

**Role of Learning Management Systems
for Formative Assessment in Higher Education**

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Dedication

I dedicate this success to my two loving parents, Amna and Khalid Usman Ghani who supported my learning journey since childhood and taught me that persistence, dedication, and hard work are fundamental ingredients for success.

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ABSTRACT

This study addresses faculty perceptions of how the features of existing learning management systems (LMS) currently and potentially enhance their assessment of student work. Within this type of technology, a selection of a couple of main systems, namely Blackboard and Moodle, was examined. A critical analysis of the exiting literature on the adoption of assessment features within the classrooms for formative purposes is presented. A mixed methods research design was used in order to evaluate the effectiveness of formative assessment tools in LMS. A survey was electronically distributed to professors in two mid-sized universities in Eastern Ontario, Canada to gather data in the first phase. The second phase of data collection entailed interviewing a subset of the professors after analysing the first set of data. Additional analysis was conducted in order to identify the factors that can elevate the perception and use of LMS as major tools for formative assessment. Results revealed that professors are generally struggling with the existing tools in LMS and perceive them to be only marginally effective to conduct formative assessment to the extent that they desire, especially at higher order level. They also consider the existing number of tools as being limited. Recommendations were made to improve the design of assessment tools in LMS for formative purposes. Training was identified as the main factor to increase the use of these tools along with receiving institutional support, extra time and technical help in integrating the new tools in their teaching.

INTRODUCTION

Recent trends in Canadian and international educational spheres are moving towards online and hybrid courses (Wingo, Ivankova, & Moss, 2017). Specifically in Ontario, Canada, the push towards bigger class sizes and more online classes has led to a greater need for electronic learning (e-learning) and mobile learning (m-learning) technologies to cater to the needs of instructors and students (Miller, 2019). Larger class sizes result in teachers having less time to engage in assessment and provide more detailed feedback. As classes become larger and more courses are taught online, better technological tools can assist teachers but there are other factors which must be accounted for in order to improve learning outcomes of students. One of these factors is the lack of opportunities for the teachers to develop an understanding of assessment techniques they can utilize. Since assessment is accepted as a cornerstone of student learning and teaching practice, building assessment literacy becomes one of the major areas to focus on prior to using technology to conduct assessment (Klinger, Volante & DeLuca, 2012).

Educational researchers and professionals are increasingly emphasizing the importance of classroom assessment, owing to the great weight placed on accountability in North American and other educational spheres (DeLuca, Klinger, Searle & Shulha, 2010; Klinger et al., 2012). Additionally, these authors assert that there is a growing need to build teacher assessment capacity, especially when it comes to formative assessment. Gikandi, Morrow and Davis (2011) state that self and peer assessment, a process whereby students or their peers grade assignments or tests based on benchmarks determined by teachers, as well as teacher performed formative assessment, can be conducted through web-based software like learning management systems (LMS). Kiryakova (2010) also asserts that the development of the LMS facilitates formative assessment by providing several tools, such as discussion boards, wiki's and quiz builders.

However, Gikandi et al. (2011), Govindasamy (2001) and Otsuka, Bernardes and da Rocha (2004) identify that LMS of the present era lack features which are specifically designed to assist in formative assessment. This compels the instructors to take additional measures to monitor, analyse and advise the learning process. The LMS needs to provide tools which support the optimum level of meaningful interactions and valuable experiences for online learners within various disciplines. The purpose of this study was to critically investigate the potential of LMS, like Blackboard and Moodle, to equip teachers in higher education to conduct formative assessment and to support student learning.

The evaluation of student performance is a central task of school administrators and teachers. The role of formative assessment within the teaching and evaluation process has been an area of increased interest. Being a relatively young phenomenon, especially in terms of popularity and acceptance, the conceptual theories that underpin formative assessment have become popular in past twenty years. Yet, the idea as an additional and practical component of the assessment process has almost swept the primary, secondary and higher educational circles and most of the instructors and students agree on, to varying extents, the effectiveness of assessing students formatively (Black and Wiliam, 1998a). Some reservations yet remain on the part of several researchers in its adaptability and its suitability in all formats of education, especially with some of the constraints that govern the paradigms that goes with formative assessment.

Recently, technology has become prominent in education in general and in formative assessment in particular. The evaluation cycle is being analyzed by researchers to ascertain how technology can effectively help instructors and learners at each step of the cycle (Natriello, 1987). Existing use of technologies are being questioned and software being re-evaluated to

improve the mechanics of the cycle. As classroom technologies become more sophisticated and more pervasive, not only are philosophers questioning the impact of digitizing the classroom, but they also point to the continuing constraints of the technologies which are not able to fully capture the classroom needs for teachers pursuing formative type of assessment with their students (Gikandi et al., 2011).

Higher education is of special focus in this conversation since newer technologies are more enthusiastically adopted at this level of education. The role of information and communication technologies (ICT) in higher education is well established. Universities have always led the way in communication technologies, like the first computer network system and e-mail. A major trend now is seeing that teaching on campus is supported by LMS such as Blackboard (and Web-CT) and Moodle or through the use of websites. Where universities use LMS or any virtual learning environment (VLE), it may include the use of online tests and quizzes for informal assessment, and formal examinations may be administered online. However, assessment using ICT as a basis is still a minority activity. This research addressed some of the issues that are involved in moving towards computer-based assessment. Would such a development be desirable, if it were found to be feasible? As any test developer will argue, high-quality tests with detailed feedback mechanisms are time and resource-consuming to develop.

In the first part of this monograph, after a segment on basic definitions being used to explain the ideas, different perspectives of how formative assessment has been theorized are examined and a common thread binds the conceptual underpinnings of cognitive constructivism with those of socio-cultural perspective. In the following section, formative assessment will be aligned with the collective theoretical aspects of cognitive constructivism, socio-cultural concept, social constructivism as well as those of ‘assessment for learning’, a term often used

interchangeably with formative assessment. Along with the discussion of conceptual frameworks, the principle challenges will also be brought forward which are being faced by the theory of formative assessment during past two decades since Black and Wiliam (1998a) expanded on the work of Bloom (1971) to make it a highly debated topic as well as a popular technique for assessment. Another discussion on formative assessment and technology frameworks of online formative assessment will argue for the potential role for electronic information systems in this field, highlighting possible benefits, drawbacks and constraints. This will help identify key considerations for designing and evaluating electronic information systems' ability to enable the educators effectively assess students

Definition of Terms

Some of the challenges of differentiating formative assessment from summative assessment and *assessment for learning* will be discussed in the definition section. Also, tensions between challenging theoretical perspectives need to be brought to light with situating formative assessment among these perspectives.

Assessment

The word 'assessment' is derived from the Middle English word *assise*. Merriam-Webster's dictionary defines the roots of the word from *asseer*, *asseoir* to seat, and from Latin *assidēre* to sit beside, assist in the office of a judge, from *ad-* + *sedēre* to sit. This root of the word points to the role of instructor being more of a guide or facilitator and away from the traditional view of a teacher-centric perspective of assessment and a more modern view of students' self-monitoring and regulation of their learning (Hume & Coll, 2009). Winter (2003) discusses the various prepositions of assessment that have gained traction in educational spheres, like *of*, *for* and *as* learning. Other terms have also been used which demonstrate varying contexts

in which the landscape of assessment is evolving and its meanings are understood. For example, Carless, Joughin and Mok (2006) introduced the term ‘learning-oriented assessment’ and Gibbs and Simpson (2004) use the phrase ‘assessment that supports learning’. Both of these phrases associate the process of assessment to improving learning.

Formative Assessment

Scriven (1967) first proposed the distinction between the summative and formative roles in the context of programme evaluation. According to him, summative evaluation is valuable in providing information to judge the overall educational programme if compared with an alternative programme, whereas formative evaluation attempts to target assisting in programme improvement. Soon after, Bloom built on this terminology and made a similar differentiation but his focus was on the students. For Bloom (1969, p. 48), the purpose of formative evaluation was “to provide feedback and correctives at each stage in the teaching-learning process”. Summative evaluation is used to evaluate what the learner has learned at the end of a course or programme. As the focus shifted from programme to students, the emphasis is gradually shifting to formative assessment. Formative assessment is said to provide both the process and instrumentation of improving teaching and learning. An alternative definition of the oft-debated phrase of formative assessment was provided by Cowie and Bell (1999, p. 101) as “the process used by teachers and students to recognize and respond to student learning in order to enhance that learning, during the learning”, whereas another definition by Yorke (2003) includes the different nuances of formative assessment with discussions of formal and informal formative assessment.

The generalisation about the definitions of formative assessment invariably leads to the limitations found in the related research as well as scarcity of empirical evidence which can

identify the best practices in the field. However, it is evident that even though the wording used by each of these authors is different, some of the elements do converge. For example, Black and Wiliam (1998a) defined formative assessment as “all those activities undertaken by teachers, and/or by their students, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged” (p.140). Popham (2008) perceived formative assessment as a process which is planned during which assessment-based evidence is used by teacher and students to improve ongoing learning and instruction. Cowie and Bell (1999) also used the elements of teachers and students using feedback to enhance student learning during the process of learning. Recurring elements in these definitions are that students as well as instructors use feedback and that this feedback is used to improve learning during the process of learning.

Even though most theorists agree on the basic idea of formative assessment, there still remains much variability in its practical application. Because formative assessment is a broad process with many different practical methods of instantiating in the classroom, there is still debate amongst educators about effectiveness of formative assessment for various purposes (Cliff et al., 2008; Van den Berg, Bosker, & Suhre, 2018; Vickerman, 2009). For example, the type of assessment can be formal or informal, oral or written, multiple choice or essay, peer or self. This complexity in executing formative assessment techniques in face-to-face or online classrooms effectively poses an ongoing issue for instructors who wish to use these techniques to enhance student engagement and learning outcomes.

More recently, Black and Wiliam (2009) defined *formative assessment* as a process through which teachers, learners and their peers acquire, interpret, and use the evidence from assessment to make better decisions about the next step of instruction. Thus, in the current age of

several mainstream educational philosophies competing to claim a major stake in the field, formative assessment has emerged as an effective means of improving student performance (Black & Wiliam, 1998b). The authors have emphasized that formative assessment can be used as an effective strategy to improve the achievement of students. Feedback is viewed as a primary component of formative assessment and is one of the factors that have the strongest influence on learning (Black & Wiliam, 1998b).

Assessment for Learning (AfL) has been defined as “the process of seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there” (Assessment Reform Group, 2002). For the purpose of this study, the term is used interchangeably with formative assessment as done by multiple researchers (e.g. Assessment Reform Group, 2002; Bennett, 2009; Hargreaves, 2013; Wiliam, 2011).

Summative Assessment

Conversely, *summative assessment* is conducted at the end of teaching units for the purpose of ascertaining competency of students and providing certification (Chen & Chen, 2009). Scriven, for example, in an attempt to define *summative assessment*, stated that “summative evaluation of a program... is conducted after completion of the program... and for the benefit of some external audience or decision-maker.” (1991, p. 340). Previously, other attempts were also made to capture the essence of summative assessment. The clear distinction between summative and formative assessment is illuminated by who uses the results of these assessments. The target audience in summative assessment is said to be external, for example, the programme evaluators, the ministry, or funding agencies who are usually more focused on the quantitative performance of schools, boards and curricula rather than how much the students

learn. Indeed, programmes like ‘No Child Left Behind’ in the United States equate student learning with the numerical or alphabetical grades students achieve in standardized tests which are administered frequently. However, Taras (2007) indicates that logically, summative and formative assessment lead into each other and are one continuous process because formative assessment can feed from summative assessment and a numerical grade could indicate the overall direction of the students’ knowledge if not his or her understanding of the subject matter. Summative assessment can test the students who have learned formatively during the course of a semester or during a programme. Therefore, the value of formative over summative assessment and vice versa cannot be categorically stated since both are valuable in different circumstances and for various purposes.

Constructivism is a theory which signifies that the learner is actively involved in the learning process with their teacher. The underlying concept is that humans construct knowledge and meaning from their experiences. Constructivist teaching strategies have been adopted in the classroom both cognitively and socially for the student (Powell & Kalina, 2009).

Cognitive constructivism is a more specific theory attributed to Piaget that focuses on how cognition develops via constructive processes and includes understanding of how new knowledge fits into prior knowledge schemas. He proposed that humans cannot immediately internalize and use information provided to them. They must fabricate their own schemas of knowledge based on the information they receive (Piaget, 1953). In cognitive constructivism, individuals construct ideas through a personal process, as opposed to social constructivism where ideas are constructed through interaction with the teacher, other adults and students.

Social constructivism emphasizes how students gain meanings and understandings out of social or group encounters. It is based on the social interactions a student has in the classroom along

with a personal critical thinking process. Building a classroom where learning is based on interaction is central to understanding Vygotsky's research and theories like cognitive dialogue, the zone of proximal development, social interaction, culture and inner speech (Vygotsky, 1962).

Organization of the Thesis

This thesis is organized in four chapters followed by a reference section and appendices.

Chapter 1 of the thesis provides a review of the literature based on the domains of assessment, formative assessment, technology in education, and learning management systems. Next, it discusses the main epistemological perspectives in order to situate the domain of formative assessment in the paradigmatic conversation and discusses some of the main perspectives that have been adopted. This chapter further discusses the history of technology used for formative assessment in addition to LMS as a tool to assess student's knowledge formatively. This literature review critically examines the principal challenges facing formative assessment over the past 20 years and includes a discussion on the potential role of electronic information systems in formative assessment, highlighting possible benefits, drawbacks and constraints. Technological implementation for the purpose of formative assessment will be communicated and challenges to the adoption of technology and specifically LMS will also be part of the discourse.

Chapter 2 details the methodology used to conduct this research project. This includes the conceptual framework, the research design and a detailed explanation of the concepts used as a basis of this research, and development of the survey instruments. The conceptual framework will highlight the discussion about the needs of educators and teachers which will also include how the adoption, drivers and barriers of the technological tools meet or impede requirements to conduct their pedagogical activities. For both quantitative and qualitative phases of data

collection, this chapter includes information about participants who were recruited from two universities in the Canada's National Capital Region and the criteria used to select them, data collection methods, data collection instruments and variables used, as well as data collection and analysis methods.

Chapter 3 focuses on presentation and analysis of the results of quantitative section followed by a detailed analysis of the qualitative section. This chapter presents a description of how the data was analysed, and the results of the analysis which comprised of many statistical functions. A discussion of these results leads into the section on analysis of qualitative results followed by a discussion of how the qualitative results can or cannot be triangulated.

Chapter 4 concludes this research project. The conclusion presents a summarized version of the findings and what this project has contributed to this domain of knowledge. Along with discussing the limitations of this research project, this final chapter also includes further avenues of research emanating from the findings of this study.

CHAPTER 1: LITERATURE REVIEW

This section provides an appraisal of the scholarly knowledge pertaining to formative use of assessment tools in LMS. The review is designed to provide the background and context for this study. After discussing the literature in the assessment and particularly formative assessment field, technological developments in this arena are highlighted. Specific focus is on LMS to understand the existing body of knowledge in this realm while examining the gaps in scholarly knowledge.

Assessment

Assessment is a core component of formal higher education. Teachers assess the knowledge and skills of their students for a variety of purposes, for example, for reporting and

assisting in improving their decisions about instruction. Assessment practices employed by teachers not only impact student learning but also improve self-monitoring and regulation of their learning (Klinger et al., 2012). As identified by Bransford, Brown, and Cocking (1999), assessment is the heart of effective learning. The authors assert that learners are provided with prospects to demonstrate their evolving aptitudes and obtain assistance to enhance their learning if teaching and learning processes are based on assessment.

Epistemological Perspectives

Tracing the recent history of assessment, standards have become the centerpiece of education for some governments and educational institutions. For the past two decades, this transition has gained momentum where assessments are based on such standards (ISBE, 2015). However, Bloom (1971), as far back as around 50 years ago, included the notion of feedback and corrective procedure with assessments and called it *Mastery Learning*. More recently, Guskey (2005) and Black and Wiliam (1998) have emphasized the role of formative assessment in mastery of learning. Feedback is information resulting from a classroom assessment or activity. Such information can be used to inform instruction. Formative feedback is information that is used to guide both teaching and learning processes to help the student and the instructor. Black and Wiliam (Black, 2003a; Black, 2003b; Black, Harrison, & Lee, 2003; Black, Harrison, Lee, Marshall, & Williams, 2003; Black and Wiliam, 1998a; Wiliam, 2000; Wiliam and Black, 1996; Wiliam, Lee, Harrison & Black, 2004) have written extensively and prominently on the practice of formative assessment in schools. Formative assessment is marked by its occurrence during learning and is designed to provide feedback to students and teachers. It could include, for example, evaluations of ongoing portfolios of assessments like quizzes and assignments, and demonstrations of work in progress. Student collaboration also provides a form of formative

assessment. In knowledge-building classrooms, students can read and comment on each other's work as peer assessment. Formative assessment may also occur outside the classroom through homework, reflection and online environments for learning.

Summative assessment commonly occurs through tests and essays at the end of a unit of study. Summative assessments provide limited feedback, often in the form of a letter or numerical grade. From a constructivist perspective, formative assessments are more valuable to the learner, but with the recent emphasis in North America on standards, and due to the poor alignment of constructivist approaches and standards, it is very difficult to harmonize formative and summative assessments. The rationale behind this disharmony is that even though formative assessment concentrates on individualized and customized feedback which aligns with the constructivist theory, summative assessment is more standardized which is administered and scored in a predetermined manner. According to Greeno, Collins and Resnick (1996), summative assessments, are grounded in behaviorist theories Yorke (2003) argues that, while approaches to learning have moved in the direction of constructivism, approaches to assessment have remained inappropriately focused on testing emphasizing the North American governments' trend. More recently Ercikan, Roth and Asil (2015) and Kempf (2016) also discussed the profound influence of standardized testing in education in the US and Canada.

Constructivism and Socio-Cultural Theory

Constructivism is the main principle behind the advent of formative assessment, but their relationship has always been under the microscope for various reasons. Shepard (2000) links formative or classroom assessment with the constructivist movement which again underlines that learning is an active process which develops upon previous knowledge, experience, skills, and interests. Since learning is highly individualized, constructivism recognizes that teaching must be

flexible to adapt to the context. It could also involve complex decision-making on part of the teacher and demand that the teacher can pick from a range of assessment techniques (Giebelhaus & Bowman, 2002). Cognitive constructivism was also used to explain the concept of formative assessment. Winne (2005) expressed the view that all elements in a learning process are cognitive strategies. For example, a learner has to engage cognitive faculties to recall past experiences and available resources while understanding and taking action on the provided feedback.

Cognitive constructivism was challenged for its focus on the internal origin of learning which emphasized students' ability to control and form a domestic locus for learning. Marks (1998) explains that those who have internal locus of control regard their achievements and learning as being dependant on their own abilities, effort or behaviour. One of the main challenges facing formative assessment was overcoming the rift between cognitive constructivism and socio-cultural theory and situating itself with one or the other. Both constructivism and socio-cultural theory, when applied to learning, are concerned with the activities that children engage in to learn. However, constructivist theory suggests that one should attend to the learning and mental processes of the individual while socio-cultural theory is more concerned with how learning is connected with cultural influences and absorption of social organization of learning.

Piaget (1963) argued that a child acquires knowledge about relations within and between people and objects through his or her experiences and how these experiences reflect on the world. Roos and Hamilton (2004) commenting on Piaget's contribution to early constructivist theory on learning assert that his firm beliefs about how knowledge is acquired led him to his conclusion about construction being the sole structure for learning. This led to constructivism

becoming a varied playing field of action and inquiry. There were reasons to this claim which gave it weight. First, it assumes that people use induction as a method of thinking and then apply it to action and that both of these processes are qualitatively different. Second, constructivism assumes that the acquisition of knowledge is based on an incremental or step-wise process of development. Finally, constructivism assumes that learning capability is advanced through mediated learning opportunities. With the help of this incremental learning built in to their language and environment, students learn how to apply their learned experiences to their everyday engagement.

Vygotsky's (1986) contribution to constructivism derives from his theories about language, thought, and society's influence on them. Vygotsky held the position that the child gradually internalizes external and social activities, including communication, with influence from and in company of others who are more competent. Although social speech is internalized in adulthood as it becomes thinking, Vygotsky contended that it still preserves its intrinsic collaborative character. In his experiments, Vygotsky studied the difference between the child's understanding when working independently and understanding when working with a more knowledgeable person. He conceived the notion of the Zone of Proximal Development (ZPD) to describe this level of difference. Vygotsky's findings suggested that learning environments involve guided interactions that permit children to reflect on the inconsistency via ZPD and to change their conceptions through communication. Piaget, on the other hand, contended that a child is more independent and learning occurs through interaction with the environment. Vygotsky's work has since been extended in many other branches of academia. Sharing expectations (criteria for success), questioning, feedback, self-assessment, and peer

assessment are intended to help students develop internal standards for their work, reflect upon it, and take ownership of learning (Wiliam, 2000).

Socio-cultural strategies have links to cognitive-scientific theory, particularly that segment of the field concerned with learning through social interaction. Socio-cultural theories, in general, now claim that students learn more effectively through interchange with others, especially with more practiced domain practitioners who can sculpt the internal beliefs and standards of mind that refine advanced competency. Socio-cultural research of Lave and Wenger, who see learning as an “integral part of generative social practice in the lived-in world” (1991, p. 35) rather than only a cognitive process of knowledge acquisition or construction by students, firmly debunked the notion of formative assessment solely being a cognitive constructivist domain.

A range of anthropological studies of learning in different contexts lead them to describe learning as a process of slow development and association, where the learner increasingly identifies with a particular community. Torrance and Pryor (2001) emphasized through their theoretical work that a student’s awareness of the social rules of the classroom was crucial for learning and that a critical aim of formative assessment was to develop this awareness. Social constructivism is a more specific term under socio-cultural theory but one that clearly identifies the process of internal cognition as being as equal contributor to learning besides the social element of learning.

Weiner (1968, p. 545) claims that the cognitive revolution also included a constructivist or ‘self-direction’ outcome. That is, feedback not only plays a part in the ‘self-regulation’ of human learning, it can also foster human development. In short, feedback can have a constructivist dimension. Black and Wiliam (2009) provided a unifying basis for the diverse

practices which are said to be formative. They emphasize creating cognitive conflicts within students through feedback rather than giving answers, promoting dialogue to assist the social construction of knowledge, and developing meta-cognition involving learners' reflection on their own learning. This brings together the cognitive and the social aspects of learning into a systematic collaboration to create discovery on an individual level. It makes it clear that they view formative assessment practices as an essential feature of any learning. In this way, the cognitive features of Piaget's theory and the feedback element in social learning were brought together.

Black and Wiliam (2003b) stress upon the need for the teachers to cognitively internalize the material and learn the process of providing feedback. Indeed, the training process that forms part of the teachers' academic programmes is essential because their adoption requires teachers to engage in such practices. Thus, while the methods and programmes of instruction can differ from each other, formative assessment lies as a central principle of their implementation.

The pertinent question being asked about the socio-cultural and cognitive aspects of formative assessment is whether technology provides the platform to facilitate the instructors to embed the social elements of learning in their assessment practices (Whipp et al., 2005). Constructivist research has shown successful patterns in tutorial, mentoring, and group discussion interactions (Vaughan, Cleveland-Innes & Garrison, 2013). A lack of active face-to-face (f2f) community participation could imply that typical Internet chat and bulletin-board systems do not support a constructivist approach to learning and instruction, however, Garrison, Anderson, and Archer (2010) claim that it does support constructivist views. Constructivist views of learning drive the designs of different goals, standards, curriculum, and assessment related to the role of technology in teaching and learning.

Formative Assessment

Assessment is an important cornerstone of scholarship within the learning process, and formative assessment is widely accepted to be a developing phenomenon holding the potential for future research and application (Black & Wiliam, 2006). It is important to note that formative assessment and summative assessment can be complimentary to each other where formative assessment provides the detailed feedback with a traditional letter or numerical grade assigned to an assessment (Wiliam & Black, 1996). Summative assessment is used to grade students to demonstrate and judge their achievement relative to the predetermined objectives. The traditional summative approach only takes into account the final learning outcomes without considering the learning process. According to their analysis of online assessment literature, Oosterhof, Conrad and Ely (2008) state that summative assessment is commonly characterized by pre-specified objectives, contents leading to uniformity of approaches and objective tests, which means assessing broader content domains.

Summative assessment promotes unfavourable learning techniques which may encourage surface learning and low order thinking because it is not characterized by reflection and feedback (Hargreaves, 2008). It is generally used to measure what students have learned at the end of a defined unit or period and thus, it assesses declarative knowledge and basic application with no substantiation of personal reflection or deep understanding (Smith, 2007; Tshibalo, 2007). These limitations have necessitated integration of formative assessment into teaching and learning in order to assist learners to develop deeper and profound knowledge. This does not mean that summative assessment is devoid of any potential to assess higher-order learning skills like analysis, synthesis and evaluation. Summative assessment depends on the nature of the underlying knowledge structures being assessed (Smith, 2007). Summative assessment is only a

measure of students' understanding and does not really play an active role in teaching methods, but summative tests or assignments can be designed in a way that help learning. For example, Bennett (2011, p. 7) states that if students are expecting a particular type of exam, their preparation for this summative assessment can lead to learning and consolidation of ideas. Thus, summative assessment can also play a role as Assessment for Learning, albeit to a lesser extent. Therefore, formative assessment is required to foster higher order learning since reflection and feedback are intrinsic to it. Miller's pyramid, which is a method of rating clinical competence in educational and workplace settings, also mirrors the types of questions in an assessment. For example, MCQs conforms to the 'knows' level and performance-based assessment focusing on higher order knowledge aligns with the 'does' level in the model.

One of the reasons for the recent ascent in the interest in formative assessment has been realization on the instructors' part that an annual summative standardized testing does not happen frequently enough to give them sufficient information to make timely instructional decisions. Similar to standardized tests, common classroom summative assessment, does not give a clear picture of what the students have learned in order to better help them in areas where they are lacking. In addition, the scores on such summative assessment tests do not provide a transparent mastery of students' learning outcomes.

Stiggins (2005) stated that assessment for learning offers an answer to all these issues. It uses many different assessment methods to provide all stakeholders including students, teachers, and parents with a constant flow of indication about student progress in mastering the knowledge and skills that build the foundation of academic standards. Assessment for learning builds on the notion that students can take their destiny in their own hands and keep moving forward with that extra feedback about their progress. This is important in terms of the concept of lifelong learning

because the students realize and understand the unraveling of their discovery as they meet those criteria for success. Students work with their teacher to continuously monitor their current level of achievement compared to the criteria in order to move to the next level of understanding and close the gap between their knowledge and their instructors (Fischer, 2000). This way, they play an active role in managing their own progress in the zone of proximal development.

Formative assessment is critical because it underlines the process and not only the outcomes (Black & Wiliam, 1998b). Formative assessment aims to improve teaching and learning through applying it in the classroom as a source of continuous and timely feedback (Hargreaves, 2008). This feedback informs further learning and evolving instruction until the desired level of knowledge has been achieved as formative activities are embedded in instructions to examine learning and appraise learner understanding. In describing the process of formative assessment, Black and Wiliam (2009) noted that:

Practice in a classroom is formative to the extent that evidence about student achievement is elicited, interpreted, and used by teachers, learners, or their peers, to make decisions about the next steps in instruction that are likely to be better, or better founded, than the decisions they would have taken in the absence of the evidence that was elicited. (p. 9)

It is necessary that a distinction is made about what a formative assessment tool is. It refers to the purposes of assessment information, not to particular assessment procedures or tools. For example, a multiple-choice quiz may be used for determining a grade for students but it can also be used formatively when the teacher uses the results to improve her instructions or provides feedback with the numerical results. Formative assessment can also be used to report to stakeholders like parents and employers about learner's progress (Smith, 2007). Thus, tools used for formative assessment could also be used summatively. Similarly, tools used for summative

assessment can be used formatively when used to modify instruction in the following offering of the course. Another case is when instructors and students adjust teaching and studying styles during the course based on assignment and exam results. Therefore, it indicates that any assessment could be formative or summative based on what purpose it is used for. Oosterhof et al. (2008) state that it is important to appreciate that both assessment types are equally important in higher education. Pangaro and Cate (2013) mention that Miller's pyramid also advocates to medical educators that they should evaluate competence on different levels and using varied assessment methods.

Based on the various definitions discussed, formative assessment can be defined as a pedagogical activity which is more rewarding when responsibility is mutually shared by the teachers and learners. It is an iterative process of determining what, how much and how well students are learning compared to the expected learning outcomes to produce personalized formative feedback and promote further learning. The remainder of this section will provide a critical appraisal of some of the literature dealing with formative assessment highlighting issues with research methodologies which are addressed in the present student. The first subsection includes some older research while the second subsection underlines similar issues with more recent studies.

Studies from 2000-2005

Orsmond, Merry and Callaghan (2004) designed a study to enhance students' ability to implement assessment marking criteria and to improve the role of verbal feedback in student learning. As part of undergraduate coursework, students produced a scientific poster on the topic of Histology. During the first of two sessions of formative assessment exercises, a workshop was conducted where students learned about different aspects of conducting formative peer

assessment. Instructions and ensuing detailed discussions were led by the tutors in order for the students to be ready for the second session. Session two involved the construction of the poster and peer marking. Results implied that formative assessment supports student learning and facilitates feedback to be given within the same or different modules or courses. Some of the areas to improve on this study were that none of the students had taken part in peer assessment exercises before. Also, this study was not nested in a conceptual context which is a key part of the design of the research. A conceptual framework of any study provides the underlying context of assumptions and a system of concepts and theories that support and inform the research (Robson, 2011).

In a similar vein, Higgins, Hartley, and Skelton (2002) set out to investigate the meaning and impact of assessment feedback for students in higher education. A survey and a semi-structured interview provided the researchers data to conclude that students value and conscientiously consume feedback from their instructors. They reported that formative assessment feedback is a vital principle in encouraging the kind of ‘deep’ learning desired by instructors. However, besides not using a conceptual framework, this study also does not focus on the needs of instructors while conducting formative assessment.

Another study was conducted by Topping, Smith, Swanson and Elliot (2000) who sought to explore the reliability and validity of reciprocal paired peer assessment of academic writing, where two students assess each other’s work. In the results, the views expressed by staff and students were generally aligned when it came to the effectiveness of peer formative assessment, but their feedback mainly focused on distinct details. Moreover, students pointed out that the process of peer formative assessment was time consuming, intellectually challenging and at times socially awkward, but they still found it to be an effective technique which could improve

the quality of their own written work. This study illuminates how combining the methods could be used to elicit contextual data to improve the instruments used in qualitative research.

Although it discusses the strategies for instructors to use peer assessment and analyzes them with reference to the evaluation conducted by the instructors, this is another example of a study that does not address the needs of the instructors while conducting formative assessment.

Wininger (2005) tested the impact of summative and formative assessments with two administrations of an educational Psychology exam. In this study, the treatment group received feedback from the instructor and classmates, and students were guided to self-evaluate their performance. On the other hand, the control group received a copy of their exam and information as to what questions they had missed but received no other feedback or guidance for self-evaluation. Upon the second administration of the initial test from which the students in the treatment group received feedback, the treatment group significantly outperformed the control group and gained almost ten points from their initial attempt at the exam whereas the control group gained only two points. Although this study provides support for formative assessment, there were a few methodological issues that could have affected the results. First, the small sample size could affect the overall procedure of hypothesis testing and further tests could add validity to the results. Also, some of the procedures for analysis are either not reported in depth or could further be analyzed to add relevance besides means and a quick mention of ANCOVA. Researcher bias could also have influenced the study results since researcher was using his own students.

Another study that was limited to a small sample size in one university but shed a positive light on the role of formative assessment in supporting students was conducted by Rees, Sheard and McPherson (2002). They employed a qualitative design in order to explore medical

students' in-depth perceptions of communication skills assessment. Results analysed by two independent analysts showed that students preferred and valued formative assessment for assessing their communication skills, even though they were not as unanimous about who would they prefer to be the assessors: themselves, peers, educators, or patients. Most of them criticized the summative method of assessment, however, they agreed that examinations in general were essential to motivate student learning.

Studies from 2006 onwards

Schneller and Brocato (2011) explored the use of a graduate integrative seminar to (1) promote critical thinking among students and competent professionals, (2) develop reliable and valid measures for assessing student learning outcomes, and (3) use assessment results to reflect upon and strengthen curriculum. Integrative seminar assimilated students' curriculum into their specific area of research. Students, who had already developed a research question and investigated it, expanded their understanding of their topic by integrating knowledge from other curricular areas in this culminating course. The results from this research further confirm the narrative that formative assessment processes encourage student learning by channelling students focus to succeed. Also, an integrative seminar being an embedded measure of learning outcome, which is one part of inter-connected modules, can function as an effective assessment tool. Although this study was posed as a mixed methods study, the quantitative analysis used in the study to demonstrate rankings of student competencies were limited to descriptive statistics. More complex analysis of results including grades could provide a deeper and richer understanding of the study.

Another qualitative study that could similarly improve with a richer research design and inclusion of a quantitative section was conducted by Bailey and Garner's (2010). They

interviewed university lecturers from a cross-section of disciplinary backgrounds with respect to their lived experiences with writing assessment feedback. The focus of the questions was on how academic staff conceptualize and experience written feedback in the broader context of what they do. The dual status of the principal researcher was a key factor. Being a member of staff at the institution under study gave him the status of an insider: a member of the cultural group being studied. The findings suggested that institutional policies and departmental practices related to formative assessment in this respect are not having the intended effect. Teachers' perceptions and beliefs about the purposes of written feedback varied, but it showed that they are uncertain about what it achieves and what use students make of it. The results also inform that far from enhancing written feedback, new institutional practices and procedures have created new problems for teachers. For example, administrative agenda's and demands to comply to assessment criteria to match the specific learning outcomes sometimes leave instructors frustrated with lack of independence and flexibility in conveying their scholarly concerns to the students.

Sargeant, Mann, van der Vleuten, and Metsemakers (2009) conducted a qualitative study, the purpose of which was to explore reflective processes which physicians described as they considered their assessment feedback and the perceived utility of that reflective process. They used principles of grounded theory and conducted interviews with family physicians participating in the programme and receiving scores across the range from high to low. Feedback, especially negative feedback, evoked reflective responses. Reflection seemed to be the process through which the physicians decided to either integrate feedback into their practice or reject it and appeared integral for to deciding on accepting and using the feedback. Facilitated reflection upon feedback was viewed as a positive influence for assimilation and acceptance.

In their seminal work on the influence of formative assessment, Black and Wiliam (1998a) claimed that large-scale improvements in student achievement can be achieved when formative assessment is used in teaching and learning. Recently, more studies have discussed the effectiveness of providing information to be used as feedback to enhance teaching and learning (Dignath & Buttner, 2008; Hattie & Timperley, 2007; Shute, 2008). These authors provide empirical evidence to demonstrate the ability of formative assessment to support learning. The effectiveness of formative assessment could depend on the medium being used to provide feedback to the students, for example, hand-written feedback or face-to-face conversations with the students. Merry and Orsmond (2008) emphasize that students tend to prefer different forms of feedback based on their learning styles. This diversity of preferences can manifest in different ways. For example, Hepplestone and Chikwa (2014) contend that students find written feedback to be the most effective. Morris and Chikwa (2016) also found that students showed a strong preference for written feedback for their assignments. On the other hand, even though most feedback is provided in written or verbal formal, students may not fully comprehend written feedback on many occasions which could be due to illegibility of handwritten feedback (Gibbs & Simpson, 2004; Scott, Shields, Gardner, Hancock, & Nutt, 2011). Another reason could be a lack of engagement that characterises written feedback (Cann, 2014).

Other authors discuss the virtues of providing face-to-face feedback to students. For example, Gurzynski-Weiss and Baralt (2014) that the face-to-face feedback presents more opportunities to learners to improve their output compared to handwritten or computerized text, and in fact, they are more receptive to face-to-face opportunities. Archer (2010) agrees that feedback is best discussed face-to-face. Since written feedback can be wordy and complex, it can be misunderstood or ignored completely if it is lengthy. Similarly, Martens et al., (2007) also

professed the effectiveness of personalized feedback when it is delivered during face-to-face sessions. While discussing the impact of face-to-face method of peer feedback to support formative assessment, Richmond, McCroskey and Hickson (2011) claimed that this medium provides a richer environment to convey the message than that of an electronic platform. However, Butler and Correia (2009) reported that participants in their research found face-to face feedback to be equally effective to written, computerized feedback. They emphasized the role of personalization of feedback rather than the medium to play a more important role for positive impact on student learning.

Technology in Education

In this section of literature review, I discuss some of the prominent technological tools that have evolved overtime for supporting learning. Furthermore, I will critically analyse the literature on the adoption of technology in education which enables the identification of key areas of concern for designing and evaluating features of electronic information systems in a way that they can be used to help educators with assessing their students more effectively.

Recent developments in higher education have involved increased adoption of information and communication technologies (ICT). Education activities such as e-learning and technology-enhanced learning (TEL) have become important elements, providing new opportunities and approaches to teaching, learning and assessment in higher education. Information technologies are widespread in our society and their influence in the learning process is substantial. Recent developments in education have involved increased adoption of ICT. Kaffash, Kargiban, Kargiban and Ramezani (2010) define *ICT* in education as a combination of computer, video and telecommunication technologies found on personal computers which can be used to enhance teaching practice in classrooms. Elmore (2000) states

that accountability-based reforms have forced schools to move beyond information system design to develop new kinds of capacity for instructional improvement. Current trends clearly indicate that online learning has become an important learning mode (Chen & Chen, 2009; Smith and Barrett, 2016). Educational activities such as e-learning have become important elements, providing new approaches to teaching, learning and assessment and opportunities to instructors.

Assessment using ICT has come to be known as *electronic assessment* (e-assessment), which includes the entire assessment process, from designing assignments to storing results with the help of ICT (Joint Information Systems Committee, 2007). However, no effective assessment mechanism for learning performance yet exists for e-learning systems. Moore, Dickson-Deane and Galyen (2011) define *e-learning* as accessing instructional material using technological tools that are based on, distributed by, or enabled by web technology as well as the material delivered through the media of CD-ROM, the Internet or an Intranet. Brenton (2009) adds other technologies like television, interactive multimedia, and mobile phones to the list. With the evolution of educational technology, the use of learning portfolios in a web-based learning environment can be beneficially adopted to record the process of learning, which evaluates the learning performances of learners and produces feedback to students in ways that enhance their learning. Within the learning process, assessment is an important pillar of scholarship and formative assessment has been widely known as a growing phenomenon in the recent past and holds the potential for future research and application. Therefore, the discourse that technological tools help and support learning processes needs to be looked at from a narrower perspective of how formative assessment assists in supporting learning.

Some of the key terms which need to be distinguished in this domain include e-learning, distance learning, online learning and blended learning. According to Guri-Rosenelt (2009),

distance learning refers to any form of learning where teaching and learning activities are distributed across time and space, thus eliminating the need for teacher and student to be present in the same place or time. Online learning refers to a form of distance education primarily conducted through web-based ICT (Guri-Rosenelt, 2009). Also, Dabbagh and Bannan-Ritland (2005) define online learning as “distance learning environments that use Internet and/or web-based technologies to support the teaching and learning process” (p. 15). Similarly, Allen, Seaman, and Garret (2007) defined online learning as a form of e-learning that is enabled by web-based technologies, does not require the teacher and the learner to be available at the same time and place, and constitutes 80% or more learning/teaching activities conducted through web-based ICT. These authors also defined blended learning as learning environments where 30-80% of learning/teaching activities are conducted through web-based ICT. Thus, e-learning encompasses an array of practices which include distance, online, blended, as well as ICT-mediated face-to-face learning.

The convergence of technological perspectives with formative assessment brings to the fore the concept of online formative assessment. Pachler, Daly, Mor and Mellar (2010) used the term formative e-assessment to illustrate this concept. They defined it as “the use of ICT to support the iterative process of gathering and analyzing information about student learning by teachers as well as learners and of evaluating it in relation to prior achievement and attainment of intended, as well as unintended learning outcomes” (p. 716). This definition includes treatment of formative assessment within different kinds of e-learning environments which include a comprehensive role of technology in blended and online learning settings as well as a secondary role of ICT in F2F settings. Online formative assessment is a feature more commonly present in online and blended learning environments where the participants are separated by geographical

proximity and time. This feature is a core component to the already significant amount of instructional activities which are conducted through web-based ICT.

As educational technology evolves, the integration of electronic portfolios (e-portfolios), which are learning portfolios in a web-based environment, can be constructively used to record the process of learning, evaluate the learning performances and generate feedback to students to enhance their learning. An e-portfolio application for education is where a collection of assessment work can be developed and stored over time (Rickards et al., 2008). Other domains besides Education, for example healthcare, also utilize e-portfolios for assessment and reflection purposes. For example, Foucault, Vachon, Thomas, Rochette and Giguère (2018) and Kardos, Cook, Butson & Kardos (2009) reported the effectiveness and potential of e-portfolios for health practitioners' professional development and practice. Barrett (2005) defines portfolios as focused collections of student work that show the student's efforts, progress, and achievements in one or more areas whereas an e-portfolio is an electronic collection of evidence that exhibits a student's learning journey over a period of time. Since LMS provide an effective vehicle to execute an e-portfolio approach, they have emerged as a possible tool that Canadian universities have been keen to adopt (Copeland, 2006).

Although research in the area of e-assessment has intensified in recent years and literature on student experiences of e-learning is emerging (Creanor, Trinder, Gowan, & Howells, 2006), little research has been conducted about the effect of e-assessment strategies and the impact on the student learning experience. Numerous case studies exist describing how to deploy e-assessment institutionally (Zakrzewski & Bull, 1998) alongside articles examining security issues and the risks surrounding e-assessment (Harwood & Warburton, 2004; Ricketts & Zakrzewski, 2004; Zakrzewski & Steven, 2000). In contrast, few studies have focussed on the

appropriateness and effectiveness of e-assessment as an assessment method and the influence it has on student learning approaches and study behaviour. The National Research Council report, *Knowing What Students Know*, highlights the poor fit of typical standardised test items with the cognitive outcomes targeted by technology-enhanced learning environments. Furthermore, it recommends a principled approach to assessment design that distinguishes the specific skills related to particular technology tools from the reasoning skills and knowledge required to better match technologies to solve complex problems (Pellegrino & Quellmalz, 2010).

Hackmann (2004) informs that during the 1990s, researchers created tools such as Knowledge Forum, the Knowledge Integration Environment, and CoVis to more fully address constructivist principles. Each of these tools invites collaboration by structuring the kinds of contributions learners can make, supporting meaningful relationships among those contributions, and guiding students' inquiries. Teachers who use information and communication technologies in their classrooms are more inclined towards having a constructivist perspective as their learning and instruction style. Additionally, sophisticated information and technology communications tools can capture the cognitive processes learners engage in when solving problems through the use of eye-tracking analysis and click-tracking technology. This allows teachers to reflect and train themselves to assist in deeper learning. It also provides a chance for teachers to learn from each other.

Martin et. al (2011) reviewed the general impact technologies have had on the field of education and evaluate which technologies have been the most influential in terms of changing the educational landscape for past half of the decade. They attempted to execute it through investigating the most promising technologies in terms of impact on education using bibliometrics. Bibliometrics use different indicators such as publications, occurrences of words,

citations and related characteristics to analyze research trends and identify emerging areas of science (Daim, Rueda, Martin, & Gerdri, 2006). According to Martin et. al (2011), the social web and mobile devices are currently the technologies that will have the highest impact in education for the near future. Next, games were also highly ranked in terms of likelihood to have a deep impact on education, although not as extended as social web and mobile devices. They also reported that other promising technologies, such as augmented reality and learning objects, do not have enough maturity in education according with their publication impact. They did, however, predict that have the potential to play a bigger role in the future.

Electronic assessment has attracted increased interest in the research community as a result of both the changing nature of higher education and increased expectations for e-assessment practice (Bull & McKenna, 2003; Nicol, 2007). Whitelock (2009) points out other important factors in e-assessment research related to its potential and to the challenges facing higher education today. For example, she highlights the significance of the tests being fair and of not disadvantaging students with e-assessment procedure. In addition, she stresses the need for research related to pedagogical principles, designs and frameworks to utilise the full potential of e-assessment for students' learning and teachers' work. Teachers and educational institutions have gradually been adopting these but the factors that influence their adoption have to be understood in order to help develop better tools which can not only help the creators of these tools but also help the end-users who are ultimately, teachers and students. It has to be done in a way that they can be used to help the educators with assessing their students more effectively.

Design and Evaluation of Features

As can be observed from the previous discussion, assessment using ICT as major tool of development is yet to reach its potential in most areas. High-quality tests are time and resource-

consuming to develop and if the costs of ICT projects are also taken into account as well as costs of producing good-quality electronic teaching materials, it will become clearer what the areas of improvement are for electronic assessment in the near future. Apart from development costs, Bennett (2002) outlines limitations of computer-based assessment systems that include dependability of hardware and software. Security is also a concern because control of access to both questions and student data has to be maintained. Although there are also problems with paper-based examinations, established practices for the security of exams before, during and after the exam exist to manage them whereas the online version's security is a work-in-progress. Measurement issues are also present that affect student performance, such as familiarity with screen-based work, and variations in speed of the Internet connections. Limitations of question types which are readily available and/or easy to use is an aspect worth researching more. Kiryakova (2010) outlines different types of assessment that lend themselves well to being implemented using technology. Among others, these assessment types include short answer questions, group projects, short tests, assignments and peer assessments. The increasing prevalence of ICT in teaching and learning presents new challenges to e-assessment, as well as new opportunities. Equity issues like access to, and familiarity with, computers are also discussion point for policy makers.

There are other ways of supporting students via ICT: using discussion boards to ask questions or address problems, and sending assignments via e-mail and receiving feedback comments via e-mail. These can be convenient and helpful for those with easy Internet access. Application of this technology could bring improvements in reliability and accuracy of marking, eradicate clerical errors, speed up the marking process and, possibly, reduce the cost.

In the UK policy context, e-assessment tends to be understood as “end-to-end electronic assessment processes where ICT is used for the presentation of assessment activity, and the recording of responses” (JISC, 2007). This suggests that the main priorities for e-assessment have been institutional strategy, the development of standards, technical infrastructure and learning support tools and not so much the pedagogical dimension of practice. The latter is on the increase, though, not least in view of a recent policy focus on personalisation and e-portfolios. As Whipp and Eckman (2005) mentioned that it is important that technology provides the platform to facilitate the instructors to embed the social elements of learning in their assessment practices, it follows that effective e-assessment needs to take account of the human-centric, social dimension as well as technological, data-gathering and management perspectives. More attention needs to be paid to the social than has been the case until now, and to the ways in which a learner appropriates social and interactive as well as technological resources within formative assessment contexts.

As Vonderwell, Liang, and Alderman (2007) indicated, assessment (whether formative or summative) in online learning contexts encompasses distinct characteristics as compared to F2F contexts particularly due to the asynchronous nature of interactivity among the online participants (the teacher and learners). Therefore, it requires educators to rethink online pedagogy in order to achieve effective formative assessment strategies that can support meaningful, higher-order learning and its assessment. Meaningful interactions within an effective learning community are antecedent to interactive collaboration which is a critical socio-cognitive process in online settings necessary to facilitate critical thinking, a desirable marker for higher-order learning particularly in formal higher education (Akyol, Garrison, & Ozden, 2009; Kehrwald, 2010). However, as Akyol et al. (2009) identified, it is not an easy process to develop

effective learning communities that will facilitate meaningful interactions particularly in online and blended settings because this requires well-structured strategies that are not always obvious among online educators.

Effective integration of formative assessment in online learning environments has the potential to offer an appropriate structure for sustained meaningful interactions among learners and the teacher, and foster development of effective learning communities to facilitate meaningful learning and its assessment (Sorensen & Takle, 2005). Moreover, this can provide a systematic structure for effective learner support through ongoing monitoring of learning and provision of adequate formative feedback. Ongoing support for scaffolded learning is critical in online learning and can be essentially facilitated through sustained interactive collaboration among the teacher and learners (Ludwig-Hardman & Dunclap, 2003). This is because it supports learners to engage productively and assists them in the development of self-regulated learning dispositions.

This in turn supports them to take primary responsibility for their learning which is an important requirement for success in online learning. McGee (2014) suggested that active learning via e-interactions support students to transform to take more ownership of the learning process. The viewpoint of all these authors is that sustained meaningful interactions and collaboration among individual learners, peers and teachers as a learning community with a shared purpose can enhance opportunities for ongoing and adequate learner support. This can ultimately foster meaningful engagement and deep learning in online higher education. Following this viewpoint, it would be safe to assume that effective application of formative assessment in online learning environments can offer an innovative pedagogical strategy to facilitate such opportunities.

Webb (2010) studied the application of information systems in education by examining how to enable novice teachers to use digital technologies effectively for learning and teaching, to develop formative assessment through peer interaction as a key aspect of pedagogy. How and to what extent digital technologies can facilitate the interactions that enable formative assessment was also examined. Teacher participants reported that this type of collaboration helped them build a richer repository of techniques to assess critical thinking and improve learning in students.

In another study which highlighted the significance of technology in relation to a learning theory, Wang (2011) promoted the use of self-regulated learning in developing a multiple-choice Web-based assessment system, the Peer-Driven Assessment Module of the Web-based Assessment and Test Analysis system (PDA-WATA). The purpose of the system was to enable learners to use self-regulatory learning behaviors and improve e-learning effectiveness. The author found PDA-WATA to be effective in promoting learners to use self-regulatory techniques by employing strategies like allowing examinees to add notes to explain why they chose a certain option as the correct answer for peers' reference. Peers were also allowed to add notes which could be used as valuable references by the examinees. PDA-WATA was also reported to be effective in facilitating e-learning.

Govindasamy (2001) brought attention to challenges that lay in the road of successful implementation of electronic instruments for effective learning. He emphasized that such challenges be addressed since many institutions of higher education and vocational training centres are relying on e-learning as a means to solve major learning and performance problems. It has resulted in a race where other institutions are trying to catch up because they cannot afford

to be left behind. Success is of paramount importance because an unsuccessful effort to implement e-learning can bear negative consequences on the return of investment.

Another major obstacle in complete adoption of technology according to Kiryakova (2010) is that the LMS do not incorporate pedagogy in the design of the software. It is primarily because of the fact that most LMS software developers and designers are not well-versed with the pedagogical issues. Firdyiwiek (1999) also argued along the same lines that there is a grave disparity between the wealth of features in LMS and the lack or nonexistence of explanation on the pedagogy that underlies the logic of inclusion of such tools. Also missing are the guiding principles on how to design, develop, deliver, and manage pedagogically reliable e-learning materials. This is a clear indication that most LMS providers perceive themselves as mere providers of technology. This leads to a situation where the vendors try to incorporate every technologically possible feature in LMS but their products are deficient when it comes to explicit pedagogical integration.

The existing state of affairs poses a stern challenge to any organization getting on board to implement e-learning. Often many features and tools of LMS are left unused. This results in a great squandering of resources since these tools have already been paid for during implementation phase and carry a great potential in helping students with their learning. With the low rate of usage, they could still be used contrary to pedagogical principles and sometimes the functions they were built for, which can impede learning (Govindasamy, 2001). For example, students may be required to use the email system within LMS to submit their assignments whereas it is a tool purely for personal communication. Almost all LMS have a tool to create a separate instance for assignments with their own submission feature. It might create confusion for students and even instructors and leads to inefficiencies. Another example is creating

customized quizzes when several templates are provided in some LMS to easily create quizzes. Regardless of which problem exists in a learning environment, it will not only impact the education but also will be reflected in the return on the e-learning investment.

The requirement to carefully consider the underlying pedagogy, or how learning takes place online, is one of the most crucial prerequisites for successful implementation of e-learning. The main objective of an e-learning implementation is not only to be able to train just anyone, anytime, anywhere. Rather, it depends on the ability of the implementer to utilize this deployment to train the right people to gain the right skills or knowledge at the right time. Only then can e-learning justify a return on investment knowing that the costs involved in an implementation of e-learning are huge. LMS are emerging to be the complete solution which can realize the total automation of administrating the teaching and learning but they require further research on careful development and utilization of resources to be realize their full potential. Next section would shift the focus from discussing technology in education to more specifically on the role of technology in formative assessment.

Technology and Formative Assessment

As this is the most significant part of the literature review section, recent empirical studies investigating the issues teachers in higher education face while providing detailed feedback were searched. Further narrowing the scope of the topic, this review will focus on how technology helps instructors provide detailed feedback to students to help them improve learning. In doing so, application of information systems with specific examples is used to illustrate the concepts more clearly.

It is becoming increasingly apparent that the pressures of improving student performance have put a strain on the resources available to schools, specifically the manpower and the number

of hours they devote to catering to the learning needs of individual students. Because school staff cannot rely on standardized test results to directly inform changes in their classroom-level practices, schools must also engage in instructional system redesign to develop data-driven practices that give teachers local, ongoing relevant, continuous, and real-time information to benchmark student progress (Halverson, 2010). Information systems have been known to streamline complicated processes which include provisions for formative feedback and require different structural changes due to the nature of work involved.

Outlining the importance of information systems for feedback many decades ago, Natriello (1987) mentioned how difficult it is to come up with a comprehensive method of evaluation because scholarly work on assessment is limited by a lack of descriptive information on actual evaluation practices in schools and classrooms. Therefore, information systems seemed to be a potential solution to produce a comprehensive evaluation system which could not only cater to different types of class structures, assignment and evaluation types and different type of feedback to be provided at different stages of evaluation, but also to integrate other aspects of the evaluation system rather than to concentrate on one or two aspects of a multifaceted evaluation process.

More recently, Shirley and Irving (2015) explored the experiences of middle and high school science teachers in their first year of implementing a particular type of connected classroom technologies (CCT) in order to understand the ways in which this technology supports the goals of effective formative assessment. The authors found that CCT support the teachers to collect and interpret student learning evidence and lead to opportunities for formative assessment by 1) facilitating the implementation of instructional tasks, 2) helping students and teachers learn about student learning, and 3) supporting teachers' pedagogical decision-making. The authors

attempted to generalize the perceptions of four participants who were trained extensively on one CCT and willingly continued to use it in their work. Extent of training being provided at other institutions and the depth of implementation of technology in the participants' classrooms are the aspects of this research that the authors did not address. This study focuses on instructors from high school and falls short of discussion on assisting higher education instructors with their needs for formative assessment using technology, which is similar to other qualitative studies such as Furtak (2012) and Ng (2014) as well as quantitative studies, for example, Wiliam et al. (2004) and Hwang and Chang (2011).

While results from Furtak's (2012) study also point to teachers using technology to track improvements in students' learning, it lacks any conceptual frameworks that could have helped situate the research. Similarly, Ng (2014) does not situate the research in a conceptual context. Wiliam et al. (2004) showed with the results of their study that the use of assessment for learning for enhancing higher order learning are promising but the authors themselves noted serious issues related to generalizability of the findings. They stated that due to the fact that each of their results reflects a separate "mini-experiment, care needs to be taken in drawing any general conclusions about the net effect of the adoption of formative assessment" (p. 60). Hwang and Chang (2011) focused on improving the learning achievements of students in a mobile learning environment. Results from the experiment showed that their approach advocates the students' interest towards learning and also improves their learning performance. However, a short period of intervention where the participants were exposed to the system for the first time disregarded the variable learning curve associated with using any novel technology.

Several mixed-method studies discuss the role of technology for formative assessment at higher education level. For example, Wilson, Boyd, Chen and Jamal (2011) investigated the

effectiveness of computer based formative assessment in a large, first-year undergraduate geography course at a Canadian higher education institution. Through the results of this study, the feedback from students revealed that they find the computer-assisted practice quizzes extremely helpful with over 95 percent indicating that it helps them to identify their strengths and areas of improvement as well as help them prepare for exams. However, this study does not highlight the role of the instructor in preparing or conducting these formative assessment tasks. Also, it does not showcase the obstacles that instructors or students could face while working with multiple choice questions as well as other types of assessment tasks.

Wang (2010) investigated the effects and experiences of a Community of Practice Framework (CoPf) in an online graduate course. The CoPf module primarily allows students and teachers in the course to interact for mutual engagement and assessment, allowing for an increased collaboration and feedback among students compared to previous semesters. The purpose of the study was to evaluate the contribution and reinforcement effect of CoPf module on three variables related to learning. For the purpose of comparing the results of CoPf implementation for the course in Educational Leadership program, academic records of the students were obtained from the immediate previous semester, where the ePortfolios were mainly assessed by the instructor. Outcomes of the study showed that the use of the CoPf module resulted in more revisions both by the students of their own work and among students of each other's work. This led to better final grade results. Students' reflective data demonstrated that students engaged in profound learning by understanding concepts and supported each other in deepening their construct knowledge. The study does not address instructors' role in monitoring the CoPf framework or strategies to scaffold higher-order thinking to promote a deeper level of

understanding of course content among students with differing levels of expertise and knowledge.

There are some studies which employed either qualitative or quantitative research methods at higher education level. For example, Buchanan (2000) examined the influence of web-based formative assessment on an undergraduate introductory psychology module exam in his quantitative study. Students taking online multiple-choice tests could access immediate feedback, as a webpage with hyperlinks and references to resources, on their areas of improvement and how to address them. When controlling for classroom attendance or non-users, he found that students who engaged in voluntary web-based formative assessments significantly outperformed students who did not participate in web-based formative assessments. However, the effect size for this difference was very small at .03. In light of the issue of self-selection in this study and the small effect size, further research with greater controls is warranted.

In another study, Wang (2007) also examined the impact of the Formative Assessment Module of the web-based Assessment and Test Analysis System (FAM-WATA). FAM-WATA is a multiple-choice web-based formative assessment module containing six formative strategies: repeat the test, correct answers not given, query scores, ask questions, monitor answer history, and pass and reward. While this study showed that students who experienced FAM-WATA showed significant gains in understanding, it was compared to two other types of formative assessments without any control group to assess expected gains in performance due to instructional effects for all students. All forms of formative assessment resulted in significant student gains, with the FAM-WATA group doing better than the normal web-based formative assessment and the pen and paper formative assessment groups. Because the gains these groups experienced with formative assessment were not compared to the gains of students in a control

group without formative assessments, it is not feasible to extrapolate that use of formative assessments was more beneficial than instruction only. The author extended the results to assume that since FAM-WATA outperformed the other groups, it must also perform better than the group without any formative assistance.

Through this analysis of relevant literature, it becomes apparent that there is a paucity of recent research in this domain. During the search for relevant literature, there were only a few representative studies which fit the criteria of studies investigating the issues teachers in higher education face while providing detailed feedback to students to help them improve learning. Even though it is an emerging field, the lack of substantial empirical evidence leads to questions around informing practice with the help of more empirical studies about current implementations in the higher education arena.

Learning Management Systems

This section is based on discussion of why LMS amongst all the other e-assessment tools is considered a popular option and will help illuminate the prominence of this tool as the major higher education facilitator. Potential role of LMS in supporting learning and formative assessment will be investigated, focusing on possible benefits, drawbacks and constraints.

There are different reasons that encourage the introduction of ICT-based assessment. It helps to avoid issues between media used for teaching and assessment if learning activities are already occurring electronically via LMS or other education technologies. It can improve efficiency by saving time in grading for certain types of assessments like multiple-choice questions. Kiryakova (2010), however, contends that not all courses require extensive use of technology, especially the ones which are completely conducted face-to-face. Nevertheless, he advocates the use of the LMS in order to utilize various techniques for carrying out assessment

including tools for the implementation of formative assessment, such as e-portfolio. There are many different options available when it comes to using LMS, like Blackboard and open source Moodle. He concludes that by using LMS both traditional means for summative assessment and various activities for formative assessment can be supported. As a result of implementation of the activities that support formative assessment, there is heightened interest and responsibility for the learning process by learners. These systems offer opportunities for conducting activities that support formative assessment but which were not possible before or took a long time to complete, for example, collaborative peer assessment on online discussion forums. Role, benefits, drawbacks and constraints of LMS in formative assessment will be further discussed in the conceptual framework which is based on the need for a novel view of formative tools in LMS.

RESEARCH QUESTIONS

1. Which LMS assessment features are currently being used by professors and what are the factors which determine the features that they use?
2. In professors' perspectives, how effective are the LMS assessment tools for formative purposes and what are the factors that determine their effectiveness?
3. What could be done to improve the effectiveness of LMS assessment tools for formative purposes or introduce new ones?
4. What can be done at the manufacturer, institution, instructor, and student levels to encourage and enhance the use of LMS assessment tools?

CONCEPTUAL FRAMEWORK

In this section, I initially discuss a universally accepted framework for technology adaptation. Subsequently, a novel framework based on a concept map depicting the relationships among the relevant constructs under study in this research is presented.

Technology Acceptance Model

The Technology Acceptance Model (TAM) was first proposed by Davis (1989) and is one of the most recognized models which attempts to understand the process of the user acceptance of technology. Lu, Yu, Liu, and Yao (2003) assert that a user's perception about a technological tool's usefulness and ease of use are the major factors which influence its adoption and use. Lee (2009) further emphasizes the significance of this tool while stating the framework's power to predict the usage and adoption of information systems. This framework helps to understand the factors that affect instructors' adoption of e-learning systems for reasons like it is one of the most popular models for IT adoption (Gefen, 2003); it has been used as a theoretical basis for multiple empirical studies (Venkatesh & Davis, 2000;); and researchers have employed it to understand usage of many technological tools (Moon & Kim, 2001).

The Conceptual Framework for this Study

In this study, however, a more nuanced and specific model was required to encompass the different aspects of the construct. A lack of literature on tools in LMS for formative assessment as well as absence of critical constructs of attributes of instructors as well as needs of the instructors led development of a new conceptual framework to nest this study in. Consequently, the needs of instructors in the domain of formative assessment were identified. Thereafter, several prominent tools and their features were discussed to illustrate how they act as drivers for supporting learning. This helped to understand how each of these tools meets the requirements

needed for effective formative assessment. Due to a lack of literature on the formative use of assessment tools in LMS, it was imperative that this topic is founded with the help of related constructs. For the purpose of establishing the relevance of this topic, assessment within the literature on LMS as well as formative assessment within the theme of electronic assessment (e-assessment) were synthesized. Figure 1 depicts these concepts and their inter-relationships with each other in a concept map.

The main concepts in the map illustrate that instructors bring with them certain attributes, for example, experience and number of hours of training on LMS. Experience can be 1) years of teaching experience at higher education level, 2) years of experience teaching using an LMS, 3) years of experience teaching using a non-LMS technological tool. They engage in classroom management, instruction, and assessment as part of their daily activities, with assessment being summative or formative in nature. Although the elements of formative assessment as outlined in the next section can be conducted via traditional assessment methods, the concept map points out that this study is striving to discover the effectiveness of LMS in this regard. The map further indicates that there are certain barriers to implementation of formative assessment via LMS which can be classified as institutional, manufacturer, and related to student competence in dealing with LMS.

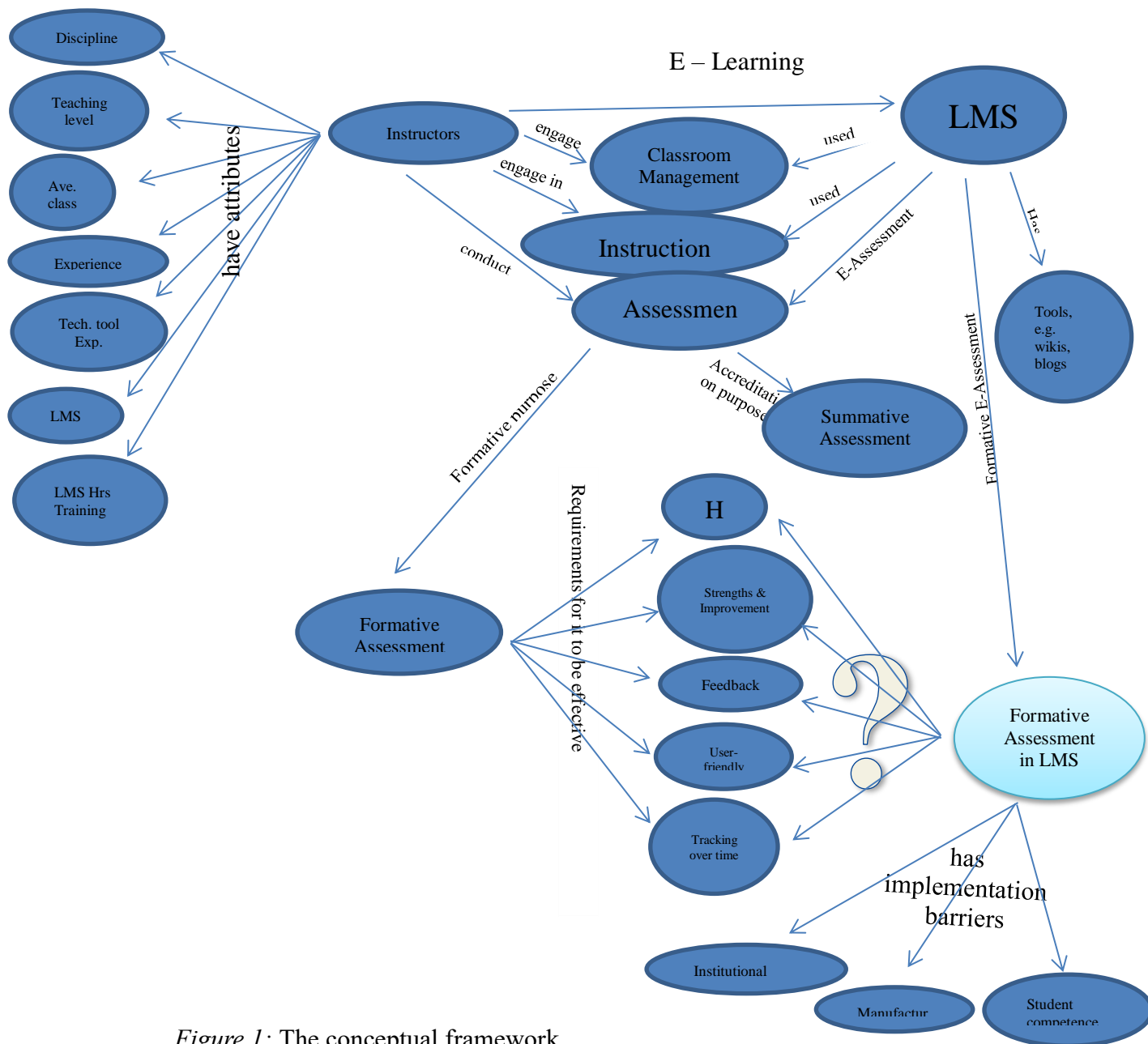


Figure 1: The conceptual framework

Needs of the instructors in formative assessment

LMS have the potential to address needs of teachers in formative assessment and to support student learning. In order to effectively meet these needs, instructors must identify the requirements of formative assessment. Trumpower, Filiz, and Sarwar (2014) succinctly lay out the criteria (hereafter referred to as 'elements') for teachers to carry out effective formative

assessment, arguing that it must (1) assess higher order knowledge, (2) identify students' strengths and areas of improvement, (3) provide effective feedback, and (4) be user-friendly. The analysis of the literature, however, is compelling to include another element to their existing scheme, specifically teachers' ability to track student learning over time (Chappuis, 2007; Clark, 2012; Evans, Zeun, & Stanier, 2014; Lyon, 2013; Waterloo Region District School Board, 2013). This concept will be discussed as the fifth significant element. These elements are connected to the concept of formative assessment in the conceptual framework.

Higher Order Knowledge

Involving students actively and cognitively in the learning process helps teachers take interest in developing their understanding of the subject matter instead of simple information intake. Bransford, Brown and Cocking (1999) and more recently, Hwang and Chang (2011) discuss at length the significance of this process, where students also learn to discern how their own and their peers' conceptual awareness of new ideas compare with learning criteria and outcomes. This emphasis on the process of learning stresses the need to develop students' higher order knowledge (i.e., analysis, evaluation and synthesis). Studies show that students who focus on the learning process and not only passing a test accomplish better results and retain information longer (William et al. 2004).

Students' Strengths and Areas of Improvement

For formative assessment to be effective, it must also be specific (Trumpower & Sarwar, 2010). A student's particular strengths and areas of improvement must be identified in order for the teacher to help scaffold learning. The teacher and potentially the students themselves can improve learning based on the remedial instruction provided once the gap is identified between existing knowledge and unit objectives.

Useful Feedback

Wiliam et al. (2004) reported what has now become a popular idea that feedback is most effective when given in a timely manner. The authors conducted a study in which the results indicated that when teachers provided formative feedback within or between teaching units in their classrooms, students' progress rates were almost doubled, compared to the control classrooms, over the course of the year. Student progress was measured through comparing results on the national tests as well as scores from school assessments. It is also essential to note that feedback should not be provided too rapidly since students should be given an opportunity to think and reflect about the concepts before seeking help from teacher or peer feedback. Rushton (2005) further indicates that learning gains tend to be bigger when feedback is focused on the task with specific suggestions for improvement rather than focusing on student's personality, even if it is positive. Effective assessment and feedback on it should be based on clear criteria, learning goals, and expectations for performance (Waterloo Region District School Board, 2013). It is also important to balance the amount of feedback based on the needs of the student. It is also important that the students get an opportunity to reflect and act upon the provided feedback for it to be useful. Branch and Paranjape (2002), from the field of clinical teaching, emphasize that reflection translates into consideration of bigger picture and integration of experience into future action.

User-friendly

The National Research Council (1999) reports that formative assessment is not popular among many teachers as they view it as a needless surcharge to their existing unmanageable workloads. Similarly, Wissick and Gardner (2008a) inform that teachers describe the need of customizing teaching practice for individual students in large classes as well as helping the

students who they deem to be more challenging to work with. Their biggest test, however, is to conform to the enormous requirements of standardized curriculum in restricted time periods. Therefore, it can be concluded that formative assessment must be user friendly in order to succeed and the entire formative assessment process must be easy to use if it is to become a viable option in the classroom (Trumpower & Sarwar, 2010). Regardless of the root cause of the frustrations like assessment fatigue through over-assessment, user-friendly systems can help to alleviate them. There are different perspectives on the process being user-friendly, however. A teacher's perspective, although rewarding, could involve a tediously long process of providing remedial feedback to each student whereas students could reap substantial benefits from the assessment feedback and be motivated to use it only if they feel it is easy to use and access.

Tracking Learning Over Time

After the identification of the learning goal, teachers assess the existing knowledge level of the student about the unit. Thereafter, progress is measured in comparison to that level toward the goal. Teacher's regular interaction with students is a key feature in classrooms using formative assessment where evidence is collected over several intervals about the growing understanding of the new concepts (Ballantyne, Hughes & Mylonas, 2002). Teachers can utilize techniques like sophisticated questioning and extended dialogues to explore students' thinking to detect any misconceptions and to help them correct the conceptual errors. Köller (2001) found positive effects on student's deep learning in several experiments and field studies where teachers gathered new evidence of student progress and understanding at successive stages. MacDonald (2007), while studying the implementation of formative assessment in classrooms, however suggests that although the concept of formative assessment may be attractive to teachers, their usual criticism is that it is challenging to utilize in teaching practice consistently.

Role of LMS in assisting instructors

The advancement in technology has been revolutionizing the way educators teach and students learn (Wells, Fieger & Lange, 2005). In the last decade or so, educational trends have been changing rapidly with a movement towards web-based instruction and blended instruction, where web-based instruction replaces components of F2F instruction (Owston, 2013). One example of this revolution is the development of LMS, course management systems (CMS), and virtual learning environments (VLE) that facilitate teaching and learning outside the physical classroom. Often, these terms are used interchangeably in designating the same tools or software.

These learning environments may be used to totally replace F2F teaching in a physical classroom, partially replace F2F teaching (blended) or only supplement existing F2F teaching (Arbaugh & Duray, 2002). The LMS can enhance learning through efficient access to learning materials, by the provision of immediate feedback to students through online assessment (Breen, Cohen, & Chang, 2003), and by improved communication between students and instructors through discussion forums and email (Beard & Harper, 2002).

The focus of this section is to illustrate how effective application of LMS for formative assessment can demonstrate their potential to assist the instructors and their educational institutions. The features discussed are by no means the only options available for that particular need of the teachers and most of them have the potential to fulfill more needs than one. However, the selected example is a representative application for each of the requirements discussed above.

Assessing Higher Order Knowledge

Most LMS help instructors with assessing student knowledge at different points during the course. Contrary to earlier versions of LMS, most recent versions provide tools like test builder tools that assist instructors by automating the process of creating and scoring questions

by providing templates for multiple-choice questions (MCQ), true/false questions (TFQ), matching questions (MQ), or short answer questions (SAQ). However, the automation of essay questions, projects, assignments, structured subjective questions and case studies has met with limited success due to lack of flexibility in some of these tools (Govindasamy, 2001). The developers of current LMS could have other objectives while developing technology and choosing the question builders to be included in the system. They probably perceived it to be necessary to equip instructors with certain tools which are ready to be used. For example, creating quiz questions, answer options, allocating weights to those answers so those can be automatically scored, and coding appropriate feedback for different options that the learners might eventually select require skills which instructors generally do not have training for. They need to be familiar with Hypertext Markup Language (HTML), Java Script, and other programming languages.

In order to assess students by means of projects, case studies, assignments, and other instruments of learning, an instructor can post assignments on a lesson page. Students then complete their assignments and submit their work to the instructor via e-mail or upload it on a webpage for the instructor to assess manually. Assuming that the underlying consideration behind the inclusion of the quiz builder templates is that any instructor with basic computer knowledge is able to do it, the developers' decision may have some negative pedagogical implications. The prominence and convenience of the builder tools may imply that the use of only MCQ, TFQ, MQ, and SAQ are valid and reliable means of assessing learning. In some cases, instructors who are fully aware of the strength of the other assessment types may not know how to go about creating and administering these assessment elements in the test builder.

It is also a common belief that MCQ assessments are not a valid means of testing the broad range of cognitive skills in students especially in higher education. It is also believed that an MCQ test works best only to assist memorization (Schultz, 2011). Use of MCQ as the only means of performing summative or formative assessment of the learners is not advisable since there is a chance of learners scoring in such assessments through guessing the correct answer and not as a result of profound understanding of the subject matter. However, this is not to say that MCQs are completely lacking of any capacity to assess higher order knowledge. A carefully designed MCQ can be deployed to assess learning even at the highest level of Bloom's Taxonomy of Educational Objectives. Rasiah and Isaiyah (2006) found in their research about MCQs that items that demonstrate good discriminating potential are more likely to be moderately difficult items, and the medium to high difficulty level items tend to show negative discrimination.

MCQs are still a boon for e-learning because well-designed MCQ tests can help learners to acquire an in-depth understanding of content with an easier and more swift way. For instance, a student who wishes to improve her mastery of a concept can use the search function to locate all questions in the question repository that revolve around this concept. She can then work on as many questions as she likes until she has mastered the concept.

Identifying Student's Strengths and Areas of Improvement

One of the characteristics of LMS is the ability to integrate with other technologies which has enabled instructors to identify students' strengths and areas of improvement via polling device which allows teachers to conduct real time surveys. Teachers pose questions and students operate the "clickers" devices to respond. These responses are relayed, grouped, analysed and displayed graphically and numerically on the teacher's computer as charts or graphs. This

technology is very conducive to yes or no responses as well as multiple-choice questions. A few such devices can also accept character or numeric values. They allow teachers to have active classroom discussions as they are able to involve all students, regardless of students' inclination to participate in classroom discussions otherwise.

Recent studies (DeBourgh, 2008; Han & Finkelstein, 2013; Premkumar & Coupal, 2008; Yarnall, Shechtman & Penuel, 2006) investigate how teachers are using the polling devices to facilitate formative assessment practices. Yarnall, Schechtman and Penuel (2006), engaged in a project to investigate the extent of instructional environments in which handheld computers could be used to support frequent assessment, and what impact they had on students participating actively in assessment. The results demonstrated that handheld computers enabled the teachers to use the tools frequently for the assessment of student learning during different phases of instruction across different phases of instruction and for different topics and types of learning activities. Also, the researchers reported that handheld technology can be easily integrated into science classrooms to support more frequent assessment practices. Another finding was that teachers perceive evident transformations during the course of a single unit in students' learning needs as well as their own assessment needs.

Using the potential of a new technology to elicit better response from types of students and applying wide-ranging communication and questioning techniques are some of the practices that help teachers identify students' strengths and areas of improvement as the model by Trumpower et al. (2014) advocates.

Providing Useful Feedback

ICT-based learning programmes can provide rapid and student-specific feedback. Several software use input from teachers to provide real-time feedback for learners, whereas other

programmes provide automated support. This feedback is usually generic in nature, but some programmes can search for patterns in submissions to create targeted feedback for students. In addition, they can then customize the complexity of problems in exercises based on student's aptitude. Tuomi (2006) discusses this phenomenon as scaffolding of learning by software.

Peer feedback is another important pillar of formative assessment which has benefited from computer-based applications recently. Luxton-Reilly (2009) conducted an analysis of studies (e.g. Ballantyne et al., 2002 and Price & Petre, 1997) on peer assessment which reported how electronic peer assessment improves on F2F reviewing using pen-and-paper.

Most LMS contain a standard set of tools that are used to facilitate learning and discussion in an online environment. Some tools, such as a threaded discussion forum, are used to foster communication, feedback, and collaborative learning. The Discussion Board tool in the LMS allows online communication with other members of the subject or community. Groups within a subject or community can also have their own private discussion board. The Discussion Board is an asynchronous communication tool, allowing messages to be posted and read any time.

User-friendliness

Formative feedback to students is a pedagogical activity which becomes relatively easier and efficient to provide with systems like LMS. In fact, LMS are emerging to be the complete solution which can provide total automation of administration of teaching and learning.

Govindasamy (2001) reports that most of the pedagogical principles followed in traditional classroom delivery method and e-learning delivery method are the same, like developing content, storing and managing content, packaging content, student support, and assessment. These principles must form the foundation of inclusion of features in LMS. If these principles are

effectively integrated with the LMS and explained to instructors and administrators with detailed guidelines and examples of best practices, they could lead to instrumentally effective teaching. The author concludes that by using LMS, both summative assessment and formative assessment can be supported.

Wissick and Gardner (2008b) advocate a complete implementation of LMS which could be utilized to help students with different types of formative assessments, like short questions and discussions, practical tasks, short tests, collaborative projects, and peer assessments. Another avenue where LMS can be user-friendly and reliable is providing effective, quick, and iterative feedback to the students, which is one of the main features of formative assessment. Reflecting on the use of LMS to support the earlier discussion about user-friendliness from the model by Trumpower et al. (2014), this technology can make the workloads of both teachers and students relatively more manageable with including all resources in one location and being accessible regardless of user's physical location. There are many different options available when it comes to selecting LMS's. Apart from the popular ones like Blackboard and Moodle, there are others like desire2learn.com and those developed using Joomla framework.

Tracking Learning Over Time

E-portfolios help teachers in developing specific tasks and then tracking the assessment of these tasks. Subsequently, many opportunities to do research and analyses of how the e-portfolio enhances the effectiveness of education exist for the new researchers. Formal evaluation of formative assessment capabilities and tracking how students perceive this new educational approach are also required in this field. A portfolio approach is useful because all the assessments along with feedback provided either by peers or instructors can be retrieved rapidly. Students can store their subsequent versions of the same assignment in the e-portfolios. Their

progress can be recorded and tracked along with different corrected versions of the assessment to provide teachers a great repository for future reference as well as research purposes if required.

It also addresses the need of students, parents, teachers and educational institutions being able to refer to the progress made by students over the years for most of their assessments and compare how the learning habits and patterns have developed over an extended period of time. Welsh (2012), in her empirical study about the effectiveness of e-portfolios in a B. Ed programme, asserts that a repository and the requirements to store, organize and retrieve the assessments and feedback would not be possible through the traditional portfolios. Kiryakova (2010) suggests that the next step in the natural progress of the adoption of technology by teachers and educational institutes in formative assessment is to implement e-portfolios in practical work. The nature of this technology is conducive to the fifth element of the model of teachers' needs in formative assessment as it helps them with reviewing student progress over regular intervals and interactions and over an extended period to support deep learning in students.

CHAPTER 2: METHODOLOGY AND DATA COLLECTION

This study used a mixed methods (Tashakkori & Teddlie, 2003) design, which is a procedure for collecting, analyzing and mixing quantitative and qualitative data at some stage of the research process within a study, to understand a research problem more completely than either of them independently (Creswell, 2009). The rationale for mixing is that neither quantitative nor qualitative methods are sufficient by themselves to capture the trends and details of the situation, such as a complex issue of professors' outlook towards features in a particular type of software used in teaching. When used in combination, quantitative and qualitative

methods complement each other and allow for more complete analysis (Greene, Caracelli, & Graham, 1989; Tashakkori & Teddlie, 1998). Mixed method research is employed to understand a research objective through multiple research phases, enhance a study with a second method, and to explain initial results (Creswell & Plano-Clark, 2011). This study endeavored to fill the gap identified by Ghani and Trumpower (2015) about the lack of mixed methods empirical evidence to support the best practices for formative assessment.

This study used a popular mixed methods design in educational research: sequential explanatory mixed methods design (Figure 2), consisting of two distinct phases (Creswell, 2002, 2003; Creswell, Plano Clark, Gutmann, & Hanson, 2003). It was utilised because the researcher wished to use qualitative findings to help interpret or contextualize quantitative results. In the first phase, the quantitative, numeric data were collected using a web-based survey and then analysed. The goal of the quantitative phase was to identify how certain variables influence the instructors' perspectives towards features in LMS. Tabulating the quantitative results and running statistical analysis to explore the trends that emerged allowed for purposefully selecting informants for the second phase. An interview schedule was prepared in order to further explore the results received from the first phase.

In the second phase, a qualitative approach was used to collect text data through individual semi-structured interviews to understand why certain factors may help explain the deficiencies in the systems. The rationale for this approach is that the quantitative data and results provide a general picture of the research problem, for example, determining the general trends of the perceptions of instructors vis a vis formative use of assessment tools in LMS, while the qualitative data and analysis refined and explained those statistical results by exploring participants' views in more depth.

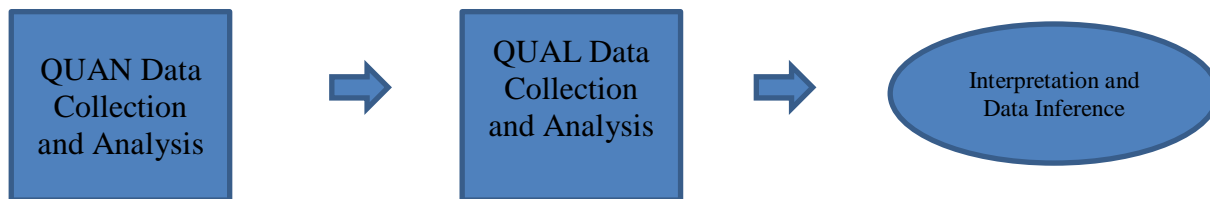


Figure 2: Sequential explanatory mixed methods design

In this study, the qualitative phase is used as a supplemental component of the research. According to Morse (2010), in mixed methods, the supplementary component provides explanation or insight within the larger research design. The supplementary component cannot be interpreted or utilized alone and is not a complete project in itself (Creswell & Plano-Clark, 2007). It could be, as is the case here, too narrow in terms of scope by itself.

Phase I - Quantitative

Participants

After obtaining REB approval from the ethics boards of Carleton University and University of Ottawa, potential participants in the study from these two universities were approached via email with introduction to the project and a hyperlink to the survey (using Fluidsurvey). Last known working e-mail addresses were used to make initial contact with the professors. An informed consent form was posted as an opening page of the survey. Participants clicked on a button, saying “I agree to complete this survey”, thus expressing their compliance to participate in the study and complete the survey. Consent was also sought in order to approach them further for interviews if required. The survey was open to all professors regardless of the years of experience in teaching or teaching with technology tools, the level they teach at

(undergraduate or graduate), whether they went through any sessions of training with LMS, or whether they use the software for formative assessment purposes or not.

For the purpose of the quantitative phase of the study, assistance from the Institutional Research and Planning (IRP) office was sought in order to distribute the survey to a select number of professors at the University of Ottawa across all faculties. Professors were randomly selected by IRP following their policy of sending it to a sample using probability proportional to size where the probability of selection for a sampling unit is directly proportional to the overall size of the group. The parameters used were 25% of the total English-speaking professors. Each professor had an equal chance of being selected (faculty representation is therefore probability proportional to size). Similarly, Carleton University's support services (Centre for Teaching and Learning) was approached who helped to distribute the survey to all the professors at the university. These centers, having access to databases of professors' emails, provided their willingness verbally to distribute the survey on the researcher's behalf. It was expected that even with a minimal response rate, which could be an issue with web-based surveys, 30-35 instructors' responses would be considered sufficient for conducting statistical analysis as demonstrated by other studies in this area (Amelung, Krieger, & Rosner, 2011; Colby-kelly & Turner, 2007; Creasy & Liang, 2004; Sly, Lombardi, Kusel, & Sly, 2005, Webb & Jones, 2009; Wiliam et al., 2004). This number ensures normality assumptions. The survey went live in the middle of April, 2016 and remained open for receiving responses for 30 days with two reminders sent during the last week in order to encourage more responses. The survey was sent to 2119 potential participants from both universities. However, a total of 99 complete responses were received from the online survey, which is a response rate of 4.7%.

Data Collection

The quantitative phase of the study focused on identifying factors influencing instructors' perspectives on effectiveness of existing formative assessment tools in LMS. Cross-sectional survey design, which implies the data was collected at one point in time (McMillan, 2000), was used. The primary technique for collecting the quantitative data was a survey instrument developed specifically for this study, containing items of different formats: multiple choice, asking either for one option or all that apply, dichotomous answers like "Yes" and "No", and self-assessment items in questions 9-27 were measured on a continuous 5-point Likert type scale. Psychometric analysis of the survey instrument was performed in order to obtain evidence about reliability and validity. A panel of professors teaching at the university level agreed to participate in the pilot study set up to acquire evidence about content validity of the survey instrument. The survey consisted of twenty-seven questions, which were organized into four sections, consistent with the number of research questions in the study. The panel verified that the items on the instrument showed evidence of content validity, that is, they mentioned that the items were mostly clear and that the content is consistent with the targeted construct of perceptions about formative assessment in LMS. There were concerns about phrasing of some of the questions not being clear and some confusion about the order of two questions. Based on the suggestions of the panel, those questions were rephrased for clarity and re-arranged to allow for a better sequence. The panel also confirmed that the instrument refers to concepts multiple times and poses questions which are interrelated to improve the reliability of the instrument. Definition of several terms were added, for example, formative assessment was defined. Also, it was highlighted that since feedback is viewed as a primary component of formative assessment and is one of the factors that have the strongest influence on learning (Black & Wiliam, 1998b), this study will

also consider providing detailed feedback on assessments as a vital component of formative assessment. The first section of the survey asked questions related to the use of LMS in general and the factors that determine why professors use them. The second section attempted to understand the extent to which the professors find LMS tools they use effective or use them for formative assessment purposes. The third section measures participants' ideas about what could be done to improve the tools with which they have experience. The fourth section is focused on participants' insights about what can be done to encourage the use of LMS at manufacturer, institution, instructor, and student levels. The items in each of the section of the questionnaire were based on the studies of the literature review as well as researcher's personal experience working with LMS and speaking with instructors who use or do not use LMS for providing feedback. One of the advantages of web-based surveys is that participants' responses are automatically stored in a database and are easily transformed into numeric data in Excel or SPSS formats, as was done in this study.

Survey Instrument and Variables in Phase I

Table 1 shows the research questions and corresponding survey instrument items based on the alterations made after the pilot study. It presents a summary of the list of research questions on left and the column on right identifies how data will be collected to address each question. A full version of this survey is presented in [Appendix A](#).

Table 1: Research Questions and focus of corresponding survey items

Demographic Factors	1. Discipline
	2. Position (Full-time, Part-time, Adjunct, Term limited non-union)
	3. Level of teaching? (Undergraduate/Graduate/Both)
	4. Average class size (Undergraduate/Graduate)
	5. Years of teaching experience at higher education level
	6. Years of experience teaching using an LMS
	7. Years of experience teaching using a non-LMS technological tool

	8. Approximate hours of training with LMS?
RQ1: What factors determine which LMS software features professors use and what are the reasons behind it.	9. LMS feature used
	a. For providing detailed feedback
	b. For assessing student knowledge
	10. LMS used for classroom management
	11. LMS used for instructional purposes
	12. LMS used for assessment purpose
	13. LMS used for formative assessment purposes
RQ2: In professors' perspective, how effective are the LMS assessment tools for formative purposes and what are the factors that determine their effectiveness?	14. Giving detailed feedback to the students on their assessments
	15. LMS provides effective mechanism for giving feedback on selected response type assessment questions
	16. Comments on a word-processed file that uploaded/mailed via LMS an effective way to give feedback on selected response type assessment questions
	17. Comments via email an effective way to give feedback on selected response type assessment questions
	18. Comments via F2F/Video Conferencing an effective way to give feedback on selected response type assessment questions
	19. LMS provides effective mechanism for giving feedback on open ended type assessment questions
	20. Comments on a word-processed file that uploaded/mailed via LMS an effective way to give feedback on open ended type assessment questions
	21. Comments via email an effective way to give feedback on open ended type assessment questions
	22. Comments via F2F/Video Conferencing an effective way to give feedback open ended type assessment questions
	RQ3: What could be done to improve the effectiveness of tools or introduce new ones?	23. LMS allows import of assessment data from external tools
24. Existing tools in the LMS	
a. allow to effectively assess higher order knowledge	
b. allow to effectively identify student's strengths and areas of improvement	
c. allow to provide effective feedback	
d. allow to track student learning over time	
RQ4: What can be done to encourage and enhance their	e. are user-friendly
	25. Professors' perception about manufacturer's focus
	26. Professors' willingness to aid developers

use (manufacturer, institution, instructor, student level)?	27. Deterrents in using the assessment tools in LMS
	a. student's lack of competence
	b. lack of institutional encouragement
	c. lack of financial support
	d. lack of technical support at the institution
	e. lack of enthusiasm from colleagues
	f. inadequate of training
	g. lack of time
	h. technical issues using LMS

Phase II - Qualitative

Participants

For the purpose of the second, qualitative phase of the study, a purposeful sample was used. Based on the analysis of results from the first phase, maximal variation sampling, in which a researcher samples individuals differing on some characteristic, was used. It implies that individuals are intentionally selected to understand the central phenomenon (McMillan & Schumacher, 1994; Miles & Huberman, 1994), i.e. professors' perspectives about use of LMS for formative assessment purposes. The idea was to purposefully select informants who can best answer the research questions and who are "information rich" (Patton, 1990, p. 169). This allowed the researcher to present multiple perspectives of individuals to "represent the complexity of our world" (Creswell, 2002, p. 194). In the survey informed consent form, the participants were informed that they might be selected for a voluntary follow up individual interview. Of the 24 participants who gave their consent for a follow up interview, eight participants were selected. Selection was based on an examination of participants' responses to survey items relating to their perceptions and use of LMS for formative assessment, as well their academic discipline and typical teaching assignment (i.e., class size and graduate/undergraduate level), such that the 8 interviewees represented diversity across these items. That is,

interviewees were selected to include some who reported frequent use of LMS for formative assessment and some who reported infrequent use of LMS for formative assessment, some who perceive LMS tools for formative assessment favourably and some who perceive them less favourably, some who typically teach graduate courses and some who teach primarily undergraduates. As well, equal proportions of interviewees were chosen from the University of Ottawa and Carleton University, and included a range of academic disciplines.

Data Collection

The qualitative phase in the study focused on explaining the results of the statistical tests obtained in the first phase. The primary technique was to conduct in-depth semi-structured face-to-face or telephone interviews with 8 selected participants. The content of the protocol questions was grounded in the results and emerging trends of the statistical tests conducted in the first phase. Scenarios to be further investigated included questions about which LMS brand influenced positive or negative experiences for professors. Which tools within those particular LMS did they use for formative purposes and what challenges did they encounter? The interplay between institutional environment and their willingness to use assessment tools formatively was also a criterion for contacting them for an interview. As well, their experiences with importing from or linking other technology tools was explored in greater depth.

The interview protocol included 9 open-ended questions and were pilot tested with the same professors who participated in the pilot test for the first phase. Debriefing with these participants was conducted to obtain information on the clarity of the interview questions and their relevance to the study aim. These participants were once more excluded from the full study. Another invitation was sent to the prospective participants of the study based on the consent provided in the first phase and the selection criteria outlined earlier. Meetings were arranged

requesting a 30-35 minutes interview. The participants received the interview questions prior to the scheduled meeting and were informed the interview would be tape-recorded and transcribed. Another consent form was signed for this phase of data collection.

CHAPTER 3: DATA ANALYSIS AND RESULTS

This chapter first presents the analysis of the quantitative data and the results of those analysis. Analysis of the qualitative data collection phase will then follow based on the constant comparative data analysis technique (Merriam, 2009).

Phase I - Quantitative

This section has been organized to reflect the sequence of the four research questions and follows the items in Table 1 corresponding to survey items. Data collected in the quantitative phase of the study was used to assess the reliability of questions. Cronbach's coefficient alpha ' α ' (Cronbach, 1988) is a reliability measure in social, behavioral, and education sciences which is widely reported in almost every research involving measuring a construct through multiple items (Zhang & Yuan, 2015). Cronbach's alpha for this instrument was .75 which is deemed adequate.

Various statistical analyses were conducted on quantitative data using SPSS. Before the statistical analysis of the quantitative survey results was performed, the screening of the data was conducted (Kline, 1998; Tabachnick & Fidell, 2012), which included examining the descriptive statistics for all the variables to measure central tendency and variability, information about the missing data, and normality. Descriptive analysis was conducted, including frequencies of each response computed to identify valid percent for responses to all the questions in the survey.

These statistics are summarized in the text and reported in tabular form in appendix B.

Correlations were computed between different variables within the survey to further analyse the

results. Group comparisons were conducted based on differentiation reported between various types of elements like programme level and universities. Detailed data tables used for these analyses can be found in Appendix B.

Demographics

The demographic section preceded the questions related to the research questions 1 through 4. Descriptive analysis of the responses included a total of 99 responses that were received from the two universities across 14 disciplines. It was revealed that 43 participants were from University of Ottawa whereas 56 were from Carleton University. Out of the total, 58 identified themselves as full time professors, 19 as part time, 14 as adjunct and 7 as non-union term limited professors ([Appendix B, Table 4](#)). 47 professors taught at undergraduate level, 10 taught at graduate level while 42 taught at both levels ([Appendix B, Table 5](#)). Class sizes at different level of studies were categorized to create suitable ranges. For example, undergraduate class sizes were: small classes of 1-39 students (30%), medium class size of 40 – 99 students (39%), and large classes of 100 or more students (25%). [Appendix B, Table 7](#) and [9](#) show that graduate classes were only divided into two categories: small of up to 14 students (45%) and large of 15 or more (53%). Based on the years of experience teaching at the higher education level, professors were also classified into low, medium and highly experienced professors ([Appendix B, Table 11](#)). Those with 1-7 years of experience were classified as low experience (23%), 8 to 14 years as medium (40%) and 15 or more years were classified as highly experienced professors (36%).

Responses show that only 5% of the respondents reported they have no *LMS experience*, whereas 74% reported that they lack *non-LMS technical experience* ([Appendix B, Table 15](#)) which is in an indication that professors are more inclined to use LMS compared to other techno-

pedagogical tools ([Appendix B, Table 13](#)). Contrasting with the statistics on professors who have no *experience* using LMS, it is interesting to note that the percentage of professors with no LMS *training* is much higher. More than a third of them have had no training on LMS. [Appendix B, Table 17](#) shows that around two thirds of all respondents had some training

Research Question 1: Which LMS assessment features are currently being used by professors and what are the factors which determine the features that they use?

Which LMS assessment features are currently being used by professors

Professors were asked about which of the LMS features from a list they have used for a) providing detailed feedback or b) assessing student knowledge. A frequency analysis shows (Table 2) that most professors have used 2 or more tools for feedback (n = 63) whereas 36 professors have not used any or just one feedback tool available in LMS. In comparison, when it comes to professors using LMS tools for assessment purposes (Table 2), 53 of them indicated using either none or one tool, whereas fewer (n = 46) indicated that they use 2 or more tools.

Table 2: Number of LMS tools used by professors for providing feedback and for assessing knowledge

Number of tools used for feedback	for providing feedback		for assessing knowledge	
	Number of professors	Percent	Number of professors	Percent
0	18	18.2	34	34.3
1	18	18.2	19	19.2
2	12	12.1	20	20.2
3	26	26.3	14	14.1
4	10	10.1	8	8.1
5	9	9.1	2	2.0
6	5	5.1	1	1.0
7	1	1.0	1	1.0
Total	99	100.0	99	100.0

As indicated by table 6, average number of tools used by professors for providing detailed feedback was 2.44 whereas for assessing student knowledge was 1.58, again indicating that providing feedback is a more popular activity on LMS than conducting assessment.

Use of LMS tools for different purposes was also analyzed. Table 3 displays that discussion forum and assignment tools within LMS are used the most by professors for providing feedback and assessing knowledge. However, email function in LMS is also popular for providing feedback and quiz builder for assessing knowledge. It highlights the fact that few professors perceive quiz builders, and even quizzes, as tools which could be used to provide feedback to students. Only small fractions of the professors confirmed the popularity of rubrics with 18 professors using it for providing feedback and 14 for assessing student knowledge. It is surprising to see rubrics still lagging in popularity for both providing feedback and assessing knowledge within LMS.

Table 3: Frequency of response for each tool used by professors

LMS feature	Frequency of profs using LMS feature for			
	a. providing detailed feedback	Percent	b. assessing student knowledge	Percent
a) Quiz builder	13	13%	26	26%
b) Discussion Forum	46	46%	29	29%
c) Comments box with submission	35	35%	10	10%
d) Email within the LMS	66	67%	10	10%
e) Wiki	3	3%	13	13%
f) Blogs	4	4%	7	7%
g) Journal	7	7%	6	6%
h) Assignment Tool	40	40%	46	46%
i) Rubrics	18	18%	14	14%
j) Other (please specify)	10	10%	4	4%

It was expected that results for LMS features professors use for providing detailed feedback should be consistent with a different question where professors rated, from 1 (Never) to 5 (Very Frequently), their usage of LMS for formative assessment purposes. Table 4 shows that 20 professors said they have not used an LMS for formative assessment purposes compared to 18 who have not used any of the tools mentioned for providing feedback (Table 2).

Table 4: Number of professors selecting options on Likert scale for using LMS for formative assessment purposes

Rating	Frequency	Percent
Never	20	20.2
Rarely	11	11.1
Sometimes	22	22.2
Frequently	17	17.2
Very Frequently	29	29.3
Total	99	100.0

Similarly, it was expected that results for LMS features professors use for assessing student knowledge should be consistent with the question where professors rated, from 1 (Never) to 5 (Very Frequently), their usage of an LMS for assessment purposes. Table 2 shows that 34 professors said they did not use any of those tools for assessment compared to a total of 29 professors who said they have never or rarely used it (Table 5).

Table 5: Number of professors selecting options on Likert scale for using LMS for assessment purposes.

Rating	Frequency	Percent
Never	21	21.6
Rarely	8	8.2
Sometimes	17	17.5
Frequently	17	17.5
Very Frequently	34	35.1
Missing	2	
	97	100.0

This question about using LMS for assessment purposes had an option for the participants to mention any other tools that they use. The highest frequency was for sharing resources (n=7) with students which points to the dissemination of course material.

Table 6: Means and Standard deviations for items related to Research Question 1

Questionnaire items	N	Mean	Std. Deviation
9a. Total number of tools used by professors for providing detailed feedback	99	2.444	1.8139
9b. Total number of tools used by professors for assessing student knowledge	99	1.576	1.5720

10. I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	99	4.455	.9505
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	99	3.818	1.4240
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	97	3.361	1.5558
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	99	3.242	1.4921

Ratings: 1 = 'Never', 2 = 'Rarely', 3 = 'Sometimes', 4 = 'Frequently', and 5 = 'Very Frequently'

What are the factors which determine the features that they use?

Cross tabulating results from LMS feature used for providing detailed feedback and for assessing student knowledge with level of teaching shows that over 72% of the professors at undergraduate level use more than one tool for providing feedback. On the other hand, 80% of the professors teaching at graduate level use more than one tool for providing feedback, which is not very different from the undergraduate level. However, professors teaching at both levels demonstrated a sizeable difference from the other groups with only 50% using more than one tool for providing feedback as shown in table 7.

Table 7: Frequency of professors using number of LMS tools for providing feedback based on teaching level

Teaching level	Aggregate of LMS tools used by professors for providing feedback						
	0	Percentage	1	Percentage	2 or more	Percentage	Total
Undergraduate	8	8.1	5	5.1	34	34.3	47
Graduate	0	0	2	2	8	8.1	10
Both	10	10.1	11	11.1	21	21.2	42
Total	18	18.2	18	18.2	63	63.6	99

Cross tabulating responses to assessing student knowledge with level of teaching shows that only around 38% of the professors at undergraduate level use more than one tool. Also, only 30% of the professors teaching at graduate level use more than one tool for assessing student knowledge, which is not very different from the undergraduate level. Similarly, 40% of the professors teaching at both levels use more than one tool for assessing student knowledge as

shown in table 8. These numbers further confirm that professors use more tools in LMS for providing feedback than they do for assessing student knowledge.

Table 8: Frequency of professors using number of LMS tools for assessing students based on teaching level

Teaching level	Aggregate of LMS tools used by professors for assessing students						Total
	0	Percentage	1	Percentage	2 or more	Percentage	
Undergraduate	20	20.2	9	9.1	18	18.2	47
Graduate	2	2	5	5.1	3	3	10
Both	12	12.1	5	5.1	25	25.3	42
Total	34	34.3	19	19.2	46	46.5	99

As far as higher education experience is concerned, professors were categorized in four levels: none = 0; low = 1-3 years; medium = 4-9 years; high = 10 or more years. Means from the results show that professors at all four levels rely on emails within LMS the most, with discussion forums being a distant second for this purpose. For assessment purposes, however, the use of LMS seems to be even less desirable (see appendix B for full set of results).

With regard to hours of training with LMS, the categories were none or no training = 0; low = 1-3; and high = 4 or more. It can be observed from table 9 that those with less training are less likely to use tools for providing feedback whereas those with more training are more likely to use a variety of tools. Professors who have had no training predictably notified that they have not used any of the tools in LMS (n=9) while low level (up to 3 hours) of training (n=19) and higher level (more than 3 hours) of training (n=25) impacted professors to use two or more tools. When it comes to using a particular tool for feedback more than others, professors with all three levels of training again opted for emails within LMS.

Table 9: Frequency of professors using number of LMS tools for providing feedback based on training

hrs of training	Aggregate of LMS tools used by professors for providing feedback						Total
	0	Percentage	1	Percentage	2 or more	Percentage	
None	9	9.1	6	6.1	19	19.2	34
1-3 (Low)	5	5.1	7	7.1	19	19.2	31
4+ (High)	4	4	5	5.1	25	25.3	34
Total	18	18.2	18	18.2	63	63.6	99

In contrast to giving feedback, the level of training did not seem to have any effect on the number of tools professors use for assessing students (Table 10). Professors in general across the training levels (n=34) notified that they prefer not to use the assessment tools in LMSs. It can be seen from generally higher or equal numbers of professors using one or less tools compared to two or more. For assessment purposes, however, the assignment tool was the most popular regardless of hours of training received.

Table 10: Frequency of professors using number of LMS tools for assessing students based on training

hrs of training	Aggregate of LMS tools used by professors for assessing students						Total
	0	Percentage	1	Percentage	2 or more	Percentage	
None	10	10.1	9	9.1	15	15.2	34
1-3 (Low)	14	14.1	5	5.1	12	12.1	31
4+ (High)	10	10.1	5	5.1	19	19.2	34
Total	34	34.3	19	19.2	46	46.5	99

An overwhelming majority - around 88% of the professors frequently and very frequently uses LMS for classroom management/administrative purposes. This percentage goes down to around 70% when professors using LMS for instructional purposes is concerned. It further drops to 53% when professors rated their use of LMS for assessment. Furthermore, when professors were asked to rate their use of LMS for formative assessment purposes, the continuous downward trend comes to be around 47%. Contrasting to giving feedback using LMS, a vast majority of the professors indicated that they usually give detailed feedback with around 84% of the respondents either strongly agreed or agreed to doing so. It is important to note that this observation lends credence to the premise of this study that even though instructors in higher education do tend to provide feedback, they are not comfortable doing it using LMS. Interestingly, none of the respondents indicated that they do not provide feedback.

Further analysing items in research question 1 in terms of the size of classes professors teach ([Table 51, Appendix B](#)), the results show that for undergraduate classes, small class sizes had highest ratings in general while medium-sized classes had lowest ratings. However, biggest class sizes had slightly higher ratings than medium sized classes which indicates that LMS are used more with small classes to benefit from the online features of the system but not to a great extent as class sizes get bigger. However, none of these differences were significant.

More professors who teach only at undergraduate level rated LMS for administration and instruction purposes higher, but when it comes to assessment and formative assessment, graduate professors rated the use of LMS higher. This trend was also visible in giving feedback in general. It reconciles with the fact that graduate classes are usually smaller which means professors can spend more time giving individual feedback, Also, it indicates that professors are more inclined to give feedback at higher level of classes.

Interestingly, the professors teaching undergraduate courses indicated ([Table 51, Appendix B](#)) providing feedback to students most strongly for medium sized classes which is opposite to other items in the section, which seems to suggest that providing feedback and using LMS in general can be inversely related.

Another dimension which was explored was how the number of hours of training professors have received affects their perception of assessment tools in LMS. It was observed that for items in research question 1, as the hours of training increased, the use of LMS for various purposes seems to increase and particularly for questions about using an LMS for classroom management/administrative purposes and for assessment purposes, it seems to change significantly based on number of hours of training ([Tables 57 and 58, Appendix B](#)). However, results from the question about giving detailed feedback to students on their assessments

(question 14) indicate that LMS training does not have any effect on the feedback professors give to students in general with all three levels of training as well as no training returning very similar mean scores. It was expected based on the other results discussed in this section.

Additionally, the correlational values between questions that deal with professors' use of LMS for various purposes, correlate significantly with each other (which also displays validity within the instrument) but do not correlate with the question about giving detailed feedback to students on their assessments ([Table 49, Appendix B](#)). However, results from questions about using LMS for formative assessment purposes and always giving detailed feedback to students on their assessments are significantly correlated with each other, $r = 0.331$, $n = 97$, $p = 0.001$ ([Table 50, Appendix B](#)). These values tend to suggest that even though professors who use LMS for other activities and for providing feedback, they do not necessarily provide feedback outside of LMS. Another explanation of this could be that professors deem communicating with LMS as giving feedback to students.

For higher education experience, professor with low experience rated use of LMS for various purposes as higher than the other groups, possibly pointing to the phenomenon that less experienced or younger professors are more inclined to use technology. Professors across all groups of experiences ranked providing detailed feedback to student equally since providing feedback is considered an increasingly important part of assessment particularly at higher education level.

Further confirming the results, correlation between total number of tools used for providing detailed feedback with using an LMS for formative assessment purposes indicates a strong, positive statistically significant correlation with $r(97) = .589$, $p < .01$. These questions and their results further provide evidence of validity/reliability in the survey with both referring

to professors' use of LMS for providing feedback. Similarly, correlation between the total number of tools used for assessing student knowledge with using an LMS for assessment purposes indicates a statistically significant correlation with $r(97) = .493, p < .01$ ([Appendix B, Table 49](#)).

Research Question 2: In professors' perspectives, how effective are the LMS assessment tools for formative purposes and what are the factors that determine their effectiveness?

The trend that manifested in the mean plots of research question 2 showed mainly a neutral tendency and followed a normal curve. However, there are some points that stood out. Most respondents strongly disagreed that comments directly via email (27%; n=25) are effective, while (32%; n=29) strongly disagreed that face to face/video conferencing are an effective way to give feedback to students on selected response type assessment questions. Most professors (30%; n=28) also strongly disagreed that providing comments via face to face (F2F)/video conferencing is an effective way to give feedback to students on open ended type assessment questions. What most professors did find effective, however, were mechanisms for LMS for giving feedback to students on selected response type assessment questions. They also perceived LMS to be effective for providing mechanisms for giving feedback to students on open ended type assessment questions. This displays the contrast in general mechanisms versus specific tools which were mentioned in the questionnaire. This was perhaps because the mechanisms which were represented in the questionnaire did not include the tools or mechanisms that professors find to be effective both for providing feedback and conducting assessments.

For undergraduate classes, most of the professors indicated that they use LMS more for smaller class sizes or very large ones, while the reliance on LMS goes down for medium sized

groups ([Table 51, Appendix B](#)). Even more emphatic were the results for the same questions for graduate classes: as the size of the class increases, so does the use of LMS technology ([Table 53, Appendix B](#)). It is possibly due to the fact that it becomes more difficult for professors to handle and provide feedback in bigger graduate classes, a trend similar to undergraduate classes. However, analysing the specific feedback items featured in LMS both for selected response type assessment questions as well as open ended assessment questions, the means of each item for graduate classes were invariably higher than the ones for undergraduate classes. This is consistent with earlier mentioned point that professors are inclined to give more feedback at higher level of classes.

Table 11: Means and Standard deviations for items in Research Question 2

Questionnaire item	N	Mean	Std. Deviation
14. I always give detailed feedback to students on their assessments.	97	4.320	.7712
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	94	3.138	1.2495
16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	94	2.840	1.2810
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	94	2.787	1.3825
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	90	2.556	1.3417
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	94	3.160	1.2977
20. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	97	3.371	1.3096
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	97	3.216	1.3403

22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).

94 2.723 1.3943

Valid N (listwise)

86

Ratings: 1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'neutral'; 4 = 'agree'; and 5 = 'strongly agree'

What are the factors that determine their perceived effectiveness?

An analysis of variance (ANOVA) of question which captures the general perception of professors regarding the effectiveness of LMS tools they use for giving feedback to students on selected response type as well as open-ended assessment questions with *level of teaching* being the factor, returned mostly significant effects as shown in table 12. This indicates that teaching level does have an effect on their perceptions about the mentioned tools. Table 13 further elucidates that professors teaching at the graduate level perceived them to be most effective, followed by undergraduate and finally professors who taught at both levels.

Table 12: ANOVA results for Research Question 2 items based on factor of level of teaching

	df	F	Sig.
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	2	.561	.573
16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	2	5.785	.004
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	2	6.580	.002
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	2	3.044	.053
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	2	4.305	.016
	2	3.658	.030

20. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).			
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	2	3.433	.036
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	2	2.966	.057

Table 13: Means and Standard deviations from ANOVA based on level of teaching for items in Research Question 2

		N	Mean	SD
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Undergraduate	44	3.114	1.3846
	Graduate	9	3.556	.8819
	Both	41	3.073	1.1703
	Total	94	3.138	1.2495
16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Undergraduate	44	3.091	1.1777
	Graduate	9	3.667	1.3229
	Both	41	2.390	1.2425
	Total	94	2.840	1.2810
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Undergraduate	45	3.000	1.3484
	Graduate	9	3.889	1.1667
	Both	40	2.300	1.2850
	Total	94	2.787	1.3825
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Undergraduate	43	2.372	1.2729
	Graduate	9	3.556	1.1304
	Both	38	2.526	1.3899
	Total	90	2.556	1.3417
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Undergraduate	43	3.163	1.3080
	Graduate	10	4.200	.9189
	Both	41	2.902	1.2610
	Total	94	3.160	1.2977
20. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Undergraduate	45	3.489	1.2545
	Graduate	10	4.200	.7888
	Both	42	3.048	1.3784
	Total	97	3.371	1.3096
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Undergraduate	45	3.356	1.2641
	Graduate	10	4.000	1.1547
	Both	42	2.881	1.3829

	Total	97	3.216	1.3403
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Undergraduate	44	2.614	1.4178
	Graduate	9	3.778	.9718
	Both	41	2.610	1.3762
	Total	94	2.723	1.3943

For graduate classes, only the question about using word processed file uploaded/emailed via LMS to give feedback on open ended type assessment questions returned significant effect based on three different *class size categories* [$F(2,7) = 7.933, p = 0.016$], which shows that class sizes at graduate level could play a role in encouraging professors to use the tools further for the purpose. ([Table 54, Appendix B](#)).

The means for these questions based on professor's *experience* were more or less similar for each group which again points out that the features used in LMS for various types of feedback do not depend on the professors' experience ([Table 59, Appendix B](#)).

Research Question 3: What could be done to improve the effectiveness of LMS assessment tools for formative purposes or introduce new ones?

For the question about current LMS allowing to import assessment data and results by linking with external tools, the professors indicated that they were neutral about it (table 14), which means that professors perceived them to be only moderately effective for this purpose. Therefore, this was explored further in the qualitative section. Similarly, for the question regarding the five elements of formative assessment, as can be seen in the table 14, responses show a tendency among professors to be very neutral towards ability of LMS to help them conduct formative assessment.

Table 14: Means and Standard deviations for items in Research Question 3

Questionnaire item	N	Mean	Std. Deviation
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23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	93	2.602	1.0544
24. I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	98	2.867	1.0711
24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	98	2.786	1.0769
24. I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	98	3.255	1.1243
24. I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	98	3.041	1.1746
24. I feel that the existing tools in the LMS that I use: | e. are user friendly	96	2.719	1.2624

Ratings: 1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'neutral'; 4 = 'agree'; and 5 = 'strongly agree'

Research Question 4: What can be done at the manufacturer, institution, instructor, and student levels to encourage and enhance the use of LMS assessment tools?

A majority of the professors held the opinion that *manufacturers* of LMS focus more on technical aspects rather than pedagogical aspects of their products. On a 5-point Likert scale, 54% (n=51) of the respondents agreed or strongly agreed to this statement, with a mean of 3.67 (st. dev = .8435). However, fewer professors were willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.

For the question regarding what deters the *professors* from using assessment tools in an LMS, training, time, technical issues seem to be the strongest reasons as they displayed the highest means, as shown in table 15. More than 40% of the professors indicated that 'lack of adequate training' is the cause whereas, 52% of the respondents rated either agree or strongly agree for 'time' being the factor of their discouragement. Even more strongly rated reason was 'technical issues' with 57% of the professors claiming it to be the deterrent.

Table 15: Means and Standard deviations for items in Research Question 4

Questionnaire item	N	Mean	Std. Deviation
25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	95	3.674	.8435
26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	95	3.137	1.1262
27. I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	94	3.011	1.1406
27. I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	94	2.606	1.2023
27. I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	94	2.840	1.1388
27. I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	94	2.649	1.1426
27. I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	94	2.596	1.0607
27. I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	94	3.032	1.2133
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	94	3.532	1.1796
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	93	3.473	1.0894
27. I often get deterred from using the assessment tools in an LMS because: | i. Others	37	3.541	1.2382
Valid N (listwise)	33		

Ratings: 1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'neutral'; 4 = 'agree'; and 5 = 'strongly agree'

An attempt to explain this phenomenon with the help of an ANOVA with the factor of class size reveals that the ratings of *professors teaching undergraduate courses* returned only 'lack of student competence, technical support, colleague support, and having technical issues' being the deterrents with statistical significance as the results show in table 16. It implies that only those factors are affected by class size at undergraduate level.

Table 16: ANOVA results for Research Question 4 items based on factor of undergraduate class sizes

	df	F	Sig.
25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	3 40 43	.635	.597
26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	3 40 43	1.058	.377
27. I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	3 40 43	2.933	.045
27. I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	3 40 43	.557	.646
27. I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	3 40 43	2.040	.124
27. I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	3 40 43	3.545	.023
27. I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	3 40 43	4.465	.009
27. I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	3 40 43	1.773	.168
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	3 40 43	.774	.515
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	3 40 43	2.908	.046
27. I often get deterred from using the assessment tools in an LMS because: | i. Others	3 14 17	.172	.913

Ratings: 1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'neutral'; 4 = 'agree'; and 5 = 'strongly agree'

Table 17: Means and Standard deviations from ANOVA based on factor of undergraduate class sizes items in Research Question 4

		N	Mean	Std. Deviation
25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	0	3	3.333	.5774
	1-39	14	3.714	.9139
	40-99	14	3.786	.8926
	100+	13	3.385	.8697
	Total	44	3.614	.8685
26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	0	3	2.333	.5774
	1-39	13	3.231	1.1658
	40-99	14	3.500	1.0919
	100+	14	3.571	1.2839
	Total	44	3.364	1.1632
27. I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	0	3	3.000	1.0000
	1-39	13	2.923	1.0377
	40-99	14	3.500	1.1602
	100+	14	2.357	.8419
	Total	44	2.932	1.0869
27. I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	0	3	3.000	1.7321
	1-39	13	2.308	1.2506
	40-99	14	2.786	1.0509
	100+	14	2.786	1.1883
	Total	44	2.659	1.1801
27. I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	0	3	2.333	.5774
	1-39	13	2.231	.8321
	40-99	14	3.071	.9169
	100+	14	2.571	1.0163
	Total	44	2.614	.9454
27. I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	0	3	2.667	1.1547
	1-39	13	1.923	1.0377
	40-99	14	3.214	.9750
	100+	14	2.429	1.0894
	Total	44	2.545	1.1300
27. I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	0	3	1.667	.5774
	1-39	13	2.154	.9871
	40-99	14	3.214	.8018
	100+	14	2.429	.9376
	Total	44	2.545	.9989
27. I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	0	3	3.000	1.0000
	1-39	13	2.615	1.5566

		40-99	14	3.643	.9288
		100+	14	2.786	1.2514
		Total	44	3.023	1.2848
27.	I often get deterred from using the assessment tools in an LMS because: | g.	I 0	3	3.000	1.0000
	do not have enough time.	1-39	13	3.000	1.0801
		40-99	14	3.571	1.0163
		100+	14	3.500	1.2860
		Total	44	3.341	1.1195
27.	I often get deterred from using the assessment tools in an LMS because: | h.	I 0	3	4.000	.0000
	experience technical issues when using the LMS.	1-39	13	3.077	1.1875
		40-99	14	3.857	.8644
		100+	14	2.714	1.3828
		Total	44	3.273	1.2078
27.	I often get deterred from using the assessment tools in an LMS because: | i.	0	2	3.500	.7071
	Others	1-39	5	3.000	1.4142
		40-99	6	3.500	1.5166
		100+	5	3.600	1.5166
		Total	18	3.389	1.3346

Ratings: 1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'neutral'; 4 = 'agree'; and 5 = 'strongly agree'

Means from different class size levels as shown in table 17 reveal that those who teach smaller classes was more likely to identify these issues as deterrents. On the other hand, when graduate level cases were selected, none of the listed deterrents returned any significant differences based on the factor of class size. This indicates a possibility of the items on the list not being decisive for deterring professors teaching graduate courses from using LMS for assessment purposes. Nonetheless, means from different class sizes at graduate level also reveal that those who teach smaller classes were more likely to identify these issues as being deterrents as shown in table 18.

Table 18: Means and Standard deviations from ANOVA based on factor of graduate class sizes items in Research Question 4

		N	Mean	Std. Deviation
25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	0	0	.	.
	1-14	2	4.000	.0000
	15+	7	3.571	1.1339
	Total	9	3.667	1.0000
26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	0	0	.	.
	1-14	2	2.500	2.1213
	15+	7	3.143	1.3452
	Total	9	3.000	1.4142
27. I often get deterred from using the assessment tools in an LMS because: | a.Student's lack competence in working with the LMS and feedback system	0	0	.	.
	1-14	2	3.000	.0000
	15+	7	2.857	1.2150
	Total	9	2.889	1.0541
27. I often get deterred from using the assessment tools in an LMS because: | b.There is a lack of institutional encouragement for using assessment tools in LMS.	0	0	.	.
	1-14	2	3.000	.0000
	15+	7	2.429	1.2724
	Total	9	2.556	1.1304
27. I often get deterred from using the assessment tools in an LMS because: | c.There is a lack of financial support at my institution.	0	0	.	.
	1-14	2	3.000	.0000
	15+	7	3.000	1.2910
	Total	9	3.000	1.1180
27. I often get deterred from using the assessment tools in an LMS because: | d.There is a lack of technical support at my institution.	0	0	.	.
	1-14	2	2.500	2.1213
	15+	7	2.571	1.2724
	Total	9	2.556	1.3333
27. I often get deterred from using the assessment tools in an LMS because: | e.There is a lack of support from other colleagues.	0	0	.	.
	1-14	2	2.500	.7071
	15+	7	2.571	.9759
	Total	9	2.556	.8819
27. I often get deterred from using the assessment tools in an LMS because: | f.I do not have adequate training on the LMS.	0	0	.	.
	1-14	2	3.000	2.8284
	15+	7	2.857	1.2150
	Total	9	2.889	1.4530
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	0	0	.	.
	1-14	2	4.000	1.4142
	15+	7	3.000	1.4142

	Total	9	3.222	1.3944
27. I often get deterred from using the assessment tools in an LMS because: | h.	I	0	0	.
experience technical issues when using the LMS.		1-14	2	4.500
		15+	7	3.286
	Total	9	3.556	1.1304
27. I often get deterred from using the assessment tools in an LMS because: | i.Others		0	0	.
		1-14	2	3.000
		15+	2	3.500
	Total	4	3.250	.5000

Ratings: 1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'neutral'; 4 = 'agree'; and 5 = 'strongly agree'

According to the *least experienced professors*, the listed items were not very representative of the issues they face while using LMS. However, they also did not indicate other issues when the option was provided for them to express other obstacles which shows that they get least discouraged from using LMS ([Table 60, Appendix B](#)). *Hours of training* also does not seem to be a deciding factor when it comes to using various features of LMS for feedback purposes ([Table 58, Appendix B](#)). Neither does it seem to be a strong factor in determining any other RQ3 and RQ4 elements, except showing that training can affect how professors feel about lack of technical support and help from colleagues. Overall, instructors with a low level of training are more inclined to indicate the listed reasons as being factors for deterring them from using LMS tools for assessment purposes, including lack of technical support and help from colleagues. It could possibly be explained by the fact that professors who have some level of training with LMS tools start using those tools but because they do not have enough training, they run into obstacles which they are unable to overcome without support.

It appears that level of training for professors leads them to believe that students lack competence in using LMS. It is shown by higher mean in their responses ([Table 57, Appendix B](#)) where those with higher training believe students have a greater lack of competence. Also, it appears that professors who have more training feel more discouraged that institutions don't

support them to use LMS assessment tools. This phenomenon is explored further in qualitative section to gauge whether the professors who have training feel that the institution is not providing enough training on assessment tools, or once trained, they feel that the culture of others using assessment tools is lacking. Professors who don't have training may not be able to objectively answer about encouragement from the institution.

In terms of hours of training ([Table 58, Appendix B](#)), it was interesting that ANOVA results show that there was a significant effect of number of hours of training on professors being deterred from using LMS due to technical issues between none, low and high training at the $p < .05$ level $F(2, 93) = 4.348, p = 0.016$. Similarly, the effect due to reliance on colleagues is at the $p < .05$ level $F(2, 93) = 3.138, p = 0.048$.

Summary of the quantitative findings

More professors indicated that they prefer using none or one LMS tool for assessment purposes than for providing feedback to students. Discussion forum and assignment tools within LMS are used the most by professors for providing feedback and assessing knowledge. However, email function in LMS is also popular for providing feedback and quiz builder for assessing knowledge.

It was found that a similar percentage of professors teaching at undergraduate or graduate level use more than one tool for providing feedback. However, professors teaching at both levels demonstrated a sizeable difference from the other groups. Those with less training are less likely to use tools for providing feedback whereas those with more training are more likely to use a variety of tools. In contrast to giving feedback, the level of training did not seem to have any effect on the number of tools professors use for assessing students.

It was also observed that even though instructors in higher education do tend to provide feedback, they are not comfortable doing it using LMS. Professors who teach only at graduate level, graduate professors use LMS more for assessment and formative assessment. LMS training does not have any effect on the feedback professors give to students in general. Less experienced or younger professors are more inclined to use technology. Professors generally found mechanisms in LMS for giving feedback to students on selected response type assessment questions and on open ended type assessment questions effective. Teaching level has an effect on their perceptions about the mentioned tools.

For undergraduate classes, most of the professors indicate that they use LMS more for smaller class sizes or very large ones. A majority of the professors held the opinion that manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products but fewer professors were willing to consult with developers of LMS.

Professors perceived training, time, technical issues to be the strongest deterrents from using assessment tools in an LMS. Professors teaching undergraduate courses feel that lack of student competence, technical support, colleague support, and having technical issues are the main deterrents. Those who teach smaller classes at graduate level also identify these issues as being deterrents. Professors with low experience get least discouraged from using LMS, however, instructors with a low level of training are more deterred from using LMS tools for assessment purposes. Those with higher training believe students have a greater lack of competence and feel more discouraged that institutions don't support them to use LMS assessment tools.

Phase II - Qualitative

The interviewees received the interview questions prior to the scheduled meeting and this allowed them to speak about their perceptions of how effective LMS tools are for formative assessment even before the questions were formally asked during the interview. In order to determine patterns from the qualitative data sources, the constant comparative technique was used (Merriam, 2009). In preparing the raw interview data and in the results section, pseudonyms were assigned to each key informant to protect confidentiality and the identity of the participants. The steps in qualitative analysis included: (1) preliminary exploration of the data by reading through the transcripts and writing memos; (2) coding the data by segmenting and labeling the text; (3) using codes to develop themes by aggregating similar codes together; (4) connecting and interrelating themes; and (5) constructing a narrative (Creswell, 2002). Qualitative data were corroborated with quantitative data to determine consistency of findings generated by the two data collection methods. Triangulation of data sources provided a deeper understanding of the phenomena which influence the use of assessment tools for formative purposes. Results were localized to each university and reported with specificity to domain, LMS type, and programme-level (undergraduate or graduate). To confirm the results of the analysis, a second independent coder interpreted the data. This two-member checking and interpretation ensured consistency in the qualitative data analysis. The questionnaire items corresponding to the research questions are depicted in figure 3. In the following section, the responses from interviews with the professors have been presented according to how they align with the four research questions.

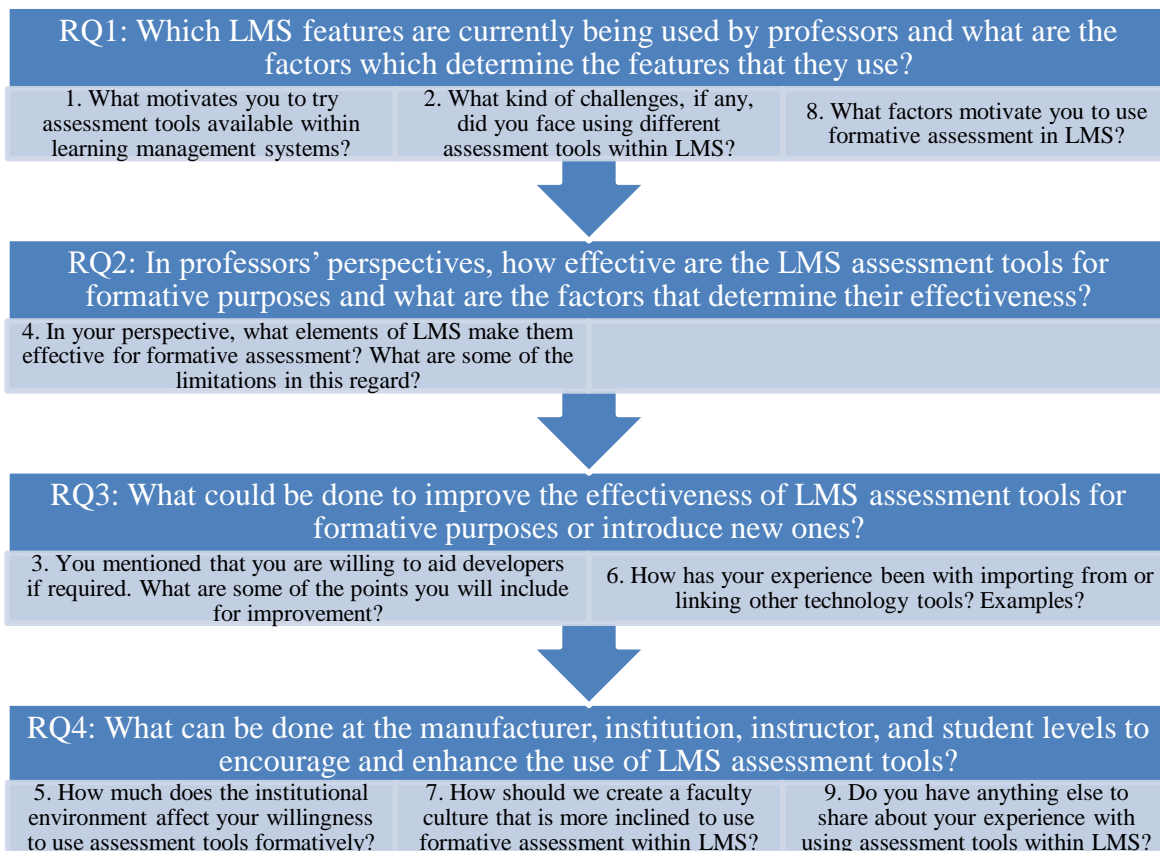


Figure 3: Questionnaire items corresponding to the research questions

Research Question 1: Which LMS assessment features are currently being used by professors and what are the factors which determine the features that they use?

In response to the question about motivation behind using assessment tools in LMS, a key theme that emerged was that most professors believed that such tools are helpful especially since online and hybrid courses are becoming more popular. One of the professors, Julian, who had become a faculty leader in adoption of hybrid courses, talked about it this way,

Every time a course finishes up, I always ask my students to tell me what would they like to experiment with? What would they like to see done differently? This is always the root of my motivation. The other part is my own desire to try different kinds of things. That's why I bought into the whole blended learning format early.

Large classes could use technology more since it is easier and more efficient to track student progress for both professors and students themselves. They also noted that it provides flexibility and ease for students in terms of providing feedback, content dissemination and submission as well as reducing the need to commute.

I need to know what students know and can do and to what extent they achieved the intended learning outcomes for the course. But when I think of formative assessment, it can be very similar kinds of things but more specifically, how students track their own learning, how students get feedback for their own learning and how I get feedback about how they are progressing so I can cycle it back to them to continue with their learning path.

Being in touch with students through various communication tools was another theme that emerged from data analysis. Some professors also pointed to their desire to experiment with new tools as their stimulus to test the LMS tools.

Most professors, however, also noted the challenges posed by using different assessment tools within LMS and agreed that technology training was indispensable without which professors are not able to utilize the software for its intended purposes. They also concurred that working with new technology can sometimes have a steep learning curve and takes time away from other academic activities. Furthermore, these software are not intuitive which compounds the problems of extra time and effort leading to the feeling of frustration among them. Apart from training, professors also mentioned technical and pedagogical support being made available in order to overcome roadblocks they might face. Some professors used the term 'user-friendliness' when describing problems with access to LMS as well as the grading system, which according to them is nonetheless more effective tool than others. Some were critical of the

overall abilities of current LMS and went as far as mentioning that they are not built for assessment or handling the reflection pieces which are more crucial for mature students.

The consistent theme of LMS providing more asynchronous avenues for interaction also manifested itself when professors were asked about factors that motivate them to use formative assessment in LMS. Multiple modes of providing feedback like video and audio - which can be repeatedly accessed by students - enhance the LMS solution and make it more user-friendly. Furthering the theme of helping students with the use of technology, most professors also mentioned that the speed of access to the content and feedback also draws them to use the formative assessment tools in LMS. Possibility of utilizing the feedback cycle with students was also a theme that professors seemed to appreciate about current LMS. They commented that it was easier now to receive questions about the feedback they provide to the students and then electronically send quick, timely and detailed feedback in order for them to reflect upon it. One of the professors mentioned that he uses the LMS tools based on the positive feedback he has received about this element of the course from the students during student evaluations. Some professors also mentioned peer feedback as a factor which could draw them to using technology for formative assessment purposes. For example, Angela, an early adaptor of technology among the professors, mentioned in terms of developing new technology by LMS companies that she would want to use better tools for assessment if they were made available and that providing feedback, specially peer to peer, should get easier as the system would help her keep track of it. "A lot of it would be around assessment. Types of questions asked. How the questions get delivered and who chooses them, the idea of student vs. instructor control. How feedback works. Both instructor to student/peer to peer."

Other factors that motivate professors to use formative technology assessment tools are: automation of some types of questions that can be created within LMS – although still limited, possibility of providing feedback to students, as well as tracking their work progress was also cited as an advantage.

Research Question 2: In professors' perspectives, how effective are the LMS assessment tools for formative purposes and what are the factors that determine their effectiveness?

The single most cited element of technological tools which make them effective for formative assessment was quick and detailed feedback that professors can provide to their students. As implicated in the responses of other questions, it was also mentioned by some professors that LMS assessment tools facilitate a more efficient handling and tracking of assessments and feedback. For example, Maleta, a professor who has been experimenting with blended learning courses and using LMS extensively, mentioned that,

The fact that I can provide quick feedback and students are even faster to give me feedback. If they were all handing them in, in a large class, it would at least be a week before I can get back to them. Also, I can put in as much detailed feedback as I want, with as many resources as I want.

Also, some stated that journals and discussion forums have proved to be useful tools for feedback in their online classes. One professor advocated the use of discussion forums over wiki's and blogs mentioning that his students are not bloggers, but are very comfortable using discussion forums. Students who take multiple courses with a professor tend to understand the style and requirements of that professor and repeat their experiences for the ease and knowing what is expected of them. The professor mentioned,

Providing feedback through LMS goes into my use of the discussion board tool, for example, all of my graduate courses had a sequence of six face-to-face and six online learning modules so the discussion board becomes the key mechanism for students to give each other feedback and for me to give them feedback. My students tell me that the discussion board is a powerful tool in learning management systems. They believe that instead of wikis and blogs discussion board is better.

However, inflexibility to cater to different instructors' needs and limited question types within the software application were the biggest limitations. Maleta went on to mention the limitations this way, "I can't anticipate all of their mistakes and cannot program all the prompt feedback. This may result in no feedback through the system, so it's not that flexible." They have experienced the LMS to be segmented and chunky, where one section or a tool does not directly communicate with another. For example, one of the professors talked about having to go through several steps to first create student groups in the LMS and additionally create two sets of groups: one to use for discussions forums and another one separately for creating group assignments.

Research Question 3: What could be done to improve the effectiveness of LMS assessment tools for formative purposes or introduce new ones?

In response to the question about aiding technical developers or technology, professors generally believed that developers should attempt to use themselves what they created to get a first-hand experience of how a user would feel using them. Professors stressed the need to get more control over the tools making it more flexible for them to use the tools according to their own needs and customized to their style. Cyril, a professor well-versed with programming languages, mentioned that,

In terms of capability, a set of step-by-step questions which can be customized to my need is not possible yet. In fact, I have been told a few times that our system isn't capable to do things, even though I know that it can be programmed to do so.

Another professor, Connor, also emphasised the need for customization of tools in LMS, "For me, it's always something personally targeted to my work, maybe just minor features that I would like added in." In terms of the having a full repertoire of tools at their disposal, they were in favor of including more mechanisms for interaction such as more intuitive discussion forums, peer-controlled content sharing and more feedback tools. Some of the other suggestions were that users should be involved in the software development phases and the feedback they receive from the users should actually be put into practice. This could lead to improving user-friendliness of the software. As Mark, an experienced professor who is also a LMS champion, explained the shortcomings of the tool he was using:

Blackboard has some interaction tools that students can control and work with other students, independent of the instructor. But to do that, you have to go find that tool. It's tucked away in a little corner, to dig into to be used. So, it's really almost designed in as an afterthought or an add on. It's not integrated in the learning experience.

Importing from or linking other technology-based tools used for assessment was a task most professors deemed difficult or considered themselves technically unequipped. Although some of them commented that they would like to try to experiment with it if they were trained to do it, a majority of them expressed that they never felt the need to import to or export any data from the LMS. A professor who mainly taught at the graduate level, indicated that smaller

graduate classes rendered importing data or linking tools as non-necessary for his teaching purposes:

I was invited as a panel member to talk about educational technology with the board of governors about two years ago. We discussed five different formats. I listened to the flipped classroom, I listened to the clicker. I believe that because of graduate classes are smaller now, I have no need to import.

Research Question 4: What can be done at the manufacturer, institution, instructor, and student levels to encourage and enhance the use of LMS assessment tools?

Some of the main institutional environmental factors which affect professors' willingness to use assessment tools formatively were adequate technical support, recognition from administration, training with the technological tools, and positive policy creation. The majority of the participants mentioned training as a pivotal support factor which the institution or their department can aim to provide. On demand technical support as well as encouragement by providing financial incentives for professors to tap into various external resources were also cited as main contributors. Moreover, an open environment with exchange of ideas and frictionless communication channels between the faculty and the administration was also advocated.

Most of the respondents confirmed that a faculty culture needs to exist which is more inclined to use technological tools for formative assessment. The need to establish a supportive culture was a key theme. The majority of participants echoed the idea that sharing best practices and success stories related to their experiences in using technology for formative assessment was very important. This type of exchange could take place at the particular faculty or department meeting or even informally. As Russel, for example, mentioned,

Talking with like minded people doesn't have to be in a meeting. Sometimes I run into a colleague and ask how the technology is working in your class, what are you using it for. It could be a 3 to 4-minute conversation outside elevator.

Also related to establishing a culture of support was the aspect of fostering a new collective mindset of student-driven environment. Professors advocated a cultural shift which will encompass creating a faculty culture to help students with their learning needs. It would also create more awareness among faculty members and administration that using new technology in general and employing it for formative assessment requires both extra time and effort from the professors. It could translate into a more conducive environment for them where their workloads are better managed in order to improve pedagogy. This would drive the professors to improve their content to meet the learning objectives of the courses. Kurtis, a seasoned professor, made the comment,

First aim is convincing that formative assessment is beneficial to learning and extending that learning to something that produces students who are more skilled and more knowledgeable. Those will be the kinds of messages that would drive the change.

Training was a recurring theme and a majority of the professors cited it as a factor to develop and nurture the environment for colleagues supporting each other with technical and pedagogical issues with LMS. This could lead to a "collaborative governance" instead of relying on external resources.

Some other prominent ideas that were discussed during the interviews were that student feedback about the course design and technology tools used as well as the design of the social media resources could be analysed to improve tools and help LMS reach its promised potential.

Also, professors and classrooms need to evolve as new technology and systems are introduced and existing ones are enhanced. This type of call to action displayed an enthusiastic approach that professors in general possessed towards LMS and technology.

Summary of the qualitative findings

As higher education landscape changes, professors are more inclined to use LMS tools for assessment purposes. In their opinion, evolution of technology tools works as their stimulus to keep testing new LMS tools. Continuing training becomes an even bigger requirement to keep the professors abreast of the new tools. Lack of technological support, time, administrative support and user-friendliness of LMS were seen as challenging. Professors used the tools for formative assessment because they allow them to provide quick and detailed feedback can to their students through mainly journals and discussion forums. However, professors also pointed out that inflexibility to cater to different instructors needs and limited question types as well as lack of interactivity in tools were important factors that determine effectiveness.

They believe that developers should have a first-hand experience of how a user would feel working with them and provide more control making it more flexible and customized for them. Professors advocated including more mechanisms for interaction, more intuitive discussion forums and better feedback tools, leading to improved user-friendliness of the software. They also repeated the ideas of technical support, recognition from administration and favourable policies to improve adoption of tools for formative assessment purposes.

DISCUSSION

This section integrates the findings from quantitative and qualitative section in order to triangulate and extrapolate the responses for the four research questions of this study.

Furthermore, these explanations will be interpreted from the perspectives of the theoretical framework developed for this study.

Research Question 1: Which LMS features are currently being used by professors and what are the factors which determine the features that they use?

Responses show that only 5% of the respondents reported they have no *LMS experience*, whereas 74% reported that they lack *non-LMS technical experience* which is an indication that professors are more inclined to use LMS compared to other techno-pedagogical tools. This stark difference could be explained by various aspects. One is indeed that they are often required by the administration to use the LMS commissioned by the institution and then they become accustomed to using various features of the system. They may also believe that students expect them to use LMS. Contrasting with the statistics on professors who have no *experience* using LMS, it is interesting to note that the percentage of professors with no *LMS training* is much higher. More than a third of them have had no training on LMS. [Appendix B, Table 17](#) shows that around two thirds of all respondents had some training. It appears that even though on one hand, higher education institutions place importance on training their faculty members on these systems, on the other hand, it could demonstrate that training is still an area which needs both institutional support and also more interest from the faculty members. It may also indicate that many professors (33%) are using them without extensive or any training to use them more effectively.

Features or tools of LMS that professors use are tabulated in Table 4, Research Question 1, Results and Data Analysis section. From the options provided, professors rated using email as the most frequently mode of providing feedback. It is possible that even though the option mentioned 'Email within the LMS', they might have inferred it to be emails in general. Discussion forums were next in terms of popularity when providing feedback followed by the assignment submission tool which also allows for professors to upload corrected files with feedback.

Some of the professors indicated that they use email within LMS for feedback but some also use it for assessment. Whereas some professors use LMS for communicating with students and might view it as feedback, those who perceive it as a tool used for assessment could be using it for sending and receiving communication regarding an assignment. Quiz can be classified more specifically as an assessment activity than feedback and the data confirm that more professors have used quiz builder for assessment than feedback.

For the purpose of assessing knowledge, the assignment tool was a clear favourite among professors with 46 of them indicating that they use it. Discussion forum and quiz builder are other tools which professors prefer to assess student knowledge. Therefore, it appeared that the assignment tool and discussion forum are widely used both for providing feedback as well as assessing knowledge. It was also confirmed through the analysis of qualitative data. However, emails are distinctly more popular for providing feedback whereas quiz builder is more popular for assessing knowledge. This could be explained by the fact even though emails are a more established means of connection between professors and students, it is not intuitive to assess students via emails. Professors' inclination to rely on emails for providing feedback could point to a lack of comfort they may experience with other designated tools in LMS for this purpose. It

could be due to a lack in training or their belief about them being ineffective as was reported in the qualitative results section. On the other hand, quiz builders can be useful for assessing student knowledge but they are still not perceived to be effective for providing detailed feedback by the majority of the professors. Having earlier established that professors use more tools in LMS for providing feedback than they do for assessing student knowledge, it appears that quiz builders are not among those which are popular for providing feedback.

The phenomenon of only 18 professors not having used any feedback tool available in LMS compared to 34 professors using none of the LMS tools for assessment purposes can be explained with the reasoning that these professors correctly make the distinction between the two activities. Another rationale for this could be that they view providing feedback not only as a response to an assessment opportunity but also to activities they do not associate with assessing their knowledge, for example, giving instructions and answering other student questions more broadly about the course structure. It could also point to professors giving feedback and conducting assessment activities through additional means than the ones listed or through LMS. Alternatively, since this question is about tools they use, it is possible that they use one or none tools for assessment but many different tools for feedback.

It appears that professors perceive that different tools as being distinct for providing feedback or to assessment students. LMS features that professors use also seems to depend on what they have been using in the past and what they are comfortable with. For example, rubrics and quiz builder tools were not deemed by the participants to be very useful for providing feedback even though they can be considered as alternative tools for formative assessment (Blanco & Ginovart, 2012; Cohen & Sasson, 2016). On the other hand, since emails have been prevalent for longer than any other option, it had the highest frequency of use for formative

assessment purposes. Another factor that determines how many tools professors use for providing feedback is hours of training. Professors who have had no training predictably notified that they have not used any of the tools in LMS while professors who had low level of training and higher level of training used more tools. This aspect was further explored in qualitative interviews and most professors believed that as online and hybrid courses gain popularity, it has emerged as a main factor for them to use these technological tools. As higher education institutions move towards larger classes, assessment features within LMS also become a motivator for professors since it is easier to track student progress for both themselves and students. They also noted that it provides flexibility and ease for students and reduces the need to commute. This reflects the Perceived ease-of-use concept of TAM where Davis (1989) emphasized the need for the user to be free from effort while using a particular system. However, it does not point to perceived benefits of these tools for formative purposes. It does indeed help in tracking student progress which is an important element of formative assessment but they do not perceive it as user-friendly for providing useful feedback.

Most professors also noted the challenges posed by using different assessment tools within LMS and agreed that new technology can be confusing compared to the previous one which they have worked and trained on. John (2015) mentioned this in terms of TAM that instructors are looking for a relative advantage and ease of use when it comes to substituting an older method with new technology. This leads to the need of new technology being more adaptive to the demands of instructor as well as being easy to learn. Contrary to their needs, the LMS in general used by the universities were perceived to be not very user-friendly. Although tools like discussion forums and wiki were cited as useful for peer assessment which is in line

with Gikandi et al., (2011) account of LMS, the overall structure and design of the system was deemed counterintuitive.

Research Question 2: In professors' perspectives, how effective are the LMS assessment tools for formative purposes and what are the factors that determine their effectiveness?

Professors' perceptions about effectiveness of assessment tools in LMS were captured through a series of questions in the quantitative survey. Although most of the results show a neutral trend in responses which points out that professors perceived them to be only moderately effective, face to face/video conferencing were deemed to be ineffective to provide feedback to students on selected response type assessment and open-ended type assessment questions. Comments directly via email were also deemed ineffective for selected response type assessment questions. These trends again seem to suggest that professors are not entirely satisfied with the range of assessment tools which can be used for formative assessment available in LMS.

One of the factors that appeared to impact their effectiveness was teaching level, with the means of each item for graduate classes being invariably higher than the ones for undergraduate classes which exemplifies the point that professors are inclined to give more feedback at higher level of classes. This could be due to the fact that strategies employed to successfully use technological assessment tools at different levels require professors to appreciate the needs of students at those levels. Even though professors' preference to use assessment tools in LMS increased as the class sizes get bigger as depicted by increasing means, it did not do so significantly. The level of studies, however, moderating the preference ratings suggests that professors give more feedback at higher level of classes. Graduate classes tend to be more reflective and conceptual in nature, and this may lead to a different type of feedback from the

professors and consequently a different selection of tools than those professors. As a graduate student, I have also experienced higher expectations from professors in terms of critical and higher order thinking skills. Graduate students also exhibit an inclination to use technology in their courses because it helps them develop their critical thinking skills. Taylor, Ghani, Atas and Fairbrother (2018) also indicated that graduate students enroll in a blended learning courses and used the additional features offered online to deepen their critical thinking abilities.

Mostly neutral values necessitated that I further investigate this question during the qualitative data collection phase. The responses from the professors seemed to corroborate with the quantitative analysis with very mixed perceptions about the assessment tools in LMS with most of them considering the tools to be only marginally effective. One of the recurring themes was that the possibility of quick and efficient feedback system for a large number of students through the tools help professors with their workload. Professors also feel that these tools help students submit and follow up on their assignments more easily and receive detailed feedback. However, some of the limitations expressed were that these tools can usually only assess superficial knowledge with ease and if more detailed assignments like analytical essays need to be evaluated, they are not very helpful or intuitive. This could explain why some specific tools are perceived as more effective than others because they still lack a streamlined and user-friendly method to integrate detailed feedback into professor's assessment of the assignment. Feedback tools for such assessments are also not effective and they have to rely on emails to provide feedback. This further confirms the findings of the quantitative section and points to lack of variety within LMS to help professors deal with different types of evaluation types. Davis (1989) referred to this aspect of TAM as perceived usefulness of the tool.

The conceptual framework refers to Trumpower et al., (2014) who maintain that assessing higher order skills is one of the essential elements of formative assessment. As students are assessed at higher levels and on higher order skills, the findings reveal that professors prefer to give them more feedback as well as want to use more technology tools for providing this feedback. Formative assessment should aid professors to assess higher order skills and it is revealed that at higher teaching level, professors are finding LMS tools comparatively more effective for formative assessment purposes. At the same time, some of the limitations that professors highlighted as well as medium ratings in the quantitative analysis underline the need for LMS to evolve and include more effective assessment tools.

Research Question 3: What could be done to improve the effectiveness of LMS assessment tools for formative purposes or introduce new ones?

One of the methods to improve the effectiveness of LMS assessment tools for formative purposes, besides introducing new ones, is to import assessment data and results by linking with external tools. Some external tools that professors use are clickers, concept mapping software, simulations as well as domain specific software like an application for drawing molecules for Chemistry topics. Some professors mentioned that they generally believed that importing assessment data through linking other software could be improved as well as improving instructor control over tools, there were indeed non-assessment features in LMS that make the software user-friendly. Since professors again indicated that they were generally neutral about LMS's ability to allow to import assessment data and results by linking with external tools, this was explored further in the qualitative section. It became evident through interview responses that they considered importing from or linking other technology tools used for assessment as a difficult task or something that requires further training. Therefore, training is an area which

needs attention, especially because the means for all responses in items of research question 3 tend to increase with the increasing number of hours of training. John (2015, p. 235) refers to an individual's conviction about their skill to use computers as "self efficacy" and mentions that there is a positive correlation between computer self-efficacy and IT adoption. He reasons that since computer self-efficacy is directly related to the perceived usefulness of an information system, it also improves the intention to use the systems. Bandura (1997) attributes this increased adoption to lower anxiety and better training leading to better self efficacy.

The quantitative section about the existing tools in the LMS returned low to medium ratings in addressing the five elements of 1) effectively assessing higher order learning in students, 2) effectively identifying students' strengths and areas of improvement, 3) allowing to provide effective feedback to students, 4) allowing to effectively track student learning over time and 5) being user friendly. These elements of formative assessment as outlined by Ghani and Trumpower (2015) and included in the conceptual framework could also form the basis of improving the effectiveness of LMS assessment tools for formative purposes. Non-conclusive responses in the quantitative section led to further clarifying the results in qualitative section and understand the reasons for low to medium ratings. The additional element of tracking of student progress over time introduced in the new conceptual framework was discussed by professors as a motivator for them to use assessment tools in LMS.

From responses of questions in this section, it was understood that even though the existing LMS allow professors to provide a certain level of feedback to students, it is not done at a desired level. They mentioned that most software, including LMS, only offer a limited number of feedback mechanisms or types of questions. Additionally, professors mentioned other shortcomings of tools available in LMS for meeting the requirements of elements of formative

assessment and for providing detailed feedback. They held the view that these tools lack in effectively assessing higher order learning in students and identifying students' strengths and areas of improvement.

It was also revealed that they can also use LMS to track student progress with built-in portfolio tool. Users can "push" or keep aside files they want to keep into this repository and can also "pull" or retrieve files they need for their course. Adaptive learning features built-in to quiz-builders also automate scaffolding of learning in students. Enriching and enhancing content in blended and online classes help them to cater to different types of learning needs of students. Dissemination of resources and posting of announcements can be done in an easier fashion and larger classes can be managed more effectively.

Research Question 4: What can be done at the manufacturer, institution, instructor, and student levels to encourage and enhance the use of LMS assessment tools?

A majority of the professors held the opinion that manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products. Fewer professors were willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products. To gain an understanding of this phenomenon, it was explored further during the interviews and it became apparent that some of the professors felt that they were not knowledgeable enough about the existing tools to identify the missing links in the LMS pedagogy. It seems that if professors are provided more opportunities to improve their command of assessment tools in LMS and also with better partnership opportunities with the developers, they can be more involved in enhancing those tools. A mutually beneficial partnership between the manufacturers and educational institutions can create solutions for all stakeholders, especially if students are also invited to contribute with their requirements and suggestions.

An important observation from the data, specifically the qualitative data, was that most professors only touched upon the idea of feedback being important for students' learning outcomes. Furthermore, they did not delve into the idea of students taking control of their own learning. This can be partially attributed to the fact that the questions in the survey and the questionnaire were posed by the researcher with a certain viewpoint about the definition of formative assessment. This definition was based on this viewpoint which emphasized that it is a process through which teachers, learners and their peers acquire, interpret, and use the information from assessments to inform and change future actions about instruction. It is not designed differently from any other assessment and it is formative only when students and teachers use the feedback.

There was a variety of experiences that professors highlighted about their use of assessment tools in LMS for formative purposes. Technical issues, time and training were rated as the strongest deterrents by professors from using assessment tools within LMS. An attempt to explain this phenomenon by factors of class size and teaching level revealed that teaching at undergraduate level, class size impacts a professor's perception about 'lack of student competence, technical support, colleague support, and having technical issues' as being the deterrents. This is shown in the table with analysis of variance in Appendix B. Class size does not affect professors' perceptions about these deterrents at graduate level. A possible explanation for this could be the fact that graduate classes are generally not as big as the undergraduate classes and therefore, these deterrents are not as impactful.

In terms of the barriers highlighted in the conceptual framework of this study, institutional and manufacturer barriers as well as lack of student competence have all been reported as obstacles to adoption of assessment tools in LMS. The findings show that all of them

are important to some degree and must to be addressed. It can be inferred that manufacturer barriers are important as highlighted by responses to question about manufacturers of LMS focusing more on technical instead of pedagogical aspects. It reaffirms Kiryakova's (2010) claim about complete adoption of technology that the LMS do not incorporate pedagogy in the design of the software. Ngai, Poon and Chan, (2007) extended the TAM model to include technical support to be one of the major foundations to technology being adopted. They highlighted the results that showed that technical support has a significant and direct effect on perceived ease of use and usefulness of a given technology. Moreover, the results indicated the significance of perceived ease of use and perceived usefulness in managing the relationship of technical support with professors' attitude towards LMS.

According to the least experienced professors, however, the listed items were not very representative of the issues they face while using LMS and that they get least discouraged from using LMS. It may be so because less experience in teaching could mean that the professors have not yet had enough exposure with the tools and the problems associated with using these tools to have struggled with the tools. Alternatively, it could also be that the newer generation of professors are more technologically adept and the listed items are not representative of any of the issues they face. However, additional issues were not brought to attention when inquired during the interviews.

It appears that higher training could affect professors' beliefs towards students lacking competence in using LMS and also strengthens their perception that their respective institutions don't encourage them to use LMS assessment tools. This phenomenon was explored further in qualitative section to understand how professors who have training feel about the role of institution. The interview responses revealed that training and the role of the institution in policy-

making, providing resources and support as well as creating an effective training program for the faculty were popular themes to talk about for professors. All respondents agreed that training is crucial and ongoing developmental programs are beneficial for anyone interested in employing more technology in their classes. Most agreed that a lack of it could be a major deterrent in using technology in general with some terming the training programs at their institution as effective and others perceiving it as not enough. Those who perceived it to be effective, however, identified time as a major barrier for them to attend the training sessions. They expected to be trained further in LMS in order to use the available tools more effectively and even mentioned sponsored training outside of campus. They also expressed their views that policies and structures which are in place can be very influential in encouraging or discouraging professors.

A culture shift inspired by the administration can be crucial for professors to adopt and experiment with technology and also motivate them to seek further training and attend workshops. However, quantitative analysis revealed that there was a disagreement about whether there was enough training being provided on LMS tools by their institution. Professors from Carleton University reported to have higher mean of 4.84 hours which is over an hour more than the mean of 3.77 for University of Ottawa professors.

The cited literature also mentioned Black and Wiliam's (2003b) emphasis on the need for teachers to be trained with the new technology for a more effective adoption of technology. Similarly, Firdyiwiek (1999) discussed an initiative required from the vendors to provide better explanation of tool and training for teachers and administrators. More recently, Taylor et al., (2018) report in their case-based study on blended learning that professors depend on training in order to delve into new methods and technologies to improve students' learning outcomes. This could include conveying to the educators how to use these tools to capture and utilize formative

assessment to enhance learning and domain-specific knowledge. Furthermore, Gil-Flores, Rodríguez-Santero, & Torres-Gordillo (2017) as well as Hennessy, Deaney, Ruthven, & Winterbottom (2007) also emphasized the importance of training in order to ease the pressures of adoption process on instructors and ensure better implementation of new technology. The main concepts in the concept map developed for this study illustrate that instructors bring with them certain attributes, for example, experience and number of hours of training. Training remains central to the needs of instructors to experiment and adapt new technology.

The main responsibility of training, especially for a more complex and multi-faceted software like LMS, usually resides with the institution. Petter, DeLone, and McLean (2013) confirmed that organizational support is a key contributor which can help reap the perceived benefits of LMS. Professors also cited that their institutions have to play an active role in ensuring that they are satisfied with the type and length of training they receive on various components of LMS. Zheng, Wang, Doll, Deng and Williams (2018) presented data which suggests that organizational support does not only come in the shape of providing opportunities to train but also as encouragement to use software further and can result in a better provision of technical support. This leads to professors feeling more comfortable using and experimenting with the untested or new tools within the system (Hsia, Chang, & Tseng, 2014; Sezgin & Erdogan, 2015). When instructors feel more confident in system use, they will actively try to initiate and apply more of the tools provided by LMS to manage larger class size and enhance teaching effectiveness.

Interpreting the results based about professors' opinion that manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products, many solutions presented themselves during data collection phase of this study. Some of them could likely

already be in place or practiced but these recommendations are based on what professors perceive to be crucial ingredients to an effective development and use of assessment tools in LMS. Following are a few of these recommendations for each level:

Manufacturers

One of the methodologies that manufacturers can utilize for specific guidelines for tool development is design science (Wieringa, 2014). Since it focuses on the development and evaluation of performance of tools, design science research can be applied to some of the following recommendations for LMS development.

1. They can involve experienced professor participation by way of focus groups or consultation. Design science recommends involving stakeholders and considering how their requirements will lead to the desired goals in the design of the tool. Stakeholders are to be involved at design as well as the evaluation phase. Treatment validation can be used to check if the requirements of professors to include a certain feature allows them to assess learning outcomes as intended.
2. Developers could test the tools from an instructor and student points of view in order to examine tools' user-friendliness. Evaluations in design science are conducted by stakeholders and the developers of the tools in order to measure how the designs and features contribute to goals. Following a methodology like design science will aid in evaluating and moving to a new design which can satisfy the requirements more effectively.
3. Testers should include non-technical people and also include people from different generations and experience level.

4. Question and course types could be varied and customized according to the demands of modern teaching methods and new classrooms.

Institutions

1. Institutions can create an environment of exchange between their LMS provider and more stakeholders within the institutions which will allow professors, students and administrators to share their viewpoints about what their expectations are from the system.
2. Provide numerous opportunities to train professors on different assessment and other tools in LMS. An ongoing training program can allow professors to continuously enhance their skills as well as confidence in using the system.
3. Faculty and department heads could take steps to address the time and workload aspects related to training of the professors which would facilitate their participation.
4. Students could also benefit from a training program geared towards better understanding of the tools which would enrich their experience as well as improve their interaction with the instructor and the course material.

Instructors

1. Professors who exhibited interest in online and blended learning courses and experimented with course redesign based on the new pedagogical formats seemed more positive about using technological tools for formative assessment. With these formats gaining higher levels of popularity, professors could benefit from the resources to reshape their courses based on them.

2. Engaging with administrators and LMS providers, when possible, could address some of the challenges that professors face. This would be possible with an open exchange and communication between the faculty and the administration. Furthermore, a faculty culture inclined to use technological tools for formative assessment would inculcate much-needed support structure. Faculty champions and technical support personnel could be valuable pillars of guidance for best practices for anyone wishing to implement the existing tools for formative purposes. The majority of participants highlighted that sharing best practices in using technology for formative assessment would make it easier for professors to focus their energies towards helping students achieve better learning outcomes.
3. Engaging students with creating easier exercises using the technological tools before a major assessment is due can help students use the tools in an improved manner.

Students

1. Students could be encouraged to utilize on-campus training opportunities as well as off-campus and online tutorials available to help them navigate through the system in general and better extract the benefits of the assessment tools specifically. If professors gain a high level of proficiency in using feedback tools after developers invest time and efforts to enhance them, yet students are not equipped to utilize the feedback through the system, then this exercise would ultimately be futile. It would mean that students could have more scaffolding and support in their formative years early in their undergraduate careers. This could also lead to a short training program

for students from the computer services which could prepare students to the kind of online exercises that graduate students do on LMS.

2. Students could also receive in class or online step by step instructions by the professors outlining how to engage with the system and what is expected of them in terms of using the feedback cycle. Again, since graduate students are commonly more experienced in using LMS tools and professors would have to pay additional attention to bring undergraduate students to a comfort level where they can be assessed with different technological tools.

CHAPTER 4: LIMITATIONS AND SIGNIFICANCE OF THE STUDY

There were several areas of improvement in the research design of this study:

1. This study focused on the perceptions of instructors to understand the effectiveness of LMS for formative assessment purposes. Students are the recipients of this feedback and their opinions must also be sought to comprehensively understand the effectiveness and shortcomings of LMS.
2. The sample in this study was taken from two very similar higher education institutions within the same region with particular demographical characteristics. A similar study could expand the sample to colleges and universities in diverse geographical region with diverse demographics.
3. The quantitative survey was distributed towards the end of a winter semester which could have impacted the response rate. A dissemination date in the middle of a regular semester might be a more suitable alternative to receive a higher number of responses.
4. A definition of various items, like ‘formative assessment’ was provided in the survey to help professors complete the survey. However, this definition was not repeated during the

interviews. I believe repeating this definition and providing short, focused ideas in the email sent prior to the interview, would have helped elicit more relevant responses from the professors, which was not always the case. Professors sometimes answered about assessment in general when a question about formative assessment was asked and did not make the connection to LMS tools they use.

5. Additionally, the language used in the questions in the survey and qualitative questionnaire was based on a definition of formative assessment which could have led to a limited range of responses from the professors. This definition focused on teachers providing feedback to students to help them improve learning outcomes. Also, the questions focused on LMS tools more than the activities that LMS enabled the professors to do. This could have broadened the conception of possibilities within LMS for the *process* of formative assessment.
6. I learned that professors like to talk about issues facing them with technology and can be very passionate about it. I could have prepared for these sessions especially at the start of the interview. Since the professors spent plenty of time talking about problems with technology, a set of probes redirecting them to focus on topics related to study's research questions to harvest more data from a rich source.

Implications for theory and practice

Teachers' contribution to the developments process of certain features of LMS to provide pedagogical depth can be further investigated. This can help the development companies produce better solutions and help teachers and students with more streamlined feedback mechanism.

Considering these insights, teachers can provide the needed scaffolding to facilitate the use of formative assessment using technology in general.

Another implication of advancement of knowledge from this study is how the field of blended learning can benefit from improvements in the tools for formative assessment within LMS. Blended learning, which is often seen as 21st century pedagogy for universities (Cheung & Hew, 2011), heavily depends on software like LMS to conduct mainly its out-of-class activities and pedagogy. For blended learning instructors to engage their students in higher-order and critical thinking through formative assessment, this study can provide a path forward and act as an important building block towards improvement.

Although this study strives to shed light on teacher's perceptions about use of assessment tools in LMS, students' perceptions about the type, amount and quality of feedback they receive through the LMS was outside the scope of this study. As well, administrators' goals and challenges could also be delved into to understand how their decisions are impacted by their knowledge of features of LMS and perceptions of both professors and students about the efficacy of these features.

One of the strategies to solve the issue of LMS not incorporating pedagogy in the design of the software could be to go back to the theoretical underpinning of this domain. Cognitive as well as social processes that guide learning could also be used as models for creating the process flowcharts for the software. Teachers, and possibly administrative personnel to a lesser extent, could be incorporated in the software development lifecycle in order to understand their needs at each step of the process. Another initiative which is required from the vendors is a better explanation of tool and training of teachers and administrators. Additional options could include conveying to the educators how to use these tools to capture and utilize formative assessment to enhance learning and domain-specific knowledge.

The present study highlights a paucity of research on the role the instructors in preparing or conducting formative assessment tasks using tools within LMS. This study attempts to illuminate the needs of instructors and also to address their perceptions about effectiveness of LMS tools for providing feedback. Therefore, it endeavours to fill a gap in this domain in higher education. It also contributes by using mixed methods to study a topic related to higher education assessment with technology in greater depth.

One of the shortcomings of this study is the limited nature of the language used for creating the survey and the questionnaire. Even though the discussions were not deliberately directed towards a broader definition and also a more modern view of formative assessment, there was a general lack of initiative from the professors to talk about the student-centric perspective of formative assessment. This could indicate a need for professors to understand the changing landscape of assessment and also points to investing in building teacher capacity within the evolving assessment culture as prescribed by Klinger et al. (2012). The discussions during the interviews illuminated that it might not be that LMS are limited in the options they offer but it could be that many professors' understanding of formative assessment leads them to perceive LMS from a teacher-centric perspective.

It is pertinent to note that the modern view of student-centric formative assessment where students self regulate and monitor their learning is more in line with the original definition of the word 'assess' as described in the Definition of Terms section. This also points to the ideas discussed regarding training and why sometimes these initiatives from the institutions are not very popular and fruitful. Perhaps once instructors are aware of the limited nature of their understanding of assessment and specifically formative assessment, they would be more encouraged to learn about and use LMS for providing more formative opportunities to their

students. Thus, a possible solution could be a multi-phase training schedule beginning with understanding of the breadth of possibilities of formative assessment. Re-imagining formative assessment as a process and what is required to accomplish that process, leading into how LMS can serve this purpose to accomplish it could help professors approach it in a different way. It is possible that their current perception of the limitations of LMS for formative assessment is based on their limited conception of formative assessment. This study will open up more avenues for future research based on the findings. Follow up studies can be done to envisage students' and administrators' perceptions about the effectiveness and challenges of assessment tools for formative purposes in LMS. Further studies can also be done to understand the processes by which teachers can use the tools more effectively. The design of the survey could be easily adapted and extended to other contexts and other higher education institutes. Similarly, it could be expanded to include other LMS or broadly, more e-assessment tools.

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APPENDICES

Appendix A – Data collection instruments

Perceived Effectiveness of Assessment Tools for Formative Purposes in Learning Management Systems (LMS)

University: _____

1. Which discipline do you teach in? _____
 2. What position do you hold at your institution? _____
 - a. Full time professor
 - b. Part time professor
 - c. Adjunct professor
 - d. Term limited non-union professor
 3. At what level do you teach? _____
 - a. Undergraduate
 - b. Graduate
 - c. Both
 4. What is the average class size you normally teach for the following levels?
 - a. Undergraduate _____
 - b. Graduate _____
 5. How many years of experience do you have teaching at the higher education level? _____
 6. How many years of experience do you have teaching using an LMS (for example, Blackboard Learn or Moodle)? _____
 7. How many years of experience do you have teaching using a **non-LMS** technological tool (for example, concept mapping software)? _____
 8. Approximately how many hours of training have you had with any LMS? _____
- I. RQ1 Which learning management solutions features are currently being used and what are the factors which determine what professors use?**
9. Which of the following LMS features have you used for the following purposes? For each feature, please indicate if you have used it for either providing detailed feedback or for assessing student knowledge, by placing a check in the corresponding box. If you have not used a particular feature for either purpose, then leave both boxes blank.

LMS feature	Purpose	
	a. For providing detailed feedback	b. For assessing student knowledge
i. Quiz builder	_____	_____
ii. Discussion Forum	_____	_____
iii. Comments box with submission	_____	_____
iv. Email within the LMS	_____	_____
v. Wiki	_____	_____
vi. Blogs	_____	_____
vii. Journal	_____	_____

- viii. Assignment Tool
- ix. Rubrics
- x. Other (please specify)

INSTRUCTION: Circle from 1 to 5, where applicable, to indicate how frequently you use an LMS for this purpose (1 = 'Never', 2 = 'Rarely', 3 = 'Sometimes', 4 = 'Frequently', and 5 = 'Very Frequently').

10. I have used an LMS for classroom management/administrative purposes (for example, posting important announcements on the bulletin board).

1 2 3 4 5

11. I have used an LMS for instructional purposes (for example, posting an instructional video).

1 2 3 4 5

12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).

1 2 3 4 5

13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).

1 2 3 4 5

II. RQ2 How effective are the LMS assessment tools for formative purposes and what are the factors that determine their effectiveness?

INSTRUCTION: Circle from 1 to 5, where applicable, with: 1 = 'strongly disagree'; 2 = 'disagree'; 3 = 'neutral'; 4 = 'agree'; and 5 = 'strongly agree'.

14. I always give detailed feedback to students on their assessments.

1 2 3 4 5

15. The **LMS that I use** provides an effective mechanism for giving feedback to students on **selected response type assessment questions** (e.g., multiple choice, True/False, etc.).

1 2 3 4 5

16. Providing **comments on a word processed file that is then uploaded/mailed via LMS** is an effective way to give feedback to students on **selected response type** assessment questions (e.g., multiple choice, True/False, etc.).

1 2 3 4 5

17. Providing **comments directly via email** is an effective way to give feedback to students on **selected response type** assessment questions (e.g., multiple choice, True/False, etc.).

1 2 3 4 5

18. Providing **comments via Face to Face (F2F)/Video Conferencing** is an effective way to give feedback to students on **selected response type** assessment questions (e.g., multiple choice, True/False, etc.).

1 2 3 4 5

19. The **LMS that I use provides an effective mechanism** for giving feedback to students on **open ended type** assessment questions (e.g., essays, problems to solve, etc.).
1 2 3 4 5
20. Providing **comments on a word processed file that is then uploaded/mailed via LMS** is an effective way to give feedback to students on **open ended type** assessment questions (e.g., essays, problems to solve, etc.). 1 2 3 4 5
21. Providing **comments directly via email** is an effective way to give feedback to students on **open ended type** assessment questions (e.g., essays, problems to solve, etc.).
1 2 3 4 5
22. Providing **comments via Face to Face (F2F)/Video Conferencing** is an effective way to give feedback to students on **open ended type** assessment questions (e.g., essays, problems to solve, etc.).
1 2 3 4 5

III. RQ3 What could be done to improve the effectiveness of the tools or introduce new ones?

INSTRUCTION: Circle from 1 to 5, where applicable, with: 1 = ‘strongly disagree’; 2 = ‘disagree’; 3 = ‘neutral’; 4 = ‘agree’; and 5 = ‘strongly agree’.

23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).
1 2 3 4 5
24. I feel that the existing tools in the LMS:
- a. allow me to effectively assess higher order learning in my students
1 2 3 4 5
 - b. allow me to effectively identify my students’ strengths and areas of improvement
1 2 3 4 5
 - c. allow me to provide effective feedback to my students
1 2 3 4 5
 - d. allow me to effectively track student learning over time
1 2 3 4 5
 - a. are user friendly
1 2 3 4 5

IV. RQ4 What can be done to encourage and enhance their use (manufacturer, institution, instructor, student level)?

INSTRUCTION: Circle from 1 to 5, where applicable, with: 1 = ‘strongly disagree’; 2 = ‘disagree’; 3 = ‘neutral’; 4 = ‘agree’; and 5 = ‘strongly agree’.

25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.
1 2 3 4 5

26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products. 1 2 3 4 5

27. I often get deterred from using the assessment tools in an LMS because:

- a. Student's lack competence in working with the LMS and feedback system
1 2 3 4 5
- b. There is a lack of institutional encouragement for using assessment tools in LMS.
1 2 3 4 5
- c. There is a lack of financial support at my institution.
1 2 3 4 5
- d. There is a lack of technical support at my institution.
1 2 3 4 5
- e. There is a lack of support from other colleagues.
1 2 3 4 5
- f. I do not have adequate training on the LMS. 1 2 3 4 5
- g. I do not have enough time. 1 2 3 4 5
- h. I experience technical issues when using LMS. 1 2 3 4 5
- i. Others, please explain

Interview Schedule

1. What motivates you to try assessment tools available within learning management systems?
2. What kind of challenges, if any, did you face using different assessment tools within LMS?
3. You mentioned that you are willing to aid developers if required. What are some of the points you will include for improvement?
4. In your perspective, what elements of LMS make them effective for formative assessment? What are some of the limitations in this regard?
5. How much does the institutional environment affect your willingness to use assessment tools formatively?
6. How has your experience been with importing from or linking other technology tools? Examples?
7. How should we create a faculty culture that is more inclined to use formative assessment within LMS?
8. What factors motivate you to use formative assessment in LMS?
9. Do you have anything else to share about your experience with using assessment tools within LMS?

Appendix B

Table 1: Means and standard deviations for the complete set of questions

Questions	N	Missing	Mean	Std. Deviation
Which university do you work for?	99	0	1.566	.4982
1. Which discipline do you teach in?	99	0		
Faculty	99	0		
2. What position do you hold at your institution?	98	1	1.69	.968
3. At what level do you teach?	99	0	1.949	.9516
4. What is the average class size you normally teach for the following levels? | Undergraduate	82	17	82.21	74.073
undergrad size code	88	11	1.818	.8912
4. What is the average class size you normally teach for the following levels? | Graduate	50	49	17.40	9.725
grad size code	51	48	1.51	.543
5. How many years of experience do you have teaching at the higher education level?	99	0	13.823	9.2649
Highered.Expcode	99	0	2.1313	.76461
6. How many years of experience do you have teaching using an LMS (for example, Blackboard Learn or Moodle)?	99	0	7.035	3.7541
LMS exp. Code	99	0	2.07	.836
7. How many years of experience do you have teaching using a non-LMS technological tool (for example, concept mapping software)?	91	8	2.780	6.3365
Non LMS exp. Code	91	8	.60	1.094
8. Approximately how many hours of training have you had with any LMS?	99	0	4.374	7.2133
hrs of training codes	99	0	1.000	.8330
9a1	13	86	1.00	.000
9a2	46	53	1.000	.0000
9a3	35	64	1.00	.000
9a4	66	33	1.000	.0000
9a5	3	96	1.00	.000
9a6	4	95	1.00	.000
9a7	7	92	1.00	.000
9a8	40	59	1.00	.000
9a9	18	81	1.00	.000

9a10	10	89	1.00	.000
Total 9a	99	0	2.444	1.8139
T9aCode	99	0	.8182	.38766
9b1	26	73	1.00	.000
9b2	29	70	1.00	.000
9b3	10	89	1.00	.000
9b4	10	89	1.00	.000
9b5	4	95	1.00	.000
9b6	7	92	1.00	.000
9b7	6	93	1.00	.000
9b8	46	53	1.00	.000
9b9	14	85	1.00	.000
9b10	4	95	1.00	.000
Total 9b	99	0	1.576	1.5720
T9bCode	99	0	.6566	.47727
10. I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	99	0	4.455	.9505
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	99	0	3.818	1.4240
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	97	2	3.361	1.5558
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	99	0	3.242	1.4921
14. I always give detailed feedback to students on their assessments.	97	2	4.320	.7712
AlwaysFBCode	97	2	.8351	.37306
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	94	5	3.138	1.2495
16. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	94	5	2.840	1.2810
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	94	5	2.787	1.3825

18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	90	9	2.556	1.3417
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	94	5	3.160	1.2977
20. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	97	2	3.371	1.3096
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	97	2	3.216	1.3403
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	94	5	2.723	1.3943
23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	93	6	2.602	1.0544
24. I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	98	1	2.867	1.0711
24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	98	1	2.786	1.0769
24. I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	98	1	3.255	1.1243
24. I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	98	1	3.041	1.1746
24. I feel that the existing tools in the LMS that I use: | e. are user friendly	96	3	2.719	1.2624
25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	95	4	3.674	.8435
26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	95	4	3.137	1.1262
27. I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	94	5	3.011	1.1406

27. I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	94	5	2.606	1.2023
27. I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	94	5	2.840	1.1388
27. I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	94	5	2.649	1.1426
27. I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	94	5	2.596	1.0607
27. I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	94	5	3.032	1.2133
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	94	5	3.532	1.1796
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	93	6	3.473	1.0894
27. I often get deterred from using the assessment tools in an LMS because: | i. Others	37	62	3.541	1.2382

Table 2: University affiliation

	Frequency	Percent
University of Ottawa	43	43.4
Carleton University	56	56.6
Total	99	100.0

Table 3: Professors' discipline

	Frequency	Percent
	12	12.1
Arts / Social science	1	1.0
Arts/Faculty of Arts and Social Sciences	1	1.0
Business	11	11.1
Computer Science	2	2.0
Education	4	4.0
Engineering	6	6.1

Faculty of Arts	8	8.1
Faculty of Arts and Social Sciences	16	16.2
Faculty of Health Sciences	2	2.0
Faculty of Law	4	4.0
Faculty of Medicine	1	1.0
Faculty of Public Affairs	12	12.1
Faculty of Science	8	8.1
Faculty of Social Sciences	8	8.1
Journalism and Communication - Carleton University	2	2.0
School of Information Technology	1	1.0
Total	99	100.0

Table 4: Professors' position/rank

2. What position do you hold at your institution?

	Frequency	Percent
Full time professor	58	59.2
Part time professor	19	19.4
Adjunct professor	14	14.3
Term limited non-union professor	7	7.1
Total	98	100.0
Missing System	1	
Total	99	

Table 5: Level at which professors teach

3. At what level do you teach?

	Frequency	Percent
Undergraduate	47	47.5
Graduate	10	10.1
Both	42	42.4
Total	99	100.0

Table 6: Average class size at undergraduate level**4. What is the average class size you normally teach for the following****levels? | Undergraduate**

	Frequency	Percent
12	1	1.2
14	1	1.2
15	1	1.2
20	6	7.3
24	1	1.2
25	5	6.1
28	1	1.2
30	8	9.8
33	1	1.2
37	1	1.2
40	4	4.9
45	1	1.2
48	1	1.2
50	6	7.3
55	1	1.2
60	5	6.1
65	2	2.4
70	3	3.7
75	2	2.4
80	3	3.7
85	1	1.2
90	5	6.1
100	5	6.1
110	1	1.2
120	2	2.4
150	3	3.7
180	1	1.2
200	6	7.3
240	1	1.2
250	1	1.2
350	1	1.2
400	1	1.2
Total	82	100.0
Missing System	17	

Total	99
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Table 7: Categories of average class size at undergraduate level

undergrad size code		
	Frequency	Percent
0	6	6.8
1-39	26	29.5
40-99	34	38.6
100+	22	25.0
Total	88	100.0
Missing System	11	
Total	99	

Table 8: Average class size at graduate level

4. What is the average class size you normally teach for the following levels? | Graduate

	Frequency	Percent
7	1	2.0
8	5	10.0
10	7	14.0
12	8	16.0
13	2	4.0
15	8	16.0
18	1	2.0
20	8	16.0
25	3	6.0
30	3	6.0
33	1	2.0
35	1	2.0
50	2	4.0
Total	50	100.0
Missing System	49	
Total	99	

Table 9: Categories of average class size at graduate level

grad size code			
	Frequency	Percent	Cumulative Percent

	0	1	1.0	2.0	2.0
	1-14	23	23.2	45.1	47.1
	15+	27	27.3	52.9	100.0
	Total	51	51.5	100.0	
Missing	System	48	48.5		
Total		99	100.0		

Table 10: Years of experience teaching at higher education level

5. How many years of experience do you have teaching at the higher education level?

	Frequency	Percent
1.0	2	2.0
2.0	3	3.0
3.0	1	1.0
3.5	1	1.0
4.0	6	6.1
5.0	5	5.1
6.0	3	3.0
7.0	2	2.0
8.0	9	9.1
9.0	6	6.1
10.0	16	16.2
12.0	6	6.1
13.0	2	2.0
14.0	1	1.0
15.0	5	5.1
17.0	1	1.0
18.0	2	2.0
19.0	2	2.0
20.0	3	3.0
21.0	1	1.0
23.0	2	2.0
24.0	1	1.0
25.0	6	6.1
26.0	1	1.0
28.0	1	1.0
30.0	7	7.1
32.0	1	1.0

35.0	2	2.0
42.0	1	1.0
Total	99	100.0

Table 11: Categories of years of experience teaching at higher education level

Highered.Expcode		
	Frequency	Percent
Low	23	23.2
Medium	40	40.4
High	36	36.4
Total	99	100.0

Table 12: Years of experience teaching using LMS

6. How many years of experience do you have teaching using an LMS (for example, Blackboard Learn or Moodle)?

	Frequency	Percent
.0	5	5.1
1.0	1	1.0
2.0	3	3.0
3.0	11	11.1
3.5	1	1.0
4.0	8	8.1
5.0	9	9.1
6.0	9	9.1
7.0	5	5.1
8.0	7	7.1
9.0	7	7.1
10.0	22	22.2
12.0	6	6.1
15.0	4	4.0
16.0	1	1.0
Total	99	100.0

Table 13: Categories of years of experience teaching using LMS

LMS exp. Code		
	Frequency	Percent
None	5	5.1

1-3	16	16.2
4-9	45	45.5
10+	33	33.3
Total	99	100.0

Table 14: Years of experience teaching using non-LMS technology tool

7. How many years of experience do you have teaching using a non-LMS technological tool (for example, concept mapping software)?

Ratings	Frequency	Percent
.0	67	73.6
1.0	1	1.1
2.0	3	3.3
3.0	1	1.1
4.0	3	3.3
5.0	1	1.1
7.0	2	2.2
8.0	1	1.1
10.0	2	2.2
11.0	1	1.1
12.0	2	2.2
15.0	3	3.3
20.0	1	1.1
24.0	1	1.1
30.0	2	2.2
Total	91	100.0
Missing System	8	
Total	99	100.0

Table 15: Categories of years of experience teaching using non-LMS technological tool

Non LMS exp. Code	Frequency	Percent
None	67	73.6
1-3	5	5.5

4-9	7	7.7
10+	12	13.2
Total	91	100.0
Missing System	8	
Total	99	

Table 16: Hours of training on LMS

8. Approximately how many hours of training have you had with any LMS?

	Frequency	Percent
.0	34	34.3
1.0	11	11.1
2.0	15	15.2
3.0	5	5.1
4.0	5	5.1
5.0	7	7.1
6.0	2	2.0
7.0	1	1.0
8.0	1	1.0
9.0	1	1.0
10.0	9	9.1
15.0	2	2.0
16.0	1	1.0
20.0	1	1.0
25.0	1	1.0
30.0	1	1.0
35.0	1	1.0
40.0	1	1.0
Total	99	100.0

Table 17: Categories Hours of training on LMS

hrs of training codes

	Frequency	Percent	Percent
None	34	34.3	34.3
1-3 (Low)	31	31.3	31.3
4+ (High)	34	34.3	34.3
Total	99	100.0	100.0

Table 18: Use of LMS for classroom management/administration purposes

10. I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).

	Frequency	Percent
1.0	4	4.0
3.0	8	8.1
4.0	22	22.2
5.0	65	65.7
Total	99	100.0

Table 19: Use of LMS for instructional purposes

11. I have used an LMS for instructional purposes (for example, posting an instructional video).

	Frequency	Percent
1.0	14	14.1
2.0	5	5.1
3.0	11	11.1
4.0	24	24.2
5.0	45	45.5
Total	99	100.0

Table 20: Use of LMS for assessment purposes

12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).

	Frequency	Percent
1.0	21	21.6
2.0	8	8.2
3.0	17	17.5
4.0	17	17.5
5.0	34	35.1
Total	97	100.0
Missing System	2	
Total	99	

Table 21: Use of LMS for formative assessment purposes

13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).

	Frequency	Percent
1.0	20	20.2
2.0	11	11.1
3.0	22	22.2
4.0	17	17.2
5.0	29	29.3
Total	99	100.0

Table 22: Giving detailed feedback to students on their assessments

14. I always give detailed feedback to students on their assessments.

	Frequency	Percent
2.0	1	1.0
3.0	15	15.5
4.0	33	34.0
5.0	48	49.5
Total	97	100.0
Missing System	2	
Total	99	

Table 23: Categories of giving detailed feedback to students on their assessments

AlwaysFBCode	Frequency	Percent
.00	16	16.5
1.00	81	83.5
Total	97	100.0
Missing System	2	
Total	99	

Table 24: Effective mechanism for giving feedback to students on selected response type assessment questions

15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).

	Frequency	Percent
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1.0	14	14.9
2.0	9	9.6
3.0	37	39.4
4.0	18	19.1
5.0	16	17.0
Total	94	100.0
Missing	5	
Total	99	

Table 25: Providing comments on a word processed file that is then uploaded via LMS effective way to give feedback on selected response type assessment questions

16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).

	Frequency	Percent
1.0	22	23.4
2.0	11	11.7
3.0	29	30.9
4.0	24	25.5
5.0	8	8.5
Total	94	100.0
Missing	5	
Total	99	

Table 26: Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions

17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).

	Frequency	Percent
1.0	25	26.6
2.0	14	14.9
3.0	23	24.5
4.0	20	21.3
5.0	12	12.8
Total	94	100.0
Missing System	5	
Total	99	

Table 27: Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions

18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).

	Frequency	Percent
1.0	29	32.2
2.0	13	14.4
3.0	26	28.9
4.0	13	14.4
5.0	9	10.0
Total	90	100.0
Missing System	9	
Total	99	

Table 28: LMS provides an effective mechanism for giving feedback on open ended type assessment questions

19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).

	Frequency	Percent
1.0	15	16.0
2.0	10	10.6
3.0	31	33.0
4.0	21	22.3
5.0	17	18.1
Total	94	100.0
Missing System	5	
Total	99	

Table 29: Providing comments on a word processed file that is then uploaded via LMS is an effective way to give feedback on open ended type assessment questions

20. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).

	Frequency	Percent
1.0	14	14.4
2.0	6	6.2
3.0	30	30.9

	4.0	24	24.7
	5.0	23	23.7
	Total	97	100.0
Missing		2	
Total		99	

Table 30: Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions

21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).

	Frequency	Percent	
	1.0	16	16.5
	2.0	13	13.4
	3.0	19	19.6
	4.0	32	33.0
	5.0	17	17.5
	Total	97	100.0
Missing System		2	
Total		99	

Table 31: Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions

22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).

	Frequency	Percent	
	1.0	28	29.8
	2.0	11	11.7
	3.0	26	27.7
	4.0	17	18.1
	5.0	12	12.8
	Total	94	100.0
Missing System		5	
Total		99	

Table 32: Providing LMS I use allows me to import assessment data and results by linking with external tools

23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).

	Frequency	Percent
1.0	22	23.7
2.0	11	11.8
3.0	42	45.2
4.0	18	19.4
Total	93	100.0
Missing System	6	
Total	99	

Table 33: Tools in the LMS allow me to effectively assess higher order learning in my students

24. I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students

	Frequency	Percent
1.0	14	14.3
2.0	18	18.4
3.0	36	36.7
4.0	27	27.6
5.0	3	3.1
Total	98	100.0
Missing System	1	
Total	99	

Table 34: Tools in the LMS allow me to effectively identify my students' strengths and areas of improvement

24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement

	Frequency	Percent
1.0	17	17.3
2.0	16	16.3
3.0	38	38.8
4.0	25	25.5
5.0	2	2.0
Total	98	100.0
Missing System	1	
Total	99	

Table 35: Tools in the LMS allow me to provide effective feedback to my students

24. I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students

	Frequency	Percent
1.0	13	13.3
2.0	4	4.1
3.0	35	35.7
4.0	37	37.8
5.0	9	9.2
Total	98	100.0
Missing System	1	
Total	99	

Table 36: Tools in the LMS allow me to effectively track student learning over time

24. I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time

	Frequency	Percent
1.0	15	15.3
2.0	12	12.2
3.0	33	33.7
4.0	30	30.6
5.0	8	8.2
Total	98	100.0
Missing System	1	
Total	99	

Table 37: Tools in the LMS are user friendly

24. I feel that the existing tools in the LMS that I use: | e. are user friendly

	Frequency	Percent
1.0	22	22.9
2.0	20	20.8
3.0	24	25.0
4.0	23	24.0
5.0	7	7.3
Total	96	100.0
Missing System	3	
Total	99	

Table 38: Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products

25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.

	Frequency	Percent
2.0	5	5.3
3.0	39	41.1
4.0	33	34.7
5.0	18	18.9
Total	95	100.0
Missing System	4	
Total	99	

Table 39: Consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products

26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.

Ratings	Frequency	Percent
1.0	9	9.5
2.0	16	16.8
3.0	34	35.8
4.0	25	26.3
5.0	11	11.6
Total	95	100.0
Missing System	4	
Total	99	

Table 40: I often get deterred from using the assessment tools in an LMS because of student's lack competence in working with the LMS and feedback system

27. I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system

Ratings	Frequency	Percent
1.0	10	10.6
2.0	22	23.4
3.0	27	28.7
4.0	27	28.7
5.0	8	8.5

Total	94	100.0
Missing System	5	
Total	99	

Table 41: I often get deterred from using the assessment tools in an LMS because there is a lack of institutional encouragement for using assessment tools in LMS

27. I often get deterred from using the assessment tools in an LMS

because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.

Ratings	Frequency	Percent
1.0	20	21.3
2.0	24	25.5
3.0	32	34.0
4.0	9	9.6
5.0	9	9.6
Total	94	100.0
Missing System	5	
Total	99	

Table 42: I often get deterred from using the assessment tools in an LMS because there is a lack of financial support at my institution

27. I often get deterred from using the assessment tools in an LMS

because: | c. There is a lack of financial support at my institution.

Ratings	Frequency	Percent
1.0	12	12.8
2.0	23	24.5
3.0	37	39.4
4.0	12	12.8
5.0	10	10.6
Total	94	100.0
Missing System	5	
Total	99	

Table 43: I often get deterred from using the assessment tools in an LMS because there is a lack of technical support at my institution

27. I often get deterred from using the assessment tools in an LMS

because: | d. There is a lack of technical support at my institution.

Ratings	Frequency	Percent
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	1.0	16	17.0
	2.0	28	29.8
	3.0	30	31.9
	4.0	13	13.8
	5.0	7	7.4
	Total	94	100.0
Missing	System	5	
Total		99	

Table 44: I often get deterred from using the assessment tools in an LMS because there is a lack of support from other colleagues

27. I often get deterred from using the assessment tools in an LMS

because: | e. There is a lack of support from other colleagues.

Ratings	Frequency	Percent
1.0	17	18.1
2.0	24	25.5
3.0	37	39.4
4.0	12	12.8
5.0	4	4.3
Total	94	100.0
Missing	System	5
Total		99

Table 45: I often get deterred from using the assessment tools in an LMS because I do not have adequate training on LMS

27. I often get deterred from using the assessment tools in an LMS

because: | f. I do not have adequate training on the LMS.

Ratings	Frequency	Percent
1.0	12	12.8
2.0	21	22.3
3.0	23	24.5
4.0	28	29.8
5.0	10	10.6
Total	94	100.0
Missing	System	5
Total		99

Table 46: I often get deterred from using the assessment tools in an LMS because I do not have enough time

27. I often get deterred from using the assessment tools in an LMS

because: | g. I do not have enough time.

Ratings	Frequency	Percent
1.0	6	6.4
2.0	11	11.7
3.0	28	29.8
4.0	25	26.6
5.0	24	25.5
Total	94	100.0
Missing System	5	
Total	99	

Table 47: I often get deterred from using the assessment tools in an LMS because I experience technical issues when using the LMS

27. I often get deterred from using the assessment tools in an LMS

because: | h. I experience technical issues when using the LMS.

Ratings	Frequency	Percent
1.0	6	6.5
2.0	11	11.8
3.0	23	24.7
4.0	39	41.9
5.0	14	15.1
Total	93	100.0
Missing System	6	
Total	99	

Table 48: I often get deterred from using the assessment tools in an LMS because of other purposes

27. I often get deterred from using the assessment tools in an LMS

because: | i. Others

Ratings	Frequency	Percent
1.0	3	8.1
2.0	3	8.1

	Sig. (2-tailed)	.711	.020	.586	.018	.001	.008	.000	.000	.000
	N	99	99	91	99	99	99	99	99	97
11.	Pearson Correlation	.031	.245*	.195	.215*	.359**	.261**	.552**	1	.364**
	Sig. (2-tailed)	.759	.015	.064	.032	.000	.009	.000		.000
	N	99	99	91	99	99	99	99	99	97
12.	Pearson Correlation	.037	.105	.305**	.250*	.561**	.493**	.367**	.364**	1
	Sig. (2-tailed)	.718	.307	.004	.014	.000	.000	.000	.000	.000
	N	97	97	89	97	97	97	97	97	97
13.	Pearson Correlation	.036	.077	.242*	.242*	.589**	.349**	.375**	.328**	.694**
	Sig. (2-tailed)	.721	.450	.021	.016	.000	.000	.000	.001	.000
	N	99	99	91	99	99	99	99	99	97

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 50 – Correlations between 13, 14 and 24

		Correlations							
				24. I feel that the existing tools in the LMS that I use: | a. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	24. I feel that the existing tools in the LMS that I use: | d. I always give detailed feedback to students on their assessments .	24. I feel that the existing tools in the LMS that I use: | a. I always give detailed feedback to students on their assessments .	24. I feel that the existing tools in the LMS that I use: | b. I allow me to effectively identify my students' strengths and areas of improvement	24. I feel that the existing tools in the LMS that I use: | c. I allow me to effectively provide effective feedback to my students	24. I feel that the existing tools in the LMS that I use: | e. I track student learning over time
13. I have used an LMS for formative assessment purposes (for	Pearson Correlation	1	.331**	.508**	.479**	.576**	.551**	.354**	
	Sig. (2-tailed)		.001	.000	.000	.000	.000	.000	

example, providing feedback to students).	N		99	97	98	98	98	98	96
14. I always give detailed feedback to students on their assessments.	Pearson Correlatio n Sig. (2- tailed)		.331**	1	.172	.203*	.044	.169	-.007
	N		97	97	96	96	96	96	94
24. I feel that the existing tools in the LMS that I use: |	Pearson Correlatio n		.508**	.172	1	.824**	.602**	.734**	.606**
a. allow me to effectively assess higher order learning in my students	Sig. (2- tailed)		.000	.094		.000	.000	.000	.000
	N		98	96	98	98	98	98	96
24. I feel that the existing tools in the LMS that I use: |	Pearson Correlatio n		.479**	.203*	.824**	1	.548**	.749**	.531**
b. allow me to effectively identify my students' strengths and areas of improvement	Sig. (2- tailed)		.000	.048	.000		.000	.000	.000
	N		98	96	98	98	98	98	96
24. I feel that the existing tools in the LMS that I use: |	Pearson Correlatio n		.576**	.044	.602**	.548**	1	.617**	.513**
c. allow me to provide effective feedback to my students	Sig. (2- tailed)		.000	.673	.000	.000		.000	.000
	N		98	96	98	98	98	98	96
24. I feel that the existing tools in the LMS that I use: |	Pearson Correlatio n		.551**	.169	.734**	.749**	.617**	1	.499**
d. allow me to effectively track student learning over time	Sig. (2- tailed)		.000	.100	.000	.000	.000		.000
	N		98	96	98	98	98	98	96

24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	Pearson Correlation	.354**	-.007	.606**	.531**	.513**	.499**	1
		Sig. (2-tailed)	.000	.945	.000	.000	.000	.000	
		N	96	94	96	96	96	96	96

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 51 - Descriptives 10-27 based on undergraduate class size

		Descriptives ^a								
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum	
						Lower Bound	Upper Bound			
10.	I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	0	3	5.000	.0000	.0000	5.000	5.000	5.0	5.0
		1-39	14	4.643	1.0818	.2891	4.018	5.267	1.0	5.0
		40-99	15	4.133	1.4075	.3634	3.354	4.913	1.0	5.0
		100+	14	4.429	.6462	.1727	4.055	4.802	3.0	5.0
		Total	46	4.435	1.0678	.1574	4.118	4.752	1.0	5.0
11.	I have used an LMS for instructional purposes (for example, posting an instructional video).	0	3	3.000	1.7321	1.000	-1.303	7.303	1.0	4.0
		1-39	14	4.500	1.1602	.3101	3.830	5.170	1.0	5.0
		40-99	15	3.133	1.5523	.4008	2.274	3.993	1.0	5.0
		100+	14	3.929	1.4917	.3987	3.067	4.790	1.0	5.0
		Total	46	3.783	1.5043	.2218	3.336	4.229	1.0	5.0
12.	I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	0	3	3.333	2.0817	1.201	-1.838	8.504	1.0	5.0
		1-39	14	3.929	1.5424	.4122	3.038	4.819	1.0	5.0
		40-99	14	2.786	1.4239	.3806	1.964	3.608	1.0	5.0
		100+	14	3.357	1.7368	.4642	2.354	4.360	1.0	5.0
		Total	45	3.356	1.6118	.2403	2.871	3.840	1.0	5.0
13.	I have used an LMS for formative assessment purposes (for example, providing feedback to students).	0	3	3.667	1.5275	.8819	-.128	7.461	2.0	5.0
		1-39	14	3.500	1.4005	.3743	2.691	4.309	1.0	5.0
		40-99	15	2.867	1.5976	.4125	1.982	3.751	1.0	5.0
		100+	14	3.214	1.7177	.4591	2.223	4.206	1.0	5.0
		Total	46	3.217	1.5479	.2282	2.758	3.677	1.0	5.0

14. I always give detailed feedback to students on their assessments.	0	3	3.667	.5774	.3333	2.232	5.101	3.0	4.0
	1-39	12	4.167	1.0299	.2973	3.512	4.821	2.0	5.0
	40-99	15	4.467	.8338	.2153	4.005	4.928	3.0	5.0
	100+	14	4.071	.7300	.1951	3.650	4.493	3.0	5.0
	Total	44	4.205	.8513	.1283	3.946	4.463	2.0	5.0
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	3	2.667	1.5275	.8819	-1.128	6.461	1.0	4.0
	1-39	13	3.385	1.1929	.3309	2.664	4.105	1.0	5.0
	40-99	14	2.571	1.3986	.3738	1.764	3.379	1.0	5.0
	100+	13	3.538	1.5064	.4178	2.628	4.449	1.0	5.0
	Total	43	3.116	1.4008	.2136	2.685	3.547	1.0	5.0
16. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	3	2.333	1.1547	.6667	-.535	5.202	1.0	3.0
	1-39	13	3.538	.8771	.2433	3.008	4.068	2.0	5.0
	40-99	14	2.714	1.2666	.3385	1.983	3.446	1.0	4.0
	100+	14	3.214	1.2514	.3344	2.492	3.937	1.0	5.0
	Total	44	3.091	1.1777	.1775	2.733	3.449	1.0	5.0
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	3	2.667	1.5275	.8819	-1.128	6.461	1.0	4.0
	1-39	13	3.231	1.3009	.3608	2.445	4.017	1.0	5.0
	40-99	14	3.143	1.4601	.3902	2.300	3.986	1.0	5.0
	100+	14	2.857	1.2924	.3454	2.111	3.603	1.0	5.0
	Total	44	3.045	1.3287	.2003	2.642	3.449	1.0	5.0
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	3	2.667	1.5275	.8819	-1.128	6.461	1.0	4.0
	1-39	12	2.500	1.1677	.3371	1.758	3.242	1.0	4.0
	40-99	14	2.214	1.3688	.3658	1.424	3.005	1.0	5.0
	100+	13	2.462	1.3301	.3689	1.658	3.265	1.0	5.0
	Total	42	2.405	1.2699	.1960	2.009	2.800	1.0	5.0
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	0	3	4.333	1.1547	.6667	1.465	7.202	3.0	5.0
	1-39	12	3.333	1.1547	.3333	2.600	4.067	1.0	5.0
	40-99	14	2.929	1.2688	.3391	2.196	3.661	1.0	5.0
	100+	13	3.154	1.4051	.3897	2.305	4.003	1.0	5.0
	Total	42	3.214	1.2790	.1974	2.816	3.613	1.0	5.0
20. Providing comments on a word processed file that is then	0	3	3.667	1.1547	.6667	.798	6.535	3.0	5.0
	1-39	13	3.846	.8987	.2493	3.303	4.389	3.0	5.0

uploaded/emailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	40-99	15	2.933	1.3870	.3581	2.165	3.701	1.0	5.0	
	100+	14	3.714	1.3260	.3544	2.949	4.480	1.0	5.0	
	Total	45	3.489	1.2545	.1870	3.112	3.866	1.0	5.0	
<hr/>										
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	0	3	2.667	1.5275	.8819	-1.128	6.461	1.0	4.0	
	1-39	12	3.667	1.0731	.3098	2.985	4.348	2.0	5.0	
	40-99	15	3.267	1.3345	.3446	2.528	4.006	1.0	5.0	
	100+	14	3.500	1.2247	.3273	2.793	4.207	1.0	5.0	
	Total	44	3.409	1.2260	.1848	3.036	3.782	1.0	5.0	
<hr/>										
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	0	3	2.667	1.5275	.8819	-1.128	6.461	1.0	4.0	
	1-39	12	2.667	1.2309	.3553	1.885	3.449	1.0	4.0	
	40-99	15	2.533	1.5055	.3887	1.700	3.367	1.0	5.0	
	100+	13	2.769	1.5892	.4408	1.809	3.730	1.0	5.0	
	Total	43	2.651	1.4123	.2154	2.217	3.086	1.0	5.0	
<hr/>										
23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	0	3	3.000	1.7321	1.000	-1.303	7.303	1.0	4.0	
					0					
	1-39	12	2.583	1.1645	.3362	1.843	3.323	1.0	4.0	
	40-99	14	2.214	1.2514	.3344	1.492	2.937	1.0	4.0	
	100+	14	2.929	1.0716	.2864	2.310	3.547	1.0	4.0	
	Total	43	2.605	1.1980	.1827	2.236	2.973	1.0	4.0	
<hr/>										
24. I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	0	3	3.000	1.0000	.5774	.516	5.484	2.0	4.0	
	1-39	14	3.000	1.1767	.3145	2.321	3.679	1.0	5.0	
	40-99	14	2.429	1.1579	.3095	1.760	3.097	1.0	4.0	
	100+	14	3.143	1.0271	.2745	2.550	3.736	1.0	4.0	
	Total	45	2.867	1.1201	.1670	2.530	3.203	1.0	5.0	
<hr/>										
24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	0	3	2.667	1.5275	.8819	-1.128	6.461	1.0	4.0	
	1-39	14	2.786	1.1883	.3176	2.100	3.472	1.0	5.0	
	40-99	14	2.214	1.1883	.3176	1.528	2.900	1.0	4.0	
	100+	14	3.071	1.1411	.3050	2.413	3.730	1.0	5.0	
	Total	45	2.689	1.2027	.1793	2.328	3.050	1.0	5.0	
<hr/>										
24. I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	0	3	4.000	1.0000	.5774	1.516	6.484	3.0	5.0	
	1-39	14	3.500	.9405	.2514	2.957	4.043	1.0	5.0	
	40-99	14	2.643	1.2157	.3249	1.941	3.345	1.0	4.0	
	100+	14	3.429	.9376	.2506	2.887	3.970	1.0	5.0	
	Total	45	3.244	1.0904	.1625	2.917	3.572	1.0	5.0	

24.	I feel that the existing tools in the LMS that I use: | d.	0	3	3.000	2.0000	1.154	-1.968	7.968	1.0	5.0
						7				
	allow me to effectively track student learning over time	1-39	14	3.143	1.2315	.3291	2.432	3.854	1.0	5.0
		40-99	14	2.429	1.4525	.3882	1.590	3.267	1.0	5.0
		100+	14	3.500	1.0190	.2724	2.912	4.088	1.0	5.0
		Total	45	3.022	1.3227	.1972	2.625	3.420	1.0	5.0
24.	I feel that the existing tools in the LMS that I use: | e.	0	3	3.000	2.0000	1.154	-1.968	7.968	1.0	5.0
						7				
	are user friendly	1-39	14	3.214	1.0509	.2809	2.608	3.821	1.0	5.0
		40-99	13	2.000	1.0000	.2774	1.396	2.604	1.0	4.0
		100+	14	3.357	1.4469	.3867	2.522	4.193	1.0	5.0
		Total	44	2.886	1.3332	.2010	2.481	3.292	1.0	5.0
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	0	3	3.333	.5774	.3333	1.899	4.768	3.0	4.0
		1-39	14	3.714	.9139	.2442	3.187	4.242	2.0	5.0
		40-99	14	3.786	.8926	.2386	3.270	4.301	3.0	5.0
		100+	13	3.385	.8697	.2412	2.859	3.910	2.0	5.0
		Total	44	3.614	.8685	.1309	3.350	3.878	2.0	5.0
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	0	3	2.333	.5774	.3333	.899	3.768	2.0	3.0
		1-39	13	3.231	1.1658	.3233	2.526	3.935	1.0	5.0
		40-99	14	3.500	1.0919	.2918	2.870	4.130	1.0	5.0
		100+	14	3.571	1.2839	.3431	2.830	4.313	2.0	5.0
		Total	44	3.364	1.1632	.1754	3.010	3.717	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	0	3	3.000	1.0000	.5774	.516	5.484	2.0	4.0
		1-39	13	2.923	1.0377	.2878	2.296	3.550	1.0	4.0
		40-99	14	3.500	1.1602	.3101	2.830	4.170	1.0	5.0
		100+	14	2.357	.8419	.2250	1.871	2.843	1.0	4.0
		Total	44	2.932	1.0869	.1639	2.601	3.262	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	0	3	3.000	1.7321	1.000	-1.303	7.303	2.0	5.0
						0				
		1-39	13	2.308	1.2506	.3469	1.552	3.063	1.0	5.0
		40-99	14	2.786	1.0509	.2809	2.179	3.392	1.0	5.0
		100+	14	2.786	1.1883	.3176	2.100	3.472	1.0	5.0
		Total	44	2.659	1.1801	.1779	2.300	3.018	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	0	3	2.333	.5774	.3333	.899	3.768	2.0	3.0
		1-39	13	2.231	.8321	.2308	1.728	2.734	1.0	4.0
		40-99	14	3.071	.9169	.2450	2.542	3.601	2.0	5.0
		100+	14	2.571	1.0163	.2716	1.985	3.158	1.0	5.0
		Total	44	2.614	.9454	.1425	2.326	2.901	1.0	5.0

27.	I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	0	3	2.667	1.1547	.6667	-.202	5.535	2.0	4.0
		1-39	13	1.923	1.0377	.2878	1.296	2.550	1.0	4.0
		40-99	14	3.214	.9750	.2606	2.651	3.777	2.0	5.0
		100+	14	2.429	1.0894	.2912	1.800	3.058	1.0	5.0
		Total	44	2.545	1.1300	.1704	2.202	2.889	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	0	3	1.667	.5774	.3333	.232	3.101	1.0	2.0
		1-39	13	2.154	.9871	.2738	1.557	2.750	1.0	4.0
		40-99	14	3.214	.8018	.2143	2.751	3.677	2.0	5.0
		100+	14	2.429	.9376	.2506	1.887	2.970	1.0	4.0
		Total	44	2.545	.9989	.1506	2.242	2.849	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	0	3	3.000	1.0000	.5774	.516	5.484	2.0	4.0
		1-39	13	2.615	1.5566	.4317	1.675	3.556	1.0	5.0
		40-99	14	3.643	.9288	.2482	3.107	4.179	2.0	5.0
		100+	14	2.786	1.2514	.3344	2.063	3.508	1.0	5.0
		Total	44	3.023	1.2848	.1937	2.632	3.413	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	0	3	3.000	1.0000	.5774	.516	5.484	2.0	4.0
		1-39	13	3.000	1.0801	.2996	2.347	3.653	1.0	4.0
		40-99	14	3.571	1.0163	.2716	2.985	4.158	2.0	5.0
		100+	14	3.500	1.2860	.3437	2.757	4.243	1.0	5.0
		Total	44	3.341	1.1195	.1688	3.001	3.681	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	0	3	4.000	.0000	.0000	4.000	4.000	4.0	4.0
		1-39	13	3.077	1.1875	.3294	2.359	3.795	1.0	5.0
		40-99	14	3.857	.8644	.2310	3.358	4.356	3.0	5.0
		100+	14	2.714	1.3828	.3696	1.916	3.513	1.0	5.0
		Total	44	3.273	1.2078	.1821	2.906	3.640	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | i. Others	0	2	3.500	.7071	.5000	-2.853	9.853	3.0	4.0
		1-39	5	3.000	1.4142	.6325	1.244	4.756	1.0	5.0
		40-99	6	3.500	1.5166	.6191	1.908	5.092	1.0	5.0
		100+	5	3.600	1.5166	.6782	1.717	5.483	2.0	5.0
		Total	18	3.389	1.3346	.3146	2.725	4.053	1.0	5.0

a. 3. At what level do you teach? = Undergraduate

Table 52 - ANOVA 10-27 based on undergraduate class size

		ANOVA ^a					
			Sum of Squares	df	Mean Square	F	Sig.
10.	I have used LMS for classroom management/administration purposes (for	Between Groups	2.928	3	.976	.847	.476
		Within Groups	48.376	42	1.152		

example, posting important announcements on the bulletin board).	Total	51.304	45			
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	Between Groups	15.664	3	5.221	2.545	.069
	Within Groups	86.162	42	2.051		
	Total	101.826	45			
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	Between Groups	9.144	3	3.048	1.188	.326
	Within Groups	105.167	41	2.565		
	Total	114.311	44			
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	Between Groups	3.569	3	1.190	.479	.698
	Within Groups	104.257	42	2.482		
	Total	107.826	45			
14. I always give detailed feedback to students on their assessments.	Between Groups	2.164	3	.721	.995	.405
	Within Groups	28.995	40	.725		
	Total	31.159	43			
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	8.016	3	2.672	1.401	.257
	Within Groups	74.403	39	1.908		
	Total	82.419	42			
16. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	6.525	3	2.175	1.638	.196
	Within Groups	53.112	40	1.328		
	Total	59.636	43			
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	1.506	3	.502	.270	.847
	Within Groups	74.403	40	1.860		
	Total	75.909	43			
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	.864	3	.288	.168	.917
	Within Groups	65.255	38	1.717		
	Total	66.119	41			
19. The LMS that I use provides an effective mechanism for giving feedback to	Between Groups	5.117	3	1.706	1.046	.383
	Within Groups	61.954	38	1.630		

students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Total	67.071	41			
20. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	7.095	3	2.365	1.560	.214
	Within Groups	62.149	41	1.516		
	Total	69.244	44			
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	2.870	3	.957	.619	.607
	Within Groups	61.767	40	1.544		
	Total	64.636	43			
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	.393	3	.131	.061	.980
	Within Groups	83.374	39	2.138		
	Total	83.767	42			
23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Between Groups	4.077	3	1.359	.943	.429
	Within Groups	56.202	39	1.441		
	Total	60.279	42			
24. I feel that the existing tools in the LMS that I use: | a.allow me to effectively assess higher order learning in my students	Between Groups	4.057	3	1.352	1.084	.367
	Within Groups	51.143	41	1.247		
	Total	55.200	44			
24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Between Groups	5.335	3	1.778	1.250	.304
	Within Groups	58.310	41	1.422		
	Total	63.644	44			
24. I feel that the existing tools in the LMS that I use: | c.allow me to provide effective feedback to my students	Between Groups	8.168	3	2.723	2.529	.071
	Within Groups	44.143	41	1.077		
	Total	52.311	44			
24. I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	Between Groups	8.335	3	2.778	1.659	.191
	Within Groups	68.643	41	1.674		
	Total	76.978	44			
	Between Groups	14.860	3	4.953	3.218	.033

24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	Within Groups	61.571	40	1.539		
		Total	76.432	43			
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Between Groups	1.474	3	.491	.635	.597
		Within Groups	30.958	40	.774		
		Total	32.432	43			
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Between Groups	4.279	3	1.426	1.058	.377
		Within Groups	53.903	40	1.348		
		Total	58.182	43			
27.	I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	Between Groups	9.158	3	3.053	2.933	.045
		Within Groups	41.637	40	1.041		
		Total	50.795	43			
27.	I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	Between Groups	2.403	3	.801	.557	.646
		Within Groups	57.484	40	1.437		
		Total	59.886	43			
27.	I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	Between Groups	5.100	3	1.700	2.040	.124
		Within Groups	33.332	40	.833		
		Total	38.432	43			
27.	I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	Between Groups	11.534	3	3.845	3.545	.023
		Within Groups	43.375	40	1.084		
		Total	54.909	43			
27.	I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	Between Groups	10.764	3	3.588	4.465	.009
		Within Groups	32.145	40	.804		
		Total	42.909	43			
27.	I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	Between Groups	8.329	3	2.776	1.773	.168
		Within Groups	62.648	40	1.566		
		Total	70.977	43			
27.	I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	Between Groups	2.958	3	.986	.774	.515
		Within Groups	50.929	40	1.273		
		Total	53.886	43			
		Between Groups	11.233	3	3.744	2.908	.046

27.	I often get deterred from using the assessment tools in an LMS because: | h.	Within Groups	51.495	40	1.287		
	I experience technical issues when using the LMS.	Total	62.727	43			
27.	I often get deterred from using the assessment tools in an LMS because: | i.	Between Groups	1.078	3	.359	.172	.913
	Others	Within Groups	29.200	14	2.086		
		Total	30.278	17			
a. 3.	At what level do you teach? = Undergraduate						

Table 53 – Descriptives 10-27 based on graduate class size

2. At what level do you teach? = Graduate

		Descriptives ^a							Mini	Maxi
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		num	num	
						Lower Bound	Upper Bound			
10.	I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	0	1	4.000	.	.	.	4.0	4.0	
		1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0
		15+	7	4.286	.9512	.3595	3.406	5.165	3.0	5.0
		Total	10	4.000	.9428	.2981	3.326	4.674	3.0	5.0
11.	I have used an LMS for instructional purposes (for example, posting an instructional video).	0	1	3.000	.	.	.	3.0	3.0	
		1-14	2	2.500	2.1213	1.500	-16.559	21.559	1.0	4.0
		15+	7	3.714	1.1127	.4206	2.685	4.743	2.0	5.0
		Total	10	3.400	1.2649	.4000	2.495	4.305	1.0	5.0
12.	I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	0	1	4.000	.	.	.	4.0	4.0	
		1-14	2	2.500	2.1213	1.500	-16.559	21.559	1.0	4.0
		15+	7	4.143	.8997	.3401	3.311	4.975	3.0	5.0
		Total	10	3.800	1.2293	.3887	2.921	4.679	1.0	5.0
13.	I have used an LMS for formative assessment purposes (for example, providing feedback to students).	0	1	4.000	.	.	.	4.0	4.0	
		1-14	2	2.500	.7071	.5000	-3.853	8.853	2.0	3.0
		15+	7	4.143	1.2150	.4592	3.019	5.267	2.0	5.0
		Total	10	3.800	1.2293	.3887	2.921	4.679	2.0	5.0
14.	I always give detailed feedback to students on their assessments.	0	1	5.000	.	.	.	5.0	5.0	
		1-14	2	4.000	.0000	.0000	4.000	4.000	4.0	4.0
		15+	7	4.571	.5345	.2020	4.077	5.066	4.0	5.0

	Total	10	4.500	.5270	.1667	4.123	4.877	4.0	5.0
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	1	5.000	.	.	.	.	5.0	5.0
	1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0
	15+	6	3.500	.8367	.3416	2.622	4.378	3.0	5.0
	Total	9	3.556	.8819	.2940	2.878	4.233	3.0	5.0
16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	1	3.000	.	.	.	.	3.0	3.0
	1-14	2	2.000	1.4142	1.000	-10.706	14.706	1.0	3.0
	15+	6	4.333	.8165	.3333	3.476	5.190	3.0	5.0
	Total	9	3.667	1.3229	.4410	2.650	4.684	1.0	5.0
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	1	4.000	.	.	.	.	4.0	4.0
	1-14	2	2.500	2.1213	1.500	-16.559	21.559	1.0	4.0
	15+	6	4.333	.5164	.2108	3.791	4.875	4.0	5.0
	Total	9	3.889	1.1667	.3889	2.992	4.786	1.0	5.0
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	0	1	4.000	.	.	.	.	4.0	4.0
	1-14	2	2.500	.7071	.5000	-3.853	8.853	2.0	3.0
	15+	6	3.833	1.1690	.4773	2.606	5.060	2.0	5.0
	Total	9	3.556	1.1304	.3768	2.687	4.424	2.0	5.0
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	0	1	4.000	.	.	.	.	4.0	4.0
	1-14	2	3.500	.7071	.5000	-2.853	9.853	3.0	4.0
	15+	7	4.429	.9759	.3689	3.526	5.331	3.0	5.0
	Total	10	4.200	.9189	.2906	3.543	4.857	3.0	5.0
20. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	0	1	4.000	.	.	.	.	4.0	4.0
	1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0
	15+	7	4.571	.5345	.2020	4.077	5.066	4.0	5.0
	Total	10	4.200	.7888	.2494	3.636	4.764	3.0	5.0

21.	Providing comments	0	1	4.000	.	.	.	.	4.0	4.0
	directly via email is an effective	1-14	2	2.500	2.1213	1.500	-16.559	21.559	1.0	4.0
	way to give feedback to students					0				
	on open ended type assessment	15+	7	4.429	.5345	.2020	3.934	4.923	4.0	5.0
	questions (e.g., essays, problems	Total	10	4.000	1.1547	.3651	3.174	4.826	1.0	5.0
	to solve, etc.).									
22.	Providing comments via	0	1	4.000	.	.	.	.	4.0	4.0
	Face to Face (F2F)/Video	1-14	2	3.500	.7071	.5000	-2.853	9.853	3.0	4.0
	Conferencing is an effective	15+	6	3.833	1.1690	.4773	2.606	5.060	2.0	5.0
	way to give feedback to students	Total	9	3.778	.9718	.3239	3.031	4.525	2.0	5.0
	on open ended type assessment									
	questions (e.g., essays, problems									
	to solve, etc.).									
23.	I feel that the current	0	1	4.000	.	.	.	.	4.0	4.0
	LMS I use allows me to import	1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0
	assessment data and results by	15+	6	2.833	.7528	.3073	2.043	3.623	2.0	4.0
	linking with external tools (e.g.	Total	9	3.000	.7071	.2357	2.456	3.544	2.0	4.0
	Clickers, concept mapping									
	software, simulations, etc.).									
24.	I feel that the existing	0	1	4.000	.	.	.	.	4.0	4.0
	tools in the LMS that I use: | a.	1-14	2	3.500	.7071	.5000	-2.853	9.853	3.0	4.0
	allow me to effectively	15+	7	3.429	.9759	.3689	2.526	4.331	2.0	5.0
	assess higher order learning in my	Total	10	3.500	.8498	.2687	2.892	4.108	2.0	5.0
	students									
24.	I feel that the existing	0	1	4.000	.	.	.	.	4.0	4.0
	tools in the LMS that I use: | b.	1-14	2	3.500	.7071	.5000	-2.853	9.853	3.0	4.0
	allow me to effectively	15+	7	3.143	.6901	.2608	2.505	3.781	2.0	4.0
	identify my students' strengths and	Total	10	3.300	.6749	.2134	2.817	3.783	2.0	4.0
	areas of improvement									
24.	I feel that the existing	0	1	4.000	.	.	.	.	4.0	4.0
	tools in the LMS that I use: | c.	1-14	2	4.000	.0000	.0000	4.000	4.000	4.0	4.0
	allow me to provide	15+	7	3.714	.9512	.3595	2.835	4.594	3.0	5.0
	effective feedback to my students	Total	10	3.800	.7888	.2494	3.236	4.364	3.0	5.0
24.	I feel that the existing	0	1	4.000	.	.	.	.	4.0	4.0
	tools in the LMS that I use: | d.	1-14	2	3.500	.7071	.5000	-2.853	9.853	3.0	4.0
	allow me to effectively	15+	7	3.571	.7868	.2974	2.844	4.299	3.0	5.0
	track student learning over time	Total	10	3.600	.6992	.2211	3.100	4.100	3.0	5.0
		0	0	.	.	.	.	.	.	.
		1-14	2	1.500	.7071	.5000	-4.853	7.853	1.0	2.0

24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	15+	7	2.714	.9512	.3595	1.835	3.594	1.0	4.0
	Total	9	2.444	1.0138	.3379	1.665	3.224	1.0	4.0	4.0
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	0	0	.	.	.	.	.	.	.
	1-14	2	4.000	.0000	.0000	4.000	4.000	4.0	4.0	4.0
	15+	7	3.571	1.1339	.4286	2.523	4.620	2.0	5.0	5.0
	Total	9	3.667	1.0000	.3333	2.898	4.435	2.0	5.0	5.0
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	0	0	.	.	.	.	.	.	.
	1-14	2	2.500	2.1213	1.500	-16.559	21.559	1.0	4.0	4.0
	15+	7	3.143	1.3452	.5084	1.899	4.387	1.0	5.0	5.0
	Total	9	3.000	1.4142	.4714	1.913	4.087	1.0	5.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	0	0	.	.	.	.	.	.	.
	1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0	3.0
	15+	7	2.857	1.2150	.4592	1.733	3.981	1.0	4.0	4.0
	Total	9	2.889	1.0541	.3514	2.079	3.699	1.0	4.0	4.0
27.	I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	0	0	.	.	.	.	.	.	.
	1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0	3.0
	15+	7	2.429	1.2724	.4809	1.252	3.605	1.0	4.0	4.0
	Total	9	2.556	1.1304	.3768	1.687	3.424	1.0	4.0	4.0
27.	I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	0	0	.	.	.	.	.	.	.
	1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0	3.0
	15+	7	3.000	1.2910	.4880	1.806	4.194	1.0	5.0	5.0
	Total	9	3.000	1.1180	.3727	2.141	3.859	1.0	5.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	0	0	.	.	.	.	.	.	.
	1-14	2	2.500	2.1213	1.500	-16.559	21.559	1.0	4.0	4.0
	15+	7	2.571	1.2724	.4809	1.395	3.748	1.0	4.0	4.0
	Total	9	2.556	1.3333	.4444	1.531	3.580	1.0	4.0	4.0
27.	I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	0	0	.	.	.	.	.	.	.
	1-14	2	2.500	.7071	.5000	-3.853	8.853	2.0	3.0	3.0
	15+	7	2.571	.9759	.3689	1.669	3.474	1.0	4.0	4.0
	Total	9	2.556	.8819	.2940	1.878	3.233	1.0	4.0	4.0
27.	I often get deterred from using the assessment tools in an	0	0	.	.	.	.	.	.	.
	1-14	2	3.000	2.8284	2.000	-22.412	28.412	1.0	5.0	5.0

LMS because: | f. I do not have adequate training on the LMS.	15+	7	2.857	1.2150	.4592	1.733	3.981	1.0	4.0
	Total	9	2.889	1.4530	.4843	1.772	4.006	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	0	0	.	.	.	.	.	.	.
	1-14	2	4.000	1.4142	1.000	-8.706	16.706	3.0	5.0
	15+	7	3.000	1.4142	.5345	1.692	4.308	1.0	5.0
	Total	9	3.222	1.3944	.4648	2.150	4.294	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	0	0	.	.	.	.	.	.	.
	1-14	2	4.500	.7071	.5000	-1.853	10.853	4.0	5.0
	15+	7	3.286	1.1127	.4206	2.257	4.315	1.0	4.0
	Total	9	3.556	1.1304	.3768	2.687	4.424	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | i. Others	0	0	.	.	.	.	.	.	.
	1-14	2	3.000	.0000	.0000	3.000	3.000	3.0	3.0
	15+	2	3.500	.7071	.5000	-2.853	9.853	3.0	4.0
	Total	4	3.250	.5000	.2500	2.454	4.046	3.0	4.0

a. 3. At what level do you teach? = Graduate

Table 54 –ANOVA 10-27 based on graduate class size

		ANOVA ^a				
		Sum of Squares	df	Mean Square	F	Sig.
10. I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	Between Groups	2.571	2	1.286	1.658	.257
	Within Groups	5.429	7	.776		
	Total	8.000	9			
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	Between Groups	2.471	2	1.236	.725	.517
	Within Groups	11.929	7	1.704		
	Total	14.400	9			
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	Between Groups	4.243	2	2.121	1.587	.270
	Within Groups	9.357	7	1.337		
	Total	13.600	9			
13. I have used an LMS for formative assessment purposes	Between Groups	4.243	2	2.121	1.587	.270
	Within Groups	9.357	7	1.337		

(for example, providing feedback to students).	Total	13.600	9				
14. I always give detailed feedback to students on their assessments.	Between Groups	.786	2	.393	1.604	.267	
	Within Groups	1.714	7	.245			
	Total	2.500	9				
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	2.722	2	1.361	2.333	.178	
	Within Groups	3.500	6	.583			
	Total	6.222	8				
16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	8.667	2	4.333	4.875	.055	
	Within Groups	5.333	6	.889			
	Total	14.000	8				
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	5.056	2	2.528	2.600	.154	
	Within Groups	5.833	6	.972			
	Total	10.889	8				
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	2.889	2	1.444	1.182	.369	
	Within Groups	7.333	6	1.222			
	Total	10.222	8				
19. The LMS that I use provides an effective mechanism	Between Groups	1.386	2	.693	.780	.494	
	Within Groups	6.214	7	.888			

for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Total	7.600	9				
20. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	3.886	2	1.943	7.933	.016	
	Within Groups	1.714	7	.245			
	Total	5.600	9				
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	5.786	2	2.893	3.259	.100	
	Within Groups	6.214	7	.888			
	Total	12.000	9				
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	.222	2	.111	.091	.914	
	Within Groups	7.333	6	1.222			
	Total	7.556	8				
23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Between Groups	1.167	2	.583	1.235	.355	
	Within Groups	2.833	6	.472			
	Total	4.000	8				
24. I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Between Groups	.286	2	.143	.161	.854	
	Within Groups	6.214	7	.888			
	Total	6.500	9				
24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Between Groups	.743	2	.371	.774	.497	
	Within Groups	3.357	7	.480			
	Total	4.100	9				

24.	I feel that the existing tools in the LMS that I use: | c.	Between Groups	.171	2	.086	.111	.897
	allow me to provide effective feedback to my students	Within Groups	5.429	7	.776		
		Total	5.600	9			
24.	I feel that the existing tools in the LMS that I use: | d.	Between Groups	.186	2	.093	.154	.860
	allow me to effectively track student learning over time	Within Groups	4.214	7	.602		
		Total	4.400	9			
24.	I feel that the existing tools in the LMS that I use: | e.	Between Groups	2.294	1	2.294	2.708	.144
	are user friendly	Within Groups	5.929	7	.847		
		Total	8.222	8			
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Between Groups	.286	1	.286	.259	.626
		Within Groups	7.714	7	1.102		
		Total	8.000	8			
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Between Groups	.643	1	.643	.293	.605
		Within Groups	15.357	7	2.194		
		Total	16.000	8			
27.	I often get deterred from using the assessment tools in an LMS because: | a.	Between Groups	.032	1	.032	.025	.879
	Student's lack competence in working with the LMS and feedback system	Within Groups	8.857	7	1.265		
		Total	8.889	8			
27.	I often get deterred from using the assessment tools in an LMS because: | b.	Between Groups	.508	1	.508	.366	.564
	There is a lack of institutional encouragement for using assessment tools in LMS.	Within Groups	9.714	7	1.388		
		Total	10.222	8			
27.	I often get deterred from using the assessment tools in an LMS because: | c.	Between Groups	.000	1	.000	.000	1.000
	There is a lack of financial support at my institution.	Within Groups	10.000	7	1.429		
		Total	10.000	8			

27.	I often get deterred from using the assessment tools in an LMS because: | d.	Between Groups	.008	1	.008	.004	.952
		Within Groups	14.214	7	2.031		
		Total	14.222	8			
	There is a lack of technical support at my institution.						
27.	I often get deterred from using the assessment tools in an LMS because: | e.	Between Groups	.008	1	.008	.009	.927
		Within Groups	6.214	7	.888		
		Total	6.222	8			
	There is a lack of support from other colleagues.						
27.	I often get deterred from using the assessment tools in an LMS because: | f.	Between Groups	.032	1	.032	.013	.912
	I do not have adequate training on the LMS.	Within Groups	16.857	7	2.408		
		Total	16.889	8			
27.	I often get deterred from using the assessment tools in an LMS because: | g.	Between Groups	1.556	1	1.556	.778	.407
	I do not have enough time.	Within Groups	14.000	7	2.000		
		Total	15.556	8			
27.	I often get deterred from using the assessment tools in an LMS because: | h.	Between Groups	2.294	1	2.294	2.025	.198
	I experience technical issues when using the LMS.	Within Groups	7.929	7	1.133		
		Total	10.222	8			
27.	I often get deterred from using the assessment tools in an LMS because: | i.	Between Groups	.250	1	.250	1.000	.423
	Others	Within Groups	.500	2	.250		
		Total	.750	3			
a. 3.	At what level do you teach? = Graduate						

Table 55 – Descriptives on 10-27 based on teaching level

Descriptives

				95% Confidence						
		N	Mean	Std. Deviation	Std. Error	Interval for Mean		Minimum	Maximum	
						Lower Bound	Upper Bound			
10. I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	Undergraduate	47	4.447	1.0593	.1545	4.136	4.758	1.0	5.0	
	Graduate	10	4.000	.9428	.2981	3.326	4.674	3.0	5.0	
	Both	42	4.571	.8007	.1236	4.322	4.821	1.0	5.0	
	Total	99	4.455	.9505	.0955	4.265	4.644	1.0	5.0	
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	Undergraduate	47	3.787	1.4882	.2171	3.350	4.224	1.0	5.0	
	Graduate	10	3.400	1.2649	.4000	2.495	4.305	1.0	5.0	
	Both	42	3.952	1.3960	.2154	3.517	4.387	1.0	5.0	
	Total	99	3.818	1.4240	.1431	3.534	4.102	1.0	5.0	
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	Undergraduate	45	3.356	1.6118	.2403	2.871	3.840	1.0	5.0	
	Graduate	10	3.800	1.2293	.3887	2.921	4.679	1.0	5.0	
	Both	42	3.262	1.5782	.2435	2.770	3.754	1.0	5.0	
	Total	97	3.361	1.5558	.1580	3.047	3.674	1.0	5.0	
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	Undergraduate	47	3.213	1.5314	.2234	2.763	3.662	1.0	5.0	
	Graduate	10	3.800	1.2293	.3887	2.921	4.679	2.0	5.0	
	Both	42	3.143	1.5072	.2326	2.673	3.613	1.0	5.0	
	Total	99	3.242	1.4921	.1500	2.945	3.540	1.0	5.0	
14. I always give detailed feedback to students on their assessments.	Undergraduate	45	4.178	.8605	.1283	3.919	4.436	2.0	5.0	
	Graduate	10	4.500	.5270	.1667	4.123	4.877	4.0	5.0	
	Both	42	4.429	.7034	.1085	4.209	4.648	3.0	5.0	
	Total	97	4.320	.7712	.0783	4.164	4.475	2.0	5.0	
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Undergraduate	44	3.114	1.3846	.2087	2.693	3.535	1.0	5.0	
	Graduate	9	3.556	.8819	.2940	2.878	4.233	3.0	5.0	
	Both	41	3.073	1.1703	.1828	2.704	3.443	1.0	5.0	
	Total	94	3.138	1.2495	.1289	2.882	3.394	1.0	5.0	
16. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Undergraduate	44	3.091	1.1777	.1775	2.733	3.449	1.0	5.0	
	Graduate	9	3.667	1.3229	.4410	2.650	4.684	1.0	5.0	
	Both	41	2.390	1.2425	.1941	1.998	2.782	1.0	5.0	
	Total	94	2.840	1.2810	.1321	2.578	3.103	1.0	5.0	

17.	Providing comments	Undergraduate	45	3.000	1.3484	.2010	2.595	3.405	1.0	5.0
	directly via email is an effective	Graduate	9	3.889	1.1667	.3889	2.992	4.786	1.0	5.0
	way to give feedback to students	Both	40	2.300	1.2850	.2032	1.889	2.711	1.0	5.0
	on selected response type	Total								
	assessment questions (e.g.,		94	2.787	1.3825	.1426	2.504	3.070	1.0	5.0
	multiple choice, True/False, etc.).									
18.	Providing comments via	Undergraduate	43	2.372	1.2729	.1941	1.980	2.764	1.0	5.0
	Face to Face (F2F)/Video	Graduate	9	3.556	1.1304	.3768	2.687	4.424	2.0	5.0
	Conferencing is an effective	Both	38	2.526	1.3899	.2255	2.069	2.983	1.0	5.0
	way to give feedback to students	Total								
	on selected response type		90	2.556	1.3417	.1414	2.275	2.837	1.0	5.0
	assessment questions (e.g.,									
	multiple choice, True/False, etc.).									
19.	The LMS that I use	Undergraduate	43	3.163	1.3080	.1995	2.760	3.565	1.0	5.0
	provides an effective mechanism	Graduate	10	4.200	.9189	.2906	3.543	4.857	3.0	5.0
	for giving feedback to students on	Both	41	2.902	1.2610	.1969	2.504	3.300	1.0	5.0
	open ended type assessment	Total								
	questions (e.g., essays, problems to		94	3.160	1.2977	.1338	2.894	3.425	1.0	5.0
	solve, etc.).									
20.	Providing comments on a	Undergraduate	45	3.489	1.2545	.1870	3.112	3.866	1.0	5.0
	word processed file that is then	Graduate	10	4.200	.7888	.2494	3.636	4.764	3.0	5.0
	uploaded/emailed via LMS is an	Both	42	3.048	1.3784	.2127	2.618	3.477	1.0	5.0
	effective way to give feedback to	Total								
	students on open ended type		97	3.371	1.3096	.1330	3.107	3.635	1.0	5.0
	assessment questions (e.g., essays,									
	problems to solve, etc.).									
21.	Providing comments	Undergraduate	45	3.356	1.2641	.1884	2.976	3.735	1.0	5.0
	directly via email is an effective	Graduate	10	4.000	1.1547	.3651	3.174	4.826	1.0	5.0
	way to give feedback to students	Both	42	2.881	1.3829	.2134	2.450	3.312	1.0	5.0
	on open ended type assessment	Total								
	questions (e.g., essays, problems to		97	3.216	1.3403	.1361	2.946	3.487	1.0	5.0
	solve, etc.).									
22.	Providing comments via	Undergraduate	44	2.614	1.4178	.2137	2.183	3.045	1.0	5.0
	Face to Face (F2F)/Video	Graduate	9	3.778	.9718	.3239	3.031	4.525	2.0	5.0
	Conferencing is an effective	Both	41	2.610	1.3762	.2149	2.175	3.044	1.0	5.0
	way to give feedback to students	Total								
	on open ended type assessment		94	2.723	1.3943	.1438	2.438	3.009	1.0	5.0
	questions (e.g., essays, problems to									
	solve, etc.).									
		Undergraduate	44	2.568	1.2085	.1822	2.201	2.936	1.0	4.0

23.	I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Graduate	9	3.000	.7071	.2357	2.456	3.544	2.0	4.0
		Both	40	2.550	.9323	.1474	2.252	2.848	1.0	4.0
		Total	93	2.602	1.0544	.1093	2.385	2.819	1.0	4.0
24.	I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Undergraduate	46	2.848	1.1149	.1644	2.517	3.179	1.0	5.0
		Graduate	10	3.500	.8498	.2687	2.892	4.108	2.0	5.0
		Both	42	2.738	1.0373	.1601	2.415	3.061	1.0	5.0
		Total	98	2.867	1.0711	.1082	2.653	3.082	1.0	5.0
24.	I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Undergraduate	46	2.674	1.1936	.1760	2.319	3.028	1.0	5.0
		Graduate	10	3.300	.6749	.2134	2.817	3.783	2.0	4.0
		Both	42	2.786	1.0009	.1544	2.474	3.098	1.0	4.0
		Total	98	2.786	1.0769	.1088	2.570	3.002	1.0	5.0
24.	I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	Undergraduate	46	3.217	1.0937	.1613	2.893	3.542	1.0	5.0
		Graduate	10	3.800	.7888	.2494	3.236	4.364	3.0	5.0
		Both	42	3.167	1.2080	.1864	2.790	3.543	1.0	5.0
		Total	98	3.255	1.1243	.1136	3.030	3.481	1.0	5.0
24.	I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	Undergraduate	46	3.000	1.3166	.1941	2.609	3.391	1.0	5.0
		Graduate	10	3.600	.6992	.2211	3.100	4.100	3.0	5.0
		Both	42	2.952	1.0809	.1668	2.616	3.289	1.0	5.0
		Total	98	3.041	1.1746	.1187	2.805	3.276	1.0	5.0
24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	Undergraduate	45	2.867	1.3246	.1975	2.469	3.265	1.0	5.0
		Graduate	9	2.444	1.0138	.3379	1.665	3.224	1.0	4.0
		Both	42	2.619	1.2485	.1926	2.230	3.008	1.0	5.0
		Total	96	2.719	1.2624	.1288	2.463	2.975	1.0	5.0
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Undergraduate	45	3.644	.8831	.1316	3.379	3.910	2.0	5.0
		Graduate	9	3.667	1.0000	.3333	2.898	4.435	2.0	5.0
		Both	41	3.707	.7824	.1222	3.460	3.954	3.0	5.0
		Total	95	3.674	.8435	.0865	3.502	3.846	2.0	5.0
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Undergraduate	45	3.356	1.1512	.1716	3.010	3.701	1.0	5.0
		Graduate	9	3.000	1.4142	.4714	1.913	4.087	1.0	5.0
		Both	41	2.927	1.0097	.1577	2.608	3.246	1.0	5.0
		Total	95	3.137	1.1262	.1155	2.907	3.366	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | a. Student's lack	Undergraduate	45	2.956	1.0862	.1619	2.629	3.282	1.0	5.0
		Graduate	9	2.889	1.0541	.3514	2.079	3.699	1.0	4.0
		Both	40	3.100	1.2362	.1955	2.705	3.495	1.0	5.0

competence in working with the LMS and feedback system	Total	94	3.011	1.1406	.1176	2.777	3.244	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	Undergraduate	45	2.667	1.1677	.1741	2.316	3.017	1.0	5.0
	Graduate	9	2.556	1.1304	.3768	1.687	3.424	1.0	4.0
	Both	40	2.550	1.2800	.2024	2.141	2.959	1.0	5.0
	Total	94	2.606	1.2023	.1240	2.360	2.853	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	Undergraduate	45	2.667	1.0000	.1491	2.366	2.967	1.0	5.0
	Graduate	9	3.000	1.1180	.3727	2.141	3.859	1.0	5.0
	Both	40	3.000	1.2810	.2025	2.590	3.410	1.0	5.0
	Total	94	2.840	1.1388	.1175	2.607	3.074	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	Undergraduate	45	2.578	1.1380	.1696	2.236	2.920	1.0	5.0
	Graduate	9	2.556	1.3333	.4444	1.531	3.580	1.0	4.0
	Both	40	2.750	1.1266	.1781	2.390	3.110	1.0	5.0
	Total	94	2.649	1.1426	.1179	2.415	2.883	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	Undergraduate	45	2.556	.9898	.1476	2.258	2.853	1.0	5.0
	Graduate	9	2.556	.8819	.2940	1.878	3.233	1.0	4.0
	Both	40	2.650	1.1886	.1879	2.270	3.030	1.0	5.0
	Total	94	2.596	1.0607	.1094	2.378	2.813	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	Undergraduate	45	3.044	1.2784	.1906	2.660	3.429	1.0	5.0
	Graduate	9	2.889	1.4530	.4843	1.772	4.006	1.0	5.0
	Both	40	3.050	1.1082	.1752	2.696	3.404	1.0	5.0
	Total	94	3.032	1.2133	.1251	2.783	3.280	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	Undergraduate	45	3.378	1.1340	.1690	3.037	3.718	1.0	5.0
	Graduate	9	3.222	1.3944	.4648	2.150	4.294	1.0	5.0
	Both	40	3.775	1.1655	.1843	3.402	4.148	1.0	5.0
	Total	94	3.532	1.1796	.1217	3.290	3.774	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	Undergraduate	45	3.289	1.1989	.1787	2.929	3.649	1.0	5.0
	Graduate	9	3.556	1.1304	.3768	2.687	4.424	1.0	5.0
	Both	39	3.667	.9272	.1485	3.366	3.967	1.0	5.0
	Total	93	3.473	1.0894	.1130	3.249	3.697	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | i. Others	Undergraduate	18	3.389	1.3346	.3146	2.725	4.053	1.0	5.0
	Graduate	4	3.250	.5000	.2500	2.454	4.046	3.0	4.0
	Both	15	3.800	1.2649	.3266	3.100	4.500	1.0	5.0
	Total	37	3.541	1.2382	.2036	3.128	3.953	1.0	5.0

18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).

Between Groups 2 1.444 1.182

	Within Groups	7.333		1.222	
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Total	10.222			
	Between Groups	1.386	.693		.780
	Within Groups	6.214		.888	
20. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Total	7.600			
	Between Groups	3.886	1.943		7.933
	Within Groups	1.714		.245	
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Total	5.600			
	Between Groups	5.786	2.893		3.259
	Within Groups	6.214		.888	
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Total	12.000			
	Between Groups	.222	.111		.091
	Within Groups	7.333		1.222	
	Total	7.556			

23.	I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Between Groups	1.167	.583	1.235	
		Within Groups	2.833		.472	
24.	I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Total	4.000			
		Between Groups	.286	.143	.161	
		Within Groups	6.214		.888	
24.	I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Total	6.500			
		Between Groups	.743	.371	.774	
		Within Groups	3.357		.480	
24.	I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	Total	4.100			
		Between Groups	.171	.086	.111	
		Within Groups	5.429		.776	
24.	I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	Total	5.600			
		Between Groups	.186	.093	.154	
		Within Groups	4.214		.602	
24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	Total	4.400			
		Between Groups	2.294	2.294	2.708	
24.	I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Within Groups	9.714	.286	1.388	.143
		Between Groups				.161
		Total	10.222	6.214		
		Within Groups			.888	

27.	I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	Between GroupsTotal	.0006.500	.000	.000	
24.	I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Within Groups	10.000.743	1.429.371		.497
		Between Groups			.774	
		TotalWithin Groups	10.0003.357	.480		
27.	I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	Between GroupsTotal	.0084.100	.008	.004	
24.	I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	Within Groups	14.214.171	2.031.086		.897
		Between Groups			.111	
		TotalWithin Groups	14.2225.429	.776		
27.	I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	Between GroupsTotal	.0085.600	.008	.009	
24.	I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	Within Groups	6.214.186	.888.093		.860
		Between Groups			.154	
		TotalWithin Groups	6.2224.214	.602		
27.	I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	Between GroupsTotal	.0324.400	.032	.013	
24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	Within Groups	16.8572.294	2.4082.294		.144
		Between Groups			2.708	

	TotalWithin Groups	16.8895.929		.847	
	Between GroupsTotal	1.5568.222	1.556		.778
25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Within	14.000.286		2.000.286	.626
	GroupsBetween				.259
	Groups				
	TotalWithin Groups	15.5567.714		1.102	
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	Between GroupsTotal	2.2948.000	2.294		2.025
26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Within	7.929.643		1.133.643	.605
	GroupsBetween				.293
	Groups				
	TotalWithin Groups	10.22215.357		2.194	
27. I often get deterred from using the assessment tools in an LMS because: | i.	Between GroupsTotal	.25016.000	.250		1.000
Others					
27. I often get deterred from using the assessment tools in an LMS because: | a.	Within	.500.032		.250.032	.879
	GroupsBetween				.025
	Groups				
	TotalWithin Groups	.7508.857		1.265	
Student's lack competence in working with the LMS and feedback system	Total	8.889			
27. I often get deterred from using the assessment tools in an LMS because: | b.	Between Groups	.508		.508	.366
	Within Groups	9.714		1.388	.564
	Total	10.222			
There is a lack of institutional encouragement for using assessment tools in LMS.					
27. I often get deterred from using the assessment tools	Between Groups	.000		.000	.000
	Within Groups	10.000		1.429	1.000

in an LMS because: | c.	Total	10.000				
There is a lack of financial support at my institution.						
27. I often get deterred from using the assessment tools in an LMS because: | d.	Between Groups	.008	.008	.004	.952	
	Within Groups	14.214	2.031			
	Total	14.222				
There is a lack of technical support at my institution.						
27. I often get deterred from using the assessment tools in an LMS because: | e.	Between Groups	.008	.008	.009	.927	
	Within Groups	6.214	.888			
	Total	6.222				
There is a lack of support from other colleagues.						
27. I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	Between Groups	.032	.032	.013	.912	
	Within Groups	16.857	2.408			
	Total	16.889				
	Between Groups	1.556	1.556	.778	.407	
	Within Groups	14.000	2.000			
	Total	15.556				
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	Between Groups	2.294	2.294	2.025	.198	
	Within Groups	7.929	1.133			
	Total	10.222				
27. I often get deterred from using the assessment tools in an LMS because: | i.	Between Groups	.250	.250	1.000	.423	
	Within Groups	.500	.250			
	Total	.750				
Others						

Table 56 – ANOVA on 10-27 based on teaching level

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
10.	I have used LMS for classroom	2.643	2	1.321	1.477	.234
		85.903	96	.895		

management/administration purposes (for example, posting important announcements on the bulletin board).	Total	88.545	98			
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	Between Groups	2.550	2	1.275	.624	.538
	Within Groups	196.177	96	2.044		
	Total	198.727	98			
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	Between Groups	2.341	2	1.170	.478	.621
	Within Groups	230.030	94	2.447		
	Total	232.371	96			
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	Between Groups	3.567	2	1.783	.798	.453
	Within Groups	214.615	96	2.236		
	Total	218.182	98			
14. I always give detailed feedback to students on their assessments.	Between Groups	1.729	2	.865	1.468	.236
	Within Groups	55.363	94	.589		
	Total	57.093	96			
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	1.768	2	.884	.561	.573
	Within Groups	143.435	91	1.576		
	Total	145.202	93			
16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	17.214	2	8.607	5.785	.004
	Within Groups	135.392	91	1.488		
	Total	152.606	93			
17. Providing comments directly via email is an effective	Between Groups	22.456	2	11.228	6.580	.002
	Within Groups	155.289	91	1.706		

way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Total		177.745	93			
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups		10.480	2	5.240	3.044	.053
	Within Groups		149.742	87	1.721		
	Total		160.222	89			
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups		13.536	2	6.768	4.305	.016
	Within Groups		143.070	91	1.572		
	Total		156.606	93			
20. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups		11.890	2	5.945	3.658	.030
	Within Groups		152.749	94	1.625		
	Total		164.639	96			
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups		11.738	2	5.869	3.433	.036
	Within Groups		160.716	94	1.710		
	Total		172.454	96			
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups		11.065	2	5.533	2.966	.057
	Within Groups		169.743	91	1.865		
	Total		180.809	93			
	Between Groups		1.584	2	.792	.708	.495

23.	I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Within Groups	100.695	90	1.119		
		Total	102.280	92			
24.	I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Between Groups	4.722	2	2.361	2.105	.128
		Within Groups	106.554	95	1.122		
		Total	111.276	97			
24.	I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Between Groups	3.220	2	1.610	1.400	.252
		Within Groups	109.280	95	1.150		
		Total	112.500	97			
24.	I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	Between Groups	3.363	2	1.682	1.339	.267
		Within Groups	119.259	95	1.255		
		Total	122.622	97			
24.	I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	Between Groups	3.532	2	1.766	1.288	.281
		Within Groups	130.305	95	1.372		
		Total	133.837	97			
24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	Between Groups	2.079	2	1.040	.647	.526
		Within Groups	149.327	93	1.606		
		Total	151.406	95			
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Between Groups	.085	2	.043	.059	.943
		Within Groups	66.799	92	.726		
		Total	66.884	94			
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Between Groups	4.129	2	2.065	1.650	.198
		Within Groups	115.092	92	1.251		
		Total	119.221	94			
27.	I often get deterred from using the assessment tools	Between Groups	.589	2	.295	.223	.801
		Within Groups	120.400	91	1.323		

in an LMS because: | a.	Total		120.989	93			
Student's lack competence in working with the LMS and feedback system							
27. I often get deterred from using the assessment tools	Between Groups		.314	2	.157	.107	.899
	Within Groups		134.122	91	1.474		
in an LMS because: | b.	Total		134.436	93			
There is a lack of institutional encouragement for using assessment tools in LMS.							
27. I often get deterred from using the assessment tools	Between Groups		2.606	2	1.303	1.005	.370
	Within Groups		118.000	91	1.297		
in an LMS because: | c.	Total		120.606	93			
There is a lack of financial support at my institution.							
27. I often get deterred from using the assessment tools	Between Groups		.715	2	.357	.269	.764
	Within Groups		120.700	91	1.326		
in an LMS because: | d.	Total		121.415	93			
There is a lack of technical support at my institution.							
27. I often get deterred from using the assessment tools	Between Groups		.205	2	.102	.089	.915
	Within Groups		104.433	91	1.148		
in an LMS because: | e.	Total		104.638	93			
There is a lack of support from other colleagues.							
27. I often get deterred from using the assessment tools	Between Groups		.204	2	.102	.068	.934
	Within Groups		136.700	91	1.502		
in an LMS because: | f. I	Total		136.904	93			
do not have adequate training on the LMS.							
27. I often get deterred from using the assessment tools	Between Groups		4.296	2	2.148	1.562	.215
	Within Groups		125.108	91	1.375		
in an LMS because: | g. I	Total		129.404	93			
do not have enough time.							
27. I often get deterred from using the assessment tools	Between Groups		3.049	2	1.525	1.293	.280
	Within Groups		106.133	90	1.179		

in an LMS because: | h.	I	Total	109.183	92			
experience technical issues when using the LMS.							
27.	I often get deterred from using the assessment tools in an LMS because: | i.	Between Groups	1.761	2	.881	.560	.576
		Within Groups	53.428	34	1.571		
		Total	55.189	36			
	Others						

From comp – hrs of training oneway

Table 57 – Descriptive based on hours of training on LMS

		Descriptives								
			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
							Lower Bound	Upper Bound		
10.	I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	None	34	4.147	1.2342	.2117	3.716	4.578	1.0	5.0
		1-3 (Low)	31	4.387	.9193	.1651	4.050	4.724	1.0	5.0
		4+ (High)	34	4.824	.3870	.0664	4.689	4.959	4.0	5.0
		Total	99	4.455	.9505	.0955	4.265	4.644	1.0	5.0
11.	I have used an LMS for instructional purposes (for example, posting an instructional video).	None	34	3.588	1.6352	.2804	3.018	4.159	1.0	5.0
		1-3 (Low)	31	3.613	1.5422	.2770	3.047	4.179	1.0	5.0
		4+ (High)	34	4.235	.9553	.1638	3.902	4.569	1.0	5.0
		Total	99	3.818	1.4240	.1431	3.534	4.102	1.0	5.0
12.	I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	None	34	3.382	1.5957	.2737	2.826	3.939	1.0	5.0
		1-3 (Low)	31	2.839	1.5726	.2825	2.262	3.416	1.0	5.0
		4+ (High)	32	3.844	1.3704	.2423	3.350	4.338	1.0	5.0
		Total	97	3.361	1.5558	.1580	3.047	3.674	1.0	5.0
13.	I have used an LMS for formative assessment purposes (for example, providing feedback to students).	None	34	2.971	1.5073	.2585	2.445	3.496	1.0	5.0
		1-3 (Low)	31	3.000	1.5706	.2821	2.424	3.576	1.0	5.0
		4+ (High)	34	3.735	1.3098	.2246	3.278	4.192	1.0	5.0
		Total	99	3.242	1.4921	.1500	2.945	3.540	1.0	5.0
14.	I always give detailed feedback to students on their assessments.	None	33	4.303	.7699	.1340	4.030	4.576	3.0	5.0
		1-3 (Low)	31	4.258	.7732	.1389	3.974	4.542	3.0	5.0
		4+ (High)	33	4.394	.7882	.1372	4.114	4.673	2.0	5.0
		Total	97	4.320	.7712	.0783	4.164	4.475	2.0	5.0

15.	The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	None	33	3.273	1.3526	.2355	2.793	3.752	1.0	5.0
		1-3 (Low)	27	2.889	1.0860	.2090	2.459	3.319	1.0	5.0
		4+ (High)	34	3.206	1.2740	.2185	2.761	3.650	1.0	5.0
		Total	94	3.138	1.2495	.1289	2.882	3.394	1.0	5.0
16.	Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	None	33	2.818	1.3336	.2321	2.345	3.291	1.0	5.0
		1-3 (Low)	28	2.643	1.1616	.2195	2.192	3.093	1.0	5.0
		4+ (High)	33	3.030	1.3343	.2323	2.557	3.503	1.0	5.0
		Total	94	2.840	1.2810	.1321	2.578	3.103	1.0	5.0
17.	Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	None	33	2.818	1.4460	.2517	2.305	3.331	1.0	5.0
		1-3 (Low)	28	2.714	1.4105	.2666	2.167	3.261	1.0	5.0
		4+ (High)	33	2.818	1.3336	.2321	2.345	3.291	1.0	5.0
		Total	94	2.787	1.3825	.1426	2.504	3.070	1.0	5.0
18.	Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	None	32	2.719	1.4421	.2549	2.199	3.239	1.0	5.0
		1-3 (Low)	26	2.115	1.2434	.2439	1.613	2.618	1.0	5.0
		4+ (High)	32	2.750	1.2700	.2245	2.292	3.208	1.0	5.0
		Total	90	2.556	1.3417	.1414	2.275	2.837	1.0	5.0
19.	The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	None	32	3.156	1.3467	.2381	2.671	3.642	1.0	5.0
		1-3 (Low)	30	3.167	1.2617	.2304	2.696	3.638	1.0	5.0
		4+ (High)	32	3.156	1.3225	.2338	2.679	3.633	1.0	5.0
		Total	94	3.160	1.2977	.1338	2.894	3.425	1.0	5.0
20.	Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	None	33	3.273	1.2814	.2231	2.818	3.727	1.0	5.0
		1-3 (Low)	31	3.258	1.4135	.2539	2.740	3.777	1.0	5.0
		4+ (High)	33	3.576	1.2508	.2177	3.132	4.019	1.0	5.0
		Total	97	3.371	1.3096	.1330	3.107	3.635	1.0	5.0
		None	33	3.333	1.3385	.2330	2.859	3.808	1.0	5.0

21.	Providing comments	1-3 (Low)	31	3.226	1.4074	.2528	2.710	3.742	1.0	5.0
	directly via email is an effective	4+ (High)	33	3.091	1.3078	.2277	2.627	3.555	1.0	5.0
	way to give feedback to students	Total	97	3.216	1.3403	.1361	2.946	3.487	1.0	5.0
	on open ended type assessment									
	questions (e.g., essays, problems to									
	solve, etc.).									
22.	Providing comments via	None	32	2.844	1.5050	.2661	2.301	3.386	1.0	5.0
	Face to Face (F2F)/Video	1-3 (Low)	29	2.448	1.2980	.2410	1.955	2.942	1.0	5.0
	Conferencing is an effective	4+ (High)	33	2.848	1.3721	.2388	2.362	3.335	1.0	5.0
	way to give feedback to students	Total	94	2.723	1.3943	.1438	2.438	3.009	1.0	5.0
	on open ended type assessment									
	questions (e.g., essays, problems to									
	solve, etc.).									
23.	I feel that the current	None	32	2.781	.9750	.1724	2.430	3.133	1.0	4.0
	LMS I use allows me to import	1-3 (Low)	29	2.483	1.2136	.2254	2.021	2.944	1.0	4.0
	assessment data and results by	4+ (High)	32	2.531	.9832	.1738	2.177	2.886	1.0	4.0
	linking with external tools (e.g.	Total	93	2.602	1.0544	.1093	2.385	2.819	1.0	4.0
	Clickers, concept mapping									
	software, simulations, etc.).									
24.	I feel that the existing	None	34	2.912	1.1643	.1997	2.506	3.318	1.0	5.0
	tools in the LMS that I use: | a.	1-3 (Low)	31	2.774	.9903	.1779	2.411	3.137	1.0	4.0
	allow me to effectively	4+ (High)	33	2.909	1.0713	.1865	2.529	3.289	1.0	5.0
	assess higher order learning in my	Total	98	2.867	1.0711	.1082	2.653	3.082	1.0	5.0
	students									
24.	I feel that the existing	None	34	2.706	1.2193	.2091	2.280	3.131	1.0	5.0
	tools in the LMS that I use: | b.	1-3 (Low)	31	2.645	.9504	.1707	2.297	2.994	1.0	4.0
	allow me to effectively	4+ (High)	33	3.000	1.0308	.1794	2.635	3.365	1.0	5.0
	identify my students' strengths and	Total	98	2.786	1.0769	.1088	2.570	3.002	1.0	5.0
	areas of improvement									
24.	I feel that the existing	None	34	3.206	1.2255	.2102	2.778	3.633	1.0	5.0
	tools in the LMS that I use: | c.	1-3 (Low)	31	3.323	1.0128	.1819	2.951	3.694	1.0	5.0
	allow me to provide	4+ (High)	33	3.242	1.1465	.1996	2.836	3.649	1.0	5.0
	effective feedback to my students	Total	98	3.255	1.1243	.1136	3.030	3.481	1.0	5.0
24.	I feel that the existing	None	34	3.059	1.2295	.2109	2.630	3.488	1.0	5.0
	tools in the LMS that I use: | d.	1-3 (Low)	31	2.839	1.0984	.1973	2.436	3.242	1.0	5.0
	allow me to effectively	4+ (High)	33	3.212	1.1926	.2076	2.789	3.635	1.0	5.0
	track student learning over time	Total	98	3.041	1.1746	.1187	2.805	3.276	1.0	5.0
		None	33	2.606	1.3214	.2300	2.137	3.075	1.0	5.0
		1-3 (Low)	31	2.645	1.1986	.2153	2.206	3.085	1.0	5.0

24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	4+ (High)	32	2.906	1.2791	.2261	2.445	3.367	1.0	5.0
		Total	96	2.719	1.2624	.1288	2.463	2.975	1.0	5.0
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	None	31	3.742	.7288	.1309	3.475	4.009	3.0	5.0
		1-3 (Low)	31	3.645	.8774	.1576	3.323	3.967	2.0	5.0
		4+ (High)	33	3.636	.9293	.1618	3.307	3.966	2.0	5.0
		Total	95	3.674	.8435	.0865	3.502	3.846	2.0	5.0
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	None	31	3.129	1.3842	.2486	2.621	3.637	1.0	5.0
		1-3 (Low)	31	2.968	1.0160	.1825	2.595	3.340	1.0	5.0
		4+ (High)	33	3.303	.9515	.1656	2.966	3.640	1.0	5.0
		Total	95	3.137	1.1262	.1155	2.907	3.366	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	None	31	2.935	1.1528	.2071	2.513	3.358	1.0	5.0
		1-3 (Low)	31	2.935	1.0935	.1964	2.534	3.337	1.0	5.0
		4+ (High)	32	3.156	1.1943	.2111	2.726	3.587	1.0	5.0
		Total	94	3.011	1.1406	.1176	2.777	3.244	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | b. There is a lack of institutional encouragement for using assessment tools in LMS.	None	31	2.452	.9605	.1725	2.099	2.804	1.0	4.0
		1-3 (Low)	31	2.710	1.2164	.2185	2.264	3.156	1.0	5.0
		4+ (High)	32	2.656	1.4053	.2484	2.150	3.163	1.0	5.0
		Total	94	2.606	1.2023	.1240	2.360	2.853	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	None	31	2.645	.9504	.1707	2.297	2.994	1.0	5.0
		1-3 (Low)	31	3.161	1.0676	.1917	2.770	3.553	1.0	5.0
		4+ (High)	32	2.719	1.3255	.2343	2.241	3.197	1.0	5.0
		Total	94	2.840	1.1388	.1175	2.607	3.074	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	None	31	2.710	1.1013	.1978	2.306	3.114	1.0	5.0
		1-3 (Low)	31	3.032	1.0796	.1939	2.636	3.428	1.0	5.0
		4+ (High)	32	2.219	1.1284	.1995	1.812	2.626	1.0	5.0
		Total	94	2.649	1.1426	.1179	2.415	2.883	1.0	5.0
27.	I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	None	31	2.581	.8860	.1591	2.256	2.906	1.0	4.0
		1-3 (Low)	31	2.935	1.0307	.1851	2.557	3.314	1.0	5.0
		4+ (High)	32	2.281	1.1705	.2069	1.859	2.703	1.0	5.0
		Total	94	2.596	1.0607	.1094	2.378	2.813	1.0	5.0
27.	I often get deterred from using the assessment tools in an	None	31	3.065	1.0935	.1964	2.663	3.466	1.0	5.0
		1-3 (Low)	31	3.355	1.1986	.2153	2.915	3.794	1.0	5.0
		4+ (High)	32	2.688	1.2811	.2265	2.226	3.149	1.0	5.0

LMS because: | f. I do not have adequate training on the LMS.	Total	94	3.032	1.2133	.1251	2.783	3.280	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	None	31	3.516	1.0915	.1960	3.116	3.916	1.0	5.0
	1-3 (Low)	31	3.516	1.1796	.2119	3.083	3.949	1.0	5.0
	4+ (High)	32	3.563	1.2936	.2287	3.096	4.029	1.0	5.0
	Total	94	3.532	1.1796	.1217	3.290	3.774	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	None	30	3.433	1.1943	.2181	2.987	3.879	1.0	5.0
	1-3 (Low)	31	3.548	.9605	.1725	3.196	3.901	1.0	5.0
	4+ (High)	32	3.438	1.1341	.2005	3.029	3.846	1.0	5.0
	Total	93	3.473	1.0894	.1130	3.249	3.697	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | i. Others	None	13	3.846	1.2142	.3368	3.112	4.580	2.0	5.0
	1-3 (Low)	10	3.800	.7888	.2494	3.236	4.364	3.0	5.0
	4+ (High)	14	3.071	1.4392	.3847	2.240	3.902	1.0	5.0
	Total	37	3.541	1.2382	.2036	3.128	3.953	1.0	5.0

Table 58 – ANOVA 10-27 based on hours of training on LMS

		ANOVA				
		Sum of Squares	df	Mean Square	F	Sig.
10. I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	Between Groups	7.985	2	3.992	4.757	.011
	Within Groups	80.561	96	.839		
	Total	88.545	98			
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	Between Groups	9.019	2	4.510	2.282	.108
	Within Groups	189.708	96	1.976		
	Total	198.727	98			
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	Between Groups	15.929	2	7.965	3.459	.036
	Within Groups	216.442	94	2.303		
	Total	232.371	96			
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	Between Groups	12.594	2	6.297	2.940	.058
	Within Groups	205.588	96	2.142		
	Total	218.182	98			

14. I always give detailed feedback to students on their assessments.	Between Groups	.309	2	.154	.256	.775
	Within Groups	56.784	94	.604		
	Total	57.093	96			
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	2.431	2	1.216	.775	.464
	Within Groups	142.771	91	1.569		
	Total	145.202	93			
16. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	2.299	2	1.150	.696	.501
	Within Groups	150.307	91	1.652		
	Total	152.606	93			
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	.212	2	.106	.054	.947
	Within Groups	177.532	91	1.951		
	Total	177.745	93			
18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	7.100	2	3.550	2.017	.139
	Within Groups	153.123	87	1.760		
	Total	160.222	89			
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	.002	2	.001	.001	.999
	Within Groups	156.604	91	1.721		
	Total	156.606	93			

20. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	2.098	2	1.049	.607	.547
	Within Groups	162.542	94	1.729		
	Total	164.639	96			
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	.974	2	.487	.267	.766
	Within Groups	171.480	94	1.824		
	Total	172.454	96			
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Between Groups	3.175	2	1.587	.813	.447
	Within Groups	177.634	91	1.952		
	Total	180.809	93			
23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Between Groups	1.601	2	.800	.715	.492
	Within Groups	100.679	90	1.119		
	Total	102.280	92			
24. I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Between Groups	.394	2	.197	.169	.845
	Within Groups	110.882	95	1.167		
	Total	111.276	97			
24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Between Groups	2.344	2	1.172	1.011	.368
	Within Groups	110.156	95	1.160		
	Total	112.500	97			
24. I feel that the existing tools in the LMS that I use: | c.	Between Groups	.229	2	.114	.089	.915
	Within Groups	122.394	95	1.288		

	allow me to provide effective feedback to my students	Total	122.622	97			
24.	I feel that the existing tools in the LMS that I use: | d.	Between Groups	2.246	2	1.123	.811	.448
		Within Groups	131.591	95	1.385		
	allow me to effectively track student learning over time	Total	133.837	97			
24.	I feel that the existing tools in the LMS that I use: | e.	Between Groups	1.712	2	.856	.532	.589
		Within Groups	149.694	93	1.610		
	are user friendly	Total	151.406	95			
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Between Groups	.216	2	.108	.149	.862
		Within Groups	66.669	92	.725		
		Total	66.884	94			
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Between Groups	1.800	2	.900	.705	.497
		Within Groups	117.421	92	1.276		
		Total	119.221	94			
27.	I often get deterred from using the assessment tools in an LMS because: | a.	Between Groups	1.029	2	.514	.390	.678
	Student's lack competence in working with the LMS and feedback system	Within Groups	119.961	91	1.318		
		Total	120.989	93			
27.	I often get deterred from using the assessment tools in an LMS because: | b.	Between Groups	1.153	2	.576	.394	.676
	There is a lack of institutional encouragement for using assessment tools in LMS.	Within Groups	133.283	91	1.465		
		Total	134.436	93			
27.	I often get deterred from using the assessment tools in an LMS because: | c.	Between Groups	4.847	2	2.424	1.905	.155
	There is a lack of financial support at my institution.	Within Groups	115.759	91	1.272		
		Total	120.606	93			
27.	I often get deterred from using the assessment tools	Between Groups	10.591	2	5.296	4.348	.016
		Within Groups	110.824	91	1.218		

in an LMS because: | d.	Total		121.415	93				
There is a lack of technical support at my institution.								
27. I often get deterred from using the assessment tools	Between Groups		6.750	2	3.375	3.138	.048	
	Within Groups		97.888	91	1.076			
in an LMS because: | e.	Total		104.638	93				
There is a lack of support from other colleagues.								
27. I often get deterred from using the assessment tools	Between Groups		7.062	2	3.531	2.475	.090	
	Within Groups		129.843	91	1.427			
in an LMS because: | f. I do not have adequate training on the LMS.	Total		136.904	93				
27. I often get deterred from using the assessment tools	Between Groups		.045	2	.023	.016	.984	
	Within Groups		129.359	91	1.422			
in an LMS because: | g. I do not have enough time.	Total		129.404	93				
27. I often get deterred from using the assessment tools	Between Groups		.264	2	.132	.109	.897	
	Within Groups		108.919	90	1.210			
in an LMS because: | h. I experience technical issues when using the LMS.	Total		109.183	92				
27. I often get deterred from using the assessment tools	Between Groups		4.968	2	2.484	1.682	.201	
	Within Groups		50.221	34	1.477			
in an LMS because: | i. Others	Total		55.189	36				

Table 59 – Descriptives 10-27 based on higher education experience

Descriptives										
			N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Mini mum	Maxi mum
							Lower Bound	Upper Bound		
10.	I have used LMS for classroom management/administration	Low	23	4.652	.4870	.1015	4.442	4.863	4.0	5.0
		Medium	40	4.425	1.0350	.1636	4.094	4.756	1.0	5.0
		High	36	4.361	1.0731	.1789	3.998	4.724	1.0	5.0

purposes (for example, posting important announcements on the bulletin board).	Total	99	4.455	.9505	.0955	4.265	4.644	1.0	5.0
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	Low	23	4.130	1.2900	.2690	3.573	4.688	1.0	5.0
	Medium	40	3.550	1.4491	.2291	3.087	4.013	1.0	5.0
	High	36	3.917	1.4614	.2436	3.422	4.411	1.0	5.0
	Total	99	3.818	1.4240	.1431	3.534	4.102	1.0	5.0
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	Low	23	3.652	1.4336	.2989	3.032	4.272	1.0	5.0
	Medium	39	3.231	1.4949	.2394	2.746	3.715	1.0	5.0
	High	35	3.314	1.7111	.2892	2.727	3.902	1.0	5.0
	Total	97	3.361	1.5558	.1580	3.047	3.674	1.0	5.0
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	Low	23	3.565	1.5323	.3195	2.903	4.228	1.0	5.0
	Medium	40	2.975	1.3679	.2163	2.538	3.412	1.0	5.0
	High	36	3.333	1.5856	.2643	2.797	3.870	1.0	5.0
	Total	99	3.242	1.4921	.1500	2.945	3.540	1.0	5.0
14. I always give detailed feedback to students on their assessments.	Low	22	4.318	.7799	.1663	3.972	4.664	3.0	5.0
	Medium	40	4.225	.7334	.1160	3.990	4.460	3.0	5.0
	High	35	4.429	.8148	.1377	4.149	4.708	2.0	5.0
	Total	97	4.320	.7712	.0783	4.164	4.475	2.0	5.0
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Low	22	3.182	1.0970	.2339	2.695	3.668	1.0	5.0
	Medium	40	3.175	1.2380	.1957	2.779	3.571	1.0	5.0
	High	32	3.063	1.3898	.2457	2.561	3.564	1.0	5.0
	Total	94	3.138	1.2495	.1289	2.882	3.394	1.0	5.0
16. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Low	23	2.739	1.3218	.2756	2.168	3.311	1.0	5.0
	Medium	39	2.872	1.1045	.1769	2.514	3.230	1.0	5.0
	High	32	2.875	1.4756	.2609	2.343	3.407	1.0	5.0
	Total	94	2.840	1.2810	.1321	2.578	3.103	1.0	5.0
17. Providing comments directly via email is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Low	23	2.043	1.0215	.2130	1.602	2.485	1.0	4.0
	Medium	40	3.000	1.3775	.2178	2.559	3.441	1.0	5.0
	High	31	3.065	1.4591	.2621	2.529	3.600	1.0	5.0
	Total	94	2.787	1.3825	.1426	2.504	3.070	1.0	5.0
	Low	20	2.100	1.0208	.2283	1.622	2.578	1.0	4.0

18. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Medium	39	2.821	1.4845	.2377	2.339	3.302	1.0	5.0
	High	31	2.516	1.2877	.2313	2.044	2.988	1.0	5.0
	Total	90	2.556	1.3417	.1414	2.275	2.837	1.0	5.0
19. The LMS that I use provides an effective mechanism for giving feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Low	22	3.227	1.2699	.2707	2.664	3.790	1.0	5.0
	Medium	39	3.128	1.2810	.2051	2.713	3.543	1.0	5.0
	High	33	3.152	1.3721	.2388	2.665	3.638	1.0	5.0
	Total	94	3.160	1.2977	.1338	2.894	3.425	1.0	5.0
20. Providing comments on a word processed file that is then uploaded/mailed via LMS is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Low	23	3.826	1.0725	.2236	3.362	4.290	1.0	5.0
	Medium	39	3.154	1.1818	.1892	2.771	3.537	1.0	5.0
	High	35	3.314	1.5295	.2585	2.789	3.840	1.0	5.0
	Total	97	3.371	1.3096	.1330	3.107	3.635	1.0	5.0
21. Providing comments directly via email is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Low	22	2.591	1.2968	.2765	2.016	3.166	1.0	5.0
	Medium	40	3.450	1.3388	.2117	3.022	3.878	1.0	5.0
	High	35	3.343	1.2821	.2167	2.902	3.783	1.0	5.0
	Total	97	3.216	1.3403	.1361	2.946	3.487	1.0	5.0
22. Providing comments via Face to Face (F2F)/Video Conferencing is an effective way to give feedback to students on open ended type assessment questions (e.g., essays, problems to solve, etc.).	Low	21	2.476	1.1233	.2451	1.965	2.988	1.0	4.0
	Medium	39	3.000	1.5218	.2437	2.507	3.493	1.0	5.0
	High	34	2.559	1.3749	.2358	2.079	3.039	1.0	5.0
	Total	94	2.723	1.3943	.1438	2.438	3.009	1.0	5.0
23. I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Low	23	2.739	1.0098	.2106	2.302	3.176	1.0	4.0
	Medium	39	2.590	1.1173	.1789	2.228	2.952	1.0	4.0
	High	31	2.516	1.0286	.1847	2.139	2.893	1.0	4.0
	Total	93	2.602	1.0544	.1093	2.385	2.819	1.0	4.0
	Low	23	3.043	.9283	.1936	2.642	3.445	1.0	5.0

24. I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Medium	39	2.667	1.0842	.1736	2.315	3.018	1.0	4.0
	High	36	2.972	1.1335	.1889	2.589	3.356	1.0	5.0
	Total	98	2.867	1.0711	.1082	2.653	3.082	1.0	5.0
24. I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Low	23	2.826	1.1140	.2323	2.344	3.308	1.0	5.0
	Medium	39	2.692	1.1039	.1768	2.334	3.050	1.0	5.0
	High	36	2.861	1.0462	.1744	2.507	3.215	1.0	4.0
	Total	98	2.786	1.0769	.1088	2.570	3.002	1.0	5.0
24. I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	Low	23	3.435	.9921	.2069	3.006	3.864	1.0	5.0
	Medium	39	3.308	1.0798	.1729	2.958	3.658	1.0	5.0
	High	36	3.083	1.2507	.2085	2.660	3.507	1.0	5.0
	Total	98	3.255	1.1243	.1136	3.030	3.481	1.0	5.0
24. I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	Low	23	3.348	1.3007	.2712	2.785	3.910	1.0	5.0
	Medium	39	2.872	1.1738	.1880	2.491	3.252	1.0	5.0
	High	36	3.028	1.0820	.1803	2.662	3.394	1.0	4.0
	Total	98	3.041	1.1746	.1187	2.805	3.276	1.0	5.0
24. I feel that the existing tools in the LMS that I use: | e. are user friendly	Low	23	3.087	1.2028	.2508	2.567	3.607	1.0	5.0
	Medium	38	2.447	1.2013	.1949	2.053	2.842	1.0	5.0
	High	35	2.771	1.3303	.2249	2.314	3.228	1.0	5.0
	Total	96	2.719	1.2624	.1288	2.463	2.975	1.0	5.0
25. Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Low	23	3.696	.9261	.1931	3.295	4.096	2.0	5.0
	Medium	37	3.514	.6921	.1138	3.283	3.744	3.0	5.0
	High	35	3.829	.9231	.1560	3.511	4.146	2.0	5.0
	Total	95	3.674	.8435	.0865	3.502	3.846	2.0	5.0
26. I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Low	23	3.087	1.0407	.2170	2.637	3.537	1.0	5.0
	Medium	38	2.947	1.2509	.2029	2.536	3.359	1.0	5.0
	High	34	3.382	1.0155	.1742	3.028	3.737	1.0	5.0
	Total	95	3.137	1.1262	.1155	2.907	3.366	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | a. Student's lack competence in working with the LMS and feedback system	Low	23	2.826	1.3022	.2715	2.263	3.389	1.0	5.0
	Medium	38	3.132	1.0180	.1651	2.797	3.466	1.0	5.0
	High	33	3.000	1.1726	.2041	2.584	3.416	1.0	5.0
	Total	94	3.011	1.1406	.1176	2.777	3.244	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | b. There is a lack	Low	23	2.478	1.2384	.2582	1.943	3.014	1.0	5.0
	Medium	38	2.605	.9737	.1580	2.285	2.925	1.0	4.0
	High	33	2.697	1.4249	.2480	2.192	3.202	1.0	5.0

of institutional encouragement for using assessment tools in LMS.	Total	94	2.606	1.2023	.1240	2.360	2.853	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | c. There is a lack of financial support at my institution.	Low	23	2.522	1.1229	.2341	2.036	3.007	1.0	5.0
	Medium	38	3.026	.9722	.1577	2.707	3.346	1.0	5.0
	High	33	2.848	1.3020	.2266	2.387	3.310	1.0	5.0
	Total	94	2.840	1.1388	.1175	2.607	3.074	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | d. There is a lack of technical support at my institution.	Low	23	2.522	1.1627	.2424	2.019	3.025	1.0	5.0
	Medium	38	2.816	1.0096	.1638	2.484	3.148	1.0	5.0
	High	33	2.545	1.2770	.2223	2.093	2.998	1.0	5.0
	Total	94	2.649	1.1426	.1179	2.415	2.883	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | e. There is a lack of support from other colleagues.	Low	23	2.261	1.1369	.2371	1.769	2.752	1.0	4.0
	Medium	38	2.816	.8654	.1404	2.531	3.100	1.0	5.0
	High	33	2.576	1.1734	.2043	2.160	2.992	1.0	5.0
	Total	94	2.596	1.0607	.1094	2.378	2.813	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | f. I do not have adequate training on the LMS.	Low	23	2.783	1.2777	.2664	2.230	3.335	1.0	5.0
	Medium	38	3.237	1.0764	.1746	2.883	3.591	1.0	5.0
	High	33	2.970	1.3106	.2282	2.505	3.434	1.0	5.0
	Total	94	3.032	1.2133	.1251	2.783	3.280	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | g. I do not have enough time.	Low	23	3.304	1.3292	.2772	2.730	3.879	1.0	5.0
	Medium	38	3.658	1.2142	.1970	3.259	4.057	1.0	5.0
	High	33	3.545	1.0335	.1799	3.179	3.912	1.0	5.0
	Total	94	3.532	1.1796	.1217	3.290	3.774	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | h. I experience technical issues when using the LMS.	Low	23	3.304	1.2946	.2699	2.745	3.864	1.0	5.0
	Medium	38	3.474	.9512	.1543	3.161	3.786	1.0	5.0
	High	32	3.594	1.1031	.1950	3.196	3.991	1.0	5.0
	Total	93	3.473	1.0894	.1130	3.249	3.697	1.0	5.0
27. I often get deterred from using the assessment tools in an LMS because: | i. Others	Low	5	3.000	.7071	.3162	2.122	3.878	2.0	4.0
	Medium	17	3.529	1.1246	.2728	2.951	4.108	1.0	5.0
	High	15	3.733	1.4864	.3838	2.910	4.557	1.0	5.0
	Total	37	3.541	1.2382	.2036	3.128	3.953	1.0	5.0

Table 60 - ANOVA 10-27 based on higher education experience

ANOVA					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.248	2	.624	.686	.506

10. I have used LMS for classroom management/administration purposes (for example, posting important announcements on the bulletin board).	Within Groups	87.298	96	.909		
	Total	88.545	98			
11. I have used an LMS for instructional purposes (for example, posting an instructional video).	Between Groups	5.469	2	2.734	1.358	.262
	Within Groups	193.259	96	2.013		
	Total	198.727	98			
12. I have used an LMS for assessment purposes (for example, posting an online assignment or quiz).	Between Groups	2.688	2	1.344	.550	.579
	Within Groups	229.683	94	2.443		
	Total	232.371	96			
13. I have used an LMS for formative assessment purposes (for example, providing feedback to students).	Between Groups	5.555	2	2.777	1.254	.290
	Within Groups	212.627	96	2.215		
	Total	218.182	98			
14. I always give detailed feedback to students on their assessments.	Between Groups	.774	2	.387	.646	.527
	Within Groups	56.319	94	.599		
	Total	57.093	96			
15. The LMS that I use provides an effective mechanism for giving feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	.279	2	.140	.088	.916
	Within Groups	144.923	91	1.593		
	Total	145.202	93			
16. Providing comments on a word processed file that is then uploaded/emailed via LMS is an effective way to give feedback to students on selected response type assessment questions (e.g., multiple choice, True/False, etc.).	Between Groups	.313	2	.156	.093	.911
	Within Groups	152.294	91	1.674		
	Total	152.606	93			
17. Providing comments directly via email is an effective	Between Groups	16.917	2	8.459	4.786	.011
	Within Groups	160.827	91	1.767		

way to give feedback to students	Total		177.745	93			
on selected response type							
assessment questions (e.g.,							
multiple choice, True/False,							
etc.).							
18. Providing comments	Between Groups		6.937	2	3.468	1.969	.146
via Face to Face (F2F)/Video	Within Groups		153.286	87	1.762		
Conferencing is an	Total		160.222	89			
effective way to give feedback							
to students on selected response							
type assessment questions (e.g.,							
multiple choice, True/False,							
etc.).							
19. The LMS that I use	Between Groups		.141	2	.071	.041	.960
provides an effective mechanism	Within Groups		156.465	91	1.719		
for giving feedback to students	Total		156.606	93			
on open ended type assessment							
questions (e.g., essays, problems							
to solve, etc.).							
20. Providing comments on	Between Groups		6.715	2	3.358	1.998	.141
a word processed file that is then	Within Groups		157.924	94	1.680		
uploaded/mailed via LMS is an	Total		164.639	96			
effective way to give feedback							
to students on open ended type							
assessment questions (e.g.,							
essays, problems to solve, etc.).							
21. Providing comments	Between Groups		11.350	2	5.675	3.311	.041
directly via email is an effective	Within Groups		161.104	94	1.714		
way to give feedback to students	Total		172.454	96			
on open ended type assessment							
questions (e.g., essays, problems							
to solve, etc.).							
22. Providing comments	Between Groups		5.188	2	2.594	1.344	.266
via Face to Face (F2F)/Video	Within Groups		175.620	91	1.930		
Conferencing is an	Total		180.809	93			
effective way to give feedback							
to students on open ended type							
assessment questions (e.g.,							
essays, problems to solve, etc.).							
	Between Groups		.667	2	.333	.295	.745

23.	I feel that the current LMS I use allows me to import assessment data and results by linking with external tools (e.g. Clickers, concept mapping software, simulations, etc.).	Within Groups	101.613	90	1.129		
		Total	102.280	92			
24.	I feel that the existing tools in the LMS that I use: | a. allow me to effectively assess higher order learning in my students	Between Groups	2.680	2	1.340	1.172	.314
		Within Groups	108.595	95	1.143		
		Total	111.276	97			
24.	I feel that the existing tools in the LMS that I use: | b. allow me to effectively identify my students' strengths and areas of improvement	Between Groups	.582	2	.291	.247	.781
		Within Groups	111.918	95	1.178		
		Total	112.500	97			
24.	I feel that the existing tools in the LMS that I use: | c. allow me to provide effective feedback to my students	Between Groups	1.913	2	.956	.753	.474
		Within Groups	120.710	95	1.271		
		Total	122.622	97			
24.	I feel that the existing tools in the LMS that I use: | d. allow me to effectively track student learning over time	Between Groups	3.288	2	1.644	1.196	.307
		Within Groups	130.549	95	1.374		
		Total	133.837	97			
24.	I feel that the existing tools in the LMS that I use: | e. are user friendly	Between Groups	6.014	2	3.007	1.923	.152
		Within Groups	145.392	93	1.563		
		Total	151.406	95			
25.	Manufacturers of LMS focus more on technical aspects rather than pedagogical aspects of their products.	Between Groups	1.800	2	.900	1.272	.285
		Within Groups	65.084	92	.707		
		Total	66.884	94			
26.	I would be willing to consult with developers of LMS to provide them with better guidance on pedagogical aspects of their products.	Between Groups	3.471	2	1.735	1.379	.257
		Within Groups	115.750	92	1.258		
		Total	119.221	94			
27.	I often get deterred from using the assessment tools	Between Groups	1.343	2	.671	.511	.602
		Within Groups	119.646	91	1.315		

in an LMS because: | a.	Total		120.989	93			
Student's lack competence in working with the LMS and feedback system							
27. I often get deterred from using the assessment tools	Between Groups		.648	2	.324	.221	.803
	Within Groups		133.788	91	1.470		
in an LMS because: | b.	Total		134.436	93			
There is a lack of institutional encouragement for using assessment tools in LMS.							
27. I often get deterred from using the assessment tools	Between Groups		3.651	2	1.826	1.420	.247
	Within Groups		116.955	91	1.285		
in an LMS because: | c.	Total		120.606	93			
There is a lack of financial support at my institution.							
27. I often get deterred from using the assessment tools	Between Groups		1.783	2	.892	.678	.510
	Within Groups		119.631	91	1.315		
in an LMS because: | d.	Total		121.415	93			
There is a lack of technical support at my institution.							
27. I often get deterred from using the assessment tools	Between Groups		4.432	2	2.216	2.013	.140
	Within Groups		100.206	91	1.101		
in an LMS because: | e.	Total		104.638	93			
There is a lack of support from other colleagues.							
27. I often get deterred from using the assessment tools	Between Groups		3.153	2	1.577	1.073	.346
	Within Groups		133.751	91	1.470		
in an LMS because: | f. I	Total		136.904	93			
do not have adequate training on the LMS.							
27. I often get deterred from using the assessment tools	Between Groups		1.800	2	.900	.642	.529
	Within Groups		127.604	91	1.402		
in an LMS because: | g. I	Total		129.404	93			
do not have enough time.							
27. I often get deterred from using the assessment tools	Between Groups		1.121	2	.560	.467	.629
	Within Groups		108.062	90	1.201		

in an LMS because: | h.	I	Total	109.183	92		
experience technical issues						
when using the LMS.						
27.	I often get deterred	Between Groups	2.021	2	1.010	.646 .530
	from using the assessment tools	Within Groups	53.169	34	1.564	
in an LMS because: | i.		Total	55.189	36		
	Others					

Highered.Expcode * Total 9a Crosstabulation

Count		Total 9a								Total
		.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	
Highered.Expcode	Low	1	5	3	7	4	1	1	1	23
	Medium	9	5	7	9	2	6	2	0	40
	High	8	8	2	10	4	2	2	0	36
Total		18	18	12	26	10	9	5	1	99

Highered.Expcode * Total 9b Crosstabulation

Count		Total 9b								Total
		.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	
Highered.Expcode	Low	4	7	8	1	2	1	0	0	23
	Medium	14	6	7	8	3	1	1	0	40
	High	16	6	5	5	3	0	0	1	36
Total		34	19	20	14	8	2	1	1	99