
Running head:

COACHES' INSTRUCTION DURING GAMES

Coaches' Instruction Provided to Female
Ice Hockey Players During Games

by

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Thesis submitted to the School of Graduate Studies and Research
of the University of Ottawa
in partial fulfilment of the requirements
for the degree of
Master of Arts in Human Kinetics



Ottawa, Canada, 1996



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ISBN 0-612-16462-4

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Acknowledgements

Thank you to the coaches who participated in the study and to the people involved in women's hockey in the Ottawa area who have helped make this research project possible.

A special thanks to my brother and sister in law and to my parents, all of whom have supported me throughout this endeavour.

A big thank you to our research group: Deanne Boyd, Stéphane Gaumon, Wade Gilbert, Leon Haughian, Mathieu Lapierre, and Stéphane Wilcox. Your feedback, thoughts and help have been invaluable to me. Of particular mention is Wade Gilbert, who was instrumental in the data collection and data analysis process.

Finally thank you to Dr. Pierre Trudel, the centre of our research group. His insight, wisdom, encouragement and feedback have helped me achieve my goal.

Dedication

To my best friend Mike Mahoney

Table of Contents

Acknowledgements	i
Dedication	ii
Abstract	vii
Introduction	1
Methods	5
Subjects	5
Data collection	7
Data analysis	8
Reliability tests	11
Results	12
Case 1: Shelley	12
Case 2: Ray	18
Case 3: Barry	24
Case 4: Derek	31
Cross-case analysis	37
Discussion	40
Conclusions	45
References	47
Appendices	53

List of Tables

1.	Overview of the Profile of Each Coach	7
2.	Overview of the Reliability Tests Performed	12
3.	“What”: Content of Shelley’s Instruction	14
4.	“When” Shelley’s Instruction was Given	16
5.	Content of Shelley’s Instruction by Major Category	16
6.	“How” Shelley’s Instruction was Communicated	17
7.	Summary of Shelley’s Instruction Provided During Games	18
8.	“What”: Content of Ray’s Instruction	20
9.	“When” Ray’s Instruction was Given	21
10.	Content of Ray’s Instruction by Major Category	22
11.	“How” Ray’s Instruction was Communicated	22
12.	Summary of Ray’s Instruction Provided During Games	24
13.	“What”: Content of Barry’s Instruction	26
14.	“When” Barry’s Instruction was Given	28
15.	Content of Barry’s Instruction by Major Category	28
16.	“How” Barry’s Instruction was Communicated	29
17.	Summary of Barry’s Instruction Provided During Games	31
18.	“What”: Content of Derek’s Instruction	33
19.	“When” Derek’s Instruction was Given	34
20.	Content of Derek’s Instruction by Major Category	35

21.	“How” Derek’s Instruction was Communicated	35
22.	Summary of Derek’s Instruction Provided During Games	37
23.	Cross-case Comparison of the Content of Instruction	38
24.	Cross-case Comparison of “When” the Instruction was Given	39
25.	Cross-case Comparison of “How” the Instruction was Given	39
26.	Cross-case Comparison of Specific Information	40

List of Figures

1. Example of the coding process 10

Abstract

The interaction between coaches and their athletes has been investigated by researchers in sport pedagogy over the last 20 years (Piéron, 1994). The majority of these studies have used systematic observation techniques to gain insight into the behavior of coaches during games and/or practices. Although studies on coaches' behaviors have provided a portrait of how coaches intervene (e.g., Trudel & Côté, 1994), information on the subject matter being taught by coaches is relatively new. The importance of including the subject matter in the study of teaching was underlined by Shulman (1986). The purpose of the present study was to investigate the content of coaches' instruction provided to female ice hockey players (12-15 yrs.) during games. More specifically, the questions to be answered were: (a) What was the content of instruction? (b) When was the instruction given? and (c) How was the instruction communicated to the player(s)? A unique coding system was developed in order to answer these questions. Although the results revealed differences between cases, and even variability between games within the same case, many similarities emerged between coaches. The coaches in the present study preferred to emphasize team tactics, over individual tactics, individual techniques, and rules. Many of the interventions by the coaches were short duration prompts, communicated while the play was in progress. The relatively low percentage of specific information given to players during games indicates that the coaches did not fully utilise opportunities arising in games to instruct players.

Coaches' Instruction Provided to Female

Ice Hockey Players During Games

There are currently over four million children participating in youth sport programs in Canada (Canadian Heritage Sport Canada, 1994). Ice hockey is among the most popular, with over 500,000 boys and girls registered during the 1994-1995 season (Canadian Amateur Hockey Association [CAHA], 1995). The number of young women playing ice hockey is augmenting each year, with a 200% increase in the number of women registered to play since 1990 (CAHA, 1995).

Many new opportunities are arising for young women playing this typically Canadian sport. Initiation to hockey programs for girls are forming, girl's minor hockey leagues are growing, and women's hockey will make its debut as a full medal sport in the 1998 Olympic Games to be held in Nagano, Japan (MacKinnon, 1994).

Women's hockey has some unique characteristics, the most salient being that body contact is not permissible. This may affect how the women's game is taught and played, as the president of the Ottawa District Women's Hockey Association conceded: "skill development should be a primary concern for our hockey coaches as the emphasis in women's hockey is on finesse" (R. Alexander, personal communication, September 11, 1995). This assertion was also found in a study where coaches were interviewed concerning different aspects of youth female ice hockey. A coach who was involved in coaching both boy's and girl's hockey for a number of years said: "Having coached the girls for as long as I have, women's hockey can be as entertaining if not more so, because it is a skilled game. It is not a physical, intimidating game, it is a game of skill" (Boyd, 1996, p.77).

An emphasis on the skills of the game, as opposed to the physical aspect of the men's game (Vaz, 1982; Trudel, Dionne & Bernard, 1992), might be an added incentive for female ice hockey players to continue playing. Skill development has been reported as one of the most frequently cited reasons for young athletes' participation in sport (Gould & Petlichkoff, 1988). Improving sport skills also seems particularly important because it can lead to a more positive sport experience (Smoll, 1986; Wankel & Sefton, 1989).

In youth sport, coaches are those responsible for helping athletes learn the techniques and tactics of their particular sport (Hastie & Saunders, 1992; Spallanzani, 1988). The interaction between coaches and their athletes has been investigated by researchers in sport pedagogy over the last 20 years (Piéron, 1994). The majority of these studies have used systematic observation techniques to gain insight into the behavior of coaches during games and/or practices (e.g., Claxton, 1988; Lacy & Darst, 1985; McKenzie & King, 1982; Wandzilak, Ansorge & Potter, 1988). Among these studies, one has provided a complete picture of coaches' behaviors during male youth ice hockey games (Trudel, Côté & Bernard, 1996). In this study, "observation" accounted for approximately half of the coaches' behaviors and roughly 11% of game time was devoted to teaching skills and tactics. The category "teaching" was composed of "giving information", "positive evaluation" and "negative evaluation" of performances. The rest of the interaction between the coaches and their players was mainly "organizing", "directing the game" and "stimulating the players".

Although studies on coaches' behaviors, in which systematic observation was used, have provided a portrait of how coaches intervene (e.g. Trudel & Côté, 1994), information on the subject matter being taught by coaches is still wanting. Questions such as: "What techniques or

tactics do coaches teach players during games and practices?", have never been answered.

In general education, as well as in physical education, the appearance of studies emphasizing the nature of subject matter are relatively recent. The importance of including the subject matter in the study of teaching was underlined by Shulman (1986, 1987). While stressing the importance of defining a knowledge base for teaching, Shulman identified pedagogical content knowledge as a critical type of knowledge for teachers. Pedagogical content knowledge goes beyond knowledge of subject matter per se, to the dimension of subject matter for teaching. For Shulman (1987), pedagogical content knowledge is defined as "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (p.8).

Since Shulman's (1986, 1987) call for the inclusion of subject matter in the study of teaching, researchers in physical education have begun to investigate knowledge from various perspectives. They have found that teachers draw on many components of subject matter and pedagogical knowledge as they plan and execute lessons (Walkwitz & Lee, 1992). To help teachers properly blend the content and pedagogy aspects of teaching, researchers should pay as much attention to the content aspects of teaching, as has been devoted to the elements of the teaching process (Shulman, 1987).

A number of studies on physical education teachers' knowledge have investigated one of the two components of pedagogical content knowledge: the subject matter or the pedagogical process (e.g., Ennis, Mueller & Zhu, 1991; Housner, Gomez & Griffey, 1993; Rink, French, Lee, Soimon & Lynn, 1994). These studies have focused on the knowledge structures, both content knowledge or pedagogical knowledge structures, of experienced versus inexperienced physical

education teachers. In general, the cognitive maps generated by experienced teachers were more complex, better organized and included more information.

Rovegno (1994), however, suggested not to limit the study of pedagogical content knowledge to planning:

Clearly, pedagogical content knowledge of a topic can be subject matter knowledge transformed by the teacher in the head during planning, but to limit research and theorizing to this conception restricts both our understanding of the situated character of pedagogical content knowledge and its potential emergence and development in and through practice (p.278).

If pedagogical content knowledge requires teachers to draw on what they know and apply it to teaching-learning settings (Walkwitz & Lee, 1992), then examination of teachers or coaches in action, as opposed to during planning, would provide a better picture of the nature and use of pedagogical content knowledge. Research has shown that teachers tended to adapt or modify their plans due to the context of the teaching situation (Riff & Durand, 1993; Rovegno, 1994).

Currently, little is known about the knowledge base and cognitive skills that underlie the instruction of sport and physical activity (Housner & French, 1994). There have only been a few studies in physical education that have examined how knowledge of subject matter was transformed and conveyed to learners in the field (e.g., Rovegno, 1991, 1994; Walkwitz & Lee, 1992). This area of research is in its infancy and no studies have yet focused on how coaches transform and present subject matter to their players in the sport context.

The purpose of the present study was to investigate coaches' instruction provided to female ice hockey players (12-15 yrs.) during games. More specifically, the questions to be

answered were: (a) What is the content of instruction? (b) When is the instruction given? and (c) How is the instruction communicated to the player(s)?

Women's hockey is a new phenomenon that has received little attention in the research community. This study was designed to provide insight into the learning opportunities provided to female ice hockey players during games. Results from this study should provide valuable information that will assist in the design of instructional interventions for youth sport coaches, specifically, for coaches of women's ice hockey teams.

Method

Subjects

Four subjects were part of a group of youth ice hockey coaches who participated during the 1994-1995 hockey season in a research project on the cognitive aspect of coaching.

Each participant in the study was considered an individual case based on Yin's (1989) multiple case study design. A separate report for each case provides the foundation for cross-case analysis, where similarities and differences between subjects can be highlighted. The identity of each coach has been protected by the use of pseudo names.

Case 1: Shelley. Shelley was in her first year as head coach of a peewee girl's (12-13 yrs.) house league team. She had two years prior coaching experience in girls' hockey, both as an assistant, before becoming the head coach. Shelley began coaching as part of her volunteer work requirement at College. She has played some minor hockey with boys, though was not playing hockey at the time of the study. Shelley was certified Level 1 by the National Coaching Certification Program (NCCP).

Case 2: Ray. Ray was the head coach of a bantam girl's (14-15 yrs.) house league team.

He had four years experience coaching boy's hockey, with his son and one year experience as the head coach in girl's hockey, with his daughter. Ray's daughter played on this years' team. Ray played minor hockey as a child at the house league level and was certified Level 1 by the NCCP.

Case 3: Barry. Barry was the head coach of a peewee girl's (12-13 yrs.) competitive team.

Prior to the study he had been actively involved in coaching both boy's and girl's hockey for five years. This was his first season as a head coach. Barry initially got involved in coaching as an assistant for his son's and daughter's teams. His competitive team was comprised of girls from all over the region. Barry's daughter played on the team. Barry played houseleague hockey growing up and had recently gone back to playing. He was certified Level 2 by the NCCP.

Case 4: Derek. Derek was the head coach of a Bantam girl's (14-15 yrs.) competitive team. Derek's players came from all over the region. The previous season he was a co-coach of a peewee girl's competitive team. Derek was selected as head coach of this year's team through an application process. He initially got into coaching hockey when his son started playing. Derek's daughter played on the team he was currently coaching. Prior to the study, he was involved in coaching both his son and daughter for about five years. Derek played organized youth hockey when he was younger and was certified Level 3 by the NCCP.

Table 1 provides an overview of the profile of each coach participating in the study.

Table 1.

An Overview of the Profile of Each Coach

	Shelley	Ray	Barry	Derek
Age-group:	PeeWee	Bantam	PeeWee	Bantam
Level:	House league	House league	Competitive	Competitive
Players drawn:	Locally	Locally	Regionally	Regionally
Prior experience	2 years	5 years	5 years	5 years
Certification	Level 1	Level 1	Level 2	Level 3
Daughter playing:	No	Yes	Yes	Yes
Sex of coach	Female	Male	Male	Male

Data Collection

The study relied on multiple data collection techniques. Yin (1989) indicated that case studies can be strengthened through triangulation. The concept of triangulation has been used to argue for the combination of methodologies in the study of the same phenomenon (Creswell, 1994). Researchers have suggested that both quantitative and qualitative data can be combined in a single study (e.g., Creswell 1994; Yin, 1989). In the present study both videotaped games and interview transcripts were used for analysis.

Videotaped games. A minimum of three and a maximum of four games for each coach were recorded on videotape. The video camera was positioned in such a way that the coach was in view throughout most of the game. The researcher followed some of the play with the camera, though when a coach spoke, went immediately back to the coach. Each coach wore a wireless microphone while coaching. This provided the researchers with a play by play account of what was being said by the coach. The videotapes of the 14 games enabled the researchers to

systematically observe the coaches at a later date.

Interviews. A number of interviews were also conducted with each coach. Background interviews covered such topics as (a) coaching experience, (b) playing experience, (c) current team, (d) a typical game, (e) a typical practice, and (f) planning. Pre-game and post-game interviews were conducted with each coach. Pre-game interviews inquired about the coach's planning, and post-game interviews focused on decisions that the coach may have made during the game. In-depth stimulated-recall interview sessions were also conducted with each coach prior to the next on-ice session. The pre-game, post-game, and stimulated recall interviews were all part of a data collection strategy developed by Trudel, Haughian and Gilbert (1996). The interviews were audiotaped and transcribed for later analysis.

Data Analysis

The coding process. In the preface to Darst, Zakrajsek and Mancini's (1989) book, Analyzing Physical Education and Sport Instruction, the authors encouraged users to utilize the systems they present in whole or in part, and for researchers to develop new systems in order to accomplish their objectives. Since none of the observation systems found in the literature fulfilled the needs of the present study, a new system was developed using an event recording procedure. The coding process involved two trained observers systematically coding 14 game tapes. All games in the study were approximately 50 minutes in length.

The observation system had three main components: (a) "what": the content of instruction, (b) "when": the instruction was given (c) "how": the instruction was communicated. An example of the coding process is presented in Figure 1. The first component detailed the content of instruction communicated to the players. A theoretical knowledge structure (TKS) for

ice hockey, comprising the major tactics and techniques of ice hockey, as well as rules of the game, was constructed based on Vickers' (1990) knowledge structure approach. The components of the adapted version of the theoretical knowledge structure for ice hockey are presented in Appendix A. The theoretical knowledge structure was divided into four main categories, (a) team tactics, (b) individual tactics, (c) individual techniques, and (d) rules. This classification was based on previous research in ice hockey (Trudel, 1987). The organization of the theoretical knowledge structure in such a fashion enabled researchers to decide: was the coach providing instruction, and if so, under which broad category did the coach's instruction fall: (a) team tactics, (b) individual tactics, (c) individual techniques, or (d) rules? Finally, once the larger category was identified, then the specific element to which the coach was referring was coded.

The second component detailed "when" the coach's instruction was given. The three options were to the player(s): (a) in action, (b) on the bench, or (c) in transition. The category "in action" was omitted from further analysis as the coach was directing the game while the play was in progress and the players could probably only hear a few key words, or not hear the coach at all. Research suggests that athletes can only consciously attend to a certain amount of information at one time (Magill, 1990). The categories "bench" and "transition" were further analyzed as the players were in position to hear the coach and there was more time for an explanation.

Event: A player came to the bench after taking a weak shot on goal.
 The coach said to the player: "Follow through when you shoot."

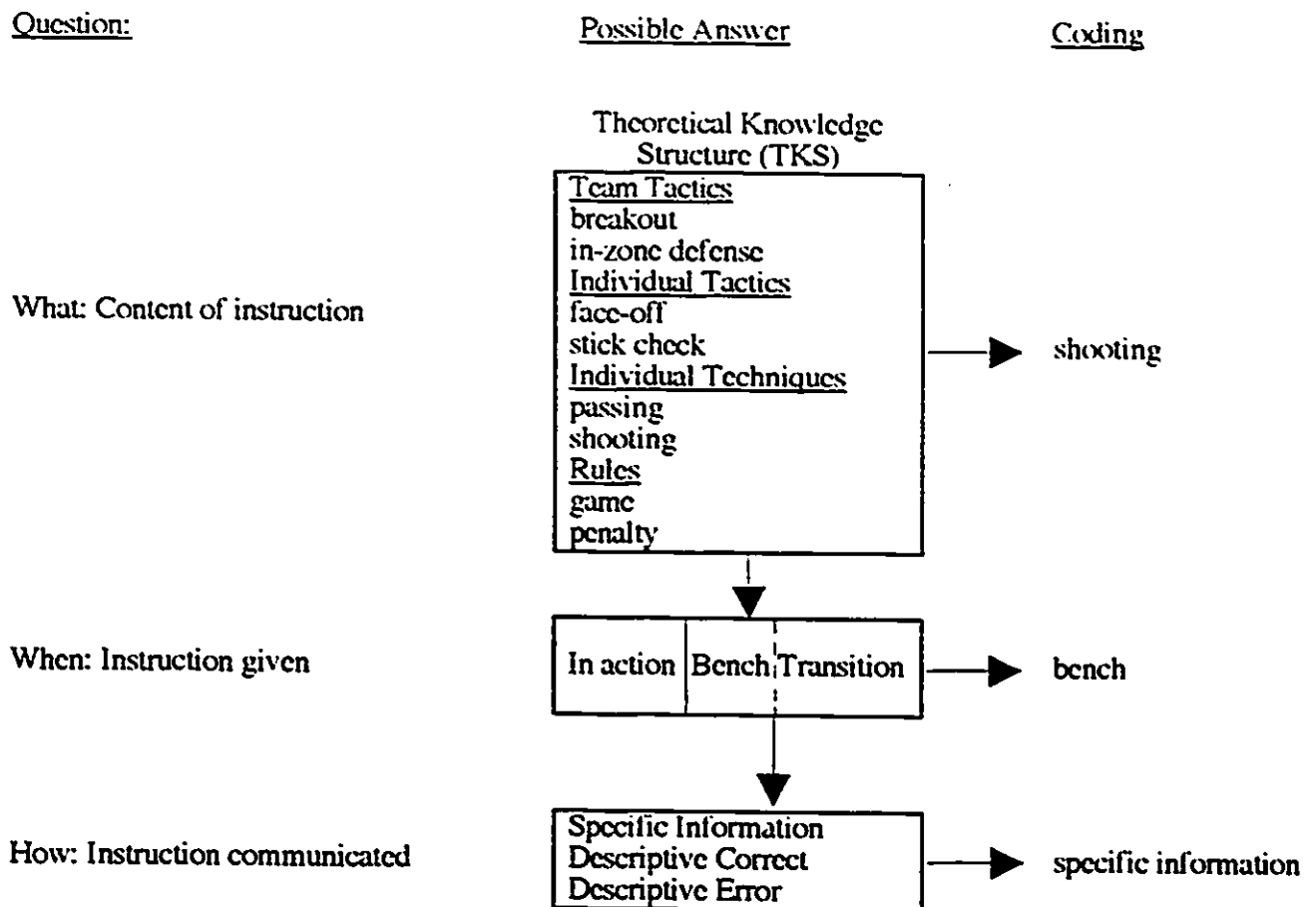


Figure 1. Example of the coding process.

The third component detailed "how" the instruction was communicated to the player(s). For instance, did the coach describe the error, provide specific information, or describe the error followed by general information? A sample coding form that helped organize the components of the coding system is provided in Appendix B.

Approximately 30 hours of coder training was required in order to use the coding system effectively. Frequent discussions about unclear instances of the codes occurred throughout the training. As suggested by van der Mars (1989), a "coding package" was developed to help minimize coding mistakes (see Appendix C).

Transcript analysis. In a separate analysis, the various interview transcripts for each coach were read in an effort to gain additional information about references to the theoretical knowledge structure. For example, references to instruction about "in-zone defence" or "passing" were highlighted in order to accentuate or counter findings obtained from the analysis of the video taped games.

Reliability Tests

Reliability was assessed four times throughout the study, using one game videotape for each of the four coaches. Two observers coded each tape together and then coded the same game tape again at a later date. The time period between the two coding sessions for each tape ranged from 9 to 26 days. It has been suggested that a time span of at least one week should lapse between the two observation sessions (van de Mars, 1989). The method used to estimate reliability was the Scored Interval method. This method van de Mars considered one of the most rigorous ways of estimating observer agreement. Table 2 presents an overview of the reliability tests. Results indicated that the overall scores for each case were above the minimum

Table 2.

Overview of the Reliability Tests Performed

Coach	Shelly	Ray	Barry	Derek
Component 1: What	87%	80%	89%	90%
Component 2: When	95%	87%	91%	94%
Component 3: How	87%	81%	93%	68%
Total	90%	83%	91%	88%

80% standard, at 90%, 83%, 91% and 88% respectively. Within each test, the codes were examined under three main components: "what", "when", and "how". Results indicated that 11 of the 12 scores were above the standard 80%. In the game in which the reliability was under 80% for component 3, there were fewer instances to code and the observers agreed 13 of the 19 times. The reliability tests have shown that with sufficient training observers could effectively use this coding procedure.

Results

This section will first present the results for each coach. Each coach in the study was considered an individual case. The research questions to be answered for each coach were: (a) "What" was the content of instruction? (b) "When" was the instruction given? and (c) "How" was the instruction communicated to the player(s)? The presentation of each case will be followed by a cross-case analysis.

Case 1: Shelley

To begin with, it is important to detail the context within which Shelley was coaching. During the background interview, Shelley noted that her peewee girls' house league team had not

yet won a game, though it was early in the season. Her team's record was zero wins, two losses and one tie before the study and zero wins, six losses and one tie after the study. Shelley's team never lead in any game. Shelley normally had two assistants on the bench with her, though not always the same two people. Shelley liked to do most of the coaching herself and did not rely on her assistants.

The coding of three games indicated that Shelley referred to the theoretical knowledge structure a total of 268 times and made reference to 23 of the 38 codes that comprised the theoretical knowledge structure. Table 3 provides an overview of the content taught by Shelley, in terms of percentages and frequencies. Since the duration of each game varied slightly in length, the percentages are more meaningful and thus appear before the frequencies.

Data in Table 3 indicates that "attack the net", under the category team tactics, was the content most often referred to, accounting for 33% of the total references to the theoretical knowledge structure. An example of the coach referring to the code "attack the net" would be Shelley instructing her players to, "go to the net" or "fire shots on net". The importance of attacking the opponent's net, in order to score a goal, was also evident in many of Shelley's interview transcripts:

I think I am going to pull the goalie the last minute and a half every game. If we are down by one or five I am going to pull the goalie. Who cares? Why not get a goal? The girls would really like to get a goal. Whether it is four nothing or seven nothing you know? But if it is tied I am not going to pull the goalie because we have not had a tie yet either. We would not want to jeopardize a tie because the girls would be pleased with a tie. So would I.

(Stimulated recall interview, Game #3)

Table 3 also indicates that "backcheck", under the category team tactics, accounted for 14% of the total references. Shelley would often direct her players by yelling "get back" or

Table 3.

"What": Content of Shelley's Instruction

Content	Game 1		Game 2		Game 3		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)
<u>Team Tactics</u>								
COFAB (attack the net)	21	(12)	34	(33)	38	(43)	33	(88)
CDERD (backcheck)	16	(9)	18	(17)	10	(11)	14	(37)
COFZC (neutral zone)	4	(2)	5	(5)	8	(9)	6	(16)
CDEDZ (in-zone defense)	5	(3)	7	(7)	5	(6)	6	(16)
COFSZ (breakout)	7	(4)	3	(3)	5	(6)	5	(13)
COF (offensive tactic)	4	(2)	4	(4)	3	(3)	3	(9)
CDEEA (forecheck)		(0)	1	(1)	4	(5)	2	(6)
CDEUS (penalty killing)	5	(3)		(0)		(0)	1	(3)
CDE (defensive tactic)	4	(2)		(0)		(0)		(2)
Sub-total	66	(37)	72	(70)	73	(83)	71	(190)
<u>Individual Tactics</u>								
TDEPO (on puck carrier)	7	(4)	5	(5)	7	(8)	6	(17)
TMJ (face-off)	2	(1)	1	(1)	2	(2)	1	(4)
TDENP (on non-puck carrier)		(0)	2	(2)		(1)	1	(3)
TDEPOMC (body check)		(0)	2	(2)		(1)	1	(3)
TDEPOMB (stick check)	2	(1)		(0)	2	(2)	1	(3)
TDE (defensive)		(0)	1	(1)		(0)		(1)
Sub-total	11	(6)	11	(11)	11	(14)	12	(31)
<u>Individual Techniques</u>								
ICRPA (passing)		(0)	2	(2)	4	(5)	3	(7)
IGAARMI (goalie freeze)	4	(2)	1	(1)	3	(3)	2	(6)
ICRTI (shooting)		(0)	1	(1)	4	(5)	2	(6)
IGAPOBA (goalie position)	4	(2)	2	(2)		(0)	1	(4)
ICR (puck control)		(0)	1	(1)		(1)	1	(2)
IGAAR (goalie save)	2	(1)		(0)		(0)		(1)
IGAPOAN (goalie angles)	2	(1)		(0)		(0)		(1)
Sub-total	12	(6)	7	(7)	11	(14)	10	(27)
<u>Rules</u>								
AREJE (game)	14	(8)	9	(9)	3	(3)	8	(20)
Total	100	(57)	100	(97)	100	(114)	100	(268)

Note. Rounded up to the nearest number therefore may not total exactly 100

"hustle back and help out" while the play was in progress. She also referred 6% of the time to each of the team tactics "neutral zone" and "in-zone defence", and "breakout" 5% of the time.

Under the category individual tactics, Shelley referred to "defensive tactic on the puck-carrier" 6% of the time. All other codes falling under individual tactics and individual technique were talked about 3% of the time or less. Shelley would have liked her players to know all the basics of hockey but she rarely referred to individual tactics or techniques. As Shelley indicated in the background interview, she was used to being a motivator and so teaching the individual techniques of the game was new to her:

This year I have a houseleague team. I am used to coaching a team with a lot of skill (competitive) and so I'm more used to being there as a motivator, than as teaching skills.

Under the category rules, the sub-category "rules of the game" was referred to third most frequently, at 8%. For example, while directing the game Shelley would yell, "get out" to her players. As explained in the stimulated recall interview from Game #1, "When I yell, get out, that means offside". Shelley would also explain what off-side was to the players who were on the bench, since some of her players had just started playing hockey:

I want to make sure every girl knows all the rules and the basics. I've got to keep each girl advancing a bit in their stages as a hockey player... For those two girls who just started playing I want them to know all the rules and I want them to be able to skate and carry the puck.

(Background interview)

Table 4 presents "when" the coach's instruction was communicated: to the player(s) "in action", on the "bench", or "in transition" and shows that Shelley communicated mostly to the player(s) "in action" (70%), followed by "bench" (25%) and "transition" (5%).

Table 4.

"When" Shelley's Instruction was Given

	Game 1		Game 2		Game 3		Global Profile	
To the players	%	(f)	%	(f)	%	(f)	%	(f)
EA (in action)	49	(28)	77	(75)	75	(85)	70	(188)
B (bench)	39	(22)	20	(19)	23	(26)	25	(67)
T (transition)	13	(7)	3	(3)	3	(3)	5	(13)
Total	100	(57)	100	(97)	100	(114)	100	(268)

A total of 80 codes, or 30% of the total number of codes (n=268) were further analyzed.

As indicated earlier, the player(s) who received the instruction while on the "bench" or "in transition" were in better position to hear the coach and there was more time for an explanation by the coach. In Table 5 the content of instruction communicated to the players on the bench or in transition, is broken down in terms of team tactics, individual tactics, individual techniques, and rules.

Table 5.

The Content of Shelley's Instruction by Major Category

	Game 1		Game 2		Game 3		Global Profile	
Category	%	(f)	%	(f)	%	(f)	%	(f)
Team Tactics	63	(18)	73	(16)	69	(20)	68	(54)
Individual Tactics	10	(3)	9	(2)	17	(5)	13	(10)
Ind. Techniques	10	(3)	14	(3)	14	(4)	12	(10)
Rules	17	(5)	5	(1)	(0)		1	(6)
Total	100	(29)	100	(22)	100	(29)	100	(80)

When Shelley spoke with the players on the bench or in transition, she emphasized team tactics 68% of the time, and individual tactics and techniques 25% of the time.

Table 6 presents "how" Shelley communicated the content to the player(s) who were on the bench or in transition.

Table 6.

"How" Shelley's Instruction was Communicated

	Game 1		Game 2		Game 3		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)
<u>Information</u>								
IS (specific)	38	(11)	36	(8)	52	(15)	43	(34)
IG (general)	21	(6)	9	(2)	21	(6)	18	(14)
<u>Feedback</u>								
DEIS (error/specific)	21	(6)	27	(6)	24	(7)	24	(19)
DC (correct)	10	(3)	14	(3)	3	(1)	9	(7)
DE (error)	7	(2)	14	(3)		(0)	6	(5)
DEIG (error/general)	3	(1)		(0)		(0)	1	(1)
Total	100	(29)	100	(22)	100	(29)	100	(80)

Shelley most often provided her player(s) with "specific information" (43%), and noted in the stimulated recall interview from Game #3 that: "They usually do what they are told, you just have to tell them". The category "specific information" was succeeded by "describing the error linked with specific information" (24%). Shelley communicated "general information" 18% of the time, described what her players did that was "correct" 9% of the time and "described the error" 6% of the total time.

Shelley's profile was fairly consistent throughout the four games (Table 3). One example

of a slight variation between games is that Shelley did not talk about the technique of "passing" or "shooting" in game #1. She talked about passing and shooting three times in game #2, and five times each in game #3.

Case conclusion. Shelley referred to two team tactics most often, "attack the net" and "back check", accounting for nearly 50% of the total references to the theoretical knowledge structure. Shelley mainly addressed the players "in action" (70%), and therefore spent a lot of the time directing the game. When she did communicate with the player(s) on the bench or in transition Shelley mainly provided her player(s) with "specific information" (43%) about team tactics (68%). In terms of frequencies, she communicated to her player(s) on the bench or in transition a total of 80 times, averaging 27 times per game. Shelley's global profile can be best summarized by Table 7.

Table 7.

Summary of Shelley's Instruction Provided During Games

Question	Predominant Trends
What: (n=268)	Attack the net (33%), Backcheck (14%)
When: (n=268)	In action (70%), Bench and Transition (30%)
How: (n=80)	Specific information (43%), Descriptive error/Specific information (24%), General information (18%)

Case 2: Ray

The study began early in the season and Ray's team had three wins and one loss. He felt that his team's loss should not have been a loss because they "completely outplayed the other team but just could not put the puck in the net". His goal for the year was "first and foremost for

the girls to have fun". His team's record was six wins, one loss and one tie after the study. Ray normally had one regular assistant and one trainer on the bench with him during games, but still liked to do most of the coaching himself.

The coding of four games indicated that Ray referred to the theoretical knowledge structure a total of 266 times, addressing 22 of a possible 38 codes. Table 8 displays the codes of the theoretical knowledge structure that Ray referred to during games, in terms of percentages and frequencies. Data shows that Ray emphasized the offensive team tactic "attack the net" most often (26%), followed by "neutral zone" (11%) and "breakout" (8%). An emphasis on offense was also noted during the background interview when Ray stated, "that putting the puck in the net is the ultimate goal". Still under the category team tactics, Ray referred to "in-zone defence" 5% of the time. Ray would say such things as: "I want you girls to keep the front of the net clear so our goalie can see the puck coming". The remainder of the codes under the broad category team tactics were referred to 3% of the time or less. There were only two references to the code "penalty killing" and no references to the "power play" throughout the four games. Accordingly Ray stated:

I do not have a power play or penalty killing team per say. Whoever happens to be going on, so be it. If it is my strongest line, that is great, if it's not that is OK too because as I mentioned earlier, I stress fun.

(Stimulated recall interview, Game #2)

Under the category individual tactics, "defensive tactic of the puck carrier" accounted for 4% of the references to the theoretical knowledge structure and was succeeded by "defensive tactic on the non-puck carrier" (3%).

Table 8

"What": Content of Rav's Instruction

Content	Game 1 % (f)	Game 2 % (f)	Game 3 % (f)	Game 4 % (f)	Global Profile % (f)
<u>Team Tactics</u>					
COFAB (attack the net)	11 (7)	21 (15)	38 (25)	33 (21)	26 (68)
COFZC (neutral zone)	12 (8)	11 (8)	9 (6)	13 (8)	11 (30)
COFSZ (breakout)	12 (8)	9 (6)	9 (6)	3 (2)	8 (22)
CDEDZ (in-zone defense)	3 (2)	4 (3)	8 (5)	5 (3)	5 (13)
CDERD (backcheck)	3 (2)	3 (2)	3 (2)	5 (3)	3 (9)
COF (offensive tactic)	2 (1)	1 (1)	5 (3)	3 (2)	3 (7)
CDE (defensive tactic)	3 (2)	3 (2)	3 (2)	(0)	2 (6)
CDEEA (forecheck)	2 (1)	(0)	3 (2)	3 (2)	2 (5)
CDEUS (penalty killing)	(0)	(0)	3 (2)	(0)	(2)
Sub-total	48 (31)	52 (37)	81 (53)	60 (41)	60 (160)
<u>Individual Tactics</u>					
TDEPO (on puck carrier)	2 (1)	7 (5)	(0)	6 (4)	4 (10)
TDENP (non-puck carrier)	3 (2)	1 (1)	(0)	6 (4)	3 (7)
TMJ (face-off)	3 (2)	(0)	(0)	5 (3)	2 (5)
TDE (defensive)	2 (1)	(0)	(0)	3 (2)	1 (3)
TOFFJ (deke)	2 (1)	(0)	(0)	2 (1)	(2)
TOFDM (get open)	(0)	1 (1)	(0)	(0)	(1)
Sub-total	12 (7)	9 (7)	(0)	22 (14)	10 (28)
<u>Individual Techniques</u>					
ICRPA (passing)	8 (5)	14 (10)	8 (5)	5 (3)	9 (23)
ICRTI (shooting)	14 (9)	9 (6)	5 (3)	3 (2)	8 (20)
ICR (puck control)	9 (6)	6 (4)	(0)	2 (1)	4 (11)
IGAARMI (goalie freeze)	(0)	1 (1)	(0)	(0)	(1)
IPT (skating)	(0)	(0)	(0)	2 (1)	(1)
Sub-total	31 (2)	30 (21)	13 (8)	12 (7)	21 (56)
<u>Rules</u>					
AREJE (game)	11 (7)	6 (4)	8 (5)	2 (1)	6 (17)
AREPE (penalty)	2 (1)	1 (1)	(0)	2 (1)	1 (3)
Sub-total	13 (8)	7 (5)	8 (5)	4 (2)	8 (20)
Total	100 (66)	100 (70)	100 (66)	100 (64)	100 (266)

Note. Rounded up to the nearest number therefore may not total exactly 100

Under the category individual techniques, "passing" and "shooting" were the most predominantly referred to codes at 9% and 8% respectively. Ray, for instance, would stress with his team to look before they pass:

See again they did it, somebody had the puck along the boards and they just shot it away without looking. I always tell them, just take a quick look, you don't have a lot of time, but just take a quick look, sometimes you will see somebody open.
(Stimulated recall interview, Game #1)

Lastly, under the category rules, "rules of the game" accounted for 6% of the total references to the theoretical knowledge structure. Ray described why some of his players were not totally familiar with all the rules:

The girls coming over from ringette do not know what an offside is, because they use the blueline a different way than we do in hockey. I seem to be constantly yelling at them, "You are offside, clear the zone!".
(Background Interview)

Table 9 reveals "when" Ray's instruction was given, to the player(s): "in action", on the "bench", or "in transition".

Table 9.

"When" Ray's Instruction was Given

	Game 1		Game 2		Game 3		Game 4		Global Profile	
To the players:	%	(f)	%	(f)	%	(f)	%	(f)	%	(f)
EA (in action)	49	(32)	60	(42)	67	(44)	72	(46)	62	(164)
B (bench)	38	(25)	34	(24)	32	(21)	17	(11)	31	(81)
T (transition)	14	(9)	6	(4)	2	(1)	11	(7)	7	(21)
Total	100	(66)	100	(70)	100	(66)	100	(64)	100	(266)

Ray spoke most often to the player(s) "in action" (62%) and the category "in action" was succeeded by "bench" (31%) and "transition" (7%).

A total of 102 codes, or 38% of the total number of codes (n=266), were further analyzed. Table 10 presents the content of Ray's instruction given to the player(s) on the bench or in transition, by major category.

Table 10.

The content of Ray's Instruction by Major Category

Category	Game 1		Game 2		Game 3		Game 4		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)	%	(f)
Team Tactics	18	(6)	29	(8)	68	(15)	50	(9)	37	(38)
Ind. Tactics	15	(5)	4	(1)		(0)	17	(3)	9	(9)
Ind. Techniques	56	(19)	64	(18)	32	(7)	22	(4)	47	(48)
Rules	12	(4)	4	(1)		(0)	11	(2)	8	(7)
Total	100	(34)	100	(28)	100	(22)	100	(18)	100	(102)

When Ray spoke to the players on the bench or in transition he emphasized team tactics 37% of the time and individual tactics and techniques 56% of the time. Table 11 indicates "how" Ray communicated to his player(s) who were on the bench or in transition.

Table 11.

"How" Ray's Instruction was Communicated

	Game 1		Game 2		Game 3		Game 4		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)	%	(f)
<u>Information</u>										
IS (specific)	47	(16)	14	(4)	15	(4)	28	(5)	28	(29)
IG (general)	6	(2)	4	(1)	23	(5)	17	(3)	11	(11)
<u>Feedback</u>										
DE (error)	38	(13)	46	(13)	36	(8)		(0)	33	(34)
DC (correct)	6	(2)	4	(1)	9	(2)	44	(8)	13	(13)
DEIS (error/specific)	3	(1)	25	(7)	14	(3)	6	(1)	12	(12)
DEIG (error/general)		(0)	7	(2)		(0)	6	(1)	3	(3)
Total	100	(34)	100	(28)	100	(22)	100	(18)	100	(102)

Ray most often "described the error" that his player(s) had committed (33%). This category was followed by "specific information" (28%) and by describing what his player(s) did that was "correct" (13%). During Ray's background interview he underscored the idea that in order for his player(s) to learn: "you have to tell them the good things, but you have to tell them the bad things too".

Ray's profile was not consistent throughout the four games. During Game #3, Ray had the highest instance of communicating the code "attack the net" (see Table 8). The goalie on the other team was injured during that game and Ray instructed his players to shoot on the new goalie as she was not used to playing in net:

I told the girls, get the puck and shoot. Make it a target practice, shoot at the net, shoot from any angle, even from behind the net, because obviously not being a goalie she doesn't know to put her stick around the side of the net when you are coming around the net. I just basically kept telling them, just shoot, shoot, shoot, just keep shooting.
(Stimulated recall interview, Game#3)

In games #1 and #2, Ray referred to the individual techniques more often than in games #3 and #4 (Table 11). One particular characteristic about games #1 and #2 was that they were both close games, as opposed to games #3 and #4. Interestingly, Ray did not "describe any errors" in Game #4. His team was never trailing in that game and the final score was 7-1.

Case conclusion. Three offensive team tactics, "attack the net" (26%), "neutral zone" (11%) and "breakout" (8%), accounted for 45% of the total references to the theoretical knowledge structure. Ray also instructed his players about the individual techniques "passing" and "shooting", 9% and 8% respectively. Ray mainly addressed the player(s) "in action" (62%). While speaking to the player(s) on the bench or in transition, Ray emphasized team tactics 37% of the time and the individual tactics and techniques 56% of the total time. Ray's predominant

method of communicating with his player(s) on the bench or in transition was by "describing the error" they had committed (33%). In terms of frequencies, Ray communicated to his player(s) on the bench or in transition 102 times, averaging 26 times per game. Ray's global profile can be best summarized by Table 12.

Table 12.

Summary of Ray's Instruction Provided During Games

Question	Predominant Trends
What: (n=266)	Attack the net (26%), Neutral zone (11%), Breakout (8%)
When: (n=268)	In action (70%), Bench and Transition (30%)
How: (n=80)	Descriptive error (33%), Specific information (28%), Descriptive correct (13%), Descriptive error/Specific information (24%)

Case 3: Barry

Barry's team averaged 13 to 14 games and about 5 practices a month. Most games were exhibition games with boys' teams and his team played one league game per week. The team's goal for the season was "to try and win the Provincials". Barry did not mention his team's record and ultimately that was not important to him. What was important was preparing his team for the Provincial Championships:

You have an overall goal of improving the team and improving each player, that goes without saying. A big measurement will be how well we do at the Provincials. Certainly the goal this year is to try and win it. We have taken the approach that we are going to enough tournaments to see all the teams we will face at Provincials, so I know what we are facing. Then we can come back here and try to prepare the team to best respond to the teams that we will face in April.

(Background interview)

At the time of the study, Barry said that he had already touched on all the "systems" or team

tactics, that he wanted to teach to his team. Barry considered himself part of a "coaching team", and was helped by his two assistant coaches. Both assistant coaches had some prior coaching experience and Barry encouraged them to speak to the player(s) directly if they saw something that he might not have seen or caught.

The coding of three games revealed that Barry referred to elements of the theoretical knowledge structure a total of 264 times, using 18 of a possible 38 codes. Table 13 provides an overview of the content of instruction taught by Barry, in terms of percentages and frequencies.

Table 13 indicates that Barry referred to the offensive team tactics "breakout" (17%) and "attack the net" (17%) most often. Barry noted in the stimulated recall interview from game #1 that getting the puck out of their own end is something that he has stressed all season:

...if you get the puck in our own end up close to the blue line, your first job is out, your second job is on to somebody's stick. If you are around this team you will hear that reminder many times.

Still under the category team tactics, "forecheck" and "neutral zone" were both referred to 11% of the time. An emphasis on what to do in the different areas of the ice is not surprising as Barry noted in the stimulated recall interview from Game #1 that: "Everybody has a job to do depending where we are on the ice and who has got the puck.". He continued:

What we have tried to work on, in essence, is the basic responsibility that each girl has depending on the position that they play. Pretty much all over the ice. We have worked on a basic break out play, and a basic forechecking system. From face-offs, what each girl is expected to do, to if the puck is in our own end, what is your job?

Still under the category team tactics, Barry talked about "in-zone defence" and "penalty killing" both 5% of the time. All other codes falling under the category team tactics were discussed less than 3% of the time.

Table 13

"What": Content of Barry's Instruction

Content	Game 1		Game 2		Game 3		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)
<u>Team Tactics</u>								
COFSZ (breakout)	29	(25)	10	(11)	14	(9)	17	(45)
COFAB (attack the net)	11	(9)	15	(17)	27	(18)	17	(44)
CDEEA (forecheck)	7	(6)	20	(23)	2	(1)	11	(30)
COFZC (neutral zone)	6	(5)	10	(11)	20	(13)	11	(29)
CDEUS (penalty killing)	12	(10)	3	(3)		(0)	5	(13)
CDEDZ (in-zone defense)	5	(4)	4	(5)	5	(3)	5	(13)
COFUS (power play)		(0)		(1)	5	(3)	2	(4)
CDERD (back check)	2	(2)		(0)	3	(2)	2	(4)
CDE (defensive tactic)	1	(1)		(0)		(0)		(1)
Sub-total	73	(62)	62	(71)	76	(49)	70	(182)
<u>Individual Tactics</u>								
TDENP (non-puck carrier)	4	(3)	7	(8)	2	(1)	5	(12)
TDEPO (on puck carrier)	1	(1)	5	(6)	2	(1)	3	(2)
TMJ (face-off)		(0)		(1)	5	(3)	2	(4)
TTB (along boards)	2	(2)		(1)		(0)	1	(3)
Sub-total	7	(6)	13	(6)	9	(5)	10	(27)
<u>Individual Techniques</u>								
ICRPA (passing)	16	(14)	17	(19)	6	(4)	14	(37)
ICRTI (shooting)	1	(1)	5	(6)	8	(5)	5	(12)
ICR (puck control)		(0)		(1)		(0)		(1)
IPT (skating)		(1)		(0)		(0)		(1)
Sub-total	17	(16)	22	(26)	14	(9)	19	(51)
<u>Rules</u>								
AREJE (game)	1	(1)		(0)	5	(3)	2	(4)
Total	100	(85)	100	(113)	100	(66)	100	(264)

Note. Rounded up to the nearest number therefore may not total exactly 100

Under the category individual tactics, "defensive tactic of the non-puck carrier" was the most frequently referred to code (5%). Barry discussed a situation in which his player should have been taking the non-puck carrier in the following fashion:

Here, what she should be doing instead of watching the puck is taking the player. That is why I talked to her there. She does know what she should be doing, but is not doing it. (Simulated recall interview, Game#1)

This category was succeeded by "defensive tactic on the puck carrier" (3%).

Under the category individual techniques, "passing" was the third most frequently referred to code of the theoretical knowledge structure at 14%. The videotaped games revealed that Barry repeatedly emphasized to his players to "look" before they pass. "Passing" was followed by the code "shooting" (5%). All other individual techniques were not discussed more than once throughout the three games.

Finally, falling under the category rules, "rules of the game" was referred to only 2% of the total time, and mention of "penalty rules" was non-existent. At the peewee competitive level, and at that point in the season, most of the players should have been fairly familiar with all the rules of hockey.

The next question to be answered for Barry was "when" did he communicate the instruction? Table 14 presents the percentages and frequencies for the categories "in action", on the "bench", and "in transition". Data indicates that Barry communicated predominantly to the players "in action" (55%), followed by "bench" (39%) and "transition" (6%).

Table 14.

"When" Barry's Instruction was Given

	Game 1		Game 2		Game 3		Global Profile	
To the players	%	(f)	%	(f)	%	(f)	%	(f)
EA (in action)	53	(45)	58	(66)	53	(35)	55	(146)
B (bench)	41	(35)	37	(42)	38	(25)	39	(102)
T (transition)	6	(5)	4	(5)	9	(6)	6	(16)
Total	100	(85)	100	(113)	100	(66)	100	(264)

A total of 118 codes, or 45% of the total number of codes (n=264) were further analyzed.

Table 15 breaks down the content of instruction in terms of team tactics, individual tactics, individual techniques, and rules.

Table 15.

The Content of Barry's Instruction by Major Category

	Game 1		Game 2		Game 3		Global Profile	
Category	%	(f)	%	(f)	%	(f)	%	(f)
Team Tactics	65	(26)	43	(20)	61	(19)	55	(65)
Individual Tactics	8	(3)	23	(11)	10	(3)	14	(17)
Ind. Techniques	28	(11)	34	(16)	26	(8)	30	(35)
Rules		(0)		(0)	3	(1)	3	(1)
Total	100	(40)	100	(47)	100	(31)	100	(118)

When Barry spoke to the players on the "bench" and "in transition" he emphasized team tactics 55% of the time, and the individual tactics and techniques 44% of the time.

Table 16 reveals "how" Barry communicated the content of instruction to the players on the bench or in transition.

Table 16.

"How" Barry's Instruction was Communicated

	Game 1		Game 2		Game 3		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)
<u>Information</u>								
IS (specific)	48	(19)	21	(10)	26	(8)	31	(37)
IG (general)		(0)	4	(2)	6	(2)	3	(4)
<u>Feedback</u>								
DC (correct)	43	(17)	23	(11)	19	(6)	29	(34)
DEIS (error/specific)	10	(4)	28	(13)	23	(7)	20	(24)
DE (error)		(0)	17	(8)	23	(7)	13	(15)
DEIG (error/general)		(0)	4	(2)		(0)	2	(2)
DCIS (correct/specific)		(0)	2	(1)	3	(1)	2	(1)
Total	100	(40)	100	(47)	100	(31)	100	(118)

Barry communicated mainly with his players on the bench or in transition by giving them

"specific information" (31%), or by describing what his player(s) did "correctly" (29%). He liked to stress important points with his players by helping them understand what they did that was right:

She is a strong defenseman but she tends to want to just dump the puck in. What I am trying to get her to do, if you have got the time let the winger get into position and get the winger the puck. She has had trouble grasping when to dump it in and when to hold onto the puck. I am trying to reinforce it. It just happened, she made the right play. So I am trying to get her to acknowledge that she has done the right things and why.
(Stimulated recall interview, Game #3)

Barry "described the error followed by specific information" 20% of the time, or simply

"described the error" 13% of the time. The following is an example of Barry talking about an incident where he described the error and followed it up with specific information:

She tried to beat the player at the red line instead of just dumping the thing into their end. Their player took the puck and went the other way. It just was not a smart decision and I wanted to make sure that she understood that. Hopefully the next time she is in that situation, she will know, just cross the red line and dump it in.
(Stimulated recall interview, Game #3)

Barry's profile was not always consistent from game to game. A review of the coding forms indicated that when his team was losing or when the game was close, Barry would use more "descriptive errors" or would "describe the error followed by specific information" more frequently. In game #2 and game #3 the incidence of "descriptive error" was elevated, at 17% and 23% respectively (Table 16). "Descriptive error linked with specific information" was also higher in game #2 and game #3, at 28% and 23% respectively. Barry's team lost game #2 by a score of 7 to 2. In game #3, the championship game, he pulled his goalie to win the game by a score of 4 to 3. Barry's team won games #1 and #4 by a goal and both were exhibition games.

Case conclusion. In terms of span of the theoretical knowledge structure used, Barry's emphasis was fairly evenly distributed among "breakout" (17%), "attack the net" (17%), "forecheck" (11%) and neutral zone" (11%). Barry also instructed his player(s) about the individual technique "passing", 14% of the time and he communicated to the player(s) "in action" just over half of the time. When speaking with his player(s) on the bench or in transition, he emphasized team tactics 55% of the time, and the individual tactics and techniques 44% of the time. This was done by giving "specific information" (31%) or by describing what his player did that was "correct" (29%). In terms of frequencies, he communicated to his player(s) on the bench or in transition a total of 118 times, averaging 39 times per game. Barry's global profile can be

best summarized by Table 17.

Table 17.

Summary of Barry's Instruction Provided During Games

Question	Predominant Trends
What: (n=264)	Breakout (17%), Attack the net (17%), Forecheck (11%), Neutral Zone (11%)
When: (n=268)	In action (55%), Bench and Transition (45%)
How: (n=80)	Specific information (31%), Descriptive correct (29%), Descriptive error/Specific information (24%), Descriptive error (13%)

Case 4: Derek

Derek's bantam competitive team played in a five team league and also played exhibition games against boy's teams. His team was on the ice close to 20 times a month. Derek did not mention his team's record in the background interview and the team's record was not something that he keyed upon. The goal for Derek's team was to win the Provincial Championships, as explained in the background interview:

Everything that we do, the league play, we play a 20 game season. Our league play isn't quite as important. We play a whole pile of exhibition games, we play 40 or so games against boys' teams...that gives us a level of competition that we need. Just about everything that we do leads up to the Provincial Championships in April, when we go back to Toronto to compete against other Bantam A girls teams from across the province.
(Background interview)

Derek indicated that he had talked about all the "major systems" or team tactics that his team would use by just after the mid-point of the season, roughly around when the study began. Derek always had two assistant coaches and a trainer on the bench with him. He communicated directly with his player(s) when there was something to tell them and his assistant coaches also helped

coach the team.

The coding of four games revealed that Derek referred to codes from the theoretical knowledge structure a total of 212 times, referring to 24 of a possible 38 codes. Table 18 depicts the content of his instruction in terms of percentages and frequencies. Derek spoke about three offensive team tactics most frequently, the highest percentage being "neutral zone" (16%), followed by "attack the net" (15%) and "breakout" (11%). In the background interview he highlighted some of the things that his team had been working on:

A standard breakout, no magic. Some triangle formations in the offensive zone, no big deal. We do have a good power play. Those are some of the things we have focused on.

Still under the category team tactics, he instructed player(s) about forechecking 8% of the time.

Derek had just implemented the "1-2-2" forechecking system at the time of the study:

We were just dumping the puck into their zone and we would be going in so deep that we were being caught three on two and four on two. The forecheck is one thing we started to work on last night in Cornwall, we just moved it into a 1-2-2 system.
(Background interview)

The code "penalty killing" accounted for 6% of the total references to the theoretical knowledge structure. Derek would constantly remind his player(s) to "set up the box" before they went on the ice for a man-down situation. All other codes falling under the broad category team tactics were referred to 3% of the time or less.

Under the category individual tactics, Derek provided his player(s) with instruction about the category "face-offs" fourth most often, accounting for 9% of the total references to the theoretical knowledge structure. This code was followed by "defensive tactic on the puck carrier" (8%). All other codes falling under the category individual tactics were referred to less than 3% of the time.

Table 18

"What": Content of Derek's Instruction

Content	Game 1 % (f)	Game 2 % (f)	Game 3 % (f)	Game 4 % (f)	Global Profile % (f)
Team Tactics					
COFZC (neutral zone)	19 (9)	17 (8)	17 (10)	12 (7)	16 (34)
COFAB (attack the net)	21 (10)	10 (5)	19 (11)	10 (6)	15 (32)
COFSZ (breakout)	11 (5)	13 (6)	9 (5)	14 (8)	11 (24)
CDEEA (forecheck)	11 (5)	10 (5)	3 (2)	9 (5)	8 (17)
CDEUS (penalty killing)	4 (2)	8 (4)	5 (3)	7 (4)	6 (13)
CDEDZ (in-zone defense)	2 (1)	2 (1)	5 (3)	3 (2)	3 (7)
CDERD (backcheck)	(0)	2 (1)	2 (1)	5 (3)	2 (5)
COFUS (power play)	(0)	2 (1)	3 (2)	3 (2)	2 (5)
COF (offensive tactic)	(0)	(0)	2 (1)	(0)	(1)
CDE (defensive tactic)	(0)	2 (1)	(0)	(0)	(1)
Sub-total	68 (32)	66 (32)	65 (38)	63 (37)	63 (139)
Individual Tactics					
TMJ (face-off)	6 (3)	4 (2)	12 (7)	10 (6)	9 (18)
TDEPO (on puck carrier)	9 (4)	6 (3)	3 (2)	12 (7)	8 (16)
TOFFJ (deke)	2 (1)	4 (2)	(0)	2 (1)	2 (4)
TDENP (non-puck carrier)	(0)	(0)	3 (2)	(0)	(2)
TDEPOMC (body check)	2 (1)	(0)	(0)	(0)	(1)
TOFDM (get open)	(0)	(0)	2 (1)	(0)	(1)
TOF (offensive)	(0)	(0)	(0)	2 (1)	(1)
TDE (defensive)	(0)	2 (1)	(0)	(0)	(1)
Sub-total	19 (9)	16 (8)	20 (12)	26 (15)	21 (44)
Individual Techniques					
ICRPA (passing)	2 (1)	10 (5)	7 (4)	3 (2)	6 (12)
ICRTI (shooting)	(0)	2 (1)	5 (3)	3 (2)	3 (6)
ICR (puck control)	2 (1)	(0)	(0)	2 (1)	(2)
IGAARMI (goalie freeze)	(0)	(0)	(0)	2 (1)	(1)
Sub-total	4 (2)	12 (6)	12 (7)	10 (6)	10 (21)
Rules					
AREJE (game)	4 (2)	4 (2)	(0)	(0)	2 (4)
AREPE (penalty)	4 (2)	(0)	3 (2)	(0)	2 (4)
Sub-total	8 (4)	4 (2)	3 (2)	(0)	4 (8)
Total	100 (47)	100 (48)	100 (59)	100 (58)	100 (212)

Note. Rounded up to nearest number therefore may not total exactly 100

Next, under the broad category individual techniques of the game, "passing" accounted for 6% of the total references to the theoretical knowledge structure and was succeeded by "shooting" at 3% and he often emphasized to his player(s) to "look" before they pass.

Finally, under the category rules, both "rules of the game" and "penalty rules" were stressed 2% of the total time. At the competitive level, and at that point in the season, most players would be fairly familiar with the rules of hockey.

Table 19 indicates "when" Derek communicated to the player(s): in action, on the bench or in transition. Derek spoke to his player(s) "in action" most often (60%), followed by "bench" (31%) and "transition" (9%).

Table 19.

"When" Derek's Instruction was Given

	Game 1		Game 2		Game 3		Game 4		Global Profile	
To the players:	%	(f)	%	(f)	%	(f)	%	(f)	%	(f)
EA (in action)	64	(30)	56	(27)	63	(37)	59	(34)	60	(128)
B (bench)	32	(15)	42	(20)	24	(14)	29	(17)	31	(66)
T (transition)	4	(2)	2	(1)	14	(8)	12	(7)	9	(18)
Total	100	(47)	100	(48)	100	(59)	100	(58)	100	(212)

A total of 84 codes, or 40% of the total references to the theoretical knowledge structure (n=212) were further analyzed. Table 20 presents the content of Derek's instruction to the player(s) on the bench or in transition, in terms of team tactics, individual tactics, individual techniques, and rules. He tended to emphasize team tactics 49% of the time and individual tactics and techniques 43% of the total time.

Table 20.

The Content of Derek's Instruction by Major Category

Category	Game 1		Game 2		Game 3		Game 4		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)	%	(f)
Team Tactics	36	(6)	71	(15)	46	(10)	42	(10)	49	(41)
Ind. Tactics	30	(5)	10	(2)	27	(6)	46	(11)	29	(24)
Ind. Techniques	12	(2)	14	(3)	18	(4)	13	(3)	14	(12)
Rules	24	(4)	5	(1)	9	(2)		(0)	8	(7)
Total	100	(17)	100	(21)	100	(22)	100	(24)	100	(84)

Table 21 indicates "how" Derek communicated to his player(s) who were on the bench or in transition.

Table 21.

"How" Derek's Instruction was Communicated

	Game 1		Game 2		Game 3		Game 4		Global Profile	
	%	(f)	%	(f)	%	(f)	%	(f)	%	(f)
<u>Information</u>										
IS (specific)	35	(6)	29	(6)	32	(7)	54	(13)	38	(32)
IG (general)	29	(5)	5	(1)	23	(5)	8	(2)	16	(13)
<u>Feedback</u>										
DC (correct)	12	(2)	10	(2)	23	(5)	33	(8)	20	(17)
DE (error)	18	(3)	24	(5)	14	(3)		(0)	13	(11)
DEIS (error/specific)	6	(1)	24	(5)	9	(2)		(0)	10	(8)
DCIS (correct/specific)		(0)	5	(1)		(0)	4	(1)	2	(2)
DEIG (error/general)		(0)	5	(1)		(0)		(0)	1	(1)
Total	100	(17)	100	(21)	100	(22)	100	(24)	100	(84)

Derek predominantly communicated with his player(s) on the bench or in transition by giving them "specific information" (38%) He would say such things as "Make sure you go to the net" or "You have to get close to her if she is going to shoot". Derek described what his player(s) did "correctly" 20% of the time, gave them "general information" 16% of the time and "described the error" 13% of the total time

Derek's profile was not always consistent from game to game. The incidence of communication to player(s) in transition was elevated during game #3 and game #4 (see Table 19). This can be explained by the fact that Derek was emphasizing face-off positioning during these games, and would thus tell the player(s) where to line up before the puck was dropped. He would yell such things as "I want the face-off back to the point so Amy move in" or "Steph move to the inside to cover the shooter". These commands also explained the higher frequency of references to the code "face-off" during these two games (see Table 18).

Case conclusion. In terms of the span of the theoretical knowledge structure used, Derek referred most often to three offensive team tactics, "neutral zone" (16%), "attack the net" (15%) and "breakout" (11%). The preceding three codes accounted for 42% of the total references to the theoretical knowledge structure. Derek provided instruction to his player(s) about the team tactic "forecheck" 8% of the time and also talked about the individual tactics "face-off" and "defensive tactic on the puck carrier", 9% and 8% respectively. Derek communicated to his player(s) in action (60%). When speaking with his player(s) on the bench or in transition, he emphasized team tactics 49% of the time, and the individual tactics and techniques 43% of the time. Derek did so by giving "specific information" (31%) or by describing what the player(s) did that was "correct" (20%). In terms of frequencies, he communicated to his player(s) on the bench or in

transition a total of 84 times, averaging 21 times per game. Derek's global profile can be best summarized by Table 22.

Table 22.

Summary of Derek's Instruction Provided During Games

Question	Predominant Trends
What: (n=212)	Neutral Zone (16%), Attack the net (15%), Breakout (11%), Forecheck (8%)
When: (n=212)	In action (60%), Bench and Transition (40%)
How: (n=84)	Specific information (38%), Descriptive correct (20%), General information (16%), Descriptive error (13%)

Cross-case analysis

The four cases presented so far were unique in many ways. One coach had less experience than the other three. Two coaches in the study had house league teams, and two had competitive teams. For the competitive teams, many of the games were exhibition games, used to help prepare the teams for the Provincial Championships. Three teams had winning records, whereas one had a losing record. All of these characteristics were in interaction and influenced the nature of the content, when, and how it was taught.

The coaches differed most in terms of specific codes under content. For instance, one coach referred often to goaltending technique, where as the other three did not. Two of the coaches emphasized "attack the net" most often, where as one stressed "breakout" and the other "neutral zone". Despite the differences that resulted when looking at specific codes, many similarities between cases emerged at a global level.

Table 23 compares the four cases on global aspects of the nature of the content. The

coaches in the present study referred to approximately the same number of categories with the use of between 18 and 24 out of a possible 38.

Table 23.

A Cross-case Comparison of the Content of Instruction

	Case 1	Case 2	Case 3	Case 4
# of components/38	23	22	18	24
<u>Team Tactics</u>				
COF-- (offensive)	47%	48%	47%	44%
CDE-- (defensive)	23%	12%	19%	19%
Sub-total	70%	60%	66%	63%
<u>Individual Tactics</u>				
TOF-- (offensive)	0%	0%	0%	2%
TDE-- (defensive)	9%	8%	8%	8%
TMJ (face-off)	1%	2%	2%	9%
Sub-total	10%	10%	10%	19%
<u>Ind. Techniques</u>				
ICR-- (control)	6%	21%	19%	9%
<u>Rules</u>				
AREJE (game)	8%	6%	2%	2%
AREPE (penalty)	0%	1%	0%	2%
Total	94%	98%	97%	95%

The four coaches tended to emphasize offensive team tactics, at 47%, 48%, 47% and 44% respectively. Under the category individual tactics, however, the emphasis was on defense, at 9%, 8%, 8% and 8%.

Table 24 presents a cross-case comparison of the four cases, detailing "when" the instruction was given. The coaches tended to address the player(s) "in action" most frequently, between 55% and 70% of the time, followed by "bench" and "in transition".

Table 24.

A Cross-case Comparison of "When" the Instruction was Given

	Case 1	Case 2	Case 3	Case 4
EA (in action)	70%	62%	55%	60%
B (bench)	25%	31%	39%	31%
T (transition)	5%	7%	6%	9%

Table 25 presents a cross-case comparison of "how" each coaches' instruction was communicated. With few instances of information and feedback per game, the frequencies are reported rather than percentages.

Table 25.

A Cross-case Comparison of "How" the Instruction was Communicated

	Case 1	Case 2	Case 3	Case 4
	f	f	f	f
Frequency/game	27	26	39	21
<u>Information</u>				
IS (specific)	11	7	12	8
IG (general)	5	3	1	3
<u>Feedback</u>				
DE (error)	2	9	5	3
DC (correct)	2	3	11	4
DEIS (error/specific)	6	3	8	3
DCIS (correct/specific)	0	0	1	0
DEIG (error/general)	1	1	1	0
DCIG (correct/general)	0	0	0	0

Coaches provided their players with information or feedback between 21 and 39 times a game

and the tendency to give "specific information" was more frequent than the other categories.

Considering the importance of specific information to learning, Table 26 reveals the amount, and content of specific information given to players by each of the four coaches.

Table 26.

A Cross-case Comparison of Specific Information

	Case 1	Case 2	Case 3	Case 4
	f	f	f	f
IS, DEIS, DCIS /game	18	10	21	11
<u>Content</u>				
Team Tactics	13	5	14	5
Individual Tactics	1	1	4	5
Individual Techniques	3	3	3	1
Rules	1	1	0	0

The coaches provided their players with "specific information" between 10 and 21 times a game, and when doing so, they mainly spoke about team tactics, as opposed to individual tactics, individual techniques or rules.

Discussion

The use of a unique coding system and various types of interviews has provided insight into the nature of coaches' pedagogical content knowledge used during youth ice hockey games. The present study not only identified the content of instruction presented to players, but also provided information about "when" and "how" the instruction was given.

The content that coaches' referred to and their approach to its communication, was probably dictated by the context of their coaching situation. Coaching, like teaching, is interactive

and to a large degree context specific (Dodge & Hastie, 1993; Woodman, 1993; Rink, 1993).

Researchers have demonstrated that coaches' behaviors will vary depending on the sport (Claxton & Lacy, 1986; Dubois, 1981; Smith, Zane, Smoll & Coppel, 1983) or even the setting, such as games or practices, within a particular sport (Horn, 1985). Caution must be applied then, when trying to compare the results of the present study with previous studies on coaches' behaviors. Additionally, the coding system in the present study was designed to consider only those coaching behaviors related to instruction, or references to the components of the theoretical knowledge structure of ice hockey, and did not consider behaviors such as praising, organization, or observing.

Although the results of the present study revealed differences between cases, and even variability between games within the same case, many similarities emerged between coaches on a global level. Beginning with the content, the coaches in the present study emphasized team tactics, over individual tactics, individual techniques or rules. In fact, between 60% and 70% of the content referred to team tactics, with 44% to 48% of that content related to offense. A preoccupation with offense indirectly supports the literature showing the importance of winning for youth sport coaches (Chaumeton & Duda, 1988; Dubois, 1981). The coaches predominantly told players what to do when their team had possession of the puck. When referring to individual tactics, however, the coaches were more inclined to emphasize defense, between 8% and 9% of the time. The coaches often told players what to do in order to stop the opposing player carrying the puck.

The relatively low percentage for the categories individual tactics and techniques, as opposed to team tactics, demonstrates that the coaches preferred to emphasize strategy over skill

instruction during games. This tendency was also demonstrated in a study that examined teaching and coaching behavior in invasion game activities, such as basketball and soccer, where coaches stressed strategy more often than skill technique or effort (Ormond, 1988).

An emphasis on team tactics during games by all the coaches may be due to the nature of high-strategy sports, such as ice hockey. In high-strategy sports, or when performing open skills, the player must (a) choose the correct response and (b) be able to execute the response (Rink, 1993; Thomas, 1994). During ice hockey games, players must make frequent transitions between offense and defense. They must also be able to read situations accurately in order to choose the proper action-decision (Perron & Chouinard, 1991). Other studies should examine the content taught in low-strategy sports, where there is not an offense-defense interaction. For low-strategy sports executing the skill is the major determinant of success (Thomas, 1994).

The global profile of each coach also indicated that they were similar on "when" they provided their players with instruction. The coaches yelled to the players in action between 55% and 70% of the time. A study on the feedback statements of youth baseball coaches also indicated that coaches yelled to the players in the field more often than they spoke to the players on the bench (McKenzie & King, 1982). Results from the present study were also consistent with previous research in ice hockey, where coaches' behaviors were directed more frequently to the players in action, as opposed to the players who were on the bench or in transition (Trudel, Côté & Bernard, 1996).

Many of the interventions by the coaches were short duration prompts, such as "go to the net", or "take her now", communicated while the play was in progress. This directive style of coaching was found in a study on the coaching behaviors of male youth ice hockey coaches,

where coaches seemed to act as a one-person show, attempting to control all the action (Trudel, Côté & Bernard, 1996). Unfortunately when coaches prompt or select the strategy for the player, the player may not learn to make the correct decisions (Thomas, 1994).

In terms of "how" the instruction was given, the coaches in the present study gave more specific information, than general information, to the players who were on the bench or in transition. Although this result may seem encouraging and in line with previous research suggesting that there is a need to increase the amount of specific information given to players (Swalus, Carlier & Renard, 1991), the frequency of specific information given per game was quite low. The players in the present study were provided with specific information about team tactics, individual tactics, individual techniques, and/or rules of the game, an average of 13 times per game. With approximately 15 players per team, this averages less than one "teachable moment" per player. This trend was also evidenced in a study where specific feedback was considered a meaningful part of effective coaching in invasion games, "but in reality was one that was rarely evidenced" (Ormond, 1988, p.134).

The present study looked closely at instruction directed to the players on the bench or in transition. The coaches statements to these players were more specific than general, contradicting other pedagogy research where coaches tended to give more general than specific feedback (McKenzie & King, 1982). If the statements that the coaches made to the players in action had been further analyzed, then the majority of these statements would have been general in nature and in line with previous research.

The concern regarding the fact that so little "teaching" occurs during ice hockey games was raised by Trudel, Côté and Bernard (1996) and confirmed in the present study. The

relatively low percentage of specific information given to players during games indicates that these coaches did not fully utilize opportunities arising in games to instruct players.

One might suggest that instruction on the skills of the game took place in practice, as opposed to during games (Wandzilak, Ansorge & Potter, 1988). Trudel and Brunelle (1985), however, painted a bleak picture of male youth ice hockey coaches' "teaching" behaviors during practices. The coaches' role in their study was described as mainly one of organization, and the authors concluded that coaches were providing little specific information and feedback to their players during practices. One must also consider the fact that the teams in the present study played games more frequently than they practised, mirroring findings that games often outnumber practices by a ratio of as much as 3 to 1 in amateur ice hockey in Canada (Chouinard & Trudel, 1993). Games, therefore, could but did not, provide excellent learning opportunities for players because they comprised approximately 70% of the ice sessions.

The occasion to learn new skills was identified as an important reason why female athletes continued to participate in women's ice hockey (Boyd, 1996). Other research has indicated that athletes prefer more frequent use of technical instruction and less general feedback by coaches (Smith, Zane, Smoll & Coppel, 1983). Results from the present study revealed that although the coaches directed the game while the players were in action, they did not frequently teach on the bench or during transitions. Will this eventually cause a negative effect on participation rates in women's ice hockey due to the lack of teaching during games?

When comparing the profiles of the coaches on the basis of level of competition, the present study contradicted findings by Chaumeton and Duda (1988) on the effect of competitive level on coaching behaviors. The profiles of the house league and competitive coaches were quite

similar. This can be explained, in part, by the number of exhibition games that the competitive teams played while the study was in progress. Although competitive leagues for women are growing (MacKinnon, 1994), the competitive teams in the present study played in a very small league and relied on exhibition games against boy's teams to fill the rest of their schedule.

The only difference that emerged between the house league and competitive coaches at a global level was that the house league level coaches tended to communicate instruction about the rules of the game. They did so 8% and 6% of the time, as opposed to 2% for each of the competitive coaches. More frequent references to rules of the game occurred during house league games because many of the houseleague players were not familiar with the rules of ice hockey.

Conclusions

Vickers' (1990) knowledge structures approach was used to develop a unique coding system that helped detail the content of the lessons taught by four youth sport coaches, during female ice hockey games. Results indicated that these coaches emphasized team tactics more often than individual tactics, individual techniques and rules. The relatively low percentage of specific information given to players during games indicates that the coaches did not fully utilize opportunities arising in games to teach players. An important link between teaching in practices and games, however, has yet to be explored.

Well over 100 hours were spent collecting and analyzing the data for each case and the researcher quickly became aware that these coaches were instructing their players to the best of their knowledge. The development of training programs for coaches should take into account findings from studies like this one, that observe coaches in the natural setting. Similar research on a sport by sport basis (Thomas, 1994) will help expand the knowledge base on coaching, and will

ultimately aid in the design of interventions that favor more learning opportunities for youth sport athletes.

Finally, the present study did not look at the role of the assistant coaches during games. Future research may find that the assistant coaches compliment the head coach, by providing additional instruction to players during games.

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Appendix A

The components of the theoretical knowledge structure
for ice hockey

Under the category technique individuelle/ **individual techniques**

IPT= INDIVIDUELLE PATINAGE/INDIVIDUAL SKATING

IPTAV=IND. PATINAGE AVANT/INDIVIDUAL FORWARD SKATING

IPTAR=IND. PATINAGE ARRIERE/INDIVIDUAL BACKWARDS SKATING

ICR=INDIVIDUELLE CONTROLE/INDIVIDUAL PUCK CONTROL

ICRMA=IND. CONTROLE MANIMENT/INDIVIDUAL STICKHANDLING

ICRPA=INDIVIDUELLE CONTROLE PASSE/INDIVIDUAL CONTROL PASSING

ICRPADR=IND. CONTROLE PASSE COUP DROIT/IND. FORHAND PASS

ICRPARE=IND. CONTROLE PASSE REVERS/IND. BACKHAND PASS

ICRTI=INDIVIDUELLE CONTROLE TIR/INDIVIDUAL CONTROL SHOOTING

ICRTIDR=IND. CONTROLE TIR COUP DROIT/IND. FORHAND SHOT

ICRTIRE=IND. CONTROLE TIR COUP REVERS/IND. BACKHAND SHOT

IGA=INDIVIDUELLE GARDIEN/INDIVIDUAL GOALIE

IGAPO=IND. GARDIEN POSITION/IND. GOALIE POSITION

IGAPOBA=IND. GARDIEN POSITION BASE/IND. GOALIE BASE POSITION

IGAPOAN=IND. GARDIEN POSITION ANGLE/IND. GOALIE ANGLE POSITION

IGAPT=IND. GARDIEN PATINAGE/IND. GOALIE SKATING

IGAAR=IND. GARDIEN ARRET/IND. GOALIE SAVE

IGAARBT=IND. GARDIEN ARRET BATON/IND. GOALIE STICK SAVE

IGAARMI=IND. GARDIEN ARRET MITAINE/IND. GOALIE GLOVE SAVE

IGAARCO=IND. GARDIEN ARRET CORPS/IND. GOALIE BODY SAVE

IGACR=IND. GARDIEN CONTROLE RONDELLE/IND. GOALIE PUCK CONTROL

Under the category tactique individuelle/**individual tactics**

TOF=TACTIQUE OFFENSIVE/OFFENSIVE TACTIC

TOFFJ=TACTIQUE OFFENSIVE FEINTE JOUEUR/OFFENSIVE TACTIC DECK A
PLAYER

TOFFG=TACTIQUE OFFENSIVE FEINTE GARDIEN/OFFENSIVE TACTIC DECK
A GOALIE

TOFEC=TACTIQUE OFFENSIVE ECRAN/OFFENSIVE TACTIC SCREEN

TOFDM=TACTIQUE OFFENSIVE DEMARQUAGE/OFFENSIVE TACTIC GET
OPEN

TDE=TACTIQUE DEFENSIVE/DEFENSIVE TACTIC

TDEPO=TACTIQUE DEFENSIVE PORTEUR/DEFENSIVE TACTIC ON PUCK
CARRIER

TDEPOMB=TACTIQUE DEFENSIVE PORTEUR MIS EN ECHEC AU BATON/
DEFENSIVE TACTIC ON PUCK CARRIER STICK CHECK

TDEPOMC=TACTIQUE DEFENSIVE PORTEUR MIS EN ECHEC CORPS/
DEFENSIVE TACTIC BODY CHECK

TDENP=TACTIQUE DEFENSIVE NON-PORTEUR/DEFENSIVE TACTIC ON
NON-PUCK CARRIER

TMJ=TACTIQUE MISE AU JEU/TACTIC FACE-OFF

TTB=TACTIQUE TRAVAIL LONG DE BANDE/TACTIC ALONG BOARDS

Under the category tactique collective/**team tactics**

COF=COLLECTIVE OFFENSIVE/OFFENSIVE TACTIC

COFSZ=COLLECTIVE OFFENSIVE SORTIE ZONE/OFFENSIVE BREAKOUT

COFZC=COLLECTIVE OFFENSIVE ZONE CENTRAL/OFFENSIVE NEUTRAL ZONE

COFAB=COLLECTIVE OFFENSIVE ATTAQUE AU BUT/OFFENSIVE ATTACK THE
NET

COFUS=COLLECTIVE OFFENSIVE UNITE SPECIALE/OFFENSIVE POWER PLAY

CDE=COLLECTIVE DEFENSIVE/DEFENSIVE TACTIC

CDEEA=COLLECTIVE DEFENSIVE ECHEC AVANT/DEFENSIVE FORECHECK

CDERD=COLLECTIVE DEFENSIVE REPLIS DEFENSIF/DEFENSIVE BACKCHECK

CDEDZ=COLLECTIVE DEFENSIVE DEFENSIVE DE ZONE/DEFENSIVE IN-ZONE
DEFENCE

CDEUS=COLLECTIVE DEFENSIVE UNITE SPECIALE/DEFENSIVE MAN DOWN

Under the category règles/rules

ARE=AUTRE REGLEMENT/OTHER RULES

AREJE=AUTRE REGLEMENT DE JEU/OTHER RULES OF THE GAME

AREPE=AUTRE REGLEMENT PENALTE/OTHER PENALTY RULES

Appendix B
Sample coding form

Coach _____ G or P # _____ Date: _____

Coach _____ G or P # _____ Date: _____

Coach _____ G or P # _____ Date: _____

[illegible]

Appendix C
Coding package

CODING PACKAGE

Start coding before the game begins (after the warm-up), just as the players gather around their bench getting ready to start.

Continue to code throughout the game, including what the coach says to the players between periods.

Coding finishes at the final buzzer.

The type of information that we are coding is that which will make the players better.

Code statements referring to skills, strategies or concepts.

Do not code statements referring to effort or organization.

Do not code the coach commenting to themselves, to their assistants, or to the referees.

Code what is directed to the players.

Keep in mind context is very important. The same words can mean different things.

Example: "get on her" can be interpreted as defensive tactic on the puck carrier or forecheck, depending where the players and the puck are on the ice.

EXAMPLES OF WHAT NOT TO CODE

"be aggressive" as it does not refer to a skill or strategy

"good try" relates to effort, not a skill or strategy

"play right wing next shift" as it refers to organization

"hustle girls" as it refers to effort

"don't hesitate" not related to a specific skill or strategy

"go get it" general encouragement

"go hard, go hard" relates to effort

"WHAT"
Content of Instruction

(examples of what to code and what not to code)

Under the category **technique individuelle/ individual technique**

1. IPT= INDIVIDUELLE PATINAGE/INDIVIDUAL SKATING
2. ICR= INDIVIDUELLE CONTROLE/ INDIVIDUAL CONTROL
3. ICRMA= INDIVIDUELLE CONTROLE MANIMENT/ IND. CONTROL
STICKHANDLING
4. ICRPA= INDIVIDUELLE CONTROLE PASSE/IND. CONTROL PASSING OR
RECEIVING A PASS
5. ICRTI= INDIVIDUELLE CONTROLE TIR/IND. CONTROL SHOOTING

*These categories are coded when the coach refers to the **technique** of skating, controlling the puck, stickhandling, passing or shooting. Also coded when one of the above is said to have been done right (see examples)

What to code:

- *IPT= "use your edges to push off"
- *ICR= "two hands on stick"
- *ICRPA= "nice pass" as it refers to what a correct pass is
- *ICRPA= "look when you pass" a technique of passing
- *ICRTI= "great shot" refers to a correct shot
- *ICRTI= "follow through when you shoot" technique of shooting

What not to code:

- "shoot" tells a player when to shoot (tactic), not technique
- "move it up" tactical rather than technical
- "off the boards" tactic, not technique

technique individuelle/individual technique cont.

6. IGAP0= INDIVIDUELLE GARDIEN POSITION/INDIVIDUAL GOALIE POSITION
7. IGAP0BA= IND. GARDIEN POSITION BASE/IND. GOALIE BASE POSITION
8. IGAP0AN= IND. GARDIEN POSITION ANGLES/IND. GOALIE ANGLE POSITION
9. IGAPT= INDIVIDUELLE GARDIEN PATINAGE/IND. GOALIE SKATING
10. IGAAR= INDIVIDUELLE GARDIEN ARRET/INDIVIDUAL GOALIE SAVE
11. IGAARBT= IND. GARDIEN ARRET BATON/IND. GOALIE STICK SAVE
12. IGAARMI= IND. GARDIEN ARRET MITAINE/IND. GOALIE GLOVE SAVE
13. IGAARCO= IND. GARDIEN ARRET CORPS/IND. GOALIE BODY SAVE
14. IGACR=IND. GARDIEN CONTROLE RONDELLE/IND. GOALIE PUCK CONTROL

What to code:

- *IGAAR= "nice save"
- *IGAARMI= "you picked it out of the air"
- *IGAARMI= "freeze it"
- *IGAP0BA= "don't go down any more"
- *IGAP0BA= "stand up"
- *IGAP0BA= "keep your stick on the ice"
- *IGAP0AN= "watch your angles"

What not to code:

- "Keep it up" general encouragement

Under the category **tactique individuelle/individual tactics**

- 15. TOF= TACTIQUE OFFENSIVE/OFFENSIVE TACTIC
- 16. TOFFJ= TACTIQUE OFFENSIVE FEINTE JOUEUR/OFFENSIVE TACTIC DECK A PLAYER
- 17. TOFFG= TACTIQUE OFFENSIVE FEINTE GARDIEN/OFFENSIVE TACTIC DECK A GOALIE
- 18. TOFEC= TACTIQUE OFFENSIVE ECRAN/OFFENSIVE TACTIC SCREEN
- 19. TOFDM= TACTIQUE OFFENSIVE DEMARQUAGE/OFFENSIVE TACTIC GET OPEN

*usually directed at one player vs another

What to code:

TOF= "give a target"

TOFEC= "screen their goalie"

TOFFJ= "good moves"

TOFFJ= "fake inside and go wide"

TOFDM= "get open for the pass"

- 20. TDE= TACTIQUE DEFENSIVE/DEFENSIVE TACTIC
- 21. TDEPO= TACTIQUE DEFENSIVE PORTEUR/DEFENSIVE TACTIC ON PUCK CARRIER
- 22. TDEPOMB= TACTIQUE DEFENSIVE PORTEUR MISE EN ECHEC AU BATON/DEFENSIVE TACTIC ON PUCK CARRIER STICK CHECK
- 23. TDEPOMC= TACTIQUE DEFENSIVE PORTEUR MISE EN ECHEC CORPS/DEFENSIVE TACTIC ON PUCK CARRIER BODY CHECK
- 24. TDENP= TACTIQUE DEFENSIVE NON-PORTEUR/DEFENSIVE TACTIC NON PUCK CARRIER

*usually directed at one player vs another

What to code:

TDE= "don't back up"

TDEPO= "stay with her"

TDEPO= "take him now"

TDEPO= "do whatever you can to get the puck away from her"

TDEPOMC= "nice check Erin"

What not to code:

"get back" tactique collective rather than tactique individuelle

"one each" tactique collective rather than individuelle

Under the category tactique individuelle/ **individual tactics** con't.

25. TMJ= TACTIQUE MISE AU JEU/TACTIC FACE OFF

26. TTB= TACTIQUE TRAVAIL LONG DE BANDE/TACTIC ALONG BOARDS

What to code:

TMJ= "pick up on the face-off"

TMJ= "stay with the centre"

TTB= coded when a player is along the boards

"use skates to kick it out"

Under the category **tactique collective/team tactics**

27. COF= COLLECTIVE OFFENSIVE/COLLECTIVE OFFENSIVE

28. COFSZ= COLLECTIVE OFFENSIVE SORTIE DE ZONE/COLLECTIVE OFFENSIVE
BREAK OUT

29. COFZC= COLLECTIVE OFFENSIVE ZONE CENTRAL/COLLECTIVE OFFENSIVE
NEUTRAL ZONE

30. COFAB= COLLECTIVE OFFENSIVE ATTAQUE AU BUT/COLLECTIVE OFFENSIVE
ATTACK THE NET

31. COFUS= COLLECTIVE OFFENSIVE UNITE SPECIALE/COLLECTIVE OFFENSIVE
SPECIAL TEAMS (POWER PLAY)

With Puck		
COFSZ ⇒	COFZC ⇒	COFAB ⇒

Without Puck		
CDEDZ ⇐	CDERD ⇐	CDEEA ⇒

What to code:

COF= "everybody play up"

COF= "stay on your wings"

COFSZ= "off the boards"

COFSZ= "get it over the blueline"

COFZC= "up to her"

COFZC= "head man it"

COFAB= "get shots on this cold goalie" (remember tactic not technique)

COFAB= "straight to the net"

COFAB= "defense get in there"

COFAB= "shoot"

COFUS= special instructions specific to the power play
"set it up"

Under the category tactique collective/**team tactics** con't.

- 32. CDE= COLLECTIVE DEFENSIVE/COLLECTIVE DEFENSIVE
- 33. CDEEA= COLLECTIVE DEFENSIVE ECHEC AVANT/COLLECTIVE DEFENSIVE
FORECHECK
- 34. CDERD= COLLECTIVE DEFENSIVE REPLI DEFENSIF/COLLECTIVE DEFENSIVE
BACK CHECK OR GET BACK
- 35. CDEDZ= COLLECTIVE DEFENSIVE DEFENSIVE DE ZONE/COLLECTIVE
DEFENSIVE IN-ZONE DEFENSE
- 36. CDEUS= COLLECTIVE DEFENSIVE UNITE SPECIALE/COLLECTIVE DEFENSIVE
SPECIAL TEAMS (PENALTY KILLING)

What to code:

CDE= "play defensively"

CDEEA= "don't pinch"

CDEEA= "one in on the forecheck, one"

CDERD= "get back"

CDEDZ= "the centre helps defense in the corners"

CDEDZ= "defend in the high slot"

CDEUS= special instructions related to penalty killing
"play the box"

Under the category règles/**rules**

37. AREJE= AUTRE REGLEMENTS DE JEU/RULES OF THE GAME

38. AREPE= AUTRE REGLEMENTS PENALTE/PENALTY RULES

What to code:

AREJE= "watch the offside"

AREJE= "get out"

AREPE= "if you put your stick between her legs it is a penalty"

"WHEN"

Coaches' instruction given to the players:

EA In action. Coach communicates (speaks loudly) to the players on the ice while the play is in progress.

B = Bench. Coach communicates to the player(s) in or around the bench. This includes to the players coming to or leaving the bench.

T = Transition. Coach communicates to the player(s) on the ice between plays, who are set for the play to begin, or who are far away
ex. the players who are lined up for a face-off, or players at the far end of the ice.

"HOW"

Instruction is divided into: Information and Feedback

Information:

IG = general information. No explanation. Names the concept.

ex. we have to backcheck, we have to forecheck, pass more, saying to the players on the bench we have to shoot.

IS = specific information. Provides an explanation. Indicates where to go or what to do. Explains criteria. Tells player exactly when to shoot while play in progress.

ex. shoot high, follow through when you shoot, lead the man, set up the box, stay in lanes when you backcheck.

Feedback:

DC = descriptive correct. Describes what the player(s) did right.

ex. good shot, good pass, way to go to the net.

DE = descriptive error. Describes what the player(s) did wrong.

ex. we had four guys in the corner, that was a horrible pass.

DCIG = descriptive correct followed by general information

ex. way to get back, next time backcheck the same hard way.

DCIS = descriptive correct followed by specific information

ex. nice deflection, you had two hands solid on your stick.

DEIG = descriptive error followed by general information

ex. you went offside, next time don't go off-side.

DEIS = descriptive error followed by specific information

ex. we had four guys in the corner, wingers have to cover the points.

**Coaches' Instruction Provided to Female
Ice Hockey Players During Games**

Pamela A. Seaborn

Revised Research Proposal

University of Ottawa

Table of Contents

Revisions	R 3
Introduction	R 4
Purpose of the study	R 6
Significance of the study	R 6
Delimitations	R 6
Limitations	R 7
Definition of terms	R 7
Review of Literature	R 8
Research on coaches' behavior	R 8
A knowledge structures approach	R12
Physical education teachers'/coaches' knowledge	R14
Method	R19
Subjects	R19
Data collection procedures	R20
Data analysis	R20
Multiple-case study design	R21
References	R22
Appendices	R28

Preface to the Revised Thesis Proposal

Several modifications were made to the thesis proposal following suggestions from the thesis committee:

1. Vickers' (1990) overview structure for ice hockey has replaced the overview structure for badminton that was used in the original proposal.
2. New categories were developed in order to best depict "how" the coaches provided instruction to their players. The content of instruction is now analyzed as either information or feedback. The information category includes specific information and general information. The feedback category includes descriptive correct, descriptive error, descriptive correct followed by specific or general information, and descriptive error followed by specific or general information.
3. The inclusion of additional literature and the re-organization of original literature improved the flow of the proposal and made the links between paragraphs and ideas clearer.
4. Finally, due to an increased understanding of the research area and the exploratory nature of the research project, the initial questions were rephrased to more accurately reflect the purpose of the research project.

Coaches' Instruction Provided to Female

Ice Hockey Players During Games

There are over 4 million children participating in youth sport programs in Canada (Canadian Heritage Sport Canada, 1994). Out of a variety of sports offered, ice hockey is among the most popular. During the 1994-1995 season there were over 500,000 boys and girls registered to play ice hockey in Canada (CAHA, 1995). The number of young women playing ice hockey is augmenting each year. There has been a 200% increase in the number of women registered to play since 1990 (CAHA, 1995).

As in many youth sport programs, adults are in charge of the structural aspect, and female hockey players rely on volunteer coaches to provide them with learning opportunities. Perron and Chouinard (1991) suggested that the role of an amateur ice hockey coach is to teach the technical and tactical skills of the game as well as making the learning experiences fun.

Women's hockey highlights quick, clean, competitive hockey without the body contact that is permissible in the men's game. As the president of the Ottawa District Women's Hockey Association conceded, "skill development should be a primary concern for our hockey coaches as the emphasis in women's hockey is on finesse" (Alexander, 1995). The increasing number of participants, as well as the specific nature of women's hockey, makes it an exciting venue within which to study the coaching process.

Coaching involves the delivery of instruction, with the central purpose being the promotion of learning (Sinclair, 1985). The interaction between coaches and their athletes has been investigated by researchers in sport pedagogy (Piéron, 1994). Trudel and Gilbert (1995) recently amassed 111 studies, published over the last 20 years, that used systematic observation techniques to gain insight into the behavior of coaches during games or practices (e.g. Claxton,

1988; Lacy & Darst, 1985, McKenzie & King, 1982; Wandzilak, Ansorge & Potter, 1988). The authors of this repertory of studies on coaches' behavior concluded that this data base is far from complete and that researchers should consider combining systematic observation with interviews to gain information not only on the frequency of behaviors but also on the cognitive processes underlying these behaviors.

Interest in the cognitive aspect of coaching is new and, as with the behavioral aspect, will probably benefit from educational research, particularly developments made in research in physical education. The area of study referred to as teachers' thinking (Clark & Peterson, 1986) has grown steadily from research efforts that were once singularly focused on the search for teachers' classroom behaviors that correlated with, or caused student learning outcomes (Marland & Osborne, 1990). Studies on teachers' cognition are designed "(a) to describe such cognitions as teachers' thinking, implicit theories, decision making, images, and subject matter knowledge and (b) to uncover how cognition connects with practice" (Rovegno, 1995, p.284).

The importance of including the subject matter in the study of teaching was introduced by Shulman (1986, 1987). While emphasizing the importance of defining a knowledge base for teaching, Shulman identified pedagogical content knowledge as one critical type of knowledge for teachers. Pedagogical content knowledge goes beyond knowledge of subject matter per se, to the dimension of subject matter for teaching.

In the field of sport, Vickers' (1990) knowledge structures approach can be used to detail the integration of subject matter with the methods and processes of instruction. A well developed knowledge structure is one which permits rapid decision making, precision, and ease in thought and action for both teachers and coaches (Vickers, 1990). To date, the various types of knowledge used by a coach in a sport-context, remain largely unexplored.

knowledge used by a coach in a sport-context, remain largely unexplored.

Coaches should possess both technical and tactical knowledge about their sport, as research has indicated that emphasis needs to be placed on skill development (Petlichkoff, 1993). Improving sport skills seems particularly important for young athletes since it can reduce competitive stress (Scanlan & Passer, 1979) and lead to a more positive sport experience (Smoll, 1986; Wankel & Sefton, 1989).

Purpose of the Study

The purpose of the present study is to investigate coaches' instruction provided to female hockey players (12-15 yrs) during games. More specifically, the questions to be answered are (a) "what" is the content of instruction taught and to what portion of the theoretical knowledge structure does the instruction correspond? (b) "when" is the instruction given? and (c) "how" is the instruction communicated to the players?

Significance of the Study

Women's hockey is a new phenomenon that has received little attention in the research community. This study is designed to provide insight into the learning opportunities provided to female ice hockey players during games. Results from this study will hopefully aid in the design of instructional interventions for youth sport coaches, specifically for coaches of women's ice hockey teams. The study put forth is also designed to contribute to the limited but growing body of research on the "science of coaching" (Segrave & Ciancio, 1990).

Delimitations

Four youth sport coaches from female ice hockey teams will be chosen for this study. In this case, the research strategy best suited to study each coaches' instruction, is a case study. A case study is an empirical inquiry that:

case study is an empirical inquiry that:

- (a) investigates a contemporary phenomenon within its real-life context; when (b) the boundaries between phenomenon and context are not clearly evident; and in which (c) multiple sources of evidence are used (Yin, 1989, p.23).

This study will analyze each coach's instructions provided to players during games. The teaching done by coaches prior to, or after games, will not be part of the analyses.

Limitations

The content of instruction that will be depicted as a result of this study may not correspond to the complete ice hockey knowledge structure of the coach, but will represent what he or she has communicated to the players during games.

Definition of Terms

Declarative Knowledge: Represents the factual or "foundational knowledge of a discipline frequently represented as content" (Ennis, Mueller & Zhu, 1991, p.309).

Instruction: The transmission of knowledge from a coach, to a player(s), for the purpose of teaching.

Knowledge Structure: Refers to the organization of knowledge as evidenced by experts (Chi & Glaser, 1980).

Pedagogical Content Knowledge: Defined as "that special amalgam of content and pedagogy that is uniquely the province of teachers, their own special form of professional understanding" (Shulman, 1987, p.8). The transmission of knowledge to learners, so that it is easily understood, has become known as pedagogical content knowledge (Ennis, Mueller, & Zhu, 1991).

1991).

Procedural Knowledge: Defined as "an assembled set of cognitive processes for performing a sequence of actions with the content" (Chi & Glaser, 1980, p.39).

Review of Literature

Over the last two decades, sport pedagogy researchers have investigated the coaching process across a multitude of sports, age groups and settings. A data base on the science of coaching (Segrave & Ciancio, 1990) however, remains far from complete (Trudel & Gilbert, 1995). Although instruction has been identified as an important coaching behavior (Sinclair, 1985), this element of coaching has not been explored beyond it's identification. This review of literature will first present the relevant findings on coaches' behavior. Next, Vickers' (1990) knowledge structures approach will be presented as it will serve as the theoretical framework within which a coaches' knowledge in action can be represented. Finally, studies on physical education teachers'/coaches' knowledge will be reviewed.

Research on Coaches' Behavior

Beginning in the mid 1970's, researchers used systematic observation instruments to assess coaches' behavior during practices and games. The categories used in these studies were defined a priori, and generally included behavior such as "organize", "stimulate", "instruct", and "observe". Studies using event recording systems revealed that "instruction" was the predominant coaching behavior (e.g. Lacy & Goldston, 1990; Segrave & Ciancio, 1990; Tharp & Gallimore, 1976). One of the earliest studies in this area, conducted by Tharp and Gallimore, revealed that 75% of coach John Wooden's behaviors contained some form of instruction. Caution must be exercised when comparing results from these studies however, as the different instruments used may produce different results. Claxton (1988) also found that instruction was the most prominent coaching

behavior, however when using an interval recording system, instruction only accounted for 9.9% of the total time.

In a study using interval recording, Trudel, Côté and Bernard (1996) provided a complete picture of youth ice hockey coaches' behaviors during games. The results of their study were consistent with existing interval recording research. Coaches spent approximately 11% of game time teaching skills. In Trudel et al.'s study, the category "teaching skills" was composed of "giving information", "positive evaluation" and "negative evaluation" of performances. The authors in this study underlined that the relatively low percentage of time spent providing information and feedback indicated that these coaches offered few "teachable moments" in games. Games, however, often outnumber practices by a ratio of as much as 3 to 1 in amateur ice hockey in Canada (Chouinard & Trudel, 1993), and could provide excellent opportunities for teaching young athletes.

The behavior of youth ice hockey coaches and players during practices has also been analyzed (Trudel & Brunelle, 1985). Forty training sessions were observed and results indicated that individual players were motor engaged an average of 33% of the time. The coaches in this study provided little specific information and feedback to their players and their role was mainly one of organizing.

Other studies have investigated specific aspects of coaching behavior during games and practices, such as the provision of feedback. Researchers have noted that the quantity and quality of feedback given by coaches, can aid in skill acquisition (Chamberland & Lee, 1993; Magill, 1990). Mackland and Martinek (1988) researched feedback given to high school varsity female volleyball players. Audio feedback was the most common way coaches gave feedback to their players. The feedback was most often given immediately and was corrective in nature. Players of

players. The feedback was most often given immediately and was corrective in nature. Players of successful coaches received significantly more feedback than players of less successful coaches.

The feedback statements of youth coaches have also been investigated by McKenzie and King (1982). The feedback statements of 64 youth baseball coaches, from five different age groups, were recorded. Results indicated that feedback statements were most often general in nature, as opposed to specific. These authors concluded that from a pedagogical standpoint the coaches in their study provided feedback that was poor in quality and provided "little specific information" that would be useful for improving performance.

The influence of coaching behaviors on young athletes has been investigated extensively by Smith and Smoll and their associates (Smith, Smoll & Curtis, 1979; Smith, Zane, Smoll & Coppel, 1983; Smith & Smoll, 1990). In these studies, coaching effectiveness was assessed relative to children's psychological growth. Results from these studies indicated that more frequent use of technical instruction, less general feedback, and mistake contingent encouragement by coaches, were positively related to self-esteem and a higher level of sport enjoyment for athletes.

Other studies have shown that a coach's behavior can affect player's feelings of competence (Black & Weiss, 1992; Horn, 1985; Segrave & Ciancio, 1990). Black and Weiss found that age-group swimmers' self-perceptions and motivation were related to perceived coaching behavior. A positive affect was elicited by coaches who gave good instruction, were encouraging, and less critical. Athletes of these coaches had higher levels of self-esteem and enjoyed swimming more.

Similarly, Horn (1985) investigated the link between coaching behaviors in practices and games, and female softball players' perceptions of competence. Contrary to Black and Weiss'

games, and female softball players' perceptions of competence. Contrary to Black and Weiss' findings however, Horn's results indicated that positive changes in self-perception came from player's own skill development, and not necessarily from the coach. Positive reinforcement was associated with lower levels of perceived confidence. Criticism was associated with higher levels of perceived physical confidence. In an attempt to explain these results, it was suggested that perceived competence of female athletes was particularly susceptible to the feedback given by their coaches.

Improving sport skills can also reduce competitive stress (Scanlan & Passer, 1979; Smoll, 1986). Smoll found that youngsters' anxiety reactions were derived in part from deficits in ability. Specifically, "feelings of insecurity and heightened anxiety might arise because of perceived lack of skill to cope with a situation" (p. 128). Scanlan underscored the nature of competitive sport where an athlete's ability is publicly tested, examined and evaluated. Young athletes are not only subject to judgement from others, but they also compare their ability to teammates and opponents. It is important that all athletes be presented with ample learning opportunities so that they feel adequately prepared.

Based on the results of many studies on coaches' behavior, Douge and Hastie (1993) listed several characteristics to identify effective coaches. Generally, "effective coaches (a) frequently provide feedback and incorporate numerous prompts and cues, (b) provide high levels of correction and reinstruction, (c) use high levels of questioning and clarifying, (d) are predominantly engaged in instruction, and (e) manage the training environment to achieve considerable order" (p. 15-16). These same authors suggested that effective coaching "is not only a set of established coaching behaviors but also a coach's ability to observe, analyze, synthesize, and modify his or her coaching to fit the situation and the needs of those involved" (p. 14).

and modify his or her coaching to fit the situation and the needs of those involved" (p.14).

Research efforts should now extend beyond the identification of certain coaching behaviors, and provide insight into the cognitive component underlying the coaching-learning process. In order to detail coaches' instruction provided to female ice hockey players during games, it is important to choose a framework within which a coach's knowledge in action can be represented.

A Knowledge Structures Approach

Vickers' (1990) knowledge structures approach brings a knowledge-based prospective to teaching and coaching. Vickers' approach was designed to aid in planning. This approach, however, can be used to link the subject matter of a sport with teaching and coaching methodology. Vickers' knowledge structures approach provides teachers and coaches with a conceptual array of structured information that acts as a reference for the design of units of instruction. A knowledge structure developed for a specific sport incorporates all the essential skills, strategies and scientific concepts for that sport. An overview structure of the knowledge structure for ice hockey is presented in Figure 1.

The term knowledge structure refers to the organization of knowledge as evidenced by experts (Chi & Glaser, 1980). Vickers (1983) defined an expert knowledge structure as "the organization of knowledge as derived from activity-specific expert sources in concert with theoretical principles of categorization as derived from cognitive, motor, and instructional psychology" (p.20). For Glaser (1984) knowledge structures can be compared to schemata, "schema theory attempts to describe how acquired knowledge is organized and represented and

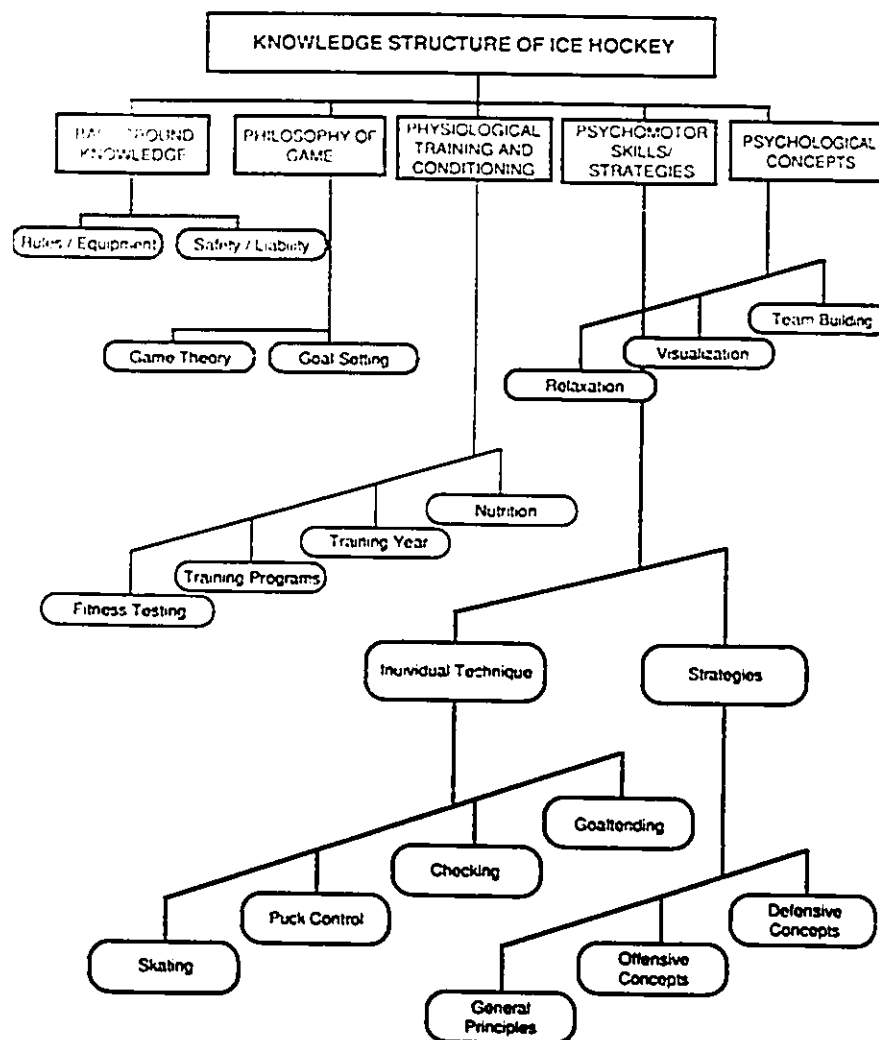


Figure 1. An overview structure for ice hockey that defines the first level of declarative knowledge for that sport.

Note. From "Instructional Design for Teaching Physical Activities: A Knowledge Structures Approach," by J. N. Vickers, 1990, Champaign, IL: Human Kinetics.

how such cognitive structures facilitate the use of knowledge in particular ways" (p.100)

Vickers' (1990) knowledge structures approach provides a framework within which both curriculum and instruction decisions about sport and physical activity can be made. "The term curriculum refers to the subject matter: what is to be taught...and the term instruction refers to the techniques, methods, or processes that are used" (Vickers, 1990, p.7).

When designed specifically for ice hockey, this type of "hierarchical overview" of a sport can provide an excellent look up chart that can detail the content of the lessons taught by coaches. The list of words comprising an adapted version of the knowledge structure for ice hockey is presented in Appendix A. Vickers' ice hockey structure has also recently been used to identify the task requirements essential to the success of professional ice hockey players (Renger, 1994). The original purpose of Vickers' (1990) approach, however, was to aide teachers and coaches in the planning process.

Vickers' (1990) knowledge structures approach emphasizes the role of subject matter in the teaching and coaching process. Shulman (1986, 1987) called for the inclusion of subject matter in the study of teaching. Shulman advocated that the content, and the purposes for which it is taught, is the very heart of the teaching process. Studies emerging from this line of research have emphasized that teachers draw on many components of subject matter and pedagogical knowledge as they plan and execute lessons (Walkwitz & Lee, 1992).

Physical Education Teachers'/Coaches' Knowledge

A growing body of research has shown the importance of declarative and procedural knowledge and how they must combine in order to produce effective teaching (e.g. Housner & Griffey, 1985; Rovegno, 1994; Shulman, 1987).

Housner and Griffey (1985) examined the planning and teaching of eight expert and eight novice teachers. Results indicated that during the planning phase, expert teachers actively collected more information and asked approximately twice as many questions, as the novices. While teaching and during the self-analysis afterwards, experienced teachers emphasized subject matter and teaching specific motor skills more, and provided more individualized feedback to students.

Only one study has shown how coaches plan for practices (Jones, Housner & Kornspan, 1995). Expert and novice amateur coaches were asked to plan for a 30 minute lesson on the give and go play in basketball. In general, experts (a) spent more time planning the practice, (b) were more linguistic planners, (c) their plans were composed of more "if-then" statements and alternatives, and (d) they had a heavy reliance on past experience. Both groups requested information about players and made planning decisions about the instructional process. The effects of the planning process on actual lesson content and presentation, however, was not a part of this study.

The study of the knowledge base underlying effective teaching in physical education can provide valuable insight into the instructional processes of other sport coaches, since research in this area does not yet exist for youth sport coaches. Recent studies in physical education have explored the development of teacher content knowledge or pedagogical knowledge by comparing the knowledge structures of expert versus novice physical education teachers (e.g. Ennis, Mueller, & Zhu, 1991; Housner, Gomez & Griffey, 1993).

In these studies, subjects are typically asked to generate different kinds of cognitive maps of their knowledge bases. Ennis, Mueller, and Zhu (1991) examined teachers' content knowledge within the parameters of a movement-based curricula. This study was achieved using a cognitive

within the parameters of a movement-based curricula. This study was achieved using a cognitive mapping technique. The content knowledge structures of three groups of prospective teachers were compared to those of elementary physical education teachers. Results indicated that the complexity and coherence of the knowledge structures increased with coursework and teaching experience. Experienced teachers had more concepts in their knowledge structures than the three preservice teacher groups.

Similarly, the pedagogical knowledge structures of prospective teachers have been compared to those of teacher educators (Housner, Gomez & Griffey, 1993; Rink, French, Lee, Solmon & Lynn, 1994). Key pedagogical concepts were identified by the subjects using a cognitive mapping technique. Housner, Gomez, and Griffey found that student's knowledge of key pedagogical concepts corresponded more closely to the instructors following the course. Preservice students at two institutions also progressed towards identifying critical concepts in their cognitive maps and organized them similarly to those of the teacher educators (Rink, French, Lee, Solmon & Lynn, 1994).

In general, the maps generated by experts are more complex, better organized and include more chunks of meaningful information. Experts tend to have more sophisticated knowledge structures about class management, subject matter and pedagogical principles, than do novices. Perhaps the maps of content knowledge and pedagogical knowledge represent a teacher's comprehension of what could be taught in the field.

Results from these studies have provided information about the knowledge base underlying effective teaching. What preservice teachers or physical education teachers use in the field, however, can add another dimension to the study of physical education teachers knowledge. Ennis (1992) underscored the idea that the nature and degree of learning in physical education

Ennis (1992) underscored the idea that the nature and degree of learning in physical education also depends on how much the teacher values and emphasizes the particular content components.

Pedagogical content knowledge requires teachers to draw on what they know and apply it to teaching-learning settings (Walkwitz & Lee, 1992). Pedagogical content knowledge is the combination of content knowledge and pedagogical knowledge that is unique to teachers (Shulman, 1987). In Shulman's (1986) words, pedagogical content knowledge includes "the ways of representing and formulating the subject that make it comprehensible to others" (p.9).

In physical education a few studies have emerged that provide insight into the nature of pedagogical content knowledge. The predominant methods of data collection used in these studies were observation and interviews (Rovegno 1991, 1994; Walkwitz & Lee, 1992). These studies were all field-base experiments.

Rovegno (1991) described how 7 students acquired pedagogical content knowledge during a field-base elementary physical education methods course. Subjects in this study began to connect their teaching actions with children's actions (Rovegno). Initially "one subject did not know what she was looking for because she did not have a clear idea about how children learn the specific content she was teaching" (p.209). At that point her pedagogical content knowledge was not strong enough to enable her to assess the students performance and give good feedback. Eventually though, a better understanding of the content facilitated her teaching.

The focus of a study by Walkwitz and Lee (1992) was on how teachers, who have varying levels of knowledge on the mechanical aspects of throwing, transformed and used this knowledge during classroom instruction. An intervention technique was used to assist a group of kindergarten teachers in building subject-specific pedagogical knowledge. Stimulated recall interviews revealed that trained kindergarten teachers utilized the knowledge concepts from the

intervention, where as untrained teachers often did not use these concepts.

In order to continue the delineation of the nature of pedagogical content knowledge in physical education, Rovegno (1994) conducted case studies of two student teachers. The student teachers were observed teaching an elementary games unit and a high school sport unit and were then interviewed. Results indicated that aspects of school culture impacted how the two student teachers taught the content, or in Rovegno's words, "this study shows how aspects of the school culture were fundamental to the pedagogical content knowledge that emerged and persisted for two student teachers" (p.278).

The study of knowledge from a naturalistic perspective has provided insight into the nature of pedagogical content knowledge used in the field by physical education teachers. The context of a coach's situation will probably also play a salient role in influencing what they teach during games, as it did with youth ice hockey coaches' decision making (Haughian, 1996).

Thomas (1994) suggested that coaches and teachers should focus on the two major things that they can directly impact: sport knowledge and sport skill. For athletes, in a high-strategy sport like ice hockey, cognition is an important variable in game performance. An athlete must know what to do in a game situation and then be able to execute the plan (Thomas, 1994). A coach must be able to transmit their knowledge to the players so that the players have the opportunity to gain knowledge about what to do in a game as well as how to execute the skills.

French and Thomas (1987) followed expert and novice basketball players over the course of a season and measured knowledge, skill, and game performance. The cognitive components of performance, (knowledge about basketball and decisions during the game), improved in advance of the skill components (dribbling, shooting, execution). French and Thomas suggested that this may have been a result of what the coaches emphasized in practice, strategy rather than skill.

may have been a result of what the coaches emphasized in practice, strategy rather than skill.

With so few studies having been conducted in this area, the effects of skill and strategy instruction on performance remain unknown. Many venues of research in this area remain unexplored. For instance, what is most often communicated to players during games, skill or strategy instruction? Given that both these components are important to performance, what is the content of the lessons taught by coaches?

Currently, little is known about the knowledge base and cognitive skills that underlie the instruction of sport and physical activity (Housner & French, 1994). There have only been a few studies in physical education that have examined how knowledge of subject matter was transformed and conveyed to learners in the field (Rovegno, 1991, 1994; Walkwitz & Lee, 1992). This area of research is in its infancy and no studies have yet focused on how coaches transform and present subject matter to their players in the sport-context.

Method

Subjects

The subjects chosen for this study will be selected from among a group of youth ice hockey coaches that participated in a research project during the 1994-1995 hockey season. Four coaches, of women's ice hockey teams registered with Ottawa District Women's Hockey Association, will be selected.

Case 1: Shelley. Shelley was in her first year as head coach of a Pee wee girls' houseleague team. She had two years prior coaching experience in girl's hockey, both as an assistant, before becoming the head coach. Shelley played some minor hockey with boys when she was younger. She was certified Coaching Level 1.

Case 2: Ray Ray was in his first year as head coach of a Bantam girls' houseleague team. He had four years coaching experience in boy's hockey and had been involved in girl's hockey for two years. He played minor hockey as a child and was certified Coaching Level 1.

Case 3: Barry Barry was the head coach of a Pee wee girls' competitive team. He had been actively involved in coaching both girl's and boy's hockey for five years. This was his first season as a head coach. Barry played youth hockey and had recently gone back to playing. He was certified Coaching Levels 1 and 2.

Case 4: Derek Derek was the head coach of a Bantam girls' competitive team. He had been involved in coaching both his son and daughter for about four or five years. He was a co-coach for his daughter's team the previous season. Derek played hockey when he was younger and he was certified Coaching Levels 1, 2, and 3.

Data Collection Procedures

Consent was obtained from all subjects prior to data collection. A minimum of four games for each coach were recorded on videotape. The camera was positioned in such a way that the coach was in view throughout the game. The coaches were wired with a cordless microphone for each game. This provided the researchers with a play by play account of what was being said by the coach during the games.

Data Analysis

The videotaped games will be analyzed by trained observers and reliability tests will be performed. The coding system will provide three types of information about each instructional action. Firstly, the content of instruction will be coded. For instance: was the coach talking about passing, attacking the net, or forechecking? Secondly, "when" was the instruction given: to the players in action, on the bench, or in transition. Finally, "how" was the instruction communicated?

players in action, on the bench, or in transition. Finally, "how" was the instruction communicated? For instance: did the coach describe the error, describe what the player did that was correct, or give specific information?

A pilot study was conducted in order to determine the effectiveness of the preceding coding procedure. Results were presented at AQSAP, 1995 in the form of a poster presentation. Some modifications were made to the theoretical knowledge structure in order to cover all of the content that the coaches were teaching. For instance, the category "rules" was added. The researcher determined that all instruction by each coach could be coded according to the theoretical knowledge structure. Three games were analyzed for the pilot study.

Interviews that were conducted with each coach will hopefully compliment or contradict data obtained from the videotaped games.

A multiple-case study design. Each coach participating in the study will be considered an individual case based on Yin's (1989) multiple-case study design. A separate report for each case will provide the foundation for cross-case analysis, where individual similarities and differences can be highlighted. Yin stated that "the evidence from multiple cases is often considered more compelling, and the overall study is therefore regarded as more robust" (p.52).

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Appendix A

The list of words comprising the knowledge structure
for ice hockey

Under the category technique individuelle/individual technique

IPT= INDIVIDUELLE PATINAGE/INDIVIDUAL SKATING

IPTAV= INDIVIDUELLE PATINAGE AVANT/INDIVIDUAL FORWARD SKATING

**IPTAR= INDIVIDUELLE PATINAGE ARRIERE/INDIVIDUAL BACKWARDS
SKATING**

ICR= INDIVIDUELLE CONTROLE/INDIVIDUAL CONTROL

**ICRMA= INDIVIDUELLE CONTROLE MANIMENT/INDIVIDUAL CONTROL STICK
HANDLING**

ICRPA= INDIVIDUELLE CONTROLE PASSE/INDIVIDUAL CONTROL PASS

**ICRPADR= INDIVIDUELLE CONTROLE PASSE COUP DROIT/INDIVIDUAL
CONTROL PASS FORHAND**

**ICRPARE= INDIVIDUELLE CONTROLE PASSE REVERS/ INDIVIDUAL CONTROL
PASS BACKHAND**

ICRTI= INDIVIDUELLE CONTROLE TIR/INDIVIDUAL CONTROL SHOOT

**ICRTIDR= INDIVIDUELLE CONTROLE TIR COUP DROIT/INDIVIDUAL CONTROL
SHOOT FORHAND**

**ICRTIRE= INDIVIDUELLE CONTROLE TIR COUP REVERS/INDIVIDUAL CONTROL
SHOOT BACKHAND**

IGA= INDIVIDUELLE GARDIEN/INDIVIDUAL GOALIE

IGAPO= INDIVIDUELLE GARDIEN POSITION/INDIVIDUAL GOALIE POSITION

**IGAPOBA=INDIVIDUELLE GARDIEN POSITION BASE/INDIVIDUAL GOALIE BASE
POSITION**

**IGAPOAN= INDIVIDUELLE GARDIEN POSITION ANGLE/INDIVIDUAL GOALIE
ANGLE POSITION**

IGAPT= INDIVIDUELLE GARDIEN PATINAGE/INDIVIDUAL GOALIE SKATING

IGAAR= INDIVIDUELLE GARDIEN ARRET/INDIVIDUAL GOALIE SAVE

**IGAARBT= INDIVIDUELLE GARDIEN ARRET BATON/INDIVIDUAL GOALIE STICK
SAVE**

**IGAARMI= INDIVIDUELLE GARDIEN ARRET MITAINE/INDIVIDUAL GOALIE
GLOVE SAVE**

**IGAARCO= INDIVIDUELLE GARDIEN ARRET CORPS/INDIVIDUAL GOALIE BODY
SAVE**

**IGACR= INDIVIDUELLE GARDIEN CONTROLE RONDELLE/INDIVIDUAL GOALIE
CONTROL PUCK**

Under the category tactique individuelle/individual tactics

TOF= TACTIQUE OFFENSIVE/OFFENSIVE TACTIC

TOFFJ= TACTIQUE OFFENSIVE FEINTE JOUEUR/OFFENSIVE TACTIC DECK A
PLAYER

TOFFG= TACTIQUE OFFENSIVE FEINTE GARDIEN/OFFENSIVE TACTIC DECK A
GOALIE

TOFEC= TACTIQUE OFFENSIVE ECRAN/OFFENSIVE TACTIC SCREEN

TOFDM= TACTIQUE OFFENSIVE DEMARQUAGE/OFFENSIVE TACTIC GET OPEN

TDE= TACTIQUE DEFENSIVE/DEFENSIVE TACTIC

TDEPO= TACTIQUE DEFENSIVE PORTEUR/DEFENSIVE TACTIC PUCK CARRIER

TDEPOMB= TACTIQUE DEFENSIVE PORTEUR MISE EN ECHEC AU
BATON/DEFENSIVE TACTIC PUCK CARRIER STICK CHECK

TDEPOMC= TACTIQUE DEFENSIVE PORTEUR MISE EN ECHEC CORPS/DEFENSIVE
TACTIC PUCK CARRIER BODY CHECK

TDENP= TACTIQUE DEFENSIVE NON-PORTEUR/DEFENSIVE TACTIC NON PUCK
CARRIER

TMJ= TACTIQUE MISE AU JEU/TACTIC FACE OFF

TTB= TACTIQUE TRAVAIL LONG DE BANDE/TACTIC ALONG BOARDS

Under the category tactique collective/collective tactics

COF= COLLECTIVE OFFENSIVE/COLLECTIVE OFFENSIVE

COFSZ= COLLECTIVE OFFENSIVE SORTIE ZONE/COLLECTIVE OFFENSIVE
BREAK OUT

COFZC= COLLECTIVE OFFENSIVE ZONE CENTRALE/COLLECTIVE OFFENSIVE
NEUTRAL ZONE

COFAB=COLLECTIVE OFFENSIVE ATTAQUE AU BUT/COLLECTIVE OFFENSIVE
ATTACK THE GOAL

COFUS=COLLECTIVE OFFENSIVE UNITE SPECIALE/COLLECTIVE OFFENSIVE
SPECIAL TEAMS

CDE= COLLECTIVE DEFENSIVE/COLLECTIVE DEFENSIVE

CDEEA= COLLECTIVE DEFENSIVE ECHEC AVANT/COLLECTIVE DEFENSIVE
FORCHECK

CDERD= COLLECTIVE DEFENSIVE REPLI DEFENSIF/COLLECTIVE DEFENSIVE
BACK CHECK

CDEDZ= COLLECTIVE DEFENSIVE DEFENSIVE DE ZONE/COLLECTIVE DEFENSIVE
IN ZONE DEFENCE

CDEUS= COLLECTIVE DEFENSIVE UNITE SPECIALE/COLLECTIVE DEFENSIVE
SPECIAL TEAMS

Under the category autre/other

ARE= AUTRE REGLEMENT/OTHER RULES

AREJE= AUTRE REGLEMENT DE JEU/OTHER RULES OF THE GAME

AREPE= AUTRE REGLEMENT PENALTE/OTHER PENALTY RULES