone? Do athletes know how their smartphone, including social media, can impact them in both negative*

and positive ways? Are athletes aware of their own reactions to smartphone and social media content? Have athletes considered what kind of cognitive, emotional, and behavioural outcomes their reactions can trigger? Do athletes know which mental/self-regulation competencies to use in the face of different usage demands? This research provides empirical knowledge to inform smartphone literacy in sport through educational workshops that could be offered through organizations like the Coaching Association of Canada, AthletesCAN, Game Plan, and School Sport Canada, to name a few. It is recommended that the main themes from this research be integrated into workshops (e.g., self-regulation, social connection, distraction, disengagement, stress, real-time tracking, seasonal influences on usage needs and demands, continuum and conditions of usage such as autonomy, context, type, concurrence, and awareness of usage). However, sport stakeholders should remain abreast of the rapidly evolving literature regarding smartphones and social media within and outside of the sport psychology domain to guide and adapt their work over time.

Limitations and Future Directions

Regardless of the significant contributions of this doctoral research, limitations and directions for future research are provided in this section. Limitations specific to each study can be found in the four articles included in the Results section, Part III (e.g., mobile app in Studies 2 and 3).

Limitations

Samples. The sample in Study 1 was relatively homogenous (i.e., student-athletes from universities in Ontario, Canada). As with all focus group research, it is possible that some athletes' perspectives were not represented or heard equally. Additionally, the samples in Studies 2 and 3 were small and results must therefore be interpreted with caution. The samples in this

project are limited to the perspectives and experiences of Canadian athletes and provide only a snapshot of sports, ages, and competitive levels in this country. Results are not generalizable and may not be applicable to all athletes across Canada and other countries.

Measures. Self-report measures were employed in Studies 2 and 3, which are susceptible to response biases, including social desirability (Van de Mortel, 2008). It is possible that athletes responded to the measures in a more socially-acceptable manner, however, several precautions were taken to reduce response biases such as anonymity and encryption of user data, covert tracking, and repeated measures over time with re-ordered questions.

No measure of problematic smartphone usage was included, so it is unknown whether any athletes would have met this threshold. However, there is still controversy over the validity of smartphone addiction and problematic usage measures because they do not capture the variety of uses that influence problematic behaviours and/or outcomes (Ellis, 2019; Panova & Carbonell, 2018). Furthermore, standard criteria do not exist for smartphone addiction.

Finally, the SEWP-S is a novel self-regulation scale based on the model of self-regulated learning (Zimmerman, 2000). Although an acceptable internal consistency coefficient was obtained for this scale, even with the scale measuring a dynamic construct (Tavakol & Dennick, 2011), there is need for further validation of this measure.

Timing. Smartphone technology and research are evolving at a rapid pace. As a result, the current research is time-limited. Another important consideration is the unforeseeable impact of COVID-19 on smartphone and social media usage prevalence and patterns. Although data collection for this research occurred before the pandemic, it is important to recognize that society at large has seen an uptick in usage of screen-based, internet enabled technology (Sangalli & Lewis, 2020). Therefore, results of this research should also be considered in light of the social,

psychological, and behavioral effects of the pandemic. As an example, it is possible that athletes now rely even more on their smartphones for communication and connectivity but along with this, they may experience even more obligation and demands to use their smartphones to accomplish tasks in the sport setting. Further study of the context, continuum, prevalence, and patterns of usage among athletes in a post-COVID world is warranted and could be guided by the methods and outcomes of this work.

Future Directions

The current research has exposed a number of important areas for continued research pertaining to athlete smartphone usage. First, Studies 1 and 3 highlight the importance of self-regulation within the athlete-smartphone relationship and Study 4 is the first known study to examine smartphone usage among athletes using two prominent self-regulation frameworks. Given that neither of these two models could fully account for the usage experiences of athletes, the SSUM model was created. Future research should continue to investigate the applicability of the SSUM model to assess various elements of smartphone and social media usage in sport, particularly the function of the smartphone as a self-regulatory tool, a source of self-regulatory depletion and its impact on essential elements of performance and well-being. Moreover, investigations of the efficacy and applicability of the SSUM within specific athlete profiles, sport contexts, and age groups would advance the use of this model in the sport psychology domain. More nuanced investigations of each condition of usage are warranted. For example, in-depth studies of mindful versus mindless usage would help to advance knowledge regarding the impact of usage on athletes. As well, studies targeting the concurrence of usage could help contextualize the ability for self-regulation skills to buffer the ill-effects of media multitasking within the athlete population.

Study 3 highlighted several potential associations that warrant further investigation, including the relationship between smartphone usage, self-regulation, perfectionistic self-presentation, and perceived sport experiences. As well, results suggested that the time of year influences important psychosocial variables and athlete needs. Future research could investigate specific psychosocial variables and their relationship to various smartphone usage purposes, particularly at key points throughout the athletic season and academic year that pose unique stressors and demands for competitive athletes (Blumenstein & Orbach, 2020; Cresswell & Eklund, 2006; DeFreese & Smith, 2014; Morris et al., 2020). Furthermore, future studies should continue to investigate the longitudinal impact of smartphone usage while remaining sensitive to the context and timing of usage, and peripheral factors occurring at the same time (e.g., exams, applications for work or graduate studies, major competitions, family events). Specific performance indicators (e.g., scores, times, standings) should also be integrated into research to continue shedding light on the extent to which smartphones are influencing athletic performance. While the current research took a largely social-cognitive focus, both sport and smartphone usage have inherent physical elements, and so it would be pertinent for future studies to consider psychophysiological variables in tandem with those described in this work.

Most investigations of social media usage among athletes have focused on the pre-performance phase (e.g., Encel et al., 2017; Fortes et al., 2019; 2020; Greco et al., 2017). However, current findings point to potential detriments occurring post-performance when self-regulatory strength is low. Since recovery is an essential component of performance and well-being (Eccles et al., 2021) and self-regulation is imperative to optimal recovery (Balk & Englert, 2020), future research should consider focusing on the implications of smartphone and social

media usage after performance when recovery, reflection, adaptation, and learning may be taking place for the next task or performance attempt (Zimmerman, 2000).

This dissertation focused on the experience of competitive and high-performance athletes; however, they are not the only actors in the sport context who are impacted by smartphone usage. Results highlight the influence of the sport environment (e.g., coaches, teammates, administrators, sport organizations). Researchers should incorporate different stakeholders' perspectives on smartphone usage in the sport context and more deeply question how the context and power structures surrounding these groups impact usage. Recent literature revealed dissonant perspectives among players, parents, and coaches regarding social media usage (Dunn et al., 2021) and coaches' abuse of power through social media (Sanderson & Weathers, 2019). Research should examine communication norms, practices, and expectations pertaining to the use of smartphones amongst athletes, coaches, and parents.

Last but not least, the current mixed methods research project is one of few in the sport psychology domain to be guided by critical realism. Given the value of the ontological, epistemological, and methodological tenets of this paradigm to conduct mixed methods research, more researchers should consider using it, particularly to study emergent phenomenon (Ryba, 2020).

PART V

Conclusion

Despite continued media attention (e.g., Cox et al., 2021; Gregory, 2019; Ottesen, 2012; Peter, 2018; Robertson, 2018; Tarabay & Zheng, 2022), only a few studies have focused on smartphone usage among athletes. Smartphones are rapidly-evolving facets of athletes' lives, which can implicate their cognitions, emotions, and behaviors. These devices house a multitude of features and functions that can act as detriments and facilitators of learning, performance, and well-being. There is no foundational knowledge on experiences, prevalence, patterns, and outcomes of athlete smartphone usage, which has limited the availability of empirical evidence to guide applied work. Considering this, the overarching aim of this research was to advance knowledge by investigating athletes' experiences of smartphone usage in and around the sport context, and uncovering the impact of this usage on psychosocial outcomes that have important implications for their performance and well-being. Four studies were conducted to fulfill this aim and the implications of each study are summarized below.

Study 1: Investigate varsity athletes' experiences with smartphones in the sport context.

Smartphones were perceived by the varsity athletes as essential tools in their daily lives and an important motive for usage was social media. The features and functions of these devices were capable of catalyzing both positive and negative experiences in the sport context. The athletes highlighted negative implications of usage such as stress, distraction, and disengagement, as well as positive implications of usage such as social connectedness and self-regulation. Smartphones concurrently offered challenges and opportunities, which were unique to each athlete. Findings suggest that experiences and outcomes are best captured using a continuum ranging from positive/helpful to negative/unhelpful smartphone usage.

Study 2: Pilot test the functionality of a novel research application to collect objective usage data and examine the interplay between this usage and key psychosocial outcomes.

The objectively tracked usage data showed that the student-athletes were prevalent smartphone users, using their phones an average of 4.5 hours per day and more than one full day per week (31.7 hours per week), predominantly for social media. The athletes had moderate-to-high self-regulation capacity, mindfulness, and mental health. The heaviest smartphone users in the sample reported the highest psychosocial scores, while the lightest users reported the lowest psychosocial scores. Results delineated benefits of using the smartphone as a research tool for automatic, non-invasive, longitudinal tracking of usage data and collection of repeated self-report measures.

Study 3: Utilize an in vivo research method to collect complex, longitudinal data on athlete smartphone usage and explore the interplay between this usage and psychosocial variables pertinent to performance, well-being, and smartphone usage.

Smartphone usage was prevalent and multifaceted among student-athletes over the course of an academic year, and the most frequently used applications pertained to social media. Athletes were categorized as heavy or light users (heavy = 5 and light = 5) and their usage remained stable throughout the year. Athletes also reported moderate-to-high psychosocial functioning, irrespective of being categorized as a heavy or light user. Only one significant relationship was observed between smartphone usage and mental health during the winter season, suggesting that smartphone usage may be gratifying athletes' needs for support during that time of year. Self-regulation capacity was also high within the sample and a posteriori analysis revealed that self-regulation may impact usage and psychosocial outcomes throughout the year. Findings suggest that more attention should be paid to the characteristics of both users

and usage to appreciate the nuanced relationship observed between smartphone usage and psychosocial outcomes over time.

Study 4: Examine the self-regulatory processes, conditions, and outcomes related to athlete smartphone usage and determine a model that can inform research and applied practice pertaining to athlete smartphone usage.

The model of self-regulated learning (Zimmerman, 2000) and model of self-regulatory strength (Baumeister et al., 2007) provided a foundation for understanding the dynamic and paradoxical uses of smartphones in sport. However, the elements of both models alone or together did not comprehensively account for athletes' perceptions and experiences. Consequently, the Self-regulation and Smartphone Usage Model (SSUM) was conceptualized to reflect the full continuum of smartphone usage and self-regulation processes, conditions, and outcomes discussed by the athletes. The SSUM includes five major components: self-regulation capacity, self-regulation processes, conditions of usage, outcomes, and self-regulation competencies. The five conditions of usage (i.e., context, type, awareness, autonomy, and concurrence of usage) help to understand how and why smartphone usage can be helpful or unhelpful to athletes and facilitative or debilitative to self-regulation. The SSUM is a novel working model that can guide future research and applied practice to optimize smartphone usage in the sport context.

In sum, the relationship between athletes and their smartphones is complex and highly nuanced. Athletes mirror iGen tendencies, however, they are confronted with unique social structures and environments that shape their experiences with smartphones. This research constitutes an important first step in understanding how smartphone usage can positively and negatively impact athletes in and around the sport context. Continued research and knowledge

translation are essential to facilitate training designed to increase smartphone literacy. Like other skills related to athletic performance, smartphone and social media usage should be planned, practiced, and evaluated. Practitioners working with athletes should therefore integrate knowledge regarding mobile technology in their future interventions.

PART VI

References and Appendixes

This section includes a list of all references made throughout the dissertation except for those that were already included in the reference lists in Part III. Appendices referenced throughout the dissertation follow the reference list.

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Appendix A: Consent Forms

Participant Informed Consent Form - Study 1

Title of Study: Smartphones and athletes: Are they helping or hindering performance and well-being?

Principal Investigator:
Dr. Natalie Durand-Bush, PhD
[Address and contact of principal investigator]

Co-Investigator:
Poppy DesClouds, PhD Candidate
[Address and contact of co-investigator]

You are invited to participate in a novel study examining the impact of smartphones on the development and performance of athletes across Canada. This study is important because research shows that smartphones can have positive and negative effects on performance and learning, but we do not yet understand how smartphones influence athletes who are under pressure to meet various demands (e.g., sport, performance, school).

Why am I being asked to participate?
You are being asked to participate in this study because you are part of an important group of athletes in Canada. As a competitive athlete, you have unique perspectives and experiences when it comes to pursuing excellence and we are interested in seeing how using your smartphone may facilitate and/or hinder your performance and well-being.

Purpose of the Study
There are only a handful of studies in which athletes' use of smartphones and features (i.e., texting, social media, games, training apps, etc.) have been investigated. As such, it is not clear who in the athletic population uses smartphones, or when, where, why, and how athletes utilize them. This will be the purpose of this study. It will provide a platform for athletes to share their perspectives and experiences surrounding their smartphone usage. The co-investigator's doctoral research is part of this project.

What is expected of me?
If you agree to participate, your involvement will consist of taking part in a 60 to 75-minute focus group interview guided by one of the researchers in order to discuss your experiences using your smartphone. The focus group interview will involve five other athletes and will be held on the University of Ottawa campus sometime between May 2017 and August 2018. It will be audio-recorded and scheduled at a time convenient for both yourself and the researcher. Following the focus group, you will be asked to review the transcript containing the information you shared and you will have the opportunity to make changes to the content. To be eligible, you must (a) be a competitive

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athlete in Canada (i.e., compete in regular competitions throughout the year), (b) own a Smartphone equipped with Google's Android or Apple's iOS mobile operating system, (c) be 13 years of age or older, and (d) speak, read, and write in English, as the interviews will be conducted in English.

Can I say no?

Your participation is completely voluntary. You may decline to participate in the study or withdraw from it at any time without penalty. You have the right to refuse to answer any question and deny comment at any time. Should you feel uncomfortable with any of the topics discussed, you have the right to leave the room.

If you choose to withdraw from the study, the data collected will be securely stored as described below or destroyed if that is your preference. Additionally, once the study has been published, you may still request to have your data destroyed to prevent its use in any further publications. Given that participants will be de-identified during transcription of the focus groups, we will not be able to identify what each, individual participant has said within our transcript. However, you will be given the opportunity to review the transcript of your focus group, during which time you can make additional comments or request to have information withdrawn.

What are some potential risks?

This study will involve minimal risk. Responses to questions are optional and voluntary; you reserve the right to withhold responses should you choose. Should any of the questions trigger psychological or emotional concerns, we will be able to immediately direct you towards appropriate resources. Moderators of the focus group will highlight the importance of respect for privacy amongst participants, and sharing of personal or identifying information will be discouraged. However, you should be aware that universal adherence to this request cannot be monitored or guaranteed by the research team. Although it will be explicitly discouraged by the group facilitators, there remains a possibility that other focus group members share information outside of the focus group.

Given the collaborative, discussion-based nature of focus groups, it will be possible for other members of your focus group to identify you and listen to your comments. This means the information you share during the focus group might not be kept entirely confidential. Nonetheless, we invite all participants who agree to take part in this study, to respect the confidentiality and anonymity of their fellow-participants by refraining from sharing *any* information from the focus group outside of the session.

What benefits will I receive from participating in this study?

By participating in this study, you will be contributing to the enhanced understanding of how athletes may best use their smartphones to facilitate optimal performance outcomes and overall well-being. You may also gain increased awareness of your own smartphone usage, as well as the benefits and drawbacks of this usage in the various contexts of your life.

Has this study received ethics approval?

This research project has received ethics approval from the Research Ethics Board of the University of Ottawa, Carleton University, Algonguin College, and La Cité Collégiale. Your participation is completely voluntary, and you may withdraw from the study at any time and/or refuse to answer questions without any negative consequences. Should you wish to withdraw your responses after you submitted them, simply email the co-investigator, Poppy DesClouds, at [co-investigator's email address] at any point during the study and your responses will be deleted from the database.

How is my personal information being protected and how will the data be conserved?
Your responses will remain anonymous and confidential. The information that you share may be used by Dr. Durand-Bush and Ms. Poppy DesClouds in conference presentations and publications in scientific journals, however, your anonymity is guaranteed at all times. You will be assigned a participant ID, and your name as well as any information that could reveal your identity in the interview transcript, scientific articles and conference presentations, will be excluded. All physical data such as printed transcripts or reports will be safely kept in Dr. Durand-Bush's laboratory in a locked cabinet. Digital and electronic data will be saved on Dr. Durand-Bush's or Ms. DesClouds' password protected computer. All of the data will be conserved for 5 years after completion of the project, after which they will be permanently destroyed. You will receive your interview transcript by email or mail based on your preference so that you can verify the content. If you choose the email option, you accept that anonymity and confidentiality will not be 100% guaranteed. You will have the opportunity to read the transcript and make any desired changes to the document and send it back via email or mail (in a self-addressed stamped envelope provided) to the researcher.

Who do I contact if I have further questions?
If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa [ethics office address and contact information]. For any questions regarding this study, you can contact Poppy DesClouds at [email address], or Natalie Durand-Bush at [email address].

Who do I provide my consent to participate in the study?
If you wish to participate in this study, please read the information below and sign in the designated space.

- I understand that I am being asked to participate in a study regarding the use of smartphones as an athlete.
- I have read each page of this Participant Informed Consent Form or have had it read to me.
- My questions have been answered to my complete satisfaction.
- I understand that I have the right to withdraw from the study at any point, should I see fit.
- I voluntarily agree to be a participant in this study.
- I agree to be audio recorded.
- I accept that the results of this study will be published in scientific articles and presented at conferences and understand that my anonymity will be protected.
- I will be given one of the two copies of this consent form.

_____	_____	_____
Participant's Printed Name	Participant's Signature	Date

Principal Investigator or Co-investigator Statement
I have carefully explained the study to the study participant. To the best of my knowledge, the participant understands the nature, demands, risks and benefits involved in taking part in this study.

_____	_____	_____
Principal Investigator or Co-Investigator's Printed Name	Principal Investigator or Co-Investigator's Signature	Date

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Participant Informed Consent Form – Studies 2 and 3

Title of Study: Smartphones and athletes: Are they helping or hindering performance and well-being?

Principal Investigator:
Dr. Natalie Durand-Bush, PhD
[Address and contact of principal investigator]

Co-Investigator:
Poppy DesClouds, PhD Candidate
[Address and contact of principal investigator]

You are invited to participate in a novel study examining the impact of smartphones on the development and performance of athletes across Canada. This study is important because research shows that smartphones can have positive and negative effects on performance and learning, but we do not yet understand how smartphones influence athletes who are under pressure to meet various demands (e.g., sport, performance, school).

Why am I being asked to participate?
You are being asked to participate in this study because you are part of an important group of athletes in Canada. As a competitive athlete, you have unique perspectives and experiences when it comes to pursuing excellence and we are interested in seeing how using your smartphone may facilitate and/or hinder your performance and well-being.

Purpose of the Study
The purpose of this study is to assess athletes' smartphone usage and determine if this usage impacts sport performance and well-being. The co-investigator's doctoral research is part of this project.

What is expected of me?
If you agree to participate, you will be asked to download a mobile application on your smartphone and allow it to run for the duration of 8 months (assistance will be provided as necessary). The data regarding your usage of different features and applications (i.e., time of day, frequency, and duration of use related to text messages, emails, phone calls, video games, social media, photos, videos, music, etc.) will be tracked in the 'background' of your regular phone activity and automatically downloaded to a secure web server on a bi-weekly basis. This will occur when you are connected to Wi-Fi or 3G during low usage times such as the middle of the night. **Of note, the mobile app for this study will NOT track any of the content within applications on your phone, so your privacy will not be violated.** You will also be asked to complete a demographic questionnaire via the mobile app one time at the beginning of the study, which will take approximately 5 minutes. You will then be prompted to complete, via the mobile app, a survey to assess various

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psychosocial variables and your sport participation and development, once per month for the 8 months of the study. It will take approximately 15-20 minutes to complete the survey on the mobile app each time. You will be able to complete it at whatever time is convenient for you within a 2-week time frame and do it in segments as you wish.

To be eligible, you must (a) be a competitive athlete in Canada (i.e., compete in regular competitions throughout the year), (b) own a Smartphone equipped with Google's Android operating system, (c) be 13 years of age or older, and (d) read and write in English, as the app is only available in English.

If you meet the criteria for a follow-up study and you are interested in taking part, you will be asked to provide your consent to be contacted to participate in a one-hour individual interview with one of the researchers to discuss more in depth your smartphone usage, including how you employ social media. You can choose to participate in the first study, without participating in the follow-up study. If you do not meet the criteria for the follow-up study, you will not be contacted about it.

Can I say no?
Your participation is completely voluntary. You may decline to participate in the study or withdraw from it at any time without penalty. You have the right to refuse to answer any question at any point in time. If you choose to withdraw from the study, the data collected will be securely stored as described below or destroyed if that is your preference. Additionally, once the study has been published, you may still request to have your data destroyed to prevent its use in any further publications.

What are some potential risks?
This study will involve minimal risk. Responses to questions are optional and voluntary; you reserve the right to withhold responses should you choose to do so. Should any of the questions trigger psychological or emotional concerns, please contact the co-investigator, Poppy DesClouds, at [email address] and she will be able to direct you towards appropriate resources.

What benefits will I receive from participating in this study?
By participating in this study, you will be contributing to the enhanced understanding of how athletes may best use their smartphones to facilitate optimal performance outcomes and overall well-being. You may also gain increased awareness of your own smartphone usage, as well as the benefits and drawbacks of this usage in the various contexts of your life.

Has this study received ethics approval?
This research project has received ethics approval from the Research Ethics Board of the University of Ottawa, Carleton University, Algonguin College, and La Cité Collégiale. Your participation is completely voluntary, and you may withdraw from the study at any time and/or refuse to answer questions without any negative consequences. Should you wish to withdraw your responses after you submitted them, simply email the co-investigator, Poppy DesClouds, at [email address] at any point during the study and your responses will be deleted from the database.

How is my personal information being protected and how will the data be conserved?
Your responses will remain anonymous and confidential. In order to minimize the risk of security breaches and to help ensure your confidentiality, we recommend that you use standard safety measures such as signing out of your account, closing your browser, and locking your screen or device when you are no longer using them / when you have completed the study.

The information that you share may be used by Dr. Durand-Bush and Ms. Poppy DesClouds in conference presentations and publications in scientific journals, however, your anonymity is guaranteed at all times. If you consent to be contacted to participate in a follow-up qualitative study should you meet the criteria, your name and contact information (i.e., email address, and phone number) will be kept in a secure, password protected participant key that links your name and contact information with your participant ID. This information will only be accessible by the research team for the purposes of selection for the follow-up study. Moreover, after installing and logging in to the mobile application, you will be identified using only a participant ID number and *no* personal identifiers. This ID will be linked to a password protected participant key, that will be accessed by the research team only.

All physical data such as printed manuscripts or reports will be safely kept in Dr. Durand-Bush's laboratory in a locked cabinet. All electronic data will be saved on Dr. Durand-Bush's or Ms. DesClouds' password protected computer. All of the data will be conserved for 5 years after completion of the project, after which they will be permanently destroyed.

Who do I contact if I have further questions?

If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa [ethics office address and contact information]. For any questions regarding this study, you can contact Poppy DesClouds at [email address], or Natalie Durand-Bush at [email address].

Who do I provide my consent to participate in the study?

If you wish to participate in this study, please read the information below, type your full name, and click the button that reads, "I consent to participate in this study".

- I understand that I am being asked to participate in a study regarding the use of smartphones as an athlete.
- I have read each page of this Participant Informed Consent Form or have had it read to me.
- My questions have been answered to my complete satisfaction.
- I understand that I have the right to withdraw from the study at any point, should I see fit.
- I voluntarily agree to be a participant in this study.
- I accept that the results of this study will be published in scientific articles and presented at conferences, and I understand that my anonymity will be protected.
- I may print a copy of this consent form for my personal files

Participant's Name: (Typed in full)

☐ I consent to participate in this study.

- I agree ☐ or I do not agree ☐ to be contacted for a follow-up qualitative study should I meet the criteria (please mark the appropriate box with an 'x').

  If you do not meet the criteria for the follow-up study, you will not be contacted about it.

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Participant Informed Consent Form - Study 4

Title of Study: Smartphones and athletes: Are they helping or hindering performance and well-being?

Principal Investigator:
Dr. Natalie Durand-Bush, PhD
[Address and contact of principal investigator]

Co-Investigator:
Poppy DesClouds, PhD Candidate
[Address and contact of co-investigator]

You are invited to participate in a novel study examining the impact of smartphones on the development and performance of athletes across Canada. This study is important because research shows that smartphones can have positive and negative effects on performance and learning, but we do not yet understand how smartphones influence athletes who are under pressure to meet various demands (e.g., sport, performance, school).

Why am I being asked to participate?

You are being asked to participate in this study because you are part of an important group of athletes in Canada. As a competitive athlete, you have unique perspectives and experiences when it comes to pursuing excellence and we are interested in seeing how using your smartphone may facilitate and/or hinder your performance and development.

Purpose of the Study

The purpose of this study is to examine if and how athletes' ability to manage themselves and their environment is impacted by their use of various smartphone features and applications, particularly, social media. The co-investigator's doctoral research is part of this project.

What is expected of me?

If you agree to participate, your involvement will consist of taking part in a 60-minute individual interview, guided by one of the researchers, in order to discuss your use of your smartphone and how it helps or hinders your self-regulation. The interview will be held sometime between September 2018 and April 2019 on the University of Ottawa campus or via Skype. If you choose the Skype option, you accept that anonymity and confidentiality will not be 100% guaranteed. The interview will be audio-recorded and scheduled at a time convenient for both yourself and the researcher. You will be asked to review the transcript containing the information you shared during the interview and you will have the opportunity to make changes to the content. To be eligible, you must (a) be a competitive athlete in Canada (i.e., compete in regular competitions throughout the year), (b) own a Smartphone equipped with Google's Android or Apple's iOS mobile operating system, (c) be 13

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years of age or older, and (d) speak, read, and write in English, as the interviews will be conducted in English.

Can I say no?

Your participation is completely voluntary. You may decline to participate in the study or withdraw from it at any time without penalty. You have the right to refuse to answer any question and deny comment at any time. Should you feel uncomfortable with any of the topics discussed, you have the right to leave the room. If you choose to withdraw from the study, the data collected will be securely stored as described below or destroyed if that is your preference. Additionally, once the study has been published, you may still request to have your data destroyed to prevent its use in any further publications.

What are some potential risks?

This study will involve minimal risk. Responses to questions are optional and voluntary; you reserve the right to withhold responses should you choose. Should any of the questions trigger psychological or emotional concerns, we will be able to immediately direct you towards appropriate resources.

What benefits will I receive from participating in this study?

By participating in this study, you will be contributing to the enhanced understanding of how athletes may best use their smartphones to facilitate optimal performance outcomes and overall well-being. You may also gain increased awareness of your own smartphone usage, as well as the benefits and drawbacks of this usage in the various contexts of your life.

Has this study received ethics approval?

This research project has received ethics approval from the Research Ethics Board of the University of Ottawa, Carleton University, Algonguin College, and La Cité Collégiale. Your participation is completely voluntary, and you may withdraw from the study at any time and/or refuse to answer questions without any negative consequences. Should you wish to withdraw your responses after you submitted them, simply email the co-investigator, Poppy DesClouds, at [email address] at any point during the study and your responses will be deleted from the database.

How is my personal information being protected and how will the data be conserved?

Your responses will remain anonymous and confidential. The information that you share may be used by Dr. Durand-Bush and Ms. Poppy DesClouds in conference presentations and publications in scientific journals, however, your anonymity is guaranteed at all times. You will be assigned a participant ID, and your name as well as any information that could reveal your identity in the interview transcript, scientific articles and conference presentations, will be excluded. All physical data such as printed transcripts or reports will be safely kept in Dr. Durand-Bush's laboratory in a locked cabinet. Digital and electronic data will be saved on Dr. Durand-Bush's or Ms. DesClouds' password protected computer. All of the data will be conserved for 5 years after completion of the project, after which they will be permanently destroyed. You will receive your interview transcript by email or mail based on your preference so that you can verify the content. If you choose the email option, you accept that anonymity and confidentiality will not be 100% guaranteed. You will have the opportunity to read the transcript and make any desired changes to the document and send it back via email or mail (in a self-addressed stamped envelope provided) to the researcher.

Who do I contact if I have further questions?

If you have any questions regarding the ethical conduct of this study, you may contact the Protocol Officer for Ethics in Research, University of Ottawa [ethics office address and contact]. For any

questions regarding this study, you can contact Poppy DesClouds at [email address] or Natalie Durand-Bush at [email address].

Who do I provide my consent to participate in the study?

If you wish to participate in this study, please read the information below and sign in the designated space.

- I understand that I am being asked to participate in a study regarding the use of smartphones as an athlete.
- I have read each page of this Participant Informed Consent Form or have had it read to me.
- My questions have been answered to my complete satisfaction.
- I understand that I have the right to withdraw from the study at any point, should I see fit.
- I voluntarily agree to be a participant in this study.
- I agree to be audio recorded.
- I accept that the results of this study will be published in scientific articles and presented at conferences and understand that my anonymity will be protected.
- I will be given one of the two copies of this consent form.

_____	_____	_____
Participant's Printed Name	Participant's Signature	Date

Principal Investigator or Co-investigator Statement

I have carefully explained the study to the study participant. To the best of my knowledge, the participant understands the nature, demands, risks and benefits involved in taking part in this study.

_____	_____	_____
Principal Investigator or Co-Investigator's Printed Name	Principal Investigator or Co-Investigator's Signature	Date

Appendix B: Ethics Approvals

File Number: H03-17-11 **Date (mm/dd/yyyy):** 06/02/2017

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Certificate of Ethics Approval

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Natalie	Durand-Bush	Health Sciences / Human Kinetics	Principal Investigator & Supervisor
Poppy	DesClouds	Health Sciences / Human Kinetics	Student Researcher

File Number: H03-17-11

Type of Project: Professor and PhD Thesis

Title: The impact of Smartphones in varsity sport: How can we leverage benefits and drawbacks to maximize performance and development?

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)
06/02/2017	06/01/2018

Special Conditions / Comments:
N/A

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http://www.recherche.uottawa.ca/deontologie/ http://www.research.uottawa.ca/ethics/index.html

File Number: H03-17-11 **Date (mm/dd/yyyy):** 06/02/2017

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement and other applicable laws and regulations in Ontario, has examined and approved the application for ethical approval for the above named research project as of the Ethics Approval Date indicated for the period above and subject to the conditions listed the section above entitled "Special Conditions / Comments".

During the course of the study the protocol may not be modified without prior written approval from the REB except when necessary to remove participants from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the study (e.g. change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, information/consent documentation, and/or recruitment documentation, should be submitted to this office for approval using the "Modification to research project" form available at: http://research.uottawa.ca/ethics/submissions-and-reviews.

Please submit an annual status report to the Protocol Officer 4 weeks before the above-referenced expiry date to either close the file or request a renewal of ethics approval. This document can be found at: http://research.uottawa.ca/ethics/submissions-and-reviews.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

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August 15, 2017

Natalie Durand-Bush
Poppy DesClouds

Re: Ethics approval of the project: *Smartphones and Varsity Athletes: Are they helping or hindering performance and development?* (CÉR 1718-04)

Dear Dr. Durand-Bush and Ms. DesClouds:

La Cité's Research Ethics Board (REB) has proceeded to the ethics evaluation of the project mentioned above based on the requirements of the *Tri-Council Policy Statement. Ethical Conduct for Research Involving Humans* (2014) (TCPS2). Your project is approved under the following conditions:

- The REB must be informed of any possible modifications to the research protocol and the documentation of the project before it is implemented;
- Any unforeseen event that increases the risk to participants in this research project must be immediately reported to the REB;
- This ethics approval is valid until **August 14, 2018** inclusively;
- For research projects lasting more than one year, a request for renewal of the ethics approval must be filed at least one month prior to the expiry date of this approval;
- For research projects lasting less than one year and for those who are terminated, a report must be filed with the REB at the end of the project.

La Cité`s REB wishes you great success with this research project.

Carleton UNIVERSITY
Canada's Capital University

Office of Research Ethics and Compliance
5110 Human Computer Interaction Bldg | 1125 Colonel By Drive
| Ottawa, Ontario K1S 5B6
613-520-2600 Ext: 4085
ethics@carleton.ca

CERTIFICATION OF INSTITUTIONAL ETHICS CLEARANCE

The Carleton University Research Ethics Board-B (CUREB-B) has granted ethics clearance for the research project described below and research may now proceed. CUREB-B is constituted and operates in compliance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* (TCPS2).

Ethics Protocol Clearance ID: Project # 106914

Faculty Supervisor: Poppy DesClouds

Research Team: Poppy DesClouds (Primary Investigator)
Dr. Natalie Durand-Bush (Principal Investigator (External))
Ms. Poppy DesClouds (Co-Investigator (External))

Project Title: Smartphones and varsity athletes: Are they helping or hindering performance and development?

Funding Source (If applicable):

Effective: **June 14, 2017** Expires: **June 30, 2018**.

Restrictions:

This certification is subject to the following conditions:

1. Clearance is granted only for the research and purposes described in the application.
2. Any modification to the approved research must be submitted to CUREB-B via a Change to Protocol Form. All changes must be cleared prior to the continuance of the research.
3. An Annual Status Report for the renewal of ethics clearance must be submitted and cleared by the renewal date listed above. Failure to submit the Annual Status Report will result in the closure of the file.If funding is associated, funds will be frozen.
4. A closure request must be sent to CUREB-B when the research is complete or terminated.
5. Should any participant suffer adversely from their participation in the project you are required to report the matter to CUREB-B.

Failure to conduct the research in accordance with the principles of the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2ndedition* and the *Carleton University Policies and Procedures for the Ethical Conduct of Research* may result in the suspension or termination of the research project.

Please contact the Research Compliance Coordinators, at ethics@carleton.ca, if you have any questions or require a clearance certificate with a signature.

ALGONQUIN COLLEGE | Research Ethics Board

Algonquin College Research Ethics Board
Certificate of Approval to Conduct Research

Protocol #: 2017-JUNE-DURANDBUSH

This is to certify that the Algonquin College Research Ethics Board (REB) has approved the application for the research project titled:

"Smartphones and varsity athletes: Are they helping or hindering performance and development?"
to be conducted by:

Dr. Natalie Durand-Bush.

The members of the REB are satisfied that this research project, as described in the application package, meets the appropriate ethical standards as set out in Algonquin College Policy RE03 – Research Involving Human Subjects.

This certification is valid for one year from the date indicated below. If the researcher(s) wish to continue their study beyond the date indicated below, they will be required to submit an Annual Research Renewal Form.

If at any time during the course of the study the participants or researcher(s) encounter any adverse events, they are required to report them to the REB immediately, per RE03 – Research Involving Human Subjects.

If at any time researchers wish to change any aspect of the study (e.g. data collection, recruitment procedures, research personnel), the researchers must inform the REB of the proposed changes and request their approval prior to implementing any changes.

Upon completion of the project, and no later than one year from the date indicated below, the principal investigator is required to submit a Project Completion Form to the REB.

The members of the Algonquin College REB would like to wish the researcher(s) well in their research.

Appendix C: Focus Group Interview Guide

INTRODUCTIONS

1. Please share with the group a bit about yourself (e.g., sport and area of study).
    - When and how did you start playing your varsity sport?

A. GENERAL OPENING QUESTIONS

1. What motivated you to participate in this study?

B. VARSITY ATHLETICS

1. What does it mean and take to be a varsity athlete?
    - What demands are placed on you as a student-athlete?
    - What is the best part of being a varsity student-athlete?
    - What is the most difficult part of being a varsity student-athlete?

C. GLOBAL PERCEPTION OF SMARTPHONE USAGE

[*Addresses: preferences and priorities; perceptions of usage; prevalence of usage*]

1. What kind of smartphone do you have?
    - Why do you have this particular make and model of smartphone?
    - How long have you owned a smartphone (not this one in particular, but a smartphone of any kind)?
    - How did you end up with a smartphone? Was it a planned, major investment?
2. **Do you consider your smartphone to be an *essential* tool/device or can you live without it?**
3. How often is your smartphone on you or very nearby you?
4. How do you feel when you cannot check or interact with your smartphone?
5. Have you ever considered or tried not using your smartphone for an extended period of time?
    - If yes, why? What was the experience like?
    - If no, why not?
6. **Would you characterize yourself as a heavy, moderate, or light smartphone user?**
    - What leads you to characterize yourself this way (e.g., in comparison to others)?

D. CONTEXT OF SMARTPHONE USAGE

[*Addresses: dialogue related to prevalence and context of usage*]

General

2. Primarily, what do you use your smartphone for?
    - What are the main features you use on a **day-to-day basis?**
    - What app(s) would you say you visit most **frequently** throughout any given day?
    - Is there anything you have *tried* to use your smartphone for, but failed?
    - Is there anything you wish your smartphone could do, but it doesn't?
3. Is any of your smartphone usage specifically related to your sport training, practice, or competition? Explain.
    - What features do you use most often related to sport?

In-Depth

Sport

1. Do you bring your smartphone with you to training, practice, and competitions?
    - How do you use your smartphone in these contexts?
        - What is the majority of your smartphone usage in training, practice, and/or competition related to? (i.e., your sport, or an unrelated context/situation)
        - Do you use your smartphone **on the way to** training, practice, and/or competition? Could you provide an example of how you use your smartphone during these times?
        - Do you use your smartphone **on the way home from** training, practice, and/or competition? Could you provide an example of how you use your smartphone during these times?
        - At training, practice, and/or competition, when (e.g., before, during, after) and where (e.g., in change room, on the field, in the car on the way home) exactly do you use these features?
    - What features do you use most often when you are at training, practice, and/or competition? Explain (i.e., why these features and how do you use them?)
2. Is there anything notable or unique about the ways in which you and athletes on your team (or with whom you train) use their smartphones?
    - Have you noticed/experienced any usage trends within your team (or training group)?
    - Have you noticed/experienced anything you would classify as negative or detrimental usage within your team (or training group)?
    - Have you noticed/experienced anything you would classify as positive or productive usage within your team (or training group)?
3. Is there anything notable about your smartphone usage as a student-athlete, **as opposed to non-athletes**?

Academic

1. Do you bring your smartphone with you to class?
    - How do you use your smartphone in class?
    - What is the majority of your usage **in class** related to? (i.e., school, or an unrelated context/situation)
    - What features do you use most often when you are in class?
2. Is any of your smartphone usage related to school (i.e., work, studying, organization)? Explain.
    - What features do you use most often related to school?
3. Based on your own experience and observations, is there anything notable or unique about the ways students at your school use their smartphones?
    - Have you noticed/experienced any usage trends within your school?
    - Have you noticed/experience anything you would classify as negative or detrimental usage?
    - Have you noticed/experienced anything you would classify as positive or productive usage?

Age Demographic

1. What do you believe characterizes the way people your age interact with and use their smartphones? (as opposed to your parents, or people in high school, for example)

Gender

1. What is your perception of the differences between how men and women use their smartphones?

Communication

1. What is your preferred method of communication?
2. What would you say is your strongest form of communication? Why?
3. To what extent do you communicate using your smartphone? What features do you use?
    - Have you experienced miscommunication via your smartphone? Explain.
    - How does your team (or training mates) use smartphones to communicate?
4. Would you say communication via your smartphone is 'good', 'bad', or both? Explain.

E. ROLE AND CONTROL OF SMARTPHONES

[*Addresses: various perceptions of the role smartphones have in their life, as well as the magnitude of this role*]

1. Generally speaking, what role does your smartphone have in your life? (e.g., an organizational tool, the hub of your social life, a source of entertainment, etc.)
2. **Do you feel that you always have control over your smartphone and your smartphone usage? Explain**.

F. RESTRICTIONS ON USAGE

[*Addresses: various rules and restrictions related to smartphone usage and potential reasons for their implementation*]

1. Do you try to self-impose any restrictions on your own smartphone usage? (i.e., turn it off one hour before bed, don't check it during class, etc.). Explain.
    - Do you and your friends have any 'rules' in place related to phone usage when you are in social situations together? Explain.
    - What rules or restrictions for smartphone usage do you have to abide by, that are implemented by someone else, such as your teachers, coaches, parents, etc.? Explain.

G. OVERALL EXPERIENCES

1. Are there any additional experiences, anecdotes, or opinions you would like to share - positive or negative - related to smartphone usage in your day-to-day life?

SUMMARY OF QUESTIONS AND COMMENTS

1. What do you take away from this interview?
2. Would you like to add anything else?
3. Thank you for your participation in this study.

Appendix D: Individual Interview Guide

SCREENING QUESTION

Self-assessment as heavy or light smartphone user

1. In order to participate in the study, I need to know whether you consider yourself to be a heavy or light smartphone user? *Note:* (a) heavy (i.e., you feel pressure to have your phone on you, feel that you have to check/respond all the time, and use it all/most of the day) or (b) light (i.e., you rarely/never feel pressure to have your phone on you, you often/always feel that you can ignore your phone, and you seldom/sometimes use it throughout the day).

OPENING DEMOGRAPHIC QUESTIONS

1. Please state your age, your gender/pronoun, your main competitive sport, level of competition, main training facility(ies).
2. How many years have you been playing your sport competitively?
3. Are you a student/were you recently? If so, do you / did you play for your competitive club or varsity team? If so, what year of athletic eligibility are you in?
4. Approximately how many hours per week do you typically…
    a. Study / do homework for courses?
    b. Train / compete for your sport?
    c. Work (if you have a job)?
    d. Use your smartphone?
5. Do you ever use your smartphone while …
    a. You are at practice/training?
    b. You are at competition?
    c. In class / at work?
6. Do you ever purposefully limit the use of your smartphone? If so, why?
7. Could you identify the three greatest stressors you experience as an athlete?

Interviewer: The purpose of this study is to examine if and how you use your smartphone, including social media, to manage yourself and your environment, so my questions will pertain to this. Please feel free to speak openly and provide anecdotes / examples.

A. SELF-REGULATION / SELF-CONTROL

General

1. Does using your smartphone help you to function on a daily basis and if so, how (e.g., reminds you to go to your physio appointment, makes you feel better when you see a compliment on social media)?
2. Does using it sometimes impede your functioning and if so, how (e.g., distracts you when doing homework, you find it hard to turn your phone off or put your phone down, makes it difficult for you to fall asleep, you lose track of time when using your phone)?
3. Does using your smartphone help you to manage or respond well to your environment and if so, how (e.g., you reach out to a friend when you see on social media that he needs help)?

4. Does using it sometimes lead you to respond poorly to your environment and if so, how (e.g., you lash out at someone in a response to her text message, causes you to spend too much time responding on social media and then experience fatigue, stress, or anxiety as a result)?
5. Overall, does using your smartphone lead you to have more or less control over your life (e.g., it helps me to keep track of everything I have to do, makes me waste valuable time)? Please explain and give examples.

In-depth

Forethought (Preparation)

1. Does using your smartphone ever help you to prepare or get ready to learn and perform (in sport and/or school)? Or, does using it ever prevent you from preparing to learn and perform? For example, does it help you:
    a. Set goals
    b. Make plans or to-do lists
    c. Prioritize activities and demands based on deadlines
    d. Manage your time
    e. Keep track of elements of tasks (e.g., assignments, tests, training, practice, competition) you must learn or perform?
    Explain and/or provide an example.
2. Does using your smartphone help you to get **motivated** and **confident** to learn and perform in sport and school? Or does using it prevent you from feeling this way? Explain.

Performance

1. During learning or performance situations in sport and school:
    a. Does using your smartphone ever help you to focus and remind yourself of what you need to do to succeed or achieve your goals? Or does using it prevent you from focusing and recalling important information? Explain/provide an example.
    b. Do you recognize when it is appropriate and inappropriate to use your cell phone? Do you act accordingly based on what is appropriate or inappropriate (e.g., can you resist the temptation to check your phone while training because it may interfere with your focus, intensity, and motivation to continue)?
    c. Does using your smartphone ever lead to you become emotional to the point where you feel energized or on the contrary, depleted? Does this impact your learning and performance? Explain/provide an example.
    d. Do you ever use your smartphone to observe, track, and/or record specific aspects of your learning or performance? If so, how (e.g., watch videos, write notes, journal)?
    e. Has using your smartphone ever showed you something about yourself of which you were otherwise unaware (e.g., through a picture, video, graph, tracking app)? Was this information helpful or unhelpful? Explain.

Self-Reflection

1. Does using your smartphone ever help you to reflect on or evaluate your learning or performance in sport and school? Or does using it after learning or performance situations prevent you from engaging in self-reflection? Explain/provide an example.
2. How quickly following learning or performance situations in sport and school do you reconnect with your smartphone? Generally, what do you do first when you reconnect with your smartphone? (i.e., is this related to sport, school, or something else?)
3. Does your satisfaction or dissatisfaction with your learning or performance in sport and school influence when and how you next interact with your smartphone? Explain/provide an example.
    a. When you are feeling down, do you generally post something positive in order to feel better? Do you post something depicting your feelings in order to garner support? Or do you find you purposefully do not post at all during these times?
4. Do you ever use any features or functions on your smartphone in order to compare your performance to the performance of others (e.g., teammates, opposition, friends, acquaintances, strangers, etc.)? If so, how and is this helpful or unhelpful?
5. Does your team use features of their smartphones to reflect on performance outcomes and/or training (e.g., through group chats)? Is the nature of this reflection honest or overly optimistic/pessimistic?

6. [Social Media] Do you ever display or discuss your learning or performance outcomes in sport and school via social media? How so? Could you provide an example?
7. Do you feel that you honestly depict your feelings, judgements, and reactions to your learning or performance in sport and school over social media? Or, do you ever portray an overly optimistic or overly pessimistic version of your learning or performance?

B. SOCIAL MEDIA

1. What forms of social media do you typically use via your smartphone?
    a. How often during the day?
2. What are some of your reasons for using social media? (e.g., entertainment, boredom, socializing, etc.)
3. How do you strive to describe or portray yourself on social media? (e.g., as an athlete, student, socialite, etc.).
4. What do your social media profiles say or reveal about you? (e.g., as an athlete, student, socialite, etc.).
5. Do you have one identity that you strive to maintain on social media? Or, many? Explain.
    a. Do you spend a lot of time building and managing this(these) identity(ies)?
    b. What kinds of things do you need to do in order to manage and maintain this(these) online identity(ies)?
    c. Do you think others see you as you'd like them to?
    d. Do you ever get concerned that others will perceive you differently than you intended? Or, do you ever get posting apprehension? (follow-up: do you find that the apprehension or worry about posting is ever time consuming or mentally draining?)

6. Generally, are you satisfied or dissatisfied with your identity(ies) and image on social media?
7. How much do(es) your online identity(ies) reflect your 'true' identity, personality, and lifestyle in your daily life? Explain.
8. If you weren't an athlete, would / how would your social media usage change?

C. USE OF SMARTPHONE TO OPTIMIZE SELF-REGULATION, LEARNING, PERFORMANCE, AND WELL-BEING

1. Overall, are there ways in which you could start or stop using your smartphone to optimize your learning, performance, and well-being as a student-athlete?
2. Are there any smartphone-related rules or regulations you would need to see enforced or lifted (within your school, sport, or peer group) to help you develop and maintain optimal performance and well-being as a student-athlete?
3. Is there any advice you would give to younger generations of student-athletes in order for them to get the most of their smartphone usage to maximize their learning, performance, and well-being? Explain.
4. Does your coach model what you perceive as acceptable smartphone behaviours at training and competition? (i.e., do they create an environment conductive to strong self-regulation and performance focus?)
5. Do your teammates model similar smartphone behaviours? Or do you notice significant differences?

SUMMARY OF QUESTIONS & COMMENTS (if there's time)

1. What do you take away from this interview?
2. Would you like to add anything else?
3. Thank you for your participation in this study.

Appendix E: App Demographic and Self-Report Survey

Demographic Questionnaire

This questionnaire must be completed before data tracking can commence.

1. Gender:
   □ Male
   □ Female
   □ You don't have an option that applies to me. I identify as (please specify):

2. Age:

3. Primary language:
   □ French
   □ English
   □ Other (please specify):

4. Ethnicity (please check all that apply):
   a. English Canadian
   b. French Canadian
   c. Aboriginal
   d. British
   e. German
   f. Scottish
   g. Irish
   h. Dutch
   i. Scandinavian
   j. Asian
   k. Russian
   l. East Indian
   m. Chinese
   n. African
   o. Arab
   p. South American
   q. Caribbean
   r. Eastern European
   s. Southern European
   t. Other (please specify):

5. Marital status:
   □ Single
   □ In a relationship
   □ Married
   □ Separated
   □ Divorced
   □ Widowed

6. Number of dependent children under 18 years of age (indicate 0 if you have no children):

7. [If applicable] At what academic institution do you currently study (e.g., University of Ottawa, Carleton University, Algonquin College, La Cité Collégiale)?

8. [If applicable] In what university or college program are you currently enrolled (e.g., Human Kinetics, Psychology, Biology)?

9. [If applicable] Please indicate your year of study (as considered official by your academic institution):
   □ First year university (undergraduate) / first year college
   □ Second year university (undergraduate) / second year college
   □ Third year university (undergraduate) / third year college
   □ Fourth year university (undergraduate) / fourth year college
   □ Fifth year university (undergraduate) / fifth year college
   □ Master's
   □ PhD
   □ Other (please specify):

10. How many courses are you taking/registered in each semester this year?
    □ Fall semester:
    □ Winter semester:
    □ Spring/Summer semester:

11. How many **hours per week** do you typically:
    a. study / do homework for your courses:
    b. train / compete for your sport:
    c. work outside school / sport (if you have a job):
    d. use your smartphone:

12. In what varsity sport are you competing this year? (e.g., badminton [doubles], badminton [singles], baseball, basketball, cross-country, curling, fencing, figure skating, football, golf, hockey, indoor soccer, rugby, soccer, softball, swimming, track, volleyball, wrestling). *If you compete in more than one sport, please indicate your main one.*

13. [If applicable] In what year of athletic eligibility are you currently competing?
    □ 1
    □ 2
    □ 3
    □ 4
    □ 5

14. Please check one or more items based on what currently best describes you:
    □ Starter
    □ Non-starter
    □ Starter / non-starter does not apply to me
    □ I do not know if I'm a starter or non-starter
    □ Redshirt (I am not using a year of eligibility this season)
    □ Injured

    If injured, please indicate the **type** and **date** of injury (ex. broken ankle - September 5, 2012):

15. Please indicate the make and model of your smartphone:
    a. Make:
    b. Model:

16. Do you use your smartphone while…
    a. You are at practice/training: □ Never □ Rarely □ Sometimes □ Often □ Always
    b. You are at competition: □ Never □ Rarely □ Sometimes □ Often □ Always
    c. You are in class: □ Never □ Rarely □ Sometimes □ Often □ Always
    d. You are studying: □ Never □ Rarely □ Sometimes □ Often □ Always

17. Do you generally limit/restrict the use of your mobile phone for the following reasons? (check all that apply)
    □ I limit my usage for my own personal reasons (ex. while studying, before bedtime, after □ I've reached my phone plan's data usage limit)
    □ I limit my usage because I abide by the 'no phone' policy imposed by one or more of my teachers in school
    □ I limit my usage because I abide by the 'no phone' policy imposed by my coach(es) at training
    □ I limit my usage because I abide by the 'no phone' policy imposed by my coach(es) at competitions
    □ I limit my usage because I abide by the usage limit imposed by my parent(s)
    □ I typically do not limit my usage

18. Please identify the three greatest stressors you experience as a student-athlete. When answering, consider the dual-role you play and the demands you face:

    1. _____
    2. _____
    3. _____

19. Have you been previously diagnosed with a mental illness (ex. depression, anorexia nervosa, bipolar disorder, anxiety disorder, attention deficit disorder, obsessive-compulsive disorder, alcohol abuse) by a medical professional (ex. psychologist, psychiatrist, physician)?
    □ Yes

□ No
□ I prefer not to say

20. If yes, please indicate the mental illness(es) and the year you were diagnosed (ex. depression, 2013), **if you feel comfortable doing so**: _____

21. If yes, are you currently taking medication to treat the mental illness(es)?
□ Yes
□ No
□ I prefer not to say

22. Have you had a concussion in the past?
□ Yes
□ No
□ I prefer not to say

If yes, please indicate **how many concussions you have had** and **the year you sustained them** (e.g., 2 concussions, 2014 and 2015): _____

Mobile Survey

Each scale included in the survey will be completed via the mobile application as a contained unit every month. However, the order of the scales will be randomly changed by the application each month (e.g., the items of the Mindfulness Scale will always be administered in the same order but the scale itself might be the first one that appears in the survey the first month, but the seventh one that appears the third month).

Mindfulness Scale
Please consider the <u>past month</u> when responding to the following items:

Rarely / Not at all	Sometimes	Often	Almost always
1	2	3	4

1. It is easy for me to concentrate on what I am doing.
2. I am preoccupied by the future. (R)
3. I can tolerate painful thoughts and feelings.
4. I can accept things I cannot change.
5. I pay attention to sensations in my body.
6. I am attuned to how I feel in the moment and can describe this.
7. I am easily distracted. (R)
8. I am preoccupied by the past. (R)
9. I can easily track my thoughts and feelings.

10. I notice thoughts going through my mind without judging them.
11. I accept the emotions I experience.
12. I am able to focus on the present moment.
13. I can pay close attention to one thing for a long period of time.

Emotional and Social Loneliness Scale

Please consider the past month when rating your agreement with each of the following statements.

Strongly Disagree	Disagree	Somewhat Disagree	Don't Agree / Don't Disagree	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

1. I experience a general sense of emptiness.
2. There are plenty of people I can rely on when I have problems. ®
3. There are many people I can trust completely. ®
4. There are enough people I feel close to. ®
5. I miss having people around.
6. I often feel rejected.

Perfectionistic Self-Presentation Scale

Please consider your general perceptions when rating your agreement with each of the following statements.

Strongly Disagree	Disagree	Somewhat Disagree	Don't Agree / Don't Disagree	Somewhat Agree	Agree	Strongly Agree
1	2	3	4	5	6	7

1. It is okay to show others that I am not perfect. (R)
2. I will do almost anything to cover up a mistake.
3. I try always to present a picture of perfection.
4. It would be awful if I made a fool of myself in front of others.
5. If I seem perfect, others will see me more positively.
6. I never let others know how hard I work on things.
7. I would like to appear more competent than I really am.
8. It doesn't matter if there is a flaw in my looks. (R)
9. I do not want people to see me do something unless I am very good at it.
10. I must appear to be in control of my actions at all times.

11. Admitting failure to others is the worst possible thing.
12. I like to gossip at times.
13. There have been occasions when I took advantage of someone.

Mental Health Scale

Never	Rarely (once or twice)	Sometimes (about once a week)	Often (about 2 or 3 times a week)	Very Often (almost every day)	Always (every day)
0	1	2	3	4	5

During the past month, how often did you feel …

1. happy
2. interested in life
3. satisfied with life
4. that you had something important to contribute to society
5. that you belonged to a community (like a social group, or your neighborhood)
6. that society is a good place, or is becoming a better place, for all people
7. that people are basically good
8. that the way society works makes sense to you
9. that you liked most parts of your personality
10. that you are good at managing the responsibilities of your daily life
11. that you had warm and trusting relationships with others
12. that you had experiences that challenged you to grow and become a better person
13. that you were confident to think or express your own ideas and opinions
14. that your life has a sense of direction or meaning to it.

Stress Scale

Please consider the last 7 days when responding to the items.

Not at all	Not really	Very little	A bit	Somewhat	Quite a bit	Very much	Extremely
1	2	3	4	5	6	7	8

1. I feel calm. (R)
2. I feel rushed and do not seem to have enough time.
3. I suffer from physical aches and pains (ex. sore back, headaches, tensed neck, stomach aches).
4. I feel preoccupied, tormented, or worried.
5. I feel confused (ex. my thoughts are muddled) and cannot focus my attention.

6. I feel full of energy and keen. (R)
7. I feel a great weight on my shoulders.
8. I have difficulty controlling my reactions, emotions, or gestures.
9. I feel stressed.
10. I have difficulty sleeping.

SEWP-S: Self-Regulation for the Enhancement of Performance and Well-Being Scale

Strongly Disagree	Disagree	Don't Agree / Don't Disagree	Agree	Strongly Agree
1	2	3	4	5

Please consider the <u>past month</u> when rating your agreement with each of the following statements.

Preparation

1. I determine what I need to do to perform well.
2. I am confident that I can perform well even when things don't go my way.
3. I set goals for myself.
4. I plan a course of action to achieve my goals.
5. I am driven to perform all necessary tasks to achieve my goals.

Performance

6. I get easily distracted while performing.(R)
7. I am able to resist temptations that prevent me from successfully performing tasks.
8. I question or talk to myself to stay on track during performances.
9. I notice and correct mistakes while I perform.
10. I cannot perform well once I experience something unpleasant or upsetting.(R)

Evaluation

11. I recognize when I have accomplished my goals.
12. I change the way I do things when I see a problem with the way I perform.
13. When I perform poorly, I take responsibility for my actions.
14. When I make progress toward my goals, I feel good and reward myself.
15. I am never satisfied with my performances. (R)
16. I evaluate my performances against the goals I set for myself.

Perception of Smartphone Usage

1. Over the last month, to what extent has your smartphone usage been **helpful** to you?

Not at all	Not really	Very little	A bit	Somewhat	Quite a bit	Very much	Extremely
1	2	3	4	5	6	7	8

Please explain (e.g., give examples):

2. Over the last month, to what extent has your smartphone usage been **detrimental** to you?

Not at all	Not really	Very little	A bit	Somewhat	Quite a bit	Very much	Extremely
1	2	3	4	5	6	7	8

Please explain (e.g., give examples):

Sport Participation Questionnaire

We want to know about the time you spent participating in different sporting activities related to your varsity sport during the last 7 days (not counting today). Here are instructions to follow:

1. For each of the 6 types of sporting activities presented below, please indicate the number of times you did the activity, how long it lasted, the intensity at which you did the activity, how much it helped you to develop, and how successful and satisfied you were with the activity.
2. If you did not participate in a particular activity, check the box that says, 'Did not participate'.
3. If you participated in a sporting activity that is not represented in the 6 that are outlined below, please add the information at the end of the table in the section that says "OTHER".

Type of sporting activity	**Frequency** How many times did you perform the activity during the last 7 days?	**Duration** Overall, approximately how much time did you spend performing the activity during the last 7 days?	**Intensity** On average, at what level of intensity did you perform the activity during the last 7 days? a. mild (hardly any increase in your heart rate, breathing rate, sweating and/or body heat) b. moderate (slight increase in your heart rate, breathing rate, sweating and/or body heat) c. intense (big increase in your heart rate, breathing rate, sweating and/or body heat)	**Perceived development, success, satisfaction** During the last 7 days, to what extent have you developed (ex. learned, stretched your limits) as an athlete as a result of performing the activity? How successful were you in performing the activity? How satisfied are you with your performance in this activity?
1. COMPETITION (sport "contest") Game, race, match, or other competitive event in which you performed sport-related skills ☐ **Did not participate**	**Frequency** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 or more	**Duration** ☐ under 30min ☐ 30min to 1hr ☐ 1 to 2hrs ☐ 2 to 4hrs ☐ 4 to 6hrs ☐ 6 to 8hrs ☐ 8 to 10hrs ☐ over 10hrs	**Intensity** ☐ mild ☐ moderate ☐ intense	**Development** ☐ developed extremely ☐ developed moderately ☐ did not develop **Success** ☐ extremely successful ☐ somewhat successful ☐ unsuccessful **Satisfaction** ☐ extremely satisfied ☐ somewhat satisfied ☐ dissatisfied
2. PRACTICE / TRAINING ("dry-land" training) Physical training to develop fitness / strength / flexibility for your sport (e.g., go for a run, lift weights, stretch, do yoga session, do resistance, circuit, and/or interval training) ☐ **Did not participate**	**Frequency** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 or more	**Duration** ☐ under 30min ☐ 30min to 1hr ☐ 1 to 2hrs ☐ 2 to 4hrs ☐ 4 to 6hrs ☐ 6 to 8hrs ☐ 8 to 10hrs ☐ over 10hrs	**Intensity** ☐ mild ☐ moderate ☐ intense	**Development** ☐ developed extremely ☐ developed moderately ☐ did not develop **Success** ☐ extremely successful ☐ somewhat successful ☐ unsuccessful **Satisfaction** ☐ extremely satisfied ☐ somewhat satisfied ☐ dissatisfied
3. PRACTICE / TRAINING ("sport" training) Technical / tactical training to develop sport-specific skills (e.g., do skating drill on the ice, practice formation on soccer field, train beam routine in gymnastics, work on skip drill on the track) ☐ **Did not participate**	**Frequency** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 or more	**Duration** ☐ under 30min ☐ 30min to 1hr ☐ 1 to 2hrs ☐ 2 to 4hrs ☐ 4 to 6hrs ☐ 6 to 8hrs ☐ 8 to 10hrs ☐ over 10hrs	**Intensity** ☐ mild ☐ moderate ☐ intense	**Development** ☐ developed extremely ☐ developed moderately ☐ did not develop **Success** ☐ extremely successful ☐ somewhat successful ☐ unsuccessful **Satisfaction** ☐ extremely satisfied ☐ somewhat satisfied ☐ dissatisfied
4. PRACTICE / TRAINING ("mind" training) Mental training to develop mental abilities and character for your sport (e.g., set goals with coach, do relaxation exercise with sport psychology consultant, do team building activity, write in journal to evaluate performance) ☐ **Did not participate**	**Frequency** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 or more	**Duration** ☐ under 30min ☐ 30min to 1hr ☐ 1 to 2hrs ☐ 2 to 4hrs ☐ 4 to 6hrs ☐ 6 to 8hrs ☐ 8 to 10hrs ☐ over 10hrs	**Intensity** ☐ mild ☐ moderate ☐ intense	**Development** ☐ developed extremely ☐ developed moderately ☐ did not develop **Success** ☐ extremely successful ☐ somewhat successful ☐ unsuccessful **Satisfaction** ☐ extremely satisfied ☐ somewhat satisfied ☐ dissatisfied

5. MEETING ("planning, instructing, or debrief") Individual or group meeting with coach / teammates to discuss sport-related information, knowledge, skills (e.g., meet with team to plan for the next competition, go over the training schedule for the season with coach, watch a video clip with coach and teammates to evaluate to last game, meet with leader/captain to discuss an issue, meet with coach right after the race to evaluate performance). ☐ **Did not participate**	**Frequency** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 or more	**Duration** ☐ under 30min ☐ 30min to 1hr ☐ 1 to 2hrs ☐ 2 to 4hrs ☐ 4 to 6hrs ☐ 6 to 8hrs ☐ 8 to 10hrs ☐ over 10hrs	**Method of communication (check all that apply)** ☐ face to face ☐ over the phone ☐ over skype or facetime ☐ over email or text	**Development** ☐ developed extremely ☐ developed moderately ☐ did not develop **Success** ☐ extremely successful ☐ somewhat successful ☐ unsuccessful **Satisfaction** ☐ extremely satisfied ☐ somewhat satisfied ☐ dissatisfied
7. OTHER **Additional sport-related activity not represented in 6 previous types - SPECIFY** _____ _____ ☐ **Did not participate**	**Frequency** ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 or more	**Duration** ☐ under 30min ☐ 30min to 1hr ☐ 1 to 2hrs ☐ 2 to 4hrs ☐ 4 to 6hrs ☐ 6 to 8hrs ☐ 8 to 10hrs ☐ over 10hrs	**Intensity (if relevant)** ☐ mild ☐ moderate ☐ intense	**Development** ☐ developed extremely ☐ developed moderately ☐ did not develop **Success** ☐ extremely successful ☐ somewhat successful ☐ unsuccessful **Satisfaction** ☐ extremely satisfied ☐ somewhat satisfied ☐ dissatisfied

Appendix F: Project Brief(s)

Project Brief for Students

We are two researchers from the SEWP Lab in the School of Human Kinetics, conducting a sport psychology research study related to the impact of smartphone usage in varsity sport. Specifically, we hope to determine the positive and negative effects of smartphone usage on student-athletes' performance and well-being. To support the data collection for this project, we have conceptualized a novel mobile research application, which is now an essential component of the research. Last semester, we collaborated with a team at Algonquin College (dept. of Information and Communication Technology) to develop a beta Android application, as well as a secure web server that will act as a data storage centre for the study.

The application we have conceptualized is used to track metadata regarding athletes' smartphone usage (i.e., frequency of usage, time of usage, duration of usage, and specific features and functions being used). Note that the app does not collect any content or personal information. The app is also used to prompt athletes to complete and submit a self-report survey remotely, once per month, via the application. The current beta version of the Android app includes this research survey mechanism; the same functions will need to be developed for the iOS version.

We have taken some big steps toward fulfilling our vision for this research project but, there is still much to be done. We are now hoping to collaborate with another department at the University of Ottawa to bring our research to fruition.

The project now requires:

a) Completion and refinement of the Android application
b) Development of a parallel version of the application for the Apple iOS platform
c) Connection of the secure web server to the mobile app(s), so data may be automatically uploaded from athletes' mobile phones

We are hoping to collaborate with **a student (or group of students) from the School of Computer Science** at the of University of Ottawa, interested in gaining programming and research experience in a novel context and with this unique subject matter. Our goal is to pilot-test the applications this Summer 2017, so interested students would commence work with our team immediately.

Should you be interested in collaborating with us, or if you would like more information, please contact either Poppy DesClouds [email address] or Dr. Natalie Durand-Bush [email address] in the SEWP Lab, School of Human Kinetics.

Project Brief for Professors

We are two researchers from the SEWP Lab in the School of Human Kinetics, conducting a sport psychology research study related to the impact of smartphone usage in varsity sport. Specifically, we hope to determine the positive and negative effects of smartphone usage on student-athletes' performance and well-being. To support the data collection for this project, we have conceptualized a novel mobile research application, which is now an essential component of the research. Last semester we collaborated with a team at Algonquin College (dept. of Information and Communication Technology) to develop a beta Android application, as well as a secure web server that will act as a data storage centre for the study.

The application we have conceptualized is used to track metadata regarding athletes' smartphone usage (i.e., frequency of usage, time of usage, duration of usage, and specific features and functions being used). Note that the app does not collect any content or personal information. The app is also used to prompt athletes to complete and submit a self-report survey remotely, once per month, via the application. The current beta version of the Android app includes this research survey mechanism; the same functions will need to be developed for the iOS version.

We have taken some big steps toward fulfilling our vision for this research project but, there is still much to be done. We are now hoping to collaborate with another department at the University of Ottawa to bring our research to fruition.

The project now requires:

a) Completion and refinement of the Android application
b) Development of a parallel version of the application for the Apple iOS platform
c) Connection of the secure web application to the mobile app(s), so data may be automatically uploaded from athletes' mobile phones

We are hoping to collaborate with a **graduate student, post-doc, professor, or team from the School of Computer Science** at the University of Ottawa**,** interested in gaining programming and research experience, as well as the opportunity to publish in a novel, interdisciplinary context. Our goal is to pilot-test the applications this Summer 2017, so we are looking to commence this partnership immediately.

Recently, we presented the proposed project at a sport and exercise psychology conference, along with information about the initial development and the Android app. The work garnered significant attention and support, as the research and method is novel, unique, and extremely timely. Likewise, we foresee that the development and pilot testing done this summer will provide a strong base for at least two publications regarding results of the pilot testing, as well as the process of developing a novel, user-friendly research application in the domain of sport psychology. We would be keen to collaborate with you and include you as co-authors on these publications.

Moreover, following completion of the research, we would like to refine the app for public use. If you would be interested in continuing to collaborate with us at this point, we would be more than happy to continue our partnership.

Should you be interested in collaborating with us, or if you would like more information, please contact either Poppy DesClouds [email address] or Dr. Natalie Durand-Bush [email address] in the SEWP Lab, School of Human Kinetics.

Appendix G: Critical Realism Applied to the Current Project

Critical realist assumption	In the context of the present research	Alignment of methods
	Epistemology	
• Human knowledge is fallible and reality is known only probably and imperfectly. • There are not "multiple" realities, but instead, several valid perspectives of reality. • Knowledge is based on the local and specifically constructed perspectives and interpretations of individuals, which are concept, context, and time-dependent (Ryba et al., 2020). • Meaning is dialogic, relative, and subjective.	• Knowledge of smartphone usage of athletes is subject to researchers' interpretation of existing evidence, the research data, self-regulation theories, participants' perspectives of usage, and the interface among these elements. • Knowledge of smartphone usage of athletes is also subject to the definition of usage, the measurement of usage.	• The researcher used mixed methods to access breadth and depth of perspectives from multiple sources. • The researcher engaged in a cyclical process of reflection, critique and adaptation throughout the research. The researcher also used 'critical friends' (Smith & McGannon, 2018) in each study to review, reflect on, critique, and revise interpretations of participant and researcher perspectives, previous empirical work, existing knowledge, and theory. • The researcher co-created meaning with qualitative study participants. Semi-structured interview guides helped to address the research objectives and engage in a critical dialogue with study participants (Smith & Elger, 2014). • Through prolonged exposure to the research data, as well as other sources of knowledge, the researcher was able to acknowledge changes and variability in meaning constructions over time.
	Ontology	
• A "real" reality exists independent of human knowledge of that reality. Research objects exist independent of scientific conceptions of them (Ryba et al., 2020). • An inclusive view of 'reality' is presented, where mental and physical entities interact to form a single real world.	• Smartphones are objects that exist independent of research on them. • There are aspects of smartphone usage that are unobservable (e.g., historical trajectory of media use; pre-existing psychosocial skills and competencies; thoughts, urges, and habits, unconscious responses; internal conflict). These aspects are as "real" as any other, but we can only infer their existence.	• The researcher strove to implement an ecologically valid research design by leveraging the object of study as an imbedded research tool (mobile application). • The researcher worked with an interdisciplinary team to assist in understanding elements of the smartphone (i.e., object) that would otherwise be unobservable or unknown by participants. • The researcher developed typologies by negotiating and consolidating existing theories, the language of participants, researcher interpretations, previous studies in the research program, and existing empirical data from comparable contexts (Bygstad et al., 2016; Fletcher, 2016) to support integration and coherency of the various pieces of the project. • The researcher used mixed methods to access the best possible conception of the layers of reality.

Critical realist assumption	In the context of the present research	Alignment of methods
	Methods	
• Both qualitative and quantitative methods, and multiple sources, are championed to promote a critical, dialogic methodology. • Existing theory is used to guide the research process and reconcile differing perspectives and methods. • Methods rely on demi-regularities, or the identification of trends or patterns in the data. • Methods rely on processes of retroduction (conceptualizing the conditions that give rise to casual mechanisms in particular social contexts), and abduction (re-describing theory using new research data (Fletcher, 2016)).	• Research on athletes' use of smartphones involves the study of both objective and subjective data, as well as an object (smartphone), actors (athletes), and psychosocial variables. This dynamic phenomenon calls for a variety of methods to access various layers of reality in the form of experiences, processes, and mechanisms. • A mix of qualitative and quantitative methods are well suited to gain access to both objective and subjective data about usage. Each data set is only one portion of a much larger whole. • Qualitative and quantitative methods help to refine, revise, and refute knowledge of athletes' smartphone usage, as well as current seminal theories of self-regulation as they pertain to this phenomenon.	• Qualitative methods were used to uncover experiences and draw inferences about causal mechanisms. • Quantitative methods were used to access objective events (i.e., smartphone usage prevalence and patterns). • Data were integrated to inform ongoing review and refinement of knowledge, as well as to compare and contrast data to produce a deeper understanding of reality, and re-describe theory.
	Generative causation / casual complexity	
• Causal explanations are important for advancing knowledge, but the causal properties of phenomena are contingent, complex, and emergent. • Aims to identify *generative* (or emergent) *causation,* which is causation that exists in an open and ever-changing system (Connelly, 2001; Ryba, 2020). • Targets the interplay of mechanisms and conditions of structures and objects that give rise to events that can be perceived and experienced at the empirical level, and may explain the existence of a phenomenon.	• The forms of usage and impact of usage among athletes are multiple, individualized, and complex. Quantifiable patterns of usage and psychosocial variables (i.e., themes and descriptive data) may point toward causal explanations that might otherwise be masked. • Qualitative methods provide insight into contexts and contingencies, and explanatory mechanisms (Stutchbury, 2021).	• Outcomes of this research reflect causal complexity. This included a dynamic and flexible re-iteration of self-regulation theory and explanations of smartphone usage using a continuum. • Data were interpreted holistically. Three-tiered triangulation (methods, data, and theory) allowed results to be negotiated and consolidated with relevant empirical evidence (Patton, 1999). • Explanatory patterns were explored during the interpretation phase of each study.

Critical realist assumption	In the context of the present research	Alignment of methods
	Theoretical re-description	
• Encourages the use of theory and existing empirical data to guide the research process and define context-specific causal mechanisms. • Involves a critical examination of guiding theories as well as a re-description of theories using multiple sources and a fluid process of induction and deduction (i.e., *retroduction*).	• Theories related to athlete smartphone usage do not exist. Two seminal theories of self-regulation were selected to guide the research because of their salience in the context of sport psychology and pertinence to smartphone usage.	• The researcher engaged in a critical appraisal of the two self-regulation theories prior to commencing the research project. • The researcher engaged in ongoing critical re-appraisal of the construct of self-regulation and its relationship to the phenomenon under study, guided by two seminal theories. • The researcher made logical inferences throughout the research project based on study outcomes and existing empirical work. • The researcher negotiated and consolidated study outcomes with the guiding theories, culminating in a re-description of self-regulation theory in Study 4.

Note. Table informed by Ryba et al. (2020).

Appendix H: Trustworthiness Considerations Specific to the Critical Realist Paradigm

As per the recommendations of Smith and McGannon (2018) and Sparke (2015), the following elements were used to align trustworthiness considerations with the critical realist paradigm that guided this dissertation.

Deriving demi-regularities (i.e., "tendencies"; Fletcher, 2016) from the research data is imperative to a critical realist approach. The mixed methods process of developing strong typologies, mirrors the creation of "demi-regularities", or identifying trends and patterns in the data related to theoretical frameworks and existing evidence, which are used as themes to inform subsequent studies (Fletcher, 2016). Strong use of typologies or demi-regularities provide the researcher with consistent and project-specific points of reference, and a 'language' common to the particular project that can enforce coherency across methods, datasets, and writing (Caracelli & Green, 1993). Moreover, by maintaining a point of reference, typologies ensure that components of mixed method studies remain tightly interwoven and do not decompose into separate entities (Yin, 2006). The typologies that were developed within the data analysis of each study were based on the language of the participants (in vivo), the researcher's own interpretation of the data (emergent), as well as existing literature (a priori; Leech et al., 2010).

Dialogic, critical engagement with various perspectives is essential to a critical realist approach (DeForge & Shaw, 2012). Cyclical and critical re-examination of the design framework supported ongoing critique and comparison of the results to other perspectives, existing research, and theory (Patton, 1999; DeForge & Shaw, 2012), The framework was continually re-examined in the face of new and emerging data, as well as methodological obstacles over the course of the study. This supported critical, dialogic interface with many perspectives on the phenomenon. Further, Teddlie and Tashakkori (2010) encourage researchers

to continuously re-examine the results from one strand or phase against the results of another in order to adjust the research design and analysis procedures accordingly. This was done to guarantee integration could be achieved and to guide the subsequent studies within the research project.

Consideration of stratified layers of reality (ontology) is important to a critical realist approach (Ryba, 2020). Multiple methods and multi-level triangulation in this project allowed the researcher to explore athlete smartphone usage in way that considered the stratified ontology of critical realism. The components of the project were used in specific, purposeful ways to probe at deeper levels of reality. Likewise, methods were mixed in purposeful, complementary ways to leverage strengths and fill in gaps from the other approaches (Creswell, 2014).

Appendix I: Sample Worksheet - Setting Smartphone Standards

Facilitator Instructions: After providing basic information on athlete smartphone usage and the continuum of possible outcomes, lead athletes through the following reflection steps, individually or in small groups. When working with a team, complete the reflections in small groups and reconvene to share, compile answers, and create a final smartphone standard (i.e., personal or shared expectations for usage). Usage standards should be created by the athlete(s), *not* the facilitator.

Step 1: Get to know your usage

1. List all the ways your smartphone usage is helpful to your training/performance/well-being/functioning. *Consider your thoughts, feelings, actions, learning, and communication.*

2. List all the ways your smartphone usage is a hindrance to your training/performance/well-being/functioning. *Consider your thoughts, feelings, actions, level of engagement, learning, and communication.*

3. List the times and/or situations in your life where smartphone usage is non-negotiable for your (whether you like it or not).

4. List the times and/or situations where you often use your phone, but don't *have* to.

5. List the times and/or situations where you often use your phone, and would rather not.

It's OK if there is overlap between your answers.

Step 2: Connect your values, goals, and smartphone usage

1. List your core values as an athlete (or as a team)…

2. List 2 or 3 goals that are important to you as an athlete (or as a team) right now …

Look at your answers in Step 1. Look at your answers in Step 2. Think about how these answers interact.

3. How does your smartphone usage interact with your values and goals as an athlete (or as a team)? Does your usage support your personal (or team) values and goals? Does it get in the way? Both?

For example. How might smartphone usage impact your ability to be accountable, authentic, passionate, a leader, trustworthy, approachable, confident, resilient, adaptable, open minded, etc.?

Step 3: Set a usage standard

1. Set *one* standard for yourself (or for the team) this month that aligns with your reflections above. You *should* revisit this standard at the end of each month as your needs may have shifted and changed.

2. How can those in your environment (e.g., teammates, coaches, support staff, parents) help you meet this standard?

Consider the important conditions of usage that we discussed: context, type, awareness, autonomy, concurrence of usage. Remember a usage standard can involve using your phone in a specific way, or not using your phone in a specific way.

Step 4: Back-up your standard

1. I am (or the team is) setting this standard because:

2. The standard is important to me (or the team) because:

3. This standard upholds my (or the team's) goals/values by:

4. I (or the team) will stay accountable by:

5. I (or the team) will be supportive/forgiving if/when:

Example Smartphone Usage Standard – Female Varsity Team

Note. This standard was created by a female varsity team using the steps above. The standard was then formalized by the team and posted in the dressing room for reference throughout the season.

Away games/travel

- Phones in the bucket for 1 hour during travelling
  Reason: To form stronger bonds with our team

- Phones away before activation. If music is needed as a "pre-game ritual", have your phone on airplane mode (only outside of the team room) and an accountability buddy.
  Reason: To get rid of distractions and focus on our sport

- Phones away for 1 hour after games
  Reason: To debrief and reflect on the game

Practice

- Phones away once you see the field, and in the bucket once you get to team room
  Reason: To focus on our sport and take out distractions

- After practice, phones can be out once you are out of the sports complex

Home games

- Phones away once you see the field, and in the bucket once you get to team room. If music is needed as a "pre-game ritual", have your phone on airplane mode (only outside of the team room) and an accountability buddy. Make playlists to avoid scrolling through your phones.
  Reason: To get rid of distractions and focus on our sport

- Phones away for 1 hour after games
  Reason: To debrief and reflect on the game

Team events/activities

- Phones away at all team dinners, events, and activities (exceptions may occur and will be announced by team leads
  Reason: To connect with your teammates and enjoy the moment!

- Phones away at all team lifts
  Reason: To be more efficient and focus on getting better

We are all working on breaking a habit, so we understand if there may be some slip-ups. That being said, it is important that no one takes it personally if your teammate tries to hold you accountable to not be on your phone. Coaches will be putting their phones in a bin as well and will not text 30 minutes before and after games and practices.

TEAM FIRST

Appendix J: Check-in for Mindful Smartphone Usage

Before unlocking your phone, ask yourself…

- What am I about to do?
- What do I want to accomplish?
- Do I have the capacity for this?
- Do I have the capacity for the unexpected?
- How long will I do this?
- What is my cue to stop?

Smartphone usage is like entering a room full of people, some you know, some you don't know. You have no control over what anyone says or does.

Indicators that I am ready to "enter" the digital space

Feelings	
Actions	
Sensations	
Thoughts	

Indicators that I am *not* ready to "enter" the digital space

Feelings	
Actions	
Sensations	
Thoughts	

Indicators that it is time for me to "leave" the digital space

Feelings	
Actions	
Sensations	
Thoughts	