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Conceptualization, Development and Validation of an Instrument to Measure Learners' Perceptions of their Active Learning Strategies within an Active Learning Context

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Abstract: This study describes the development and validation of a psychometrically-sound instrument, the Active Learning Strategies Inventory (ALSI), designed to measure learners' perceptions of their active learning strategies within an active learning context. Active learning encompasses a broad range of pedagogical practices and instructional methods that connect with an individual learner's active learning strategies. In order to fulfill the study's goals, a conceptual framework on learners' active learning strategies was developed and proposed, drawing upon the research literature on active learning. The development and construct validation of the Active Learning Strategies Inventory (ALSI), based on the conceptual and methodological underpinnings, involved identifying five scales of learners' active learning strategies: engagement, cognitive processing, orientation to learning, readiness to learn and motivational orientation. An item pool of 20 items was generated following an extensive review of the literature, standardized card sorting procedures including confirmatory factor analysis and scale validation of a pilot (n = 407) survey. The ALSI scale demonstrated strong internal consistency and reliability with a Cronbach's alpha ranging from 0.81 to 0.87. High item loading scores from the factor analysis provided initial support for the instrument's construct validity of the five-factor model. The ALSI scale provides a reliable and valid method for researchers and academicians who wish to measure learners' perceptions of their active learning strategies within an active learning context. Finally, we discuss the implications and address the limitations and directions for future research.

Keywords: *Active learning, instrument development, engagement, cognitive processing, orientation to learning.*

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Introduction

Active learning has begun to emerge as a learning theory and a model of instruction that focuses on learners actively engaging in their learning by immersing themselves in a meaningful experience that they view as conducive to their tasks and to their learning goals. Over the last two decades, active learning as a pedagogical approach has emerged, placing strong relative importance on various methods of instruction and the conditions in which learning takes place. Many educators assert that learning is an inherently active process and hence, active involvement in the learning process enables learners to interact in a continuous process of knowledge construction, meaning making and cognitive engagement (Ginsburg, 2010). However, a comprehensive examination of the research literature suggests that learners must construct their own knowledge and understandings rather than receive information passively. Foremost, to be actively involved, learners need to engage in higher-order cognitive-processing skills such as synthesis, analysis and critical thought. Specifically, the main principle of active learning focuses on learner engagement through activities that translate into deeper levels of learning, motivation and achievement (Prince, 2004). The concept of active learning has been broadly and variously defined by Prince, as "any instructional method that engages students in the learning process" (p. 1). Bonwell and Eison (1991) emphasized the importance of active involvement in which "students must

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engage in such higher-order thinking tasks as analysis, synthesis, and evaluation” (p. 2). Hence, active learning, as a pedagogical approach, gives learners the opportunity to utilize their cognitive and higher-order skills and strategies by creating meaning from their experiences and the environment and from thereon, constructing their own knowledge and understanding (Chi & Wylie, 2014; Stanberry, 2018).

Historically, active learning has been considered a powerful pedagogical method and effective instructional strategy for enhancing student learning *and* motivation (deWinstanley & Bjork, 2002; Michael, 2006). Pedagogical approaches such as inquiry/problem-based learning promote engaged learning, higher-order thinking and complex cognitive processes in learners (Roehl et al., 2013). Considerable research has shown that active learning can be an effective method for engaging learners (Ellerton, 2013; Wolff et al., 2015; Zepke & Leach, 2010). Learning takes place when learners actively construct meaning by building on existing knowledge and experience. However, research has affirmed that learners’ cognitive levels of development should not only be aligned with active learning strategies, but also imbued with constructivist principles to subsequently drive learners toward internalizing their own knowledge and understandings (Baeten et al., 2013; Chi & Wylie, 2014; Haikari et al., 2021; Kwan & Wong, 2015).

The fundamental notion of active learning involves providing learners with the necessary learning skills and strategies to be active self-directed learners (van Hout-Wolters et al., 2000). Within an active learning context, learners are empowered to fully engage themselves in the learning process by taking advantage of multiple learning strategies, engaging in self-directed learning and subsequently, personalizing their learning by being able to connect to their learning environment and to each other (Fritz, 2002; Pintrich, 1999; Powell, 2005). However, the term active learning lacks conceptual clarity as well as a universal definition of what constitutes active learning among educational researchers, scholars and educators. Moreover, a major problem that arises is that different researchers and educators, representing a range of disciplines such as nursing and healthcare, social psychology, education and engineering, offer varying definitions of the term with no comprehensive agreement on how the term should be defined across theoretical perspectives. Various definitions of the term exist concurrently and as yet, there exists no common definition or consensus of the term within the context of a research community. Furthermore, the absence of a generally agreed-upon definition of the term and the lack of an objective measurement has been highlighted by numerous researchers (Aydede & Kesercioğlu, 2010; Dickson & Ladefoged, 2017; Karamustafaoglu, 2009). The definition has slowly evolved over the years and several researchers have attempted to provide a generally accepted definition of active learning, summarized in Table 1 below.

Table 1: Definitions of active learning and primary proponents of each definition

Definitions of Active Learning	Proponents	Field
“learning in which the learner uses opportunities to decide about aspects of the learning process.”	(van Hout-Wolters et al., 2000, p. 1)	Education
“the extent to which the learner is challenged to use his or her mental abilities while learning.”	van Hout-Wolters et al., 2000, p. 1)	
“students become actively engaged in the learning process by participation in activities that require them to consider their understanding and incorporate new information into their personal conceptual framework.”	(Ernst & Colthorpe, 2008, p. 1)	Pharmaceutical Education
“learners explore ideas related to their own insights”	(Scott, 2011, p. 192)	Music Education
“the level of engagement by the student in the instructional process.”	(Fern et al., 1993, p. 3)	Language Education
“learners are at the center of the learning process by their high engagement in practical activities and discussion.”	(Festus, 2013, p. 9)	Education
“complex group exercises in which students apply course material to “real life” situations and/or new problems.”	(Faust & Paulson, 1998, p. 4)	Education
“activities that involve the students in the learning process.”	(Nagda et al., 2003, p. 171)	Social Psychology
“any instructional method that engages students in the learning process.”	(Prince, 2004, p. 1)	Engineering Education
“a philosophy of education based on the premise that students best internalize information when they are directly involved in their own learning.”	(Greek, 1995, p. 153)	Criminal Justice Education
“engagement in meaningful tasks where students have ownership of the content.”	(McCown et al., 1996, p. 236)	Educational Psychology
“an approach or methodology for learning that draws on, integrates and creatively synthesizes numerous learning methods.”	(Dewing, 2010, p. 274)	Nursing and Healthcare
“instructional activities involving students in doing things and thinking about what they are doing; to be actively involved, students must engage in such higher order thinking tasks as analysis, synthesis, and evaluation.”	(Bonwell & Eison, 1991, p. 2)	Higher Education
“an educational process where high levels of learning interactions and mental engagement are initiated by the learner.”	(Ren et al., 2015, p. 6)	Engineering
“increasing of student participation, or ‘interactivity’, for the purpose of positively affecting student learning and attitudes.”	(Georgiou & Sharma, 2015, p. 2)	Physics

Although the existing definitions of active learning vary in current research literature, the term is frequently used interchangeably and therefore, lacks consistency in its use and interpretation. Hence, active learning as a concept for research purposes has not yet been well defined and clarified in the literature. Page (1990) concluded that active learning as a concept is complex and fragmented: "There is neither a comprehensive body of research nor a consolidated discussion of active learning in the literature" (p. 4). Moreover, according to Page(1990), the research on active learning is "skimpy and scarce" and suffers from poorly defined terms and inappropriate measures. Since the term lacks a clear and consistent definition, we provide a more conceptually-grounded definition and a wider perspective of active learning based on an extensive synthesis of the relevant research and literature, which informs the conceptual framework, which in turn guides the instrument development and validation in this study.

A critical review of the research and development work on active learning highlights the nonexistence of a singular commonly accepted definition of the term active learning - rather, the conceptualization is vague and open to various interpretations and understandings, thus causing confusion. For these reasons, the following expanded definition is provided based on a thorough and systematic review of the pertinent research and literature. Active learning is defined as a pedagogical approach that allows learners to apply their active learning strategies by 1) interacting and engaging in the joint-construction of knowledge mediated by purposeful appropriation of higher order cognitive skills (i.e., cognitive processing); 2) expressing an underlying value and perception of the context for learning (i.e., orientation to learning); 3) generating a desire to positively contribute to the learning process and experience (i.e., readiness to learn) and; 4) a desire to participate in intellectually challenging tasks and activities that evoke a sense of interest, validate a sense of control and allow for probing a variety of issues at greater depth (i.e., motivational orientation). This reworked and expanded definition of active learning is adopted in the present study and is intended to provide a cogent and comprehensive description of the term, consistent with the definitions of active learning in various fields and based on a systematic literature review of the relevant empirical studies and bodies of work of existing conceptual foundations and research.

Rationale in using a developed instrument

Although the concept of active learning has been discussed widely in educational literature in general and in specific disciplines as mentioned above, we were unable to find scales or instruments that directly assessed learners' active learning strategies within an active learning context. Despite numerous studies and systematic reviews on the impact of active learning on increased learner performance, to date, no previously developed scale or comprehensive instrument has been found in the existing body of literature that specifically measures the extent to which individual learners perceive their active learning strategies within an active learning context. In light of the gaps in the current literature identified in the preceding discussion on active learning, this study aims to employ a rigorous and systematic procedure to develop and validate the Active Learning Strategies Inventory (ALSI), specifically designed to measure learners' perceptions of their active learning strategies within an active learning context. The significance of developing an instrument is justified in light of this gap in the research literature and filling it would considerably add to our overall understanding of the methods by which learners appropriate active learning strategies within an active learning context. The development of the ALSI involves identifying key determinants of learners' active learning strategies based on previous research and sound conceptual foundations and research underpinnings. Moreover, the development of an instrument may inform research seeking to gain an in-depth and informed understanding of the underlying mechanisms that support compelling active learning contexts, through which learners are able to apply their active learning strategies through the use of higher-level cognitive skills such as complex problem solving, synthesis and analytical thinking.

Conceptual Model

Active Learning

Active learning as a pedagogical concept, implies that learners are active when they are motivated, engaged and interacting in their own learning process (Bonwell & Sutherland, 1996). In an active learning context, the learner assumes an active role in the learning situation by applying various active learning strategies, thereby allowing the learner to subsequently engage in much deeper levels of learning (Gleason et al., 2011). Active learning pertains to the varying pedagogical approaches and instructional delivery methodologies such as authentic learning, task-based learning, peer-assisted learning and problem-based and team-based learning (Gormally et al., 2009; Hmelo-Silver & Barrows, 2006; McCarthy & Anderson, 2000; Michael, 2006). These distinct pedagogical approaches are most often applied to the subset of active learning – broadly defined, active learning is an umbrella concept that covers a broad spectrum of pedagogical models and instructional approaches to support learning (Roehl et al., 2013).

In line with the research conducted by Hanson and Moser (2003), active learning has been previously demonstrated to "increase student interest and motivation and to build students' critical thinking, problem solving and social skills." Moreover, active learning is considered a central tenet of the constructivist model of learning through the facilitation of cognitive processing skills such as synthesis, conceptualization, application and evaluation of information. This cognitive processing is essential to enable learners to engage in higher-order learning. The results of a study by Johnson

and Johnson (2009) led to the following conclusions: 1) Learners learn more deeply through active engagement and when they are active participants in their own knowledge construction and make meaning through higher-order thinking skills; and 2) learners' performance increases as a consequence of increased motivation to participate in the task and/or activity at hand. Furthermore, Newmann and Wehlage (1993) noted that learners who are faced with real-world experiences that simulate real-world complexities, are motivated to apply higher-order thinking skills in their learning process and active learning strategies.

The different learning approaches and instructional methods of active learning such as case-based, problem-based and task-based learning activities offer an opportunity for deeper understanding, as learners are constantly engaged in higher-order thinking skills such as questioning, justifying, drawing conclusions and substantiating their reasoning and arguments (Ciraj et al., 2010; Gormally et al., 2009; Tandogan & Orhan, 2007). Moreover, in an active learning context, learners are accountable for their own learning, thereby giving them a sense of autonomy and control over their learning strategies and learning goals (Dunlap & Grabinger, 1996). Furthermore, in an active learning context, learners are subsequently able to develop their competencies to critically reflect and perform complex problem-based tasks and construct and synthesize new knowledge through active participation and involvement in the learning process (Auerbach & Andrews, 2018; Marrone et al., 2018). However, as we will explain below, to unleash the full potential of active learning, pedagogical learning models and instructional approaches should be employed in a way that allows learners to appropriate their active learning strategies based on their own needs, experiences and skills.

Active Learning Strategies

As active agents in the learning process, learners, in accordance with their different styles of learning and learning environments need to systematically apply their learning strategies to their learning tasks and situations (Keyser, 2000). Research has demonstrated that active learning strategies not only foster interaction and the application of higher-order cognitive skills, but also promote learners' cognitive and motivational engagement (Gleason et al., 2011). Within an active learning context, learners are able to apply various active learning strategies appropriate to their own learning styles and needs (Fritz, 2002). Based on a thorough and systematic review of the existent literature and scholarly research conducted on active learning and a conceptual examination of the different pedagogical learning models and instructional approaches that align with learners' active learning strategies, we characterize active learning strategies by learner interaction and engagement, cognitive processing (i.e., higher-level thought processes), orientation to learning (i.e., value towards the learning situation and experience), readiness to learn (i.e., the propensity to enrich the learning experience) and motivational orientation (i.e., activities that sustain interest and stimulate curiosity and exploratory behavior).

As discussed above, active learning being an umbrella term, encapsulates different pedagogical models of instruction that align with learners' active learning strategies. In this context, the proposed table (Table 2 below), provides the classification of the different pedagogical learning models or instructional approaches, which can be represented as subsets of the broader concept of active learning, their theoretical underpinnings and demonstrated active learning strategies within an active learning context. Within an active learning context, learners are able to apply various active learning strategies: that is, the learners' interaction and engagement, their use of higher-level thought processes, their orientation to learning, their readiness to learn and their motivational orientation, which all constitute significant determinants of active learning. Moreover, active learning takes place when learners are able to effectively apply these active learning strategies to different active learning approaches and instructional methods.

Table 2: Classification of the different instructional approaches, theoretical underpinnings and demonstrated active learning strategies (PLM: Pedagogical Learning Model, IA: Instructional Approach)

PLM/ IA	Definition of PLM/ IA	Focus	Theoretical Underpinning	Demonstrated Active Learning Strategies
Authentic learning	An instructional approach through which learners apply knowledge in real-life contexts and situations through problem-solving activities.	<ul style="list-style-type: none"> ▪ Extracting meaning and applying to real-world contexts, issues and problems; ▪ Actively participating by considering multiple forms of evidence, weighing ideas or investigating contradictions. 	<ul style="list-style-type: none"> ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963); ▪ Social Constructivism theory (Vygotsky, 1980); 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Engaging in <i>real-world challenges and</i> problem-solving activities. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Developing critical thinking and analytic reasoning processes. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Integrating values and practices into evidence-based real-world contexts. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ The propensity to learn by a "learning-by-doing" approach. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Discovering knowledge and exploring connections and relationships between concepts and meaning.

Table 2: Continued

PLM/ IA	Definition of PLM/ IA	Focus	Theoretical Underpinning	Demonstrated Active Learning Strategies
Case-based learning	An instructional approach through which learners use case studies within the context of authentic or real-world situations.	<ul style="list-style-type: none"> ▪ Examining specific situations (cases) of real-world problems or situations; ▪ Analyzing scenarios that imitate real-life situations. 	<ul style="list-style-type: none"> ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963); ▪ Social Constructivism theory (Vygotsky, 1980); 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Interacting with the content and discussing ideas revolving around <i>real-life</i> problems. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Solving and drawing appropriate inferences and conclusions. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Self-perception of the impact towards learning achievement. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A readiness to improve, broaden and enrich the learning experience. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Participating in intellectually challenging tasks and activities that sustain interest and stimulate exploratory behavior.
Collaborative learning	A set of instructional strategies that emphasizes group efforts, in which learners work together in groups or pairs in learning tasks to achieve a common learning goal.	<ul style="list-style-type: none"> ▪ Active participation, autonomous learners; ▪ Learner-learner interaction; ▪ Engagement in a shared learning community; ▪ Joint construction of meanings; ▪ Tackling complex problems. 	<ul style="list-style-type: none"> ▪ Social Constructivism theory (Vygotsky, 1980); ▪ Socio-cognitive conflict theory (Doise et al., 1975); ▪ Situated cognition (Lave, 1988); ▪ Distributed cognition theory (Salomon, 1997); 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Interacting with peers through collaborative dialogue. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Constructing shared meaning through collaborative knowledge building. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ A perception of the learning environment. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A desire to positively contribute to the learning process and experience. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Enjoyment of learning characterized by mastery and control.
Cooperative learning	A learning approach or instructional method that employs small class groups or teams, whereby learners interact together to attain group goals or outcomes.	<ul style="list-style-type: none"> ▪ Engagement with peers; ▪ Individual and group accountability; ▪ Learner-learner interaction; ▪ Selecting/absorbing information; ▪ Generating ideas and solving problems together through discussion and reflective thought; ▪ Think-pair-share. 	<ul style="list-style-type: none"> ▪ Social Constructivism theory (Vygotsky, 1980); ▪ Social interdependence (Johnson & Johnson, 2009) ▪ Cognitive-development theory (Piaget, 1964); ▪ Achievement motivation theory (Atkinson, 1964); ▪ Social learning theory (Bandura, 1978) 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Facilitating the exchange of information through group interaction. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Analyzing information, formulating judgments. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Realizing the value of learning in terms of real life needs and experiences. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A willingness to perform or complete the specific activity or task at hand. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Triggering individual curiosity and interest.
Discovery learning	An instructional approach through which learners interact with their environment through investigation and exploration of authentic problems and contexts.	<ul style="list-style-type: none"> ▪ Drawing on knowledge, experience and insights to discover facts, concepts and connections (i.e., guided-discovery) ▪ Making connections between concepts and real-world applications; ▪ Incorporating new information and making connections. 	<ul style="list-style-type: none"> ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963); ▪ Cognitive-development theory (Piaget, 1964); ▪ Social Constructivism theory (Vygotsky, 1980). 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Engaging in an open exchange of ideas and opinions by mapping abstract concepts to real-world applications. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Examining problems from a deeper perspective. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Value towards the learning situation and experience. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A propensity to advance learning capabilities by drawing on experience and know-how. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Probing and exploring a variety of issues at greater depth and with greater fervor.

Table 2: Continued

PLM/ IA	Definition of PLM/ IA	Focus	Theoretical Underpinning	Demonstrated Active Learning Strategies
Experiential learning	An instructional approach through which learners apply their knowledge and understanding in an integrated manner, to real-world complexities and challenges.	<ul style="list-style-type: none"> ▪ Actively participating and reflecting on experiences; ▪ Extracting meaning and applying to real-world problems; ▪ Making connections between the course material and applying it outside of the classroom. 	<ul style="list-style-type: none"> ▪ Experiential learning theory (Kolb& Fry, 1975) ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963) ▪ Social Constructivism theory (Vygotsky, 1980). 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Interacting with content, engaging in an activity and connecting the knowledge to the experience. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Learning through experience and applying problems to real-world contexts. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Value inherent in doing that task or activity. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A desire to learn new skills and put them into practice. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Interest in a particular task, activity or context.
Inquiry-based learning	An instructional approach through which learners acquire and construct knowledge through the process of inquiry and discovery.	<ul style="list-style-type: none"> ▪ Posing questions, problems or scenarios; ▪ Exploring topics, drawing inferences, making connections, and asking questions. 	<ul style="list-style-type: none"> ▪ Experiential learning theory (Kolb& Fry, 1975); ▪ Social learning theory (Bandura, 1978); ▪ Social Constructivism theory (Vygotsky, 1980). 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Interacting with the content that allows knowledge building and construction through inquiry. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Identifying a problem and drawing appropriate inferences and conclusions. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Realizing the value of the learning experience by making meaning out of the learning process. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A favorable predisposition towards learning and the learning process. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Making flexible choices and co-constructing about what and how to learn.
Peer-assisted learning	An instructional approach through which learners engage with the support of other learners, to help them to learn more effectively and improve their knowledge in the process.	<ul style="list-style-type: none"> ▪ Learners assisting other learners with conceptual understanding and problem solving; ▪ Peer tutoring and scaffolding from a more competent peer. 	<ul style="list-style-type: none"> ▪ Social Constructivism theory (Vygotsky, 1980). ▪ Cognitive Congruence theory (Cornwall, 1979). ▪ Social learning theory (Bandura, 1978); 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Interacting with each other in relevant and meaningful ways. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Articulating reasoned arguments through review and evaluation. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Self-perception of beliefs and values that underpin the nature of learning. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A propensity to adapt to different learning styles, preferences and needs. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Driving the learning process through interest, enjoyment and locus of causality.
Problem-based learning	An instructional approach whereby learners work together to apply the knowledge and skills to solve a presented problem.	<ul style="list-style-type: none"> ▪ Learners work in pairs or groups to solve real-world complexities and practical issues; ▪ Learners apply their skills to a problem. 	<ul style="list-style-type: none"> ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963); ▪ Social Constructivism theory (Vygotsky, 1980); ▪ Theory of Multiple Intelligences (Gardner, 1987). 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Exchanging information and ideas through social discourse and interaction. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Finding and evaluating information, interpreting and performing critical analysis. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Self-perception of the principles and values that underpin the learning experience and outcomes. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A willingness to step out of the comfort zone and try new approaches to learning. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Seeking and attempting to conquer optimal challenges.

Table 2: Continued

PLM/ IA	Definition of PLM/ IA	Focus	Theoretical Underpinning	Demonstrated Active Learning Strategies
Self-directed learning	An instructional approach in which learners take the initiative and assume personal responsibility and autonomous ability to manage their learning process.	<ul style="list-style-type: none"> ▪ Learners take responsibility for the learning context; ▪ Learners assume ownership of their own learning, their learning goals and decide on which learning methods to use and evaluate their progress. 	<ul style="list-style-type: none"> ▪ Metacognition Theory (Flavell, 1976); ▪ <i>Social Cognitive Theory</i> (Bandura, 1977). ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963) 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Engaging in learning tasks or activities in “expert-like” ways. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Constructing shared meaning to support multiple perspectives. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ A willingness to <i>learn</i> new skills and/or approaches to learning. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ The inclination to take ownership and responsibility for learning. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Expending effort by persisting at challenging tasks.
Self-regulated learning	An instructional approach in which learners apply the necessary strategies to regulate their cognition and exercise control over their learning goals and behavior.	<ul style="list-style-type: none"> ▪ Learners take control and responsibility of the learning process; ▪ Learners optimize their learning by planning, monitoring and evaluating their learning processes; ▪ Emphasizes task mastery and autonomous learning. 	<ul style="list-style-type: none"> ▪ <i>Self-regulated Learning Theory</i> (Zimmerman, 1989) ▪ Metacognition Theory (Flavell, 1976); ▪ <i>Social Cognitive Theory</i> (Bandura, 1977). ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963) 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Interacting with the content and engaging with information to broaden and deepen understanding. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Actively interpreting, analyzing and evaluating information to make thoughtful decisions. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Perception of being <i>shaped by learning</i> goals and strategies. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A propensity and willingness to learn autonomously. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ The capacity to exercise and validate a sense of control in respective tasks or activities.
Situated learning	An instructional approach through which learners engage in authentic tasks that take place in real-world contexts.	<ul style="list-style-type: none"> ▪ Reflecting on and drawing implications from previous experiences; ▪ Applying knowledge to real life problems and complexities in a systematic way. 	<ul style="list-style-type: none"> ▪ Situated cognition (Lave, 1988); ▪ Social Constructivism theory (Vygotsky, 1980); ▪ Theory of Inquiry (Dewey, 1938) 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Engaging with material and relating it to <i>real life</i> complexities through social interactions and dialogue. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Constructing shared meaning to support multiple perspectives in a “<i>real life</i>” context. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ Reinforcing values and beliefs towards learning. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ Predisposition towards adapting to different learning preferences. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Stimulating curiosity with a desire to resolve incongruities and conquer intellectual challenges.
Task-based/task-oriented learning	An instructional method in which learning content is oriented to the requirements of tasks that learners are required to complete when solving complex problems.	<ul style="list-style-type: none"> ▪ Learners work through task- specific learning content focusing primarily on mastery of tasks. 	<ul style="list-style-type: none"> ▪ Achievement goal theory (Dweck, 1986; Locke & Latham, 1990) ▪ Self-determination theory (Ryan & Deci, 2000) ▪ Constructivist learning theory (Bruner, 1961; Piaget, 1963) 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ Engaging in task-oriented dialogue and interactions through structured group work. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ <i>Solving complex</i> tasks requiring identification and evaluation of solutions to <i>address</i> the issues identified. <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ <i>Being receptive</i> to new learning approaches and methods. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A propensity to learn through coordinated efforts and hands-on learning tasks. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Stimulating curiosity with a desire to master challenging tasks.

Table 2: Continued

PLM/ IA	Definition of PLM/ IA	Focus	Theoretical Underpinning	Demonstrated Active Learning Strategies
Team-based learning	An instructional approach through which learners engage and interact with each other in teamwork, emphasizing collaboration among group members.	<ul style="list-style-type: none"> ▪ Individual and team responsiveness, group engagement and interaction; ▪ A 'flipped' approach to learning; ▪ Engages learners in higher-order cognitive reasoning and thinking skills such as <i>problem-solving</i>, synthesis, application and evaluation. 	<ul style="list-style-type: none"> ▪ Social Constructivism theory (Vygotsky, 1980); ▪ Socio-cognitive conflict theory (Doise et al., 1975); ▪ Situated cognition (Lave, 1988); ▪ Distributed cognition theory (Salomon, 1997); 	<p><i>(Engagement)</i></p> <ul style="list-style-type: none"> ▪ <i>Engaging in team-based dialogue</i> by exchanging opinions, expressing thoughts and sharing ideas. <p><i>(Cognitive processing)</i></p> <ul style="list-style-type: none"> ▪ Solving complex problems together by identifying, <i>synthesizing, analyzing and generating solutions to the problems.</i> <p><i>(Orientation to learning)</i></p> <ul style="list-style-type: none"> ▪ An openness to new learning experiences. <p><i>(Readiness to learn)</i></p> <ul style="list-style-type: none"> ▪ A willingness to partake in learning activities supported by the desire to achieve learning goals. <p><i>(Motivational orientation)</i></p> <ul style="list-style-type: none"> ▪ Seeking to validate some form of control over the learning task.

A multitude of pedagogical learning models, as exemplified in Table 2 above, emphasize the theoretical underpinnings and demonstrated active learning strategies. Engagement as an active learning strategy, is essential for peer-to-peer participation and involves learning through discussions between learners or between learners and instructors (Bulut, 2019, Crouch & Mazur, 2001; Georgiou & Sharma, 2015). Cognitive processing, as an active learning strategy, is associated with the reinforcement of higher order cognitive abilities and complex problem-solving skills (Chi & Wylie, 2014; Schellens & Valcke, 2005). Orientation to learning, as an active learning strategy, consists of learners' values, beliefs and perceptions towards learning (Pintrich & Schrauben, 1992; Ramsden, 1992). Readiness to learn, as an active learning strategy, is characterized by a desire or propensity to improve, broaden and enrich the learning experience (Dewing, 2010). Finally, motivational orientation, as an active learning strategy, is associated with learners' preferences for challenging tasks, learning that is driven by an innate sense of curiosity and interest and a perceived sense of control over the learning experience (Nyman, 2017; Oudeyer et al., 2016).

Toward a Conceptual Model for Active Learning

By examining the body of literature on active learning and laying the conceptual groundwork, a conceptual model for active learning was devised by identifying the following five constructs of learners' active learning strategies: engagement, cognitive processing, orientation to learning, readiness to learn and motivational orientation. The active learning conceptual framework presented in Figure 1 below forms the conceptual base of the various stages of instrument development and validation for the current study.

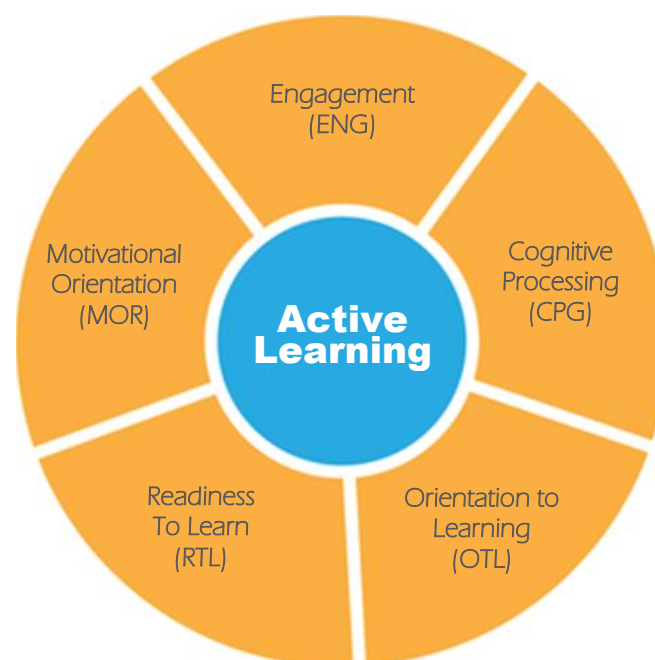


Figure 1. Active learning conceptual model

Guided by the existing relevant literature and conceptual considerations, a conceptual model, depicted in Figure 1 above, was developed to illustrate and explain graphically the underlying constructs of learners' active learning strategies within an active learning context. Below, we discuss in more detail, each of the constructs included in the proposed conceptual model, which form the basis of the measurement instrument used in the study.

Engagement

Engagement, a key construct within the literature on active learning, is described as the exchange of information, including processing and integrating the relevant information and dialogue that occurs between learners in a structured or non-structured context. In order to understand the construct of learner engagement as an active learning strategy, it is necessary to briefly review the theory of motivation and learning from a behaviorist perspective. From the behaviorist perspective, the conditions within which purposeful learning takes place are contingent upon the degree to which learners engage in meaningful tasks. According to Berlyne (1966), a behaviorist, learners seek to sustain an optimal level of interaction with the environment. These interactions can have significant and compelling effects on learner attitudes, perceptions and intrinsic motivation (Deci, 1975; Ocker & Yaverbaum, 2002). One method of integrating active learning into the classroom is to structure opportunities for learners to learn together through peer discussions. Peer discussions allow learning to be transformed from passive to active, enabling learners to participate in a process of inquiry, thereby facilitating an exchange of ideas and understanding through open communication, engagement, social interactions and peer feedback. In verbal peer interaction, learners listen to others and generate new comments or construct new knowledge. Interactions around purposeful discussions challenge the learners' current understanding, allowing multiple points of views to be expressed and triggering a deeper and more critical and robust understanding of the discussion topic.

Cognitive Processing

Based on the theoretical foundations of Dewey, Bruner, Piaget and Vygotsky, active learning takes place when there is cognitive processing on the part of the learner. Leonard et al. contended that, "...students assimilate material better when they work actively to apply it and make sense of it" (p. 1502). Cognitive processing as an active learning strategy, emphasizes the notion that learners construct a deep level of understanding of concepts, rather than simply memorizing and recalling facts, by applying the knowledge and information gained, constructing their own meanings and subsequently moving towards more higher-order thinking skills, often associated at the upper levels of the cognition scale of Bloom's taxonomy (Anderson & Krathwohl, 2001). Hence, learners are involved in deeper levels of cognitive processing such as assimilating, analyzing, evaluating and synthesizing new information (Anderson & Krathwohl, 2001). Cognitive processing enables them to think critically, make decisions and solve complex problems. Similarly, learners who expend more cognitive effort (Schiefele & Krapp, 1996) and spend more time on the task (Wade et al., 1993) typically process information on a deeper level, resulting in higher-order thinking and deeper cognitive processing (Schiefele, 1991). This allows learners to engage in knowledge construction at a higher level of cognition by constructing their own meaning and understanding, thinking critically, solving problems through the manipulation of concepts, generating new information and synthesizing the new information into existing knowledge.

Orientation to Learning

Orientation to learning, as an active learning strategy, is closely related to learners' attitudes towards learning and is described as the summation of learners' aims, attitudes and purposes that demonstrate their value towards the learning environment, learning situation and learning experience (Ratwatte, 1999; Taylor et al., 1981). Orientation to learning is conceptualized by learners' self-perception of the impact toward learning achievement as well as learners' dispositions and educational experiences that express their perception of the context for learning towards real-life situations and real-world applications (Karge et al., 2011). Hence, learners recognize the value of the learning by making meaning out of the learning process, having an openness to new learning experiences and a willingness to get involved in educational processes (Finelli et al., 2001). Learners' orientation to learning is a key parameter that is influenced by instructional methodology. Ramsden (1992) asserted that the learning outcomes of learners are a direct consequence of their orientation to learning. Moreover, learners' orientation to learning is likely to be influenced by their self-perception of the principles, beliefs and values that underpin their learning experience and outcomes (Brown, 2004).

Readiness to Learn

Closely related to orientation to learning is readiness to learn – both these constructs are similar yet distinct from one another. Readiness to learn derives from McClusky's (1963) theory of margin, which focuses on the learners' needs to balance internal and external forces in order to influence what, when, and how they learn (McFadden, 2013). Readiness to learn, as an active learning strategy, is characterized by a desire to positively contribute to the learning process and experience (Chan, 2001; Dewing, 2010). To learn, there must be a goal which learners aspire to achieve – this is reflected in the learners' readiness to learn as they have a desire to learn new skills and put them into practice (Tyler, 1964). Taylor and Kroth (2009) posited that "learning should be organized around life-application categories and

sequenced according to the learners' readiness to learn" (p. 47). Moreover, Bruner (1966) contended that learners will not learn unless the conditions are propitious for them to learn. Moreover, readiness to learn, as a construct, is viewed as the learners' predisposition towards adapting to different learning styles, preferences and needs. Hence, we define readiness to learn in terms of the learners' propensity to advance their own learning capabilities, in addition to a willingness to partake in learning activities, supported by the desire to achieve learning goals and objectives.

Motivational Orientation

The construct of motivational orientation is guided by social cognitive theories of motivation and is conceptually defined as that which motivates learners to participate in challenging tasks, driven by interest, control and curiosity (Krapp, 2005; Vygotsky, 1980). Research has demonstrated that motivational orientation is influenced by the degree of challenge, interest, control and curiosity that learners contend against whilst learning. Motivational orientation, as an active learning strategy, is characterized by a desire to participate in intellectually challenging tasks and activities that evoke a sense of interest, validate a sense of control and subsequently, allow learners to probe a variety of issues at greater depth. These motivational orientation factors are associated with the cognitive and affective elements of motivation (Hidi & Renninger, 2006; Schraw & Lehman, 2001). Challenge is characterized by the learners' ability to conquer challenging tasks of sufficient complexity and difficulty for the learners' skill levels, while interest is described as the learners' satisfaction and enjoyment of the task and activity itself (Abbott et al., 2017). Moreover, when learners find the task or activity in itself satisfying, they are compelled to engage in an activity for enjoyment and fulfillment. Control and curiosity, finally, are characterized by an intrinsically motivated desire or inquisitiveness to seek out new information and create, assimilate and integrate new knowledge through a process of discovery and exploration. According to Berlyne (1966), exploratory behavior is motivated by a curiosity drive to explore and control the environment and it is this intrinsic drive that subsequently directs and guides learner behavior and motivation.

Methodology

Instrument Development Process

To establish greater confidence in the reliability and validity of the constructs, a systematic instrument development and validation approach, similar to that proposed by Moore and Benbasat (1991) was performed. An important part of the instrument development approach was item generation and instrument construction to verify construct and content validity and determine internal reliability of the survey items. Based on the Moore and Benbasat procedure, a proposed three-stage development process was conducted to refine and finalize the pool of items and scales for the final ALSI measure.

Item Creation

The first stage of the instrument development process involved ensuring content validity of the measurement items. Individual items were created to reflect the identified constructs that are derived from the conceptual model (see Figure 1) and review of literature presented earlier. Hence, an initial item pool of items for the various constructs was generated. Finally, items, considered being too narrow in scope or items that failed to adequately capture the underlying construct(s) or were not sufficiently reliable, were excluded from the questionnaire if they were deemed redundant, ambiguous or unrepresentative of the construct.

Card Sorting

After the first phase of item creation, a card sorting process was employed following Moore and Benbasat's (1991) instrument development process. The intent of the card sorting stage was to assess construct validity of the proposed constructs, including eliminating redundant or ambiguous constructs that could be deemed as problematic. Two rounds of card sorting procedures were conducted to establish construct validity, where the first round was exploratory and the second round confirmatory in nature and approach.

Accordingly, judges were instructed to sort the respective items into predefined construct categories by ranking the appropriateness of how well the items fit in their particular construct definitions. In the first round, the labels of the underlying constructs were not disclosed to the judges - instead the judges were instructed to generate and assign their own construct labels. Four new judges were recruited for the second round of card sorting and tasked with sorting the items into the different pre-defined categories. Thus, greater confidence in the construct validity of the scales strengthened if the judges' definitions largely corresponded with the scale's intent.

In the next phase of the card sorting, two different measurements, Cohen's (1960) kappa and item placement ratio, were performed to assess the reliability of the sorting conducted by the judges. Firstly, using Cohen's kappa, the level of agreement among all four judges was measured by categorizing all 20 items and five categories (Maxwell, 1970). Accordingly, for the first round, inter-observer agreement was expressed as overall agreement and calculated as a kappa statistic, averaging 0.80, thereby indicating satisfactory inter-observer or inter-rater agreement. The value for

kappa coefficient of 0.90 was higher than the value achieved in the first round, thereby suggesting an excellent fit, according to the benchmark standards of Landis and Koch (1977) for evaluating the strength of agreements.

Next, item placement ratio was computed as a second measurement to assess the reliability of the sorting task conducted by the judges and establish the content validity of the scale. Item placement ratio is an indicator of how many items were correctly placed by the panel of judges for each round within the intended or target construct. Specifically, measurements were performed to calculate the overall frequency with which the judges placed the items within the intended constructs. Accordingly, 4 items were developed for each of the five theoretical constructs. This implied that with a panel comprised of four judges, a theoretical total of 20 placements could be established within each target construct. As indicated in Table 3 below, a matrix of item placements for the first round was constructed in which each of the judges were tasked to sort the items into the target constructs – this included a “N/A” (Not Applicable) column, whereby judges could place items which they felt did not accurately represent the constructs as originally conceptualized.

Table 3. Matrix of item placements – judges’ classification of first round

	Engagement (ENG)	Cognitive Processing (CPG)	Orientation to Learning (OTL)	Readiness to Learn (RTL)	Motivational Orientation (MOR)	N/A	TOTAL	% Hits
Engagement (ENG)	16	0	2	2	0	0	20	80%
Cognitive Processing (CPG)	0	17	1	1	1	0	20	85%
Orientation to Learning (OTL)	0	0	16	3	1	0	20	80%
Readiness to Learn (RTL)	0	0	3	15	2	0	20	75%
Motivational Orientation (MOR)	0	0	1	1	18	0	20	90%
Item Placements: 100	Hits: 82			Overall “Hit Ratio”: 82%				

An examination of the diagonal matrix (Table 3 above) indicated a theoretical maximum of 100 placements (i.e., 5 constructs at 20 placements), meaning a total of 82 “hits” was attained, thereby indicating an overall placement “hit ratio” of 82%. Moreover, an examination of each row gave an indication of how the items created tapped the particular constructs being measured. Specifically, the “Motivational Orientation” row indicated that 18-item placements were within the target construct – however, in the “Readiness to Learn” row, only 75% (15/20) were within target. Accordingly, attention was directed to those items positioned in the “off-diagonal” cells and any items that were unclear, ambiguous, confusing or least representative of the constructs were identified and either rewritten or eliminated. Subsequent to the placements made by the judges, the items under consideration were re-examined and re-evaluated, and any ambiguous, inconsistently understood items or items shown to be problematic were then re-phrased or deleted. The revised items were subsequently put through a second item-placement round with a new set of four judges. Consequently, it was deemed necessary to conduct a second round of item placements to help further clarify and validate the items and constructs of the instrument (see Table 4).

Table 4. Matrix of item placements – judges’ classification of second round

	Engagement (ENG)	Cognitive Processing (CPG)	Orientation to Learning (OTL)	Readiness to Learn (RTL)	Motivational Orientation (MOR)	N/A	TOTAL	% Hits
Engagement (ENG)	20	0	0	0	0	0	20	100%
Cognitive Processing (CPG)	0	19	1	0	0	0	20	95%
Orientation to Learning (OTL)	0	0	18	1	1	0	20	90%
Readiness to Learn (RTL)	0	0	1	19	0	0	20	95%
Motivational Orientation (MOR)	0	0	0	0	20	0	20	100%
Item Placements: 100	Hits: 96			Overall “Hit Ratio”: 96%				

Finally, a second round of the judges’ classification of item placements (Table 4 above) indicated a higher agreement among the judges in comparison to the first round, thereby resulting in an overall significant improvement in item placement. Hence, all four judges in the second round accurately and precisely placed the reworded and modified items in the correct cells. This led to an overall placement “hit ratio” of 96%, indicating that all constructs established a high item placement ratio, thereby resulting in a high degree of construct validity of the five constructs underlying the 20 items of the ALSI scale (Moore & Benbasat, 1991).

Instrument Testing

The Research Setting

A total of 620 undergraduate medical and dental students enrolled in the Endocrine and Reproductive Systems Block (ERS) comprised an adequate pool of subjects and were considered an appropriate sample for the purpose of the study. The selection of this course was determined by the following criteria. Firstly, the course provided a unique and timely

opportunity for adopting team-based learning, an instructional approach to active learning that promotes peer-to-peer learning, self-directed learning and collaboration, initiated by the Li Ka Shing Faculty of Medicine at the University of Hong Kong. Secondly, the team-based learning approach in the form of clinical scenarios tackled individually, in teams and within-teams were thoughtfully and purposefully structured into the design and delivery of the course.

Instructional Method as the Course Framework

Endocrine and Reproductive Systems Block (ERS) is an undergraduate course offered to Year 2 medical and dental students enrolled in the Bachelor of Medicine and Bachelor of Surgery (MBBS) and Bachelor of Dental Surgery (BDS) programme at the Li Ka Shing Faculty of Medicine of the University of Hong Kong. The ERS course, implemented in the Spring Semester of 2019, was structured according to a task-based learning approach, a pedagogical learning model that is increasingly being applied to medical education (Hamdy, 2015; Li et al., 2017; Meng et al., 2015). The task-based or task-oriented practical, which allows learners to apply their active learning strategies through a group-based peer-to-peer format, was subsequently embedded into the course structure. The objective of using the task-oriented learning model is to prepare medical students for the various tasks they will face as future medical or health care professionals, by providing opportunities to apply conceptual knowledge in solving clinical problems and real-world case-based scenarios, through the progression of various learning tasks that comprise of individual involvement and team-based exercises. Hence, the task-oriented practical comprised of a series of tasks carried out at laboratory workstations by groups of students. The tasks comprised of open-ended instructional approaches, such as evaluation of a clinical problem, creation of a simplified model, drawing of a diagram and creation of a video presentation, which needed to be accomplished at an area equipped with the relevant teaching resources called 'the station'. Moreover, the tasks corresponded to the learning outcomes and were aligned with the higher skill levels of Bloom's taxonomy such as synthesis, evaluation and application. Furthermore, the tasks helped students to understand complex concepts and promote collaborative and team-based learning. Students worked in groups of 3 to 5 students for 15 minutes at each station and then moved on to the next station. The task-oriented practical consisted of eight stations and at the end of the sessions the different groups would compare and contrast their findings.

Measurement Scales

The finalized instrument consisted of two parts. Part I identified the demographic traits of the respondents such as gender, academic year, course major and perceptions about course difficulty. On the basis of the extensive literature review and conceptual model on active learning presented in the preceding section, the questions in part II consisted of 20-items separated into the five theoretical constructs: "engagement" (4 items), "cognitive-processing" (4 items), "orientation to learning" (4 items), "readiness to learn" (4 items) and "motivational orientation" (4 items). The response format for all items was a 7-point Likert scale (Lam & Klockars, 1982) coded as 7: *strongly agree*; 6: *moderately agree*; 5: *slightly agree*; 4: *neither agree nor disagree*; 3: *slightly disagree*; 2: *moderately disagree*; 1: *strongly disagree*. A Likert scale was chosen because it measures levels of agreement, allows for a less biased measurement, and furthermore is used to yield interval level data.

Data Collection

For the present study, a hard-copy of the Active Learning Strategies Inventory (ALSI), wherein the order of items was randomized was administered to 620 students to complete in class, with the assistance of the instructor facilitating the class. The collection of these questionnaires yielded 407 usable data responses, providing a response rate of 65%. Given the sample size and standard deviations, the study had a power of 88% to yield a statistically significant result at a significance level (alpha) of 0.05 (Cohen, 1992). Hence, a sample size of 407 was adequate at 5% level of significance and statistical power of 88%. Finally, the data collected from the 407 responses was analyzed to present evidence for the validity and reliability of the survey instrument.

Results

The results and analysis presented here serve to address the instrument development and instrument validation process, ensuring construct validity and item reliability — including content, convergent and discriminant validity. This section describes the findings of the confirmatory factor analysis and the reliability analysis of the five constructs. Cronbach's alpha reliability coefficient were computed for the reliability and homogeneity of the ALSI scale, ensuring construct validity and item reliability in the instrument, which thereafter provided overall credibility to the conceptual framework presented in Figure 1.

Descriptive Statistics

Table 5 summarizes the descriptive statistics for the five theoretical constructs. The mean and standardized deviations for each of the 20 items are reported. As indicated, all five constructs (engagement, cognitive-processing, orientation to learning, readiness to learn and motivational orientation) had means above the midpoint of 4.00. The standard deviations ranged from 1.037 to 1.150 indicating adequate variability.

Table 5: Summary of means and standard deviations

Constructs	Question	Mean	Std	N
Engagement (ENG)	1	5.49	1.057	407
	6	5.22	1.087	407
	11	5.41	1.071	407
	16	5.25	1.108	407
Cognitive Processing (CPG)	2	5.37	1.150	407
	7	5.10	1.130	407
	12	5.23	1.106	407
	17	5.20	1.092	407
Orientation to Learning (OTR)	3	5.35	1.047	407
	8	5.24	1.136	407
	13	5.16	1.089	407
	18	5.16	1.143	407
Readiness to Learn (RTL)	4	5.46	1.096	407
	9	5.43	1.098	407
	14	5.17	1.077	407
	19	5.27	1.062	407
Motivational Orientation (MOR)	5	5.40	1.098	407
	10	5.49	1.131	407
	15	5.30	1.119	407
	20	5.26	1.037	407

Construct Validity

Confirmatory factor analyses (CFA) was performed to affirm construct validity of the items in the survey instrument. The reliabilities of factors and scales (for the items loading on each factor) were assessed using Cronbach's (1951) alpha. All items demonstrated satisfactory loadings on their own particular constructs that they were intended to measure, ranging from .704 to .887. The items associated with each factor and their factor loadings are presented in Table 6. All items loaded consistently on their designated factor (i.e., engagement, cognitive-processing, orientation to learning, readiness to learn and motivational orientation) and did not exhibit any cross-loadings, thereby indicating that the scales were measuring distinct constructs. Table 6 shows the items, constructs and factor loadings of ALSI for the sample of 407 students, using the individual student as the unit of analysis. The results of the CFA determined that the scales were not only reliable, but also valid for the factors under study.

Table 6: Constructs, items and loading statistics

Question	Constructs	Items	Factor loading
Engagement (ENG)			
1	ENG1	I felt the activity allowed me to effectively engage in an open exchange of ideas.	.785
6	ENG2	I felt the activity encouraged me to engage in discussions revolving around real-life contexts.	.760
11	ENG3	I felt the activity allowed me to effectively interact with the content to broaden my understanding of the topic of discussion.	.830
16	ENG4	I felt the activity allowed me to effectively interact in thought-provoking dialogue through collaborative discourse.	.812
Cognitive Processing (CPG)			
2	CPG1	I felt the activity allowed me to examine problems from a deeper perspective.	.801
7	CPG2	I felt the activity allowed me to define the problem systematically by viewing it from different angles in an effort to find possible solutions.	.775
12	CPG3	I felt the activity allowed me to analyze my own views and their wider contexts in order to draw firm conclusions.	.804
17	CPG4	I felt the activity allowed me to formulate judgments by taking into account different points of view.	.809
Orientation to Learning (OTL)			
3	OTL1	I was able to realize the value of the learning situation by making meaning out of the learning process.	.834
8	OTL2	I felt the activity shaped my beliefs towards learning by reinforcing my learning goals.	.704
13	OTL3	I felt the activity allowed me to integrate my values into real-world practice.	.799
18	OTL4	I felt the activity encouraged me to be open to new learning experiences.	.704

Table 6: Continued

Question	Constructs	Items	Factor loading
Readiness to Learn (RTL)			
4	RTL1	I felt the inclination to take responsibility for my learning by adopting a “learning-by-doing” approach.	.789
9	RTL2	I felt I was able to advance my own learning capabilities by drawing on my own experiences.	.761
14	RTL3	I felt a willingness to step out of my comfort zone by trying new approaches to learning.	.781
19	RTL4	I felt a willingness to adapt to different learning needs.	.718
Motivational Orientation (MOR)			
5	MOR1	I felt the activity allowed me to explore a variety of different issues that I may not have otherwise considered.	.787
10	MOR2	I felt the activity aroused my curiosity about the topics being addressed.	.781
15	MOR3	I felt I had a sense of control as to how much I could participate in the activity.	.887
20	MOR4	I felt the activity held my interest.	.812

The constructs were analyzed using Cronbach's (1951) alpha to determine if they displayed acceptable levels of reliability. The ALSI scale exhibited excellent internal consistency overall, ranging from .834 to .877 (see Table 7), thereby exceeding the reliability estimates ($\alpha = 0.70$) recommended by Nunnally (1967).

Table 7: Cronbach's alpha reliability coefficient

Construct	Items	Alpha
Engagement (ENG)	4	.858
Cognitive Processing (CPG)	4	.877
Orientation to Learning (OTL)	4	.850
Readiness to Learn (RTL)	4	.840
Motivational Orientation (MOR)	4	.834

Convergent and Discriminant Validity

Convergent and discriminant validity were also examined by comparing shared variance between constructs with the average variance extracted (AVE) of the respective constructs. Shared variance and AVEs for each construct are depicted in Table 8. The average variance extracted (AVE) was well above the recommended cut-off levels of .70 and .50 for all constructs (ranging from .643 to .913) indicating that the constructs exhibited a high degree of convergent validity. Following Fornell and Larcker (1981), discriminant validity was assessed by verifying that the square root of the average variance extracted (diagonal elements in Table 8) is higher than the correlation between constructs (off-diagonal). Moreover, as indicated by the independency of the five constructs, which is ascertained from the results shown in Table 8 below, each of the constructs demonstrated excellent discriminant validity since the square roots of the AVEs of each construct were larger or slightly lower than the correlation coefficient values of each construct relative to other constructs.

Table 8: Assessment of convergent and discriminant validity

Construct	ENG	CPG	OTR	RTL	MOR
Engagement (ENG)	.643				
Cognitive Processing (CPG)	.732	.843			
Orientation to Learning (OTR)	.668	.757	.667		
Readiness to Learn (RTL)	.661	.703	.673	.701	
Motivational Orientation (MOR)	.783	.842	.781	.820	.913

Note. Diagonal values (bold figures) are the square roots of the AVE. Off-diagonal values are the correlations between constructs.

Table 9 below summarizes the overall model fit measures for the model, with all fit indices above the commonly accepted levels. The model yielded a statistically significant chi-square result, $\chi^2 (N = 407) = 644.3, p < 0.01$. The chi-square statistic is a measure of overall fit of the model to the data, that is, goodness-of-fit between data and model (Bentler & Bonett, 1980). As recommended by Hair, Black, Babin, Anderson and Tatham (1998), several other fit indices were used to evaluate the model. Overall, the various goodness-of-fit indices explained below in Table 9 (GFI = .850, CFI = .925, AGFI = .803 and NFI = .903) indicated a good fit.

Table 9: Goodness of fit measures

Fit measures	Values
χ^2	644.3
RMR	.047
RMSEA	.086
GFI	.850
CFI	.925
AGFI	.803
NFI	.903

Note. CFI, cut-off > .90

Discussion

This study proposes a rigorous conceptual model by laying a conceptual foundation for measuring learners' perceptions of their active learning strategies within an active learning context. The development of the Active Learning Strategies Inventory (ALSI), a 20-item self-report instrument, involved identifying the following five scales of students' active learning strategies, based on the theoretical and conceptual work in existing literature: engagement, cognitive processing, orientation to learning, readiness to learn and motivational orientation. Based on a conceptual model and framework, an instrument was developed consisting of a multi-staged scale construction process including item generation, item refinement and pilot testing (Moore & Benbasat, 1991). The items assessed by a panel of judges, were evaluated employing confirmatory factor analyses (CFA) to test the construct validity of the items. The reliability of the items was verified using Cronbach's (1955) alpha. Cronbach's alpha of all items varied from .83 to .87. Construct validity is the degree to which a scale measures the targeted underlying construct. Results of the analyses revealed that the 20-item ALSI scale exhibited excellent reliability and validity in preliminary analyses. The results revealed that the 5-factor model provided a satisfactory and parsimonious fit to the data. Overall, the results of the study suggest that the Active Learning Strategies Inventory (ALSI) is a psychometrically sound and conceptually valid measure of learners' perceptions of their active learning strategies within an active learning context.

Conclusion

This study offers several contributions that build on the literature on active learning and guides the instrument development and validation process reported in this paper. This paper is a notable attempt at filling a major conceptual gap in current academic research on active learning and the creation of an overall instrument to collect and present analyzed data associated with learners' perceptions of their active learning strategies within an active learning context. The instrument creation process included a thorough review of existing literature on active learning, item generation and undertaking an extensive scale development process using a formalized procedure which included generating items which were categorized into the following five scales of students' active learning strategies: engagement, cognitive processing, orientation to learning, readiness to learn and motivational orientation. In order to test the construct validity of the items, confirmatory factor analyses (CFA) was performed to establish whether the five constructs had good fit with the data collected. The result is a parsimonious, 20-item instrument comprising five scales, all with acceptable levels of reliability and internal consistency. Finally, another potential contribution is that the study extends extant literature by providing a strong conceptual framework that could be further used by a continuously growing community of research scholars and educators.

To conclude, this study is of potential significance because it emphasizes the need for appropriate measures to assess learners' perceptions of their active learning strategies within an active learning context. Moreover, this study contributes to present literature by developing a methodological and conceptual framework on active learning and subsequently expanding the existing body of knowledge on active learning. Furthermore, this study is relatively significant because it empirically validates the Active Learning Strategies Inventory (ALSI), that is, the design, refinement and validation of the instrument provides us with a valid and reliable measurement scale for future research in measuring learners' perceptions of their active learning strategies within an active learning context on a much larger scale. Finally, the provision of a valid and reliable instrument can assist both researchers and educators to better capture the complex multifaceted aspects of active learning.

Recommendations

Turning the focus to directions for future work, several studies could be pursued, for example, a study of the causal links between the constructs (engagement, cognitive processing, orientation to learning, readiness to learn and motivational orientation) on performance or goal attainment. Moreover, future research studies could consider several additional areas for investigation such as examining correlations among learners' active learning strategies on achievement goals, academic performance measures and learning environments. Finally, the psychological construct of self-efficacy could be examined in order to extend the scope of future studies. For example, students' degree of self-efficacy in relation to learning tasks may be shown to relate positively to their active learning strategies. Hence,

students' degree of self-efficacy is thought to be a relevant construct that warrants further explication in future research on active learning and active learning methods.

Limitations

Although the conceptualization, development and validation of the instrument we employed represents its strengths, this study is not without several limitations that need to be considered to help drive future research efforts. Since our data were obtained from subjects comprised of local Hong Kong students, caution should be employed when generalizing our results to different populations globally and diverse contexts. For that reason, the data generated, yielded results that cannot be generalizable across every age group, socio-economic status or entire populations. Another limitation of the study is that there could have been a variety of situational or contextual factors (for example, bias towards the instructors) which may have influenced learners' responses to the Active Learning Strategies Inventory (ALSI). These limitations demonstrate the need to build up a more substantial body of evidence for further studies, which would fill the conceptual and theoretical gaps within the literature.

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Appendix

Active Learning Strategies Inventory (ALSI)

BACKGROUND

Please [√] only one answer for the following questions.

1. In general, how confident are you in learning without the use of technology in class?

Very Confident Somewhat Confident Confident Less Confident Not Confident

2. In general, how confident are you in learning without the use of technology after completing this course?

Very Confident Somewhat Confident Confident Less Confident Not Confident

3. For how much of your class time would you prefer to learn without technology in another course?

80-100% 60-79% 40-59% 20-39% 0-19%

4. In general, do you prefer to learn without the use of technology in class?

Yes No

5. Before this course, how much experience did you have in learning with the use of technology?

High experience Moderate experience Low experience

6. Before this course, how much experience did you have in learning without the use of technology?

High experience Moderate experience Low experience

7. Your Gender:

Male Female

8. Your year in school:

1 2 3 4

Using the following scale, (7 = Strongly Agree 6 = Moderately Agree 5 = Slightly Agree 4 = Neither Agree nor Disagree 3 = Slightly Disagree 2 = Moderately Disagree 1 = Strongly Disagree), please circle the number that indicates your level of agreement with the following statements:

		Strongly Agree	Moderately Agree	Slightly Agree	Neither Agree nor Disagree	Slightly Disagree	Moderately Disagree	Strongly Disagree
9.	I felt the activity allowed me to effectively engage in an open exchange of ideas.	7	6	5	4	3	2	1
10.	I felt the activity allowed me to examine problems from a deeper perspective.	7	6	5	4	3	2	1
11.	I was able to realize the value of the learning situation by making meaning out of the learning process.	7	6	5	4	3	2	1
12.	I felt the activity allowed me to explore a variety of different issues that I may not have otherwise considered.	7	6	5	4	3	2	1
13.	I felt the activity encouraged me to engage in discussions revolving around real-life contexts.	7	6	5	4	3	2	1
14.	I felt the activity allowed me to define the problem systematically by viewing it from different angles in an effort to find possible solutions.	7	6	5	4	3	2	1
15.	I felt the inclination to take responsibility for my learning by adopting a "learning-by-doing" approach.	7	6	5	4	3	2	1
16.	I felt the activity aroused my curiosity about the topics being addressed.	7	6	5	4	3	2	1
17.	I felt the activity allowed me to effectively interact with the content to broaden my understanding of the topic of discussion.	7	6	5	4	3	2	1
18.	I felt the activity shaped my beliefs towards learning by reinforcing my learning goals.	7	6	5	4	3	2	1
19.	I felt I was able to advance my own learning capabilities by drawing on my own experiences.	7	6	5	4	3	2	1
20.	I felt I had a sense of control as to how much I could participate in the activity.	7	6	5	4	3	2	1
21.	I felt the activity allowed me to effectively interact in thought-provoking dialogue through collaborative discourse.	7	6	5	4	3	2	1
22.	I felt the activity allowed me to analyze my own views and their wider contexts in order to draw firm conclusions.	7	6	5	4	3	2	1
23.	I felt the activity allowed me to integrate my values into real-world practice.	7	6	5	4	3	2	1
24.	I felt a willingness to step out of my comfort zone by trying new approaches to learning.	7	6	5	4	3	2	1
25.	I felt the activity allowed me to formulate judgments by taking into account different points of view.	7	6	5	4	3	2	1
26.	I felt the activity encouraged me to be open to new learning experiences.	7	6	5	4	3	2	1
27.	I felt a willingness to adapt to different learning needs.	7	6	5	4	3	2	1
28.	I felt the activity held my interest.	7	6	5	4	3	2	1