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A Qualitative and Quantitative Inquiry into the Learner Engagement Construct

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The present study seeks to develop a situated construct of learner engagement within an instructional experience. Despite compelling potential benefits to instructional practice, extant learner engagement research has been limited to either within-the learner constructs or adding a simplistic behavioral component to a model and largely discounting the effects of diverse learning environments, instructional techniques and educational technology, and their collective effects on the learner's attitudes, behaviors, perceptions, and performance *while learning*. The present study seeks to develop a construct of learner engagement applying a situated cognition theoretical framework to evaluate the effects of diverse learning environments on the learning experience by addressing the perceived dimensions and characteristics of learner engagement and developing a model of latent learner engagement construct using a learner-environment interaction as the unit of analysis.

This study employed an exploratory sequential mixed methods design. Based on qualitative data from 12 individuals engaged in industry learning and development of adults in professional settings and a comprehensive literature review, three factors were identified for the latent learner engagement construct: Affective Learner Engagement, Cognitive Learner Engagement, and Situated Learner Engagement. Using themes that emerged from the qualitative data, items were developed and subjected to content validation to produce an affective instrument to measure the learner engagement construct. Through a content validation, the initial instrument consisted of 17 revised items out of the original 87 candidate items and subjected to an Exploratory Factor

Analysis (EFA) using a 300-participant sample. The EFA results confirmed the hypothesized three dimensions and all items were retained. Confirmatory Factor Analysis (CFA) was subsequently conducted with another sample of 300 participants. The identified three-factor structure of the learner engagement construct model showed an acceptable level of internal consistency, construct validity, and internal reliability. Moderate inter-item correlation indicated that additional inquiry into the construct domain as defined by the three factors may be required. The present study advanced beyond simple behavioral indicia in defining an environmental interaction as part of the learner engagement construct that will permit more substantive studies seeking to evaluate the relationship of learner engagement with individual and organizational outcomes.

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A Qualitative and Quantitative Inquiry into the Learner Engagement Construct

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Chapter 1

Introduction

Workplace training is ubiquitous – the needs of organizations are often addressed with some form of training or development in a standing workforce. In the United States in 2018 alone, government and industry organizations spent $87.6B and countless man-hours and other resources on advancing the skills and knowledge of personnel (ATD, 2018; Carnevale, Strohl, & Gulish, 2015), aligned along various organizational objectives relating to, *inter alia*, enhanced performance and productivity, regulatory compliance, or new skill development. Advances in alternative instructional treatments such as self-paced have enhanced flexibility in delivery and outreach to more of the targeted population (Arkorful & Abaidoo, 2015), but many in the learner population have failed to participate in learning in a proactive manner as part of their vocational "responsibility" – training is often mandated by the organization rather than requested or sought after by the learner (Rana, Ardichvili, & Polesello, 2016). This challenge is well-understood in the learning and development industry sector whose task is to enhance the effectiveness and efficiency of professional training, while making the prospect of attending attractive to the learner – it is a tough sell, as traditional methods of mandated workforce training often strikes fear and/or loathing into the hearts of a worker – eliciting images of classrooms, short bathroom and lunch breaks, stale air, and limited, if any, interest in the subject matter.

Exemplar of the challenge is attrition rates for self-paced online courses - within industry, personnel who start an online self-paced instructional program required for their occupation are much more likely to attrite before completing it – attrition approaches 80% for non-compulsory training (Kaufmann, 2015; Moody, 2004). Typical attendance rates of non-mandatory training (regardless of treatment or delivery method) in some industry sectors hovers at 10% of those that

express interest in the subject matter. To be sure, there are a variety of cause and factors to be considered in addressing this issue, but many practitioners and organizations have focused on driving the learner to "engage" in the learning experience to improve outcomes, reduce attrition, and accomplish the organizational goals of the training program (Wolff, Wagner, Poznanski, Schiller & Santen, 2015).

A casual review of current literature in academic research finds more than 300 scholarly articles and more than 2,000 trade articles in 2018 alone that use the term "learner engagement", but few commentators define learner engagement explicitly – often researchers conflate engagement with other constructs, most often motivation (Mayer, 2014; Yoo & Huang, 2013). It is perhaps the ubiquity of the usage that allows researchers and commentators to continue the practice without a strict definition – it is assumed *everyone* knows what is meant by the term. Most practitioners in the learning and development industry, be it K-12 public education, post-secondary instruction, or industry professional training, can easily distinguish an "engaged" learner from one that is not engaged, in many cases simply on sight (Figure 1-1). Anecdotally, it is easy to "see" when someone is not engaged, but much more difficult to articulate what is meant by "learner engagement."

In the industry, learner engagement has developed into a short-hand term that loosely represents an amalgam of learner subject-matter interest/expertise, attitude, motivation, and mastery. Moreover, it is often explicitly or implicitly assumed that an engaged learner will achieve better outcomes against measurable rubrics than one who is not engaged (Wolff et al., 2015). Most researchers that do investigate the phenomenon of learner engagement either confound learner engagement with motivation (Beal, Qu, & Lee, 2006), or treat engagement as some other trait of the learner that exists before the learning experience as a means to an enhanced outcome. Drawing

on parallels from the organizational behavior domain, Appleton et al. (2006) provides what is perhaps the most formalistic approach to date in this line of research, articulating a model of two factors – intellectual and emotional – that define the construct, and seeks to evaluate the effect of learner engagement on outcome.

Figure 1-1. Identifying an (Dis-) Engaged Learner

Figure 1-1. Identifying whether a learner is engaged or not is something anecdotally easy to identify in the instructional setting, but difficult to articulate. Used with permission. Marks, G. (Photographer) (1953). Retrieved from http:// https://www.gettyimages.com/detail/photo/boy-sitting-at-table-over-open-book-head-resting-on-royalty-free-image/57539253.

Appleton's research and its progeny fail to address the entirety of the learning experience, instead opting to developing a static within-the-learner model (Appleton, Christenson, Kim, &

Reschly, 2006). Viewed epistemologically from a situation cognition framework, this approach fails to contemplate the real and meaningful relationships of learning environments and the learner as a unit of analysis, and the interactions between these factors that can produce variance in the construct as the environment and the learner change (Anderson, Reder, & Simon, 1996; Young, Kulikowich, & Barab, 1997). Despite compelling differences and benefits to instructional practice, little qualitative or quantitative investigation has been conducted with a diverse learner audience to understand the effect of various aspects of learning environments on/with the learner, and in particular these effects on the learner's attitudes, behaviors, perceptions, and performance *while learning* (Halverson & Graham, 2019).

With respect to learning environment and instructional treatment, most commentators since the mid-1970's have suggested that different treatments or methods of instructional delivery produce at least comparable learning outcomes relative to traditional classroom-based courses (Sitzmann, Kraiger, Stewart, & Wisher, 2006), irrespective of the learning environment in which they are presented. These studies were largely initiated in reaction to the broad adoption of "correspondence" courses wherein the learner would self-direct study according to a prescriptive plan, and has since been expanded and confirmed several times by the researcher in meta-analyses incorporating new development in training delivery methods, all with the same result (Clark, 1994). In a sequence of extensive studies, Clark (1983) claimed that instructional outcomes are media/modulus independent. These assertions are largely restricted to the specific instructional application measured – a significant limitation of such comparison studies of learning conducted in varied learning environments is the focus of the analysis (Buerck, Malmstrom, & Peppers, 2003). Most studies consider a limited set of learner characteristics such as gender (Arbaugh, 2000), learning preferences (Clouse & Evans, 2003), or opportunities for learner activity (Martin,

Parker & Deale, 2012) in their designs in measuring course equivalence, the conclusions drawn are nearly exclusively based on performance in a summative assessment, typically a declarative recall instrument (Gagne, Wager, Golas, Keller, & Russell, 2005), rather than a more expansive examination of the learner experience (Clark, 1994).

Indeed, the issue of equivalence of instructional treatment and learning environment should include the variance of instructional experience in two different delivery methods – a well-designed virtual instructional program often takes very different methods, activities, and approaches to delivery from its traditional classroom analog – the environments (and resulting learner interaction in that environment) are *fundamentally different* (Dobbs, Waid, & del Carmen, 2009; Sautter, 2007; Yap, Wong, Wong, & Turner, 2001). Additional variance in program delivery stems from student attitudes, perceptions of, and interaction with a particular environment (Buerck, Malmstrom, & Peppers, 2003). As such, these factors can, and do, influence the learner's experience in an online delivery format (Clarke III, Flaherty & Mottner, 2001; Glasnapp, Poggio, Poggio, & Yang, 2005).

Another shortcoming in conventional research on learner engagement as a construct is its characterization as a stable trait of the learner (Appleton, 2006). As mentioned earlier, Appleton et al. (2006) characterizes learner engagement as an index at a certain point of time. Other researchers have found, however, compelling evidence to support the notion that the process of learning involves situated cognitive dynamic cognitive and social processes unique to the specific intentional trajectory of the learner and the environment in which learning occurs (i.e., deliberate practice, Ericsson, 2006; learning from others, Grenier, 2009). Rather than a stable characteristic, learning is better characterized by a continuous interaction within a learning environment to develop expertise (Kuchinke, 1997; Daley & Cervero, 2016). The challenge for practitioners in

learning and development is determining the optimal treatment, technique(s), and learning environment in which to address a particular training need. What is required is a method of measuring learner engagement within the learning experience, to allow the evaluation of how it changes over time and providing standardized measurement rubric that includes valid and reliable instrumentation to assess the critical dimensions of individuals' engagement in learning. The instrument and measurement method can thus be used to advance enhanced instructional treatments, reduce instructional attrition, and improve workforce development. For learners, instructional treatments and environments that are tailored to enhance their learning experience and outcomes.

Purpose of Research

As a first step in a line of research relating to "learner engagement" and outcome, this study seeks to establish a more expansive and dynamic model of the "learner engagement" construct that includes the learner, the environment, and the learner-environment interaction. Subsequent research will evaluate the relationship of learner engagement with individual and organizational outcomes. The consequences of fully developing a model could not be higher – the wasted resources of sub-optimal training and professional development opportunities stagnate the opportunities of individual workers and limit the growth and capabilities of organizations (Herling & Provo, 2000).

Extant research exploring the impact of different learning environments on learning outcomes misses a fundamental point - many of the most salient measures of effectiveness for the classroom experience are highly subjective or not captured at all and informed by the individual learner's set of goals and objectives within that environment. Moreover, for a contextual perspective, online learning is *de facto* different than a traditional classroom, simply by virtue of

being delivered differently than the traditional face-to-face format (Lave & Wenger, 1991). To date, nearly all research relating to learning engagement has focused on summative assessment of learning outcomes of an operationalized environment (Clarke III et al., 2001), ignoring personal subjectivities relating to the learning experience in favor of quantitative data relating to assessments of outcome, with but a few exceptions as they relate to vocational training and anecdotal perceptions of worth assigned by the learner (Peltier, Schibrowsky, & Drago, 2007). This approach to research fails to measure the causal effects on the learner of instructional treatment and learning environment from the ecological and situated perspective. Despite compelling differences and benefits to educational practice, little qualitative or quantitative investigation has been conducted with a diverse learner audience to understand the effects of the interaction of a learner in a particular learning environment on learner's attitudes, behaviors, perceptions, and performance *while in the learning experience*.

Review of the literature suggests that emotional, and cognitive dimensions of self-reported engagement are common variables in engagement research and have been found to relate to numerous desirable academic and behavioral outcomes (Fredricks et al., 2004). For this study, an additional factor relating to the interaction of the learner in the learning environment is added, supporting a situated cognitive perspective, and posits that learner engagement is not stable across time (Betts, Appleton, Reschly, Christenson, & Huebner, 2010) but rather highly dynamic within the instructional experience.

The purpose of this mixed-method study is to provide a model of learner engagement that incorporates the learner and the learning environment, and then evaluate the effect of engagement on learning in academia, industry, and society. Research will be conducted in several stages, starting with a qualitative inquiry into learning experience and the concept of learner engagement,

and culminating in development of a quantitatively supported prescriptive model for instructional treatment and delivery that leverages specific environments and treatments to achieve particular learning outcomes. The proposed theoretical framework of this study seeks to link learner engagement with improved learner outcomes. This theoretical framework examines the situated experience of the learner, his/her interaction with the environment, and its impact on the ultimate success of the learner in achieving the particular outcomes desired by that learner *and the organization.*

Conceptual Framework

Situated cognition provides a promising framework to address learner engagement that addresses the rapidly evolving variety of learning environments and instructional techniques extant in today's workplace learning domain. Brown, Collins, and Duguid (1989) detail a theory of situated cognition particularly apropos to the environmental analysis of learner engagement. For situated cognitivists, the task of learning is the confluence of a set of personal motives with a particular environment that provides affordances to which the learner attunes his/her perception. Action and response to stimuli in the learning process is based on those invariances of the environment that invite action (Hutchins, 1995). Each individual's experience is thus unique to their perceptions and the affordances within a particular learning environment that are both present *and perceived* in a constructivist context (Jonassen & Rohrer-Murphy, 1999; Mills, Bonner, & Francis, 2006) – previous studies eschew the perception and motivation of the individual learner in favor of merely cataloging environment factors and measuring observable simple behaviors (Breslin, Hodges & Williams, 2009).

Situated cognition, as a theory of learning, conceptualizes learner engagement as a unique experience for each learner-within-an-environment. Central to a situated framework of cognition

is that the dynamic interaction between action and environment in the learning process is real time and ongoing - the learner takes action, prospectively perceives the effect of action on the environment within the timeline of goals/objectives in that moment, the subsequent environmental response, and takes subsequent action. A central tenet of this theoretical framework thus focuses on the dynamic interaction of perception, action, and environment that forms and dissolves minute by minute while in the learning process. "A perceiving/acting agent is coupled with a developing/adapting environment and what matters is how the two interact" (Young et al., 1997, p. 139) - a learner in a particular environment, by definition, adapts perception and interaction based on the environment. As this process continues, the learner refines his/her perception to the environment and learning is the consequence of interacting with those affordances. "The environmental consequences of actions produce new experiences that can draw the attention of the perceiver to new affordances of the environment" (Young, 2004, p. 172). To properly address the intricacies of these interactions, this study seeks first to identify several key elements of learning environments and learner-environment interactions that affect engagement.

The experience of both student and instructor are highly dynamic in a learning environment, and collection of this data seems likely to provide insight into those aspects of the learning experience that inform engagement. To that end, the first step of this research is to develop a framework for qualitative evaluation of the learner within a learning environment, and the effects on both the learner *and the learning environment* that result from the inclusion of different environmental affordances in a program of study – the focus is not just on the actions and changes of the learner but also the corresponding changes in the environment. This initial stage of research will consist of a basic interpretive inquiry into individual subjective effects of educational technology on learner attitudes, motivations, and perceptions within an online learning

environment. The central and related concepts resulting from the basic interpretive study will be used qualitatively to evaluate particular learning environments through theoretical sampling, and then quantitatively investigate the relationship between learner engagement and instructional outcomes as specific phenomena (Ciborra, 2004).

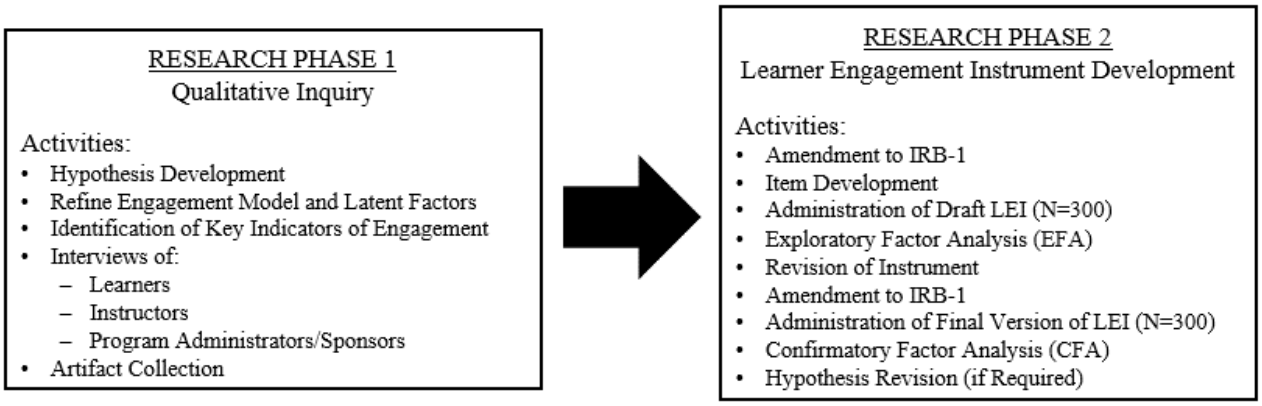
This study is similarly rooted in a constructivist lens – each participant in the learning environment (educator, learner, and sponsor) constructs a different sense of the efficacy and consequences of adoption of pedagogical technique or technology in the learning environment. These experiences and constructs are highly dynamic within the experience of the participants, and adoption of a constructivist lens in this context will allow the "claims, concerns, and issues of stakeholders to serve as organizational foci" (Guba & Lincoln, 1989, p. 50). These organizational foci will, in turn, be used for follow-on studies and additional purposed sampling to fully refine the theory (Charmaz, 2014) in evaluating the learning environment and defining "new" pedagogies and technologies as elements of the learning environment. Grounded Theory is particularly appropriate when viewed against the Situated Cognition/Constructivist framework of the research – the theory emerges from, and is validated against, the data, rather than "forcing the data into preconceived categories" (Charmaz, 2006). Situational Cognition/Constructivist theory similarly relies on individual perception and development of realities within a particular environment (Brown, Collins, & Duguid, 1989; Charmaz, 2006). In the aggregate, the use of a *Constructivist Interpretive Inquiry* will address the process of learning as a social construct, with "the phenomena of study and sees both data and analysis as created from shared experiences and relationships with participants and other sources of data" (Charmaz, 2006, p.130).

General Overview of the Research

The program of research is directed at first defining the learner engagement construct, and subsequently developing an instrument and methodology to measure it. This research will be conducted in two phases (Figure 1-2):

1. Explore "learner engagement" through qualitative inquiry into the experience of stakeholders; and
2. Develop an instrument and related methodology to measure the learner engagement construct.

Figure 1-2. Research Plan Outline



Phase 1 – Qualitative Inquiry - The research began with a basic interpretive inquiry into what precisely is meant by "learner engagement." Interviews were conducted with personnel of extensive background and expertise in learning and development in government, academia, and industry. The goal of the interviews was to collect a robust set of data from the perspectives of principle stakeholders in the learning and development program/process on learner engagement and its function within the learning experience. Respondents were also queried about what observable indicia they felt provided evidence of engagement of a learner in a particular learning environment. Stratified purposeful sampling was employed to fully treat the perspectives of these three critical roles (learner, instructor/moderator, and program sponsor) in the learning and

development domain. The interpretive inquiry approach began with *open coding* of data along a topical or theoretical framework guided by the research question(s) of interest, then reduction of the data through focused synthesis and aggregation of the codes into themes (Charmaz, 2006). Code development and memoing were applied iteratively to provide deeper reading of the qualitative data, informed by the initial open coding effort to fully contextualize the data across data sources. As codes are identified and evaluated for relevance to the research, axial coding of the data was applied to align the codes into categories. Categories, in turn, were evaluated by the researcher to develop themes that provide insight into aspects of the research questions (Strauss & Corbin, 1998) that would guide the development of items in the development of a learner engagement instrument.

Phase II – Instrument Development and Validation –The next step in the research was to operationalize the constructs identified in the qualitative inquiry by generating items for an instrument designed to measure learner engagement. Based on the emerged themes and concepts from the Phase I qualitative data along with a literature review, items were developed for the three factors identified (Affective, Cognitive/Intellectual, and Environmental). Four content experts were recruited based on their fields of expertise and professional experiences in learning and development to conduct an Item Alignment Review. These experts reviewed the conceptual definitions and the correspondence between the conceptual and the operational definitions. These experts were prompted to provide qualitative feedback and substantive recommendations that were then be incorporated into the construct definitions. From there, an item pool of 90 items was developed for an item alignment review by content area experts as part of the instrument validation. Items were evaluated for both relevance and alignment to the learner engagement construct factors. The final draft instrument was developed from these candidate items that

demonstrated the best characteristics of relevance and alignment, and after IRB review and approval as an amendment to the research proposal, administered to a sample population (N=300). An Exploratory Factor Analysis (EFA) was conducted, the instrument revised based on the factors and items and factor loading. At the conclusion of the EFA analysis, a revised instrument was prepared, and an IRB-1 amendment filed. Upon approval, an administration of the final version of the instrument (N=300) and Confirmatory Factor Analysis (CFA) was conducted

Subsequent research following this study will further operationalize the model in instructional delivery, using the indicia and artifacts identified in the qualitative study and additional data collection methods such as Ecological Momentary Assessment (EMA) and automated learner analytics to assess the dynamics of learner engagement within the learning experience, and evaluate their effect on learner outcome.

Research Questions

Table 1-1 provides the research questions and underlying hypotheses of this study. It bears noting that during the first phase of this research, it is likely that the hypothesis will be revised based on the qualitative data collected. This is a natural and expected consequence of conducting an interpretive inquiry (Strauss & Corbin, 1998).

Table 1-1.

Hypotheses and Corresponding Research Questions

Hypothesis	Research Question(s)
The learner engagement construct is defined in three factors of: 1. Affective 2. Cognitive/Intellectual 3. Environmental	What are the perceived dimensions and characteristics of learner engagement? (RQ1)
	What experiences and perceptions of the learner, and the interactions within the environment, affect learner engagement? (RQ2)
	What observable indicia exist of the learner-environment unit of analysis for engagement of a learner in a particular environment? (RQ3)
	How can those experiences, perceptions, and interactions be used to develop a model of learner engagement? (RQ4)

Chapter 2

Literature Review

Workforce Development & the Adult Learner

The target population of this study is adult learners that have or are currently engaged in some form of professional training experience. In contrast to the advanced and well-grounded theories in early development and education from researchers such as Piaget (1964) and Vygotsky (1962), the dynamics and characteristics of adult learning in the workforce were not well addressed until the late 20th century. In the early 1970's, Dr. Malcolm Knowles noted that this training context was fraught with unique challenges largely derived from the characteristics of the learner (Knowles, 1973). Knowles noted that adult learners face a variety of different challenges towards committing to the instructional experience (the term "engagement" did not emerge until much later than his original treatise), and as such, the benefit of the instruction must be patent to the learner. From this analysis, Knowles developed an approach to instructional *content* and *methodology* that required an adaptation to the needs and intentionality of adults as learners – he termed this approach *andragogy*, a term "used by my colleagues in Yugoslavia" (Knowles, 1973, p. 40). He noted that, "most scholars in the field of adult education itself have dealt with the problem of learning by trying to adapt theories about child learning to the 'differences in degree' among adults" (Knowles, 1973, p.34).

Of interest to this study, Knowles and his research progeny focus entirely on the *externalities* of the learner – the content, the job requirement, etc. and the *perception* of the adult learner in the value of the instruction (Caffarella, Baumgartner & Lisa, 2007). As professional development and workplace instruction expanded in both scope and treatment, researchers repeatedly found that self-direction and readiness to learn (the mitigation of typical barriers to

participation – resources, etc.) were predictive of reduced attrition in adult learning contexts (Park & Choi, 2009). Adult learning researchers, however, take *prima facie* the concept of perceived relevance and/or utility when instructing the adult learner (McIver, Fitzsimmons, & Flanagan, 2016). Their andragogical construct stops at the instructional treatment and treats the perception of the adult learner as a static characteristic resulting from the appropriate instructional design and delivery method (Mirriahi, Alonzo & Fox, 2015) – essentially saying, "build the content for adults, and they will come." Since its introduction and review, Knowles' characterization of adult learners as possessing unique requirements and needs has led to extensive criticism that the construct is not a theory, but rather a simplification of a more complex model for learning (Norman, 1999)

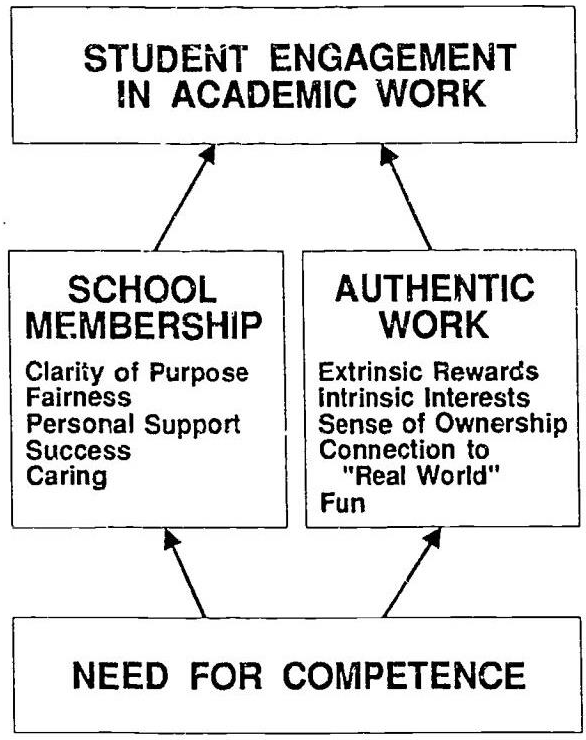
Constructs of Learner Engagement

The challenge of applying an andragogical model from Knowles' line of research to define engagement is that the externalities of adult learners are only part of the puzzle – adult learner engagement as a construct requires a more complex analysis of learners' experiences and perceptions rather than relying on implicit assumptions of them based on guidance around content development and delivery. Perhaps the first constructive approach to learner engagement was in the pre-secondary education context in the 1980s, derived from a line of research into attrition in public education (Miller, Leinhardt, & Zigmond, 1987). In Finn (1989), a learner model relating to the concept of engagement (and subsequent persistence in school) is described as a two-factor model, consisting of a behavioral component relating to observable participation in class and school and an affective component relating to a sense of identification with the school community and a sense of belonging. Citing Miller et al. (1987), Finn (1989) notes "the student's engagement in at least one sub-component …is necessary (and may be sufficient) for keeping at risk students in school" although noting (at the time) "little research to help design interventions" to enhance

engagement" (p. 133). This early research did little to define a formal psychometric model of engagement but rather focused on observable learner behaviors (e.g. deciding to attrite or not to attrite, participate in activities, etc.).

Also working in the domain of public education, Newmann, Wehlage, and Lamborn (1992) advanced the definition of student engagement with the introduction of a within-the-learner factor separate and distinct from learner characteristics such as motivation, noting "conceivably students can be motivated to perform well in a general sense without being engaged in the specific tasks of school." The researchers propose a model derived from "need for competence" that is expressed through a sense of belonging to the school (belonging) and performance of perceived authentic work (behavioral) (Newmann et al., 1992, p. 18) (see Figure 2-1).

Figure 2-1 A Model of Engagement (Newmann et al., 1992, p.18)



The sense of belonging with the school derives from a perception of "the general enterprise

of schooling as legitimate" and a sense of alignment between the goals of individual and the goals of the school that develops "when students establish affective, cognitive, or behavioral connections to the institution" (Newmann et al., 1992 citing to Wehlage et al. (1989), p.20). The model as proposed relied heavily on observable indicia of engagement, ranging from self-declared intent to frequency of participative activity, and the authors offered no means of measuring student engagement other than frequency of discerning learner behaviors.

One of the limitations of Newmann et al. (1992) is the "need for competence" latent factor as a construct and the lack of any form of measuring it – limitations addressed by Marks (2000) and its progeny. Marks' (2000) construct incorporated the learning environment through research of Bronfenner (1979) in ecological support structures in learner (termed an "exosystem" in the study), although obliquely as a mechanism for facilitating participative behavior rather than a factor of engagement in and of itself. In developing measures, Marks (2000) defined a construct ("student engagement in instructional activity") with four component measures – two of which were behavioral in nature (student effort and assignment completion) and two affective in nature (attentiveness and lack of boredom). Her experimental design controlled for a variety of learner characteristics employed a 3-level hierarchical linear model to determine whether the measured factors were sufficient to define the construct. Factor invariance and dependency aside, the research reflects an important step in the evolution of learner engagement as proposed in this study – namely, that *the learning environment* figured in the calculus of learner engagement, and within-the-learner factors alone were insufficient to address the construct (Marks, 2000). This line of research has continued in research using analytics derived from learning systems to assess learners engagement using behavioral measures as part of its calculus, albeit within only one specialized learning environment and instructional treatment (Kahn, Everington, Kelm, Reid, & Watkins,

2017; Manwaring, Larsen, Graham, Henrie & Halverson, 2017).

Appleton et al. (2006) advanced the construct by seeking declarative data from respondents related directly to their perceived sense of engagement and employing a more advanced within-the-learner engagement model composed of two factors – intellectual and emotional. Appleton's research, like its information processing antecedents, however, failed to contemplate the entirety of the learning experience, instead developing an entirely within-the-learner model and eschewing Marks' (2000) inclusion of an ecological perspective. This approach fails to measure the causal relationships of learning environments with outcomes from the ecological and situated perspective (Young, et al., 1997). Despite compelling differences and benefits to educational practice, little qualitative or quantitative investigation has been conducted with a diverse learner audience to understand the effect of various aspects of learning environments on the learner, and in particular these effects on the learner's attitudes, behaviors, perceptions, and performance *while learning.*

More recent research has expanded Appleton's construct to address the lack of observable behavior (and reverting to that proposed by Marks (2000). Trowler (2010) notes that engagement is "more than involvement or participation – it requires feelings and sense-making as well as activity" (Trowler, 2010, p.7). Drawing on research from several sources, Fredericks, Blumenfeld, & Paris (2004) first proposed a construct of learner engagement with a three-factor model: behavioral (e.g., positive conduct, effort, participation), cognitive (e.g., self-regulation, learning goals, investment in learning), while others remained firmly in a within-the-learner construct of emotional and affective (e.g., interest, belonging, positive attitude about learning) Jimerson, Campos, & Greif, 2003). As noted in a comprehensive literature review, Trowler (2010) summarizes the factors of learning engagement construct as:

> 1. Behavioral: relating to students' actions. For example, class attendance, submission of work, contribution to class discussion, or

> participation in school-related activities (e.g., extra-curricular sports or school governance).
>
> 2. Emotional: relating to students' affective reactions in relation to their learning. For example, an emotionally engaged student might report that they were interested in their course and that they enjoyed learning.
>
> 3. Cognitive: relating to students' psychological investment in their learning. For example, the desire to go beyond the requirements of the class and the adoption of metacognitive learning strategies.

In contrast to earlier studies, Trowler (2010) makes several key assertions regarding the construct of learner engagement:

1. Engagement does not always have to be positive: a student could be negatively engaged if they report dislike or anxiety towards their learning. Thus, attrition can be the result of *negative* engagement rather than an absence of positive engagement;
2. Learner engagement is a dynamic construct within the learning experience; and
3. A measurement of learner engagement relies solely on observable behaviors of the learner to assess engagement.

Subsequent work on these concepts by Wang and Eccles (2013) used a longitudinal study to look at learner engagement construct changes over time, applying a construct that measured in years as the timeframe for measurement of learner engagement.

Situated Cognition & Engagement

Gibson (1986) details a theory of ecological and situated cognition particularly apropos to the environmental analysis of learner engagement. For situated cognitivists, the task of learning is the confluence of a set of personal motives with a particular environment that provides affordances to which the learner attunes his/her perception. Action and response to stimuli in the learning process is based on those invariances of the environment that invite action (Gibson, 1986). Each individual's experience is thus unique to their perceptions and the affordances within a

particular learning environment that are both present and perceived in a constructivist context (Mills, Bonner, & Francis, 2006) – previous studies eschew the perception and motivation of the individual learner in favor of merely cataloging environment factors or behavioral artifacts and measuring outcomes at a superficial level (Hodges, 2009).

Situated cognition as a theory of learning has potential in understanding learner engagement as a dynamic construct within the learning experience for each learner. Central to Gibson's situated cognitivist model is that the interaction between action and environment in the learning process is real time and ongoing - the learner takes action, prospectively perceives the effect of action on the environment within the timeline of goals/objectives in that moment, the subsequent environmental response, and takes subsequent action. A central tenet of this theoretical framework thus focuses on the interaction perception, action, and environment that forms and dissolves minute by minute while in the learning process. "A perceiving/acting agent is coupled with a developing/adapting environment and what matters is how the two interact" (Young, Kulikowich & Barab, 1997) - a learner in a particular environment, by definition, adapts perception and interaction based on the environment in question. As this process continues, the learner refines his/her perception to the environment and learning enhanced. "The environmental consequences of actions produce new experiences that can draw the attention of the perceiver to new affordances of the environment" (Young, 2004). A simple example is the question-and-answer paradigmatic interaction between a learner (the one asking the question) and the environment (the rest of the class, the instructor, etc.) – in asking a question, the environment responds, and the learner and environment changes – more questions may be prompted from other learners, the instructor may add a clarifying point of instruction, etc. Rather than simply observable behaviors of the learner, the more relevant measure is *the interaction* of the learner and the learning environment and what

changes in engagement result in timeframe measured moment-to-moment.

Learning Environments & Learner Engagement

The focus on learning environment as an element of learner engagement is of concern, because while adult learners in the workplace are essentially the same as those of 30 years ago, learning environments are not. The use of educational technology and new instructional techniques has advanced to become a prevalent practice in education, industry, and government over the last 30 years. Networked technology is now used to deliver and assess across a wide spectrum of intellectual domains ranging from technical literacies and declarative knowledge to task performance in immersive simulations to licensure and professional credentialing. The adoption of a specific technology implementation in instruction is largely driven by operational requirements and measured effects of "differences." Since early research in the mid-1970's, most commentators have suggested that instructional delivery courses delivered online produce at least comparable learning outcomes relative to traditional classroom-based courses (Sitzmann et al., 2006), based largely on comparisons of summative assessment outcomes in the two delivery methodologies. Clark (1994) claims that instructional outcomes are environment and media independent and asserted that learner preferences or biases produced variance in learner performance rather than any limitation of a particular environment. These assertions are largely restricted to the specific instructional environment(s) measured and dismiss the extensive difference in learner experience and capacity to interact in the learning experience in different learning environments.

Confounding the issue of comparative analysis of delivery methods with respect to the learner and their respective level of engagement is the variance of instructional experience and outcome in two different instructional environments – a well-designed virtual online instructional

program often employs very different methods, activities, and approaches to delivery from its traditional classroom analog (Clark, 1994; Sautter, 2007). Fundamentally, the environments that employ educational technology are different from those that do not - additional variance in program delivery stems from student attitudes and perceptions of technology, which can vastly influence success in an online delivery format (Clarke III, Emerson & MacKay, 2011; Glasnapp, Poggio, Poggio, & Yang, 2005). Recent research has begun to contemplate the learner and the factors affecting learner retention – what keeps a learner in an instructional program – but fail to go beyond typical demographic or attitudinal measures (Park & Choi, 2009). Moreover, these studies eschew any form of analysis that would relate terminal outcomes to factors affecting participation while in the learning experience. The question of "equivalence" of delivery methodology between a technology-enhanced online learning experience and that of a traditional classroom misses a fundamental point - many of the most salient measures of effectiveness for the classroom experience are highly subjective or not captured at all, and informed by the individual learner's set of goals and objectives within that environment (Brown, Collins, & Duguid, 1989).

To date, nearly all research relating to technology adoption and implementation within an instructional implementation for adult learners has focused on summative assessment of learning outcomes and persistence. Commentators often refer to these data collectively as indicia of "learner engagement", yet there is a pervasive lack of any hypothesis relating to the development and consequences of engagement in the learning process. These studies have largely ignored the personal subjectivities and the unique characteristics of learning environments relating to the learning experience in favor of quantitative data relating to assessments of outcome (Manwaring et al., 2017). The few exceptions noted in the literature relate to vocational training and anecdotal perceptions of worth assigned by the learner (Peltier, Schibrowsky, & Drago, 2007). This

approach to research fails to measure the causal relationship between engagement and learning outcome from the ecological and situated perspective. Despite compelling differences and benefits to educational practice, little qualitative or quantitative investigation has been conducted with a diverse learner audience to understand and measure learner's attitudes, behaviors, perceptions, and performance *while learning*.

Conclusion

The adult learner in the workplace today is beset on all sides – the skills he/she possesses have "a decreasing half-life," the training environments used to develop new skills are inauthentic, the technologies used in delivery can be unreliable or unfamiliar, and implementations are often undertaken without any consideration of the needs or intentionalities of the learner. It then comes as no surprise that persistence in such training implementations is poor, absent some organizational mandate to complete it. The construct of learner engagement for adults in the workforce is still nascent – much of the research in learner engagement today is directed at primary and secondary education and addressing the important issues there. However, drawing from extant research and addressing its shortcomings allows for the development of a robust model that, if properly used to guide implementation of training, will provide a roadmap for workforce development that is effective and resource efficient. The first step in that process is to clearly articulate *what* learner engagement is, including elements of cognitive, affective, and environmental factors, and determine how to measure it.

Chapter 3

Methodology

Investigating the Construct of Learner Engagement

Through Sequential Mixed Methods

This chapter presents the method used for development of the learner engagement construct. and subsequent scale development This research study was conducted in three stages, starting with a qualitative, basic interpretive inquiry into learning experiences and the concept of learner engagement, and will culminate in development of a quantitatively supported prescriptive model of instructional treatment and delivery leveraging specific environments customized for particular learning outcomes. This program of research is directed at first defining the learner engagement construct, and subsequently developing an instrument and methodology to measure it. This research was conducted in two phases:

1. Explore "learner engagement" through qualitative inquiry into the experience of stakeholders; and
2. Develop an instrument and related methodology to measure the learner engagement construct.

To further refine the focus of the study, the research was framed around four research questions:

1. What are the perceived dimensions and characteristics of learner engagement? (RQ1)
2. What experiences and perceptions of the learner, and the interactions within the environment, affect learner engagement? (RQ2)
3. What observable indicia exist of the learner-environment unit of analysis for the engagement of a learner in a particular environment? (RQ3)
4. How can those experiences, perceptions, and interactions be used to develop a model of learner engagement? (RQ4)

This chapter describes the methodology and procedures employed in developing a learner engagement construct and then, developing and validating an instrument to assess this construct model using a sample of learners from the population of adult learners who participate in periodic

vocational or professional development training. It outlines the research design, participant characteristics, data collection procedures, data analyses procedures, and limitations of the methods used in the present study.

Research Design – Phase I – Basic Interpretive Inquiry

The Phase I portion of this research employed a basic interpretive qualitative study to investigate the perceptions of a variety of professional training stakeholders in typical vocational training settings. A basic interpretive qualitative study (Merriam, 2002) was deemed particularly appropriate, given the innovative application of a situated cognition framework in this domain. Basic interpretive is a methodology of inquiry associated with a qualitative research that seeks to create theoretical categories from collected data and then analyze relationships between key categories (Charmaz, 2006). The main purpose of using a basic interpretive approach is to develop a hypothesis through identification and classification of concepts that are related by means of statements of relationships (Strauss & Corbin, 1998). For this study, the experience of the research participants (i.e., how they construct and perceive their learning environment as they learn), how they develop relationships between those perceptions, their respective set of intentions while learning, and the evaluation of the learning outcome outlined the basic structure and factors of the learner engagement construct.

Within this proposed study, the research considered the interactions and perceptions of instructional program stakeholders (including learners, instructors, designers, and sponsors/administrators), and aggregated these data into categories. A combination of structured interviews, observational data from corresponding instructional deliveries, and artifact collection from corresponding instructional deliveries were conducted to fully capture both individual and group data in the learning environment (see Appendix A). As one characteristic of interest in the

learning environment is the dynamic between individuals within the learning environment, both self-reported emic and etic observational data were collected as part of the interviews to assist in the conduct of the basic interpretive study. Similarly, participants with diverse professional contexts and differentiated learning environments were specifically chosen through purposeful sampling to facilitate the emergence of persistent categories within the data (Merriam, 2002) independent of a specific instructional subject area or learning environment.

During analysis of the data, a situated cognition framework (Brown et al., 1989) was used to develop the central concept and related concepts of a qualitative study, wherein the effectiveness of learning and pedagogical method are largely defined by both the assessed outcome and the individual *and his/her perception of the learning experience*, rather than the environment or outcome alone (Lave & Wenger, 1991). This framework was routinely referred to during analysis to guide the basic interpretive inquiry into learner engagement. While several qualitative methodologies could be applied to these research questions, basic interpretive methodology was selected to allow the definition and factors affecting learner engagement to emerge from the data collected, rather than initiating research into the experience of the learner with a variety of predefined concepts against which to develop themes (Chamaz, 2006). This approach was adopted to enhance transferability of the research to a variety of learning environments in subsequent studies (Merriam, 2002).

Sampling – Phase I

Candidates for this stage of the research were identified through purposeful stratified sampling of participants, instructors, and program administrator/sponsors in traditional and online professional development programs in industry that provide different perspectives into the same instructional domain (Creswell, 2000; Creswell & Creswell, 2016). Four subjects from each of the

populations of interest were selected using purposeful stratified sampling with the criterion detailed in Table 3-1 and interviewed using the protocol detailed in Appendix A.

Table 3-1

Sample Populations for this Study

Sample Population of Interest	Short Description	Selection Criterion
Learners	Adult learners with recent experience participating in vocational and/or professional training.	Candidates must be an adult learner (ages 28+) with at least a college undergraduate degree.
		Candidates must be engaged in full time employment in a career trajectory that requires ongoing professional development;
		Candidate must have first-hand experience in a traditional face-to-face professional development program in their field within the last year; and
		Candidate must have participated in a program of study consisting of eight or more hours in duration related to their profession.
Instructors	Professional instructors whose principal function in the workplace is the delivery of professional and/or vocational training to a workforce audience.	Candidates must be an adult instructor (ages 28+) with at least a college undergraduate degree.
		Candidates must be engaged in full time employment in a career trajectory that requires delivery of professional development instruction;
		Candidates must have first-hand experience as an instructor in a traditional face-to-face professional development program in their field within the last year; and
		Candidates must have participated in a program of study as an instructor consisting of eight or more hours in duration related to their profession.
Program Sponsors & Administrators	Professionals whose responsibilities include the development and delivery of training programs to audiences within their organizational claimancy.	Candidates must be an adult program sponsor or senior executive (ages 28+) with at least a college undergraduate degree.
		Candidates must be engaged in full time employment in a career trajectory that requires planning for and execution of professional development instruction; and
		Candidate must have first-hand experience as a program administrator or program sponsor for instructional programs in a variety of formats.

The sampling in each of these sample populations sought variance in relevant cultural dimensions (e.g., gender, race/ethnicity, technical background, instructional domain) to achieve data saturation in theme development. Following initial coding, axial coding of the interview transcript was employed to identify the key categories used to develop a learner engagement construct and instrument. Where available, additional artifacts from respective participant experience were collected to provide additional insights into the specific instructional context being analyzed (see Table 3-2).

Table 3-2

Additional Instructional Artifacts for Basic Interpretive Study

Sample Population of Interest	Short Description	Additional Data Collected
Learners	Adult learners with recent experience participating in vocational and/or professional training.	Syllabus, instructional materials (presentations texts, references), participant materials, recordings, online environment artifacts, notes.
Instructors	Professional instructors whose principal function in the workplace is the delivery of professional and/or vocational training to a workforce audience.	Lesson plans, preparation recordings, instructional delivery recordings.
Program Sponsors & Administrators	Professionals whose responsibilities include the development and delivery of training programs to audiences within their organizational claimancy.	Budgets, training policy, organizational planning documents, design documents, delivery schedules, measurements & evaluation plans.

The intent of this supplemental data collection effort is to collect relevant materials that are directly related to the interview data collected to provide a more robust context for the instructional delivery. This study employed routine engagement activities that include member checks and a protocol for communication that ensured a complete and accurate measure of the stakeholders and their experience (Shenton, 2004).

Analysis Method– Phase I

Observational, interview and artifact data were open coded to contextualize the data into categories (Pidgeon, 1996). Axial coding was performed concurrently by the researcher and two peer researchers to facilitate the identification and refinement of categories into concepts and defining how these concepts are related (Ruona, 2005). Member checks (n=7) were conducted with participants where supplemental data or clarification was desired and to ensure that the coding adhered to the initial intent of the participant (Merriam & Grenier, 2019; Shenton, 2004). The constant comparison method of analysis (Strauss & Corbin, 1990) was employed to identify the central concepts by persistent review of all data from all sources to establish and refine the relationship of the central concepts to other concepts that are identified. At every stage, the researcher sought validation of qualitative data through triangulation method and reviews for internal consistency within item responses (Shenton, 2004). The central concepts identified in this analysis were used as factors in subsequent model definition and instrument development (Bulger, Mayer, Almeroth, & Blau, 2008).

Research Design – Phase II – Construct/Factor Definition & Instrument Development

The second phase of this research was directed at the formal measurement of the construct by construction of orthogonal factors, developing content validity evidence for the construct, and operationalizing the construct in an affective instrument. The first step in developing evidence of

content validity consisted of two experts reviewing the conceptual definitions and the correspondence between the conceptual and the operational definitions of the factors comprising the construct of interest. These experts were prompted to provide qualitative feedback and substantive recommendations that were incorporated into the construct factor definitions. The experts held a Ph.D. (n = 3) and had expertise in cognition and instruction, as well as operational experience in the adult/workplace learning industry or human resource development experience in both practical and academic practices in relevant fields for at least 15 years. Drawing from an extensive body of instruments relating to learner affective and cognitive measures, personal experience working in the field, and the results from the qualitative study, items were developed and reviewed for alignment along the three dimensions of interest. The initial candidate list was generated through informal discussions with practitioners in the field as well as a literature review of the current instruments relating to learner engagement for factors shared between those and the construct under research. While many of these instruments individually suffer from limited construct validity or applicability across multiple instruction contexts (Appleton et al, 2006), this study conducted a broad survey of the body of instrumentation to elicit persistent themes and items stems for further evaluation and development within this study. While the methodology followed involved generating unique items, the factors and underlying themes of other instruments were thought to provide some opportunity at a later date of developing criterion validity in follow-on research. The learner engagement construct was operationalized by generating a candidate pool of thirty items per factor (a total of ninety items). This candidate item list was then reviewed by the panel of three experts that reviewed the construct in the field to identify which items were redundant or confusing. As in the first review, the experts held a Ph.D. (n = 3) and had expertise in cognition and instruction, as well as operational experience in the adult/workplace learning

industry or human resource development. All of them had experience in both practical and academic practices in relevant fields for at least 15 years. Items identified as redundant or confusing were either discarded or revised, with the intent of conducting a content validity analysis of at least eighteen items per each of the three factors identified, with the intention of final selection of six to eight questions per factor following item content validation (Grant & Davis, 1997).

For item validation, a panel of six content area experts were recruited to review the instrument and candidate items in order to evaluate the relevance and dimensional alignment of the items within the construct of interest (Gable & Wolf, 1993). The experts selected for reviewing the draft instrument items included academic researchers in measurement/assessment, cognition, and instruction, and adult education. In addition, four doctoral practitioners from government and industry with current experience in the areas of adult professional development and training were recruited from across the United States. Experts participating in the content validity review were provided the background of the study, the construct of interest with detailed factor definition, a copy of the draft instrument items, instructions, and a form soliciting feedback on relevance, strength of association, and qualitative comments. The purpose and significance of the content validation study was explained together with the potential uses of the instrument in the field (see Appendix B – Content Validation Survey).

An item alignment rating scale was defined to allow experts to evaluate the dimensionality of each item defined along the factor structure relating to the individual construct factors, as well as an option for none of the factors. A classification rating was also solicited to allow the researcher to self-evaluate the level of certainty with which items were classified. This index allowed for redaction of draft items that failed to achieve a certainty rate of 0.80 for which factor the item loads on (Gable & Wolf, 1993).

A relevance rating scale to the identified factor was solicited to allow experts to rate each separate item by using the five-point Likert scale. This approach was used to quantitatively analyze agreement for each item and the entire tool, as well as direct relevance of the items to its associated factor. With the data collected, the researcher then conducted a content validity analysis to develop a Content Validity Index (CVI) to establish proportion/percent agreement among the experts (McCoach, Gable & Madura, 2013). The proportion of items receiving ratings of 4 and 5 (the strongest alignment scores in the scale) constitute the actual CVI, and any items rated below a normalized score of 0.75 were eliminated. Items were considered to have adequate content validity if they achieved a relevance agreement of 0.875 or higher. Items with relevance scores ranging from 0.75 to 0.875 agreement were further reviewed for adequacy using any qualitative data collected on those items from the expert review and reworded/revised accordingly. Items were discarded or revised if they were found to have unacceptable content validity with an agreement of 0.75 or lower. A draft Learner Engagement Instrument (LEI) composed of all of the remaining items was created from the candidate pool of items found to satisfy all the content validity criteria, balancing the number of items per factor as much as possible (see Appendix C).

Sampling Method– Phase II

With a draft LEI developed, a sample of respondents for a pilot phase were drawn from a population of working adults in the United States who had participated in an instructional program related to professional development in the past twelve months. A research protocol was approved by the University of Connecticut Institutional Review Board (IRB) that included measures for data security, consent, and anonymization using online recruitment via Amazon Mechanical Turk. Amazon Mechanical Turk is an online resource that provides a crowd-sourced distributed sampling platform for data collection. A variety of screening and performance filters are available

to enhance the reliability of the data, including those detailed for this study drawing only from a verified respondent sampling population. Amazon Mechanical Turk is appropriately deemed convenience sampling (cite), but does provide some significant benefits to research, most notably the speed and capacity to collect large and diverse data sets. Research in Amazon Turk and similar platform demographics and data reliability are mixed, but do consistently find that samples are more diverse than those from traditional methods in regard to socioeconomic status and are more geographically distributed (Buhrmester, Kwang, & Gosling, 2011; but see (Ophir, Sisso, Asterhan, Tikochinski, & Reichart, 2019). Moreover, empirical studies have shown that the data collected from internet is as reliable as those collected in traditional methods, and in fact statistical power can be enhanced from traditional convenience sampling methods through the use of filters in the respondent population (Thomas & Clifford, 2017). The sample of adult learners (*n=300*) were recruited from a population of adult workplace learners and stakeholders coupled with a coordinated campaign of social media recruitment. All responses obtained through the blind online platform were screened for employment status and residency as meeting the criteria for participation. All rights of the subjects were protected such that no one person's response could be identified, either through survey code markings or any other method. A summary of the respondent sample for the EFA detailing demographics and industry classification is provided in Appendix D.

Analysis Method – Phase II

The data from the pilot study was subjected to an EFA to "explore the dimensionality of an instrument by finding the smallest number of interpretable factors needed to explain the correlations among set of items" (McCoach, et al., 2013). The analysis consisted of:

1. Screening for missing or miscoded data
2. Evaluating the data for suitability of EFA

3. Factor extraction, rotation selection
4. Evaluation of item and sub-scale performance
5. Revision of the LEI (if indicated by the EFA)
6. Structural Validity/Subscale Analysis
7. Reliability & Descriptive Statistics Analysis

Data Screening: The data was screened for univariate outliers and list-wise missing data. Of note, the instrument was implemented in such a way that missing or incomplete data precluded successful completion by the participant and compensation. Preliminary analysis at this stage of the analysis focused on determination of the appropriate number of factors for formal EFA.

Suitability for EFA: To evaluate the appropriateness of conducting EFA, some basic statistical analyses were conducted, including Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity. In addition, the analysis applied criteria from Lackey et al. (2003) to assess Measures of Sampling Adequacy (MSAs) in the anti-image correlation matrix. Finally, the communalities values for all items were evaluated for correlation of items with each other such that EFA is appropriate (McCoach, et al., 2013).

Number of Factors to Extract: With suitability for EFA established, a preliminary factor analysis was conducted on the data to determine the number of factors to extract from the data (McCoach, et al., 2013). Analysis employed a "holistic" approach (McCoach, et al., 2013) that considers several criteria, including Kaiser's criterion (eigenvalue (λ) > 1.0), Scree Plot Evaluation, Parallel Analysis (both Principal Component Analysis (PCA) and Principal Axis Factoring (PAF)), and Minimum Average Partial Procedure (MAP) (McCoach, et al., 2013). Lastly, composite scores were calculated for each of the factors, based on the mean of the items which had their primary loadings on each factor. The skewness and kurtosis of these score data

were evaluated for normal distribution.

Revision of the LEI: Following the EFA, items within the LEI found to improperly load or otherwise identified as poor indicators for sub-scale trait were either redacted from the model or amended to address the deficiency. Similarly, items demonstrating strong negative partial correlation were revised to ensure they remain aligned to their instrument while eliminating their model-irrelevant correlation. Additional revision of items was performed to ensure a complete LEI with all items loading on one of the three factors was prepared for reliability analysis and follow-on CFA.

Subscales Analysis/Structural Validity: The EFA results were used to develop the final subscales of the LEI. The subscales correspond the latent factors of the learner engagement construct, and "reflect the judgmental categories from which the conceptual and operational definitions of the affective characteristic were developed" (McCoach, et al., 2013). In evaluating the results, analysis consisted of a thorough review of the aggregations of items suggested by the EFA loadings (Fabrigar, Wegener, MacCallum, & Strahan, 1999), and factor definitions were refined and further defined in the model (Fabrigar & Wegener, 2012).

Reliability & Descriptive Statistics Analysis: Reliability of the revised LEI subscales was tested by conducting an Item Analysis and calculating Cronbach's α and developing sum scores and descriptive statistics pertaining to those scores. For examination of the distributions of each item responses and the relations of each item with others and the entire survey, item analyses were conducted, including item-total correlations for each item and Corrected Item-Total statistic (revised correlation modelling the instrument/subscale with the item deleted). In the aggregate, this information indicates the degree to which the items are related to each other, and to the aggregate sub-scale. Then, items whose item-total correlations were below a cut-off criterion of

0.20 (Thompson, 2004) were examined for redaction from the instrument. Negative item correlations (if any) were also analyzed, as these are indicia of poor correlation with the desired sub-scale and/or need for reverse scoring or redaction.

Cronbach's Alpha (α) coefficient was calculated for each of sub-scales, evaluating both the value and the Confidence Interval to ensure adequate reliability under the constraint of tau-equivalence of indicators, where the entire CI for Cronbach's Alpha should be > 0.80 (Raykov, 2001). In addition, Cronbach's Alpha was evaluated for instruments with each item within each subscale removed to further assess model robustness by evaluating the removal of individual items within subscales to evaluate the individual contribution of each item to modeling the total variance observed within each subscale. Values and variance of Inter-Item Correlations were evaluated to determine the level of redundancy between items and ensure that the variance/standard deviation of these statistics is low (preferably $\sigma < 0.1$). In addition, mean scores and standard deviation of the response data within each sub-scale were evaluated for normality and appropriate distribution of response data (skew/kurtosis) to ensure the data represents the population response pattern and was appropriate for analysis.

Confirmatory Factor Analysis (CFA): Following the EFA, items within the LEI found to improperly load or otherwise identified as marginal indicators for sub-scale trait were amended to better align with the subscales identified with the EFA. Items demonstrating strong negative partial correlation were revised to ensure they remain aligned to their instrument while eliminating their model-irrelevant correlation. Additional revision of items was performed to ensure a complete LEI with all items loading on the construct of interest factors was prepared for reliability analysis and follow-on CFA analysis on a new sample. A summary of the respondent sample for the CFA detailing demographics and industry classification is provided in Appendix D.

Following collection of an independent second sample from the same population, CFA was used to evaluate fit of the learner engagement model drawn from the EFA to alternative models. The objective of CFA was to test how well the empirical data fits the hypothesized latent learner engagement model. A variety of fit criteria evaluated model fit, including Kline's (1998) criteria, Comparative fit index (CFI), the root-mean-square error of approximation (RMSEA), and the standardized root-mean-square residual (SRMR). Lastly, the underlying model and hypothesis was reviewed based on the results of the CFA for subsequent research.

Chapter 4 – Results

Introduction

This research employed an exploratory sequential mixed methods design (Creswell, 2018) to answer the research questions because there are no instruments or structured measurement methods based on a situated cognition theoretical framework that assesses dimensions of learner engagement. Initially, qualitative data was obtained to design the learner engagement instrument and subsequently the designed instrument was administered to two representative samples to quantitatively validate its construct validity. This chapter presents results of the study in three sections. The first section presents the results of the phase I qualitative study and the phase II content validation and describe dimensions of the initial instrumentation developed from the themes that emerged from qualitative data and expert's judgment. The second section presents the EFA results from the initial instrument implementation in the population of interest, analysis of item performance, construct definition, and decisions relating to individual item redaction/revision. The final section presents the CFA results from the revised instrument implementation in the population of interest and final reliability analysis of the construct and item performance. Lastly, instrument validity and additional analyses that further examine the utility of the construct and instrument is provided.

Phase I – Qualitative Study

As a first step in researching the learner engagement construct, this study sought to elicit insights in the perceptions of learning and development professionals working with the population of interest. The research questions in the qualitative inquiry were necessarily limited in scope to prevent confounding multiple factors and influences with those relating to over work and professional attitudes, experience, etc. The goal of the qualitative inquiry was to more fully define

factors that could be explored applying qualitative measurement techniques to understand the construct. Creswell and Plano-Clark (2018) characterize this type of mixed method research as "exploratory sequential design" wherein the "qualitative method can help develop or inform the second, qualitative method" (p. 84, citing Greene et al., 1989). This initial study examined individual thoughts and experiences on several "sides" of the instructional experience – that of the learner, the instructor, and the program sponsor or manager. The questions derived in the interview protocol (see Appendix A) for this study were administered to both collect qualitative data relating to three research questions of this study relating to learner engagement wherein some of the factors associated with the construct of interest are not well defined in the current literature (Creswell, 2018):

1. What are the perceived dimensions and characteristics of learner engagement? (RQ1)
2. What experiences and perceptions of the learner, and the interactions within the environment, affect learner engagement? (RQ2)
3. What observable indicia exist of the learner-environment unit of analysis for the engagement of a learner in a particular environment? (RQ3)

In this fashion, the questions developed sought to balance open-ended inquiry against the practicalities of asking questions that evoked meaningful responses that could be used to both refine the question and develop themes relating to learner engagement in constructivist framework (Patton, 2015).

The interview protocol was implemented to collect impressions, opinions, and perceptions as they relate to the experience of a typical learner (Seidman, 2013), as well as relevant artifacts (policy documents, syllabi, learner notes, etc.) related to the instructional experiences discussed. Probes relating to the differences of any particular learning experience from the traditional instructional environment were also utilized. The artifacts were employed in several interviews to guide a discussion regarding the perceptions of the instructional experience from the perspective of the learner, the instructor, and the program sponsor. Of note, the role of the artifacts varied

from group to group – learners used the artifacts (and in particular, presentations and syllabi) to recount specific perceptions and experiences, instructors used their facilitation guides and notes to describe their desired treatment and learner experience during delivery, and the program sponsors used them as evidence of training conducted and outcomes achieved. The data collected provided insight into the totality of experience in the learning environment while conforming to the general precepts of a constructivist framework wherein the themes emerge from the data (Patton, 2015). In addition, further analyses of these themes and the artifacts relating to individual instructional experiences were conducted to determine whether relationships exist between learner-perceived level of engagement in an instructional experience and subsequent outcome. The purpose of the phase I study was to develop and define the general dimensions underlying learner engagement applying a situated cognition framework. From the literature review, recent studies identify general learner engagement constructs with an affective, a cognitive, and a behavioral aspect, which collectively fail to address the underlying latent intentionality of the learner-environment unit of analysis, instead choosing to substitute some form of frequency measure based on observational data (Fredricks, Bloomfield & Paris, 2004).

I began the analysis with repeated readings of the transcripts and then proceeded to open coding of the data (Patton, 2015). As noted by Patton, the repeated readings permit meanings and patterns to emerge, and concurrently allow the researcher to gain "an understanding of the themes and events covered in the text" (Thomas, 2006, p. 241) before committing to codes and a coding schema. The initial set of readings was meant to provide context and meaning for the entire set interviews across all interviewees. All the transcripts were read in this manner before any coding of the transcripts was conducted (Thomas, 2006). Open coding of the transcripts was performed that consisted of the researcher reading each response in its entirety, and then focusing on the

meaning of each phrase, identifying it as a code, and noting any particular context or meaning (Patton, 2015) to seek solitary meaning within each phrase or line of discourse (Thomas, 2006). *In vivo* codes were found to be very effective for developing an overall sense of the transcript, an analytic approach recommended by Patton (2002) as providing the "cumulative core content of the interviews" (p. 240). Shorthand summary terms for each selected code in the margin and basic iconography were employed to identify repeated terms across interviews, particular emphasis, etc. In several cases, the actual video recordings were used to evaluate the specific meaning of the speaker – largely the use of body language and visuals to emphasize a particular point.

After open coding the data from each interview and reviewing relevant artifacts (where collected), research memos were developed from the notes and related parentheticals. The process included general impression of the interviewee, the spoken (and unspoken) meanings interpreted from the data, as well as the loose open codes that appear to repeat across participants in an effort to develop "a heightened sensitivity to the meanings contained therein" (Birks, Chapman, & Francis, 2008, p. 69). The actual *mechanics* of developing the memos proved to be of significant assistance in follow-on development of categories and themes – the repeated review of open codes and collapsing of codes into others prompted further review of the data and subsequent analysis, and the framework of the results thereby emerged (Birks, et al, 2008). After the open coding process was complete, word processing software was used to compile all of the codes, phrases, and *in vivo* comments from each interview to code comment tags, color code emerging categories, and conduct spell checking/frequency count/word count to develop consistency across all transcripts. The data were then reviewed in three iterations several days apart for occurrences of categories within each interview transcript by both the researcher and a peer reviewer, with the intent of returning to the data unbiased by recent analysis. In the content analysis, categories were

identified broadly to accommodate multiple codes and (mostly) preclude overlap. Synthesis of categories was achieved by examining the relationship between categories and the underlying codes – seeking no overlap of where a code "belongs" (Saldana, 2013). In addition, category development was refined through the evaluation of the relationship of each category with the others and the research questions.

As a next step, the categories were axially coded along relational lines to affirmatively link categories to codes that define its meaning (Strauss & Corbin, 1990). An organizational taxonomy proposed by Strauss and Corbin (1998) was applied wherein categories were further refined along the phenomenon (in this case, the instructional experience), the context of the phenomenon, the implementation of the phenomenon, and the consequences of the actions/interactions related to the phenomenon. Of note, the operationalization of most corporate training contexts was found to align well with this taxonomy, and category aggregation assisted in evaluating the relevance of each category to the research questions. Within each category, sub-topics were identified, including "contradictory points of view and new insights" (Thomas, 2006, p. 242). Finally, core themes were composed for the categories that "convey the core theme or essence of a category" (Thomas, 2006). This step in the analysis, above all others, facilitated the organization of the data into meaningful responses to the research questions and allowed development of emerging themes that summarized the key concepts of the high-level categories.

Learner Engagement Construct. Eleven themes emerged from twelve sets of qualitative data and reflected essential aspects of two of the factors identified by previous research (Affective and Cognitive), while providing extensive insight into a third, situated factor, characterizing the dynamic relationship of the learner and the learning environment. Three dimensions of learner engagement were thus derived from the qualitative study and they are: Affective Learner

Engagement (ALE), Cognitive Learner Engagement (CLE), and Situational Learner Engagement (SLE). Moreover, the qualitative data consistently supported the concept that learner engagement was not fixed throughout a learning experience, but rather changed – often quite quickly, both as a consequence of the learner and the environment. Respondents noted that "I started out intent on getting a lot of out of the class, but within 5 minutes I knew the training was a waste of time", and another noting "the instructor made the accounting topic interesting, even though I came in not expecting much." The sub-themes and themes are presented in Figure 4-1, along with postulated rates of change based on the qualitative data.

Figure 4-1 Themes and Sub-Themes Related to Learner Engagement Using a Situated Cognition Framework

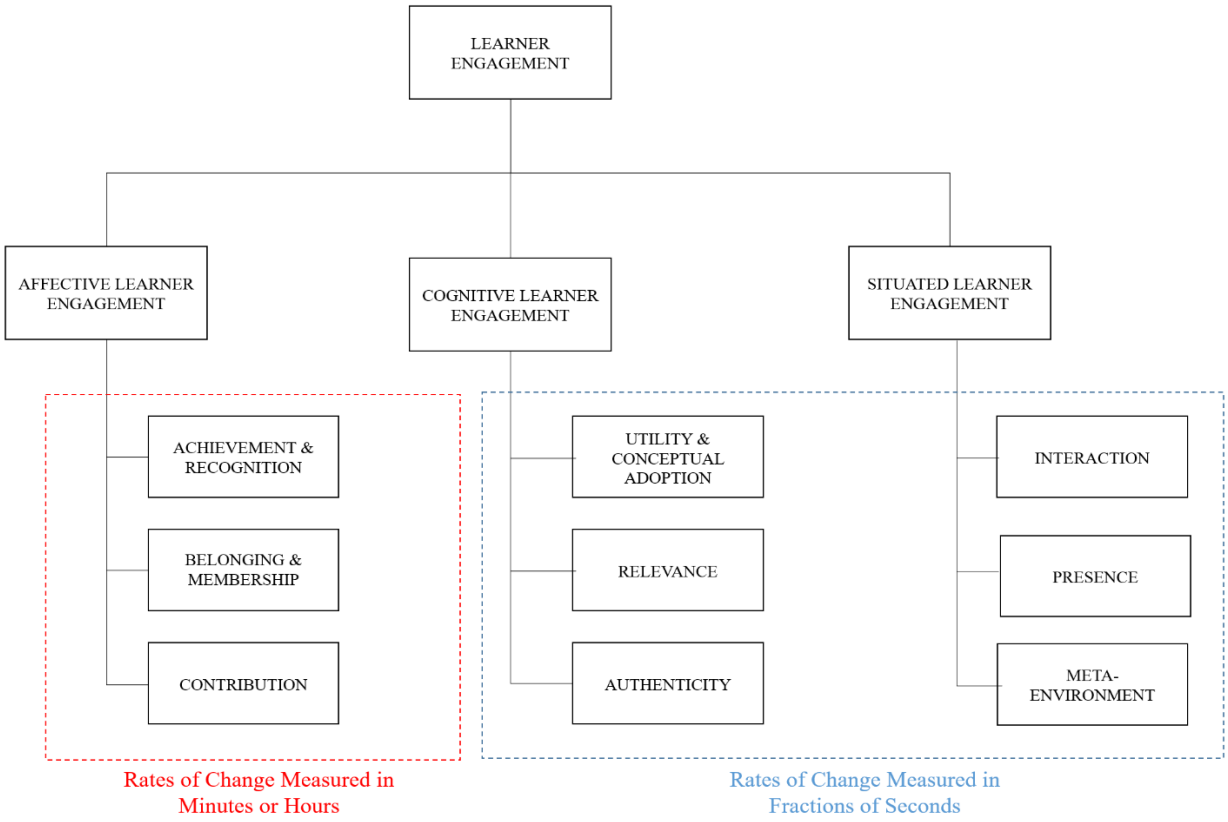


Figure 4-1 Rates of change (or dynamism) based on the qualitative data associated with a recurring theme that learner engagement changed over time.

Affective Learner Engagement (ALE). Affective learner engagement is the emotional response experienced by the learner while participating in the instructional session. This theme was expected to emerge, as most recent research has identified an emotional aspect to the engagement construct. As noted by Trowler (2010), "engagement is more than involvement or participation – it requires feelings and sense-making as well as activity. Acting without feeling engaged is just involvement or even compliance; feeling engaged without acting is dissociation" (p. 5). Three themes emerged from the qualitative data relating to affective response: belonging and membership, achievement & recognition, and contribution.

Belonging & Membership. Many of responses collected during the qualitative interviews, particularly from the learners, had to do with the relationship that they formed (or did not form) with their peers and instructor. All three populations interviewed noted the value of including people of diverse technical background or experience in a particular learning program; this laid the groundwork for program sponsors to design programs targeting a population while enhancing cross-departmental expertise. Facilitators found that developing a relationship with the learners and fostering a relationship between the learners produced a better outcome and improved their sense of the quality of the delivery. The primary phrases or key elements of this sub theme was the use of the first-person plural ("we") in describing the interactions in instructional experience and the overall sense that learners felt in contributing opinion or experiences within the instructional session. This sense of shared experience in learning commonly extended beyond the learning experience, with learners and instructors both noting lasting professional relationships that formed initially during an instructional experience.

Achievement & Recognition. The sense of actually accomplishing something within the instructional experience was of primary importance, particularly to the learners. Every participant

in an instructional experience interviewed highlighted the importance of having done something valuable to them and how it made them feel. Learners felt that an instructional experience was of value if they felt they had accomplished something important to them (and to a lesser extent, their organization). In many cases, this theme emerged in the negative alternative, wherein learners neither recognized the rationale nor the importance of the learning experience. This particular negative example was noted by all three populations interviewed for the qualitative study, with common phrases including "waste of time" or "training for the sake of training", with particular vitriol reserved for enterprise-wide compulsory training for compliance (e.g. workplace environment, fiduciary responsibility, or interpersonal interactions). Achievement as interpreted by instructors, learners, and program sponsors often took the form of some kind of formative feedback or some measure of adoption by the learner population within the instructional experience.

Contribution. Instructors and learners frequently noted the importance of contribution and informed response by others (instructor or peer learners) to their sense of satisfaction with the learning experience. This thematic element is very closely related to recognition but is more principally directed to a sense that the learner had actually advanced the experience of the entire class, whether it was recognized or not. In reviewing artifacts for an instructional experience, this was often reflected by one individual building on a concept introduced by another, with many acknowledgments and supporting phrases like "yes, exactly" or "in addition, I would add" within the classroom dialogue. The important thing for the learner was the sense that they had contributed something meaningful or that they had gotten something very meaningful from one of their peers or the instructor. Representative phrases from learners included "I valued the interaction with other practitioners – it made my work better" and "I felt we advanced our understanding together", and in the negative case identified others that "were along for the ride" or "didn't do their part of the

(assigned) project". Of note, other elements of the learning environment could also quash this sense of contribution – another participant (a learning and development consultant in an MBA program) noted "in one of my classes, the professor shuts down discussion as soon as it starts and delivers the content. We're not encouraged to ask relevant questions, and the entire learning experience is uncomfortable. The class is entirely filled with people disinclined to contribute at all and it makes actually learning this material and how to apply it very difficult." For their part, program sponsors and instructors noted the value of learners that actively contribute in instructional programs, highlighting a sense of accountability for learners. One program sponsor went so far as to say, "I can build the best training in the world, but if the learners aren't ready to take some responsibility for their own development, the program will fail".

Cognitive Learner Engagement (CLE). Several studies have identified the role of the cognition, interest, and participation in the engagement of learners (Coates, 2007). As distinguished from exclusively learner-centric observable studies (see Fredericks et al., 2004; Jimerson et al., 2003), this study found that a cognition-based theme of *both the learner and the environment* better represented the qualitative data. The characteristics of cognition that emerge from this study involve interest and relevance and utility of the learning for the learner in the environment. These themes most closely reflect characteristics of learning related to adult learners (Knowles, 1973; Merriam, 2001). Perhaps most importantly however, cognition moderates both the affective and the environmental response of the learner within the learning experience. It would appear that without a cognitive latent factor, engagement is unlikely to occur. Participants in the qualitative study noted, "the training program was useful for my job" and "I started the PMP program because I needed the certification for work, but I found the material very relevant to a variety of challenges in both my personal and professional life." From

the data collected in this study, cognitive learner engagement is an amalgam of interest, value, and utility related to the concepts and practices being presented in a learning experience viewed through the lens of a particular learner's experience and intent. Three principal themes that characterized CLE emerged from the data.

Utility/Conceptual Adoption. The utility/conceptual adoption theme refers to the perceived usefulness of the materials being presented in an instructional experience. Separate and distinct from a learner's affective reaction within the learning experience (how they feel about it), this theme relates to the cognitive response *while in the learning experience* to how the learner perceives the utility of information presented, both within the instructional experience and afterwards. Participants in the qualitative study noted a broad and diverse experience with professional instruction, and it was both the strongly positive and strongly negative perceptions of the utility of the material that stood out for them. If a learning experience led to deeper understanding of complex concepts related to their professional practice (even if beyond the ordinary boundary of his/her expertise), participants would be more likely to say they were engaged. The PMP participant noted, "I use elements of risk management and project planning everywhere – the concepts have really changed my perspective when I approach any new project, and I now understand many of the processes in place in other parts of the procurement and accounting department." In contrast, when the instructional experience offers nothing new of utility to the learner, they are likely to disengage. One participant (a learning and development professional pursuing an MBA) saw little utility "in an organizational behavior class focusing on basics that I've been working with for 15 years" because of the lack of new information to contribute to her professional practice, but noted "several of the students saw the stuff for the first time and they were amazed."

Relevance: Content Alignment with Intentionality. This theme most frequently emerged

when the question of whether training was mandated or voluntary/self-selected by the learner arose. Rather than facial perception of relevance (Knowles, 1973), this theme can best be characterized as an alignment of intent between that of the instructional program design (as promulgated by the program sponsor) and that of the learner (Biggs, 1996). Participants interviewed in this study noted much higher dissatisfaction with mandatory training not directly useful or applicable to them as learners in their role, with one participant noting "most mandatory company-wide training is a waste of time". The concepts underlying this theme are not simple affective responses to poorly designed training – rather, this theme derives from an alignment between the instructional program and the learner's intended trajectory. If a learner intends to learn something, develop a new skill, etc. the key question under this theme is whether the instructional program provides the means to fulfill that intent. The perceived lack of relevance or utility is really a lack of alignment between what the organization and the learner want to accomplish in the training.

Authenticity: Content Alignment with Experience. Similar to the perception of relevance, learners' perception of authenticity in an instructional experience is also a consequence of an alignment. For learning to be perceived as authentic, an individual learner's experience in the domain needs to align with the concepts and practices presented. Of note, an exact alignment is not necessary, but rather the information and task-interaction in the instructional delivery must at least complement the learner's experience and interactions in the same domain. Not surprisingly, in situations where learners are working in an entirely new domain with no past experience or "informational expectation", this theme is not apparent. Notably, it was extremely negative reactions that were very prevalent amongst participants (learners, instructors, and program sponsors) – the most damning example recalled by one participant (an HR professional) that found new-hire mandated training related to workplace environment "a complete waste of my time. I've

authored books on this material, and perhaps what made it most galling is that they got it wrong. Rather than correct it – it was too big a class – I just read news on my tablet and checked off the box."

Situated Learner Engagement (SLE). Situated learning theories suggest a person's perception of and interaction with a learning environment are promising elements to explain a dimensionality of their level of learner engagement. The process of learning results in observable indicia driven by the extrinsic (and observable) factors of the tasks performed and the relationships formed between the learner and the environment in the learning environment (Brown et al., 1989). Lave and Wenger (1991) note, "learning involves the whole person; it implies not only a relation to specific activities…it implies becoming a full participant, a member…able to be involved in new activities, to perform new tasks and functions, to master new understandings" (p. 53). Subsequent independent research by Lave (1991) and Wenger (1998) into communities of practice and more recent research into workplace learning suggest that how an individual leverages experience in interaction with a peer community of learners leads to a meaningful learning activity (Gray, 2004). In this study, participants reported that the learning environment and the dynamic interactive experiences with their peers both in structured and unstructured learning environments as a major influence on their level of engagement. Three themes emerged in this dimension: interaction, presence, and meta-environment.

Interaction. The foremost theme within situated learning engagement characterizes the perception-reaction dynamic between the learner and the learning environment. This theme is distinguished from simple observable behaviors such as a frequency count proxy for engagement (Jimerson et al., 2003), instead assessing the changes in both the learner *and the environment* to evaluate the level of engagement present. Participants recalled experiences provided extensive

positive and negative data relating to the presence or absence of engagement in a particular instructional context that stemmed from their ability to interact with each other and the materials. This issue is reminiscent of enabling learner agency as an important element in social-constructivist learning environments (Dwight & Garrison, 2003; Woo & Reeves, 2007; Alt, 2015) or the focus on interaction events in behaviorist learning environments (Trowler, 2010), but is notably different because the unit of analysis is substantively different – it is the interaction of the learner and the environment (Young et al, 1997). One participant (a manager completing a PMP certificate program) reported, "The learning environment was not great – the instructor acted as a gatekeeper between us (the learners) in the moderated forum and directed each of how and with whom we should interact on a weekly basis. I shut down and did the bare minimum to get by." In contrast, another participant (Director of Customer Training) noted, "what I really like about different learning environments is that learners have the kind of anonymity they want or not depending on what they want to accomplish with their interaction, so they feel more free to ask questions and volunteer opinion. They have the courage to ask a question or participate in a way that maybe they wouldn't otherwise." Participants also noted that the design of the interaction was critical, as one participant (a university distance education director) noted, "without means to interact with the materials, you end up with a poor learning experience notwithstanding having the best instructor in the world. Learners follow their perception of whether they'll have the opportunity and do what they need to do with each other and the instructor to achieve their goals in the class." Lastly, learner perceptions of the environment itself (whether technology, other learners, an instructor, content, etc.) were often cited as directly related to learner engagement. One participant (an experienced instructor in blended learning delivery) noted, "learners will often follow the lead of someone else in the environment and there's nothing you can do to save a dead class." In

contrast, the same factor can contribute positively to individual learner engagement, as a participant (the MBA student) noted "The other participants are my best resource (in an instructional session). They look at things from different perspectives that often provide me the best insight into how I understand the content."

Presence. Participants frequently reported the need for learners to be "present in the moment" or "mindful" during an instructional experience for them to be considered engaged. Follow up questioning was used to explore those terms meant in the context of learning and cognition. Several participants noted that "being present" in an instructional experience was distinct from simple reaction to the learning experience. Instead, the degree to which someone perceived a change in the learning environment and then reacted to it reflected a great deal more complexity than previous studies using a "did-or-did-not" binary analysis (Trowler, 2010). The sharing of knowledge and experience by whatever means available in a learning environment was similarly a consistent component in this aspect of engagement, as one participant (an experienced instructor) noted "I think there's a couple levels of being present in a learning experience. Initially it is basics – Are you listening? Are you involved in the conversation? […] Then there's a deeper level where the questions are more important - Are you adding to the conversation? Are you making connections to other experiences (both yours and other learners')? Is the conversation evolving? Are you changing, and how?"

"Meta-Environment." Separate from the actual learning environment, the meta-environment is the organizational and physical context of the training delivery that can vastly affect the learners' instructional experience. For the learners and instructors in the study, the broad diversity of learning environments and delivery methods implicates that *where* they participate in a learning environment impacts their ability to engage and organizational context often informs

why they participate in the instructional program at all. One participant noted that the learning management system accessed from home impacted the instructional environment in live instruction, noting "it's essentially an online portal where you get to submit your homework, to take quizzes, post on discussion boards etc. But neither our grades nor our interactions are properly recorded, so it becomes more stressful to attempt to understand the experience while live in class. Rather than focusing on the learning of the content of the skills I am supposed to have, we find ourselves attempting to outsmart the system to get to where we have to complete the course". For program sponsors, the meta-environment was often characterized by where the training mandate originated and ultimately who was responsible to satisfy it. From this perspective, learner engagement often depended on the organizational context of the learning experience as perceived by the learner. An exemplar of this theme was a statement by one participant who noted, "we have a lot of people who get sent the stuff they don't actually even know what they're being sent to for…they may be told its compliance training, it's safety training, or some kind of mandatory thing…but they may not even know what they're there for, and this may not get resolved before completing the program." Another participant (chief learning officer for a Fortune 100 company) noted, "(participants feel) if the outcome really isn't going to be their individual responsibility, why should they care?"

Item Development. Themes were categorized based on characterizing the underlying mechanisms and observable phenomena in regard to learner engagement, instead of the specific contexts or anecdotes provided in the data in order to increase generalizability of the themes (Yin, 2015). Within the situated cognition theoretical framework, the themes were found to converge meaningfully to represent each of the corresponding three dimensions of the learner engagement construct (ALE, CLE, and SLE). Instrument development began with the development of items

related to the principle themes identified that, respectively, reflected the potential variables within the construct of learner engagement. A total of 87 items relating to the theorized learner engagement model were developed as candidates related to those factors identified in the qualitative study through both independent development and a review of existing instrumentation and informal discussions with practitioners in the field. As noted in the review of literature, while many of these instruments individually suffer from limited construct validity or applicability across multiple instruction contexts (Appleton et al, 2006), the author elected to conduct a broad survey of the body of instrumentation to elicit persistent themes and items stems for further evaluation and development within this study. After the generation of initial candidate items, two subject matter experts in workplace learning and adult education were engaged to discuss the overall conceptualization of the constructs as well as the content of the individual items. Each of the subject matter experts possessed an advanced degree in cognitive psychology and over 20 years of experience in workforce development and research. Their review recommended omission of 17 candidate items as repetitive and 18 additional candidate items for using terminology not generally in use by the professional learning and development community, as well as some revision of the construct factor descriptions. In total, 52 items were developed for the three factors of learner engagement (Grant & David, 1997; Rubio, Berg-Weger, Tebb, Lee, & Rauch, 2003) for the initial content validity analysis.

Content Validity. The first step in the content validation analysis sought to obtain qualitative feedback on content adequacy and model definition through an independent review of the construct and proposed factor structure by two experts in cognition and instruction (McKenzie et al., 1999). Both experts are practicing researchers with advanced degrees in cognition (one M. Ed. and one Ph.D.) and possess extensive background in adult instructional practice in industry.

The construct of interest (Learner Engagement) and its three factors (ALE, CLE, and SLE) were defined and provided to these experts for correspondence between the conceptual and the operational definitions of the construct (McKenzie et al., 1999). These experts provided qualitative feedback and substantive recommendations that were then incorporated into the construct definitions.

The second step consisted of item generation reflecting the domain of content and the purpose for the instrument (McKenzie et al., 1999). A draft instrument was constructed from all of the candidate items, a scale adopted for use, instructions to subjects was created, and items reviewed to ensure consistency in wording and format. A panel of six content experts was recruited to review the instrument in order to evaluate the relevance and dimensional alignment of the candidate items within the construct of interest (Gable & Wolf, 1993) and provide additional qualitative feedback on the construct definitions. The experts selected for reviewing the draft instrument included academic researchers in measurement/assessment, cognition, and instruction, and adult education. Experts participated in the content validity review through electronic forms that included background of the study, the construct of interest, a copy of the draft instrument items, instructions, and a form soliciting feedback on relevance, strength of association, and qualitative comments. The purpose and significance of the content validation study were explained together with the potential uses of the instrument in the field.

Two scaled responses were solicited for each item from each expert (Clark & Watson, 1995). The *alignment rating scale* allowed experts to evaluate the dimensionality of each item defined along three dimensions (or "factors") relating to the affective response to learner experience, cognitive response to learner experience, situated learning experience, or none of the factors. Items with less than 5 of 6 experts' agreement were eliminated (Gable & Wolf, 1993).

Certainty of classification was also collected on a 3-point scale to allow the researcher to then eliminate those items that failed to achieve a certainty rate of 0.80 for which factor the item loads on (Gable & Wolf, 1993). The relevance rating scale allowed experts to rate each separate item by using the four-point Likert scale. This approach was used to quantitatively analyze agreement for each item and the entire instrument as well as direct relevance of the items to its associated factor. The Content Validity Index (CVI) was then used to establish proportion/percent agreement among the experts. The proportion of items receiving ratings of 3 and 4 constitute the actual CVI, and any items rated below a normalized score of 0.75 were eliminated. Items were considered to have adequate content validity if they achieved a relevance agreement of 0.833 or higher. Items with relevance scores ranging from 0.75 to 0.833 agreement were further reviewed for adequacy and redundancy using any qualitative data collected on those items from the expert review, and reworded/revised accordingly. Items were found to have unacceptable content validity if they achieved an agreement of 0.75 or lower. The Content Validity Ratio (CVR) was used to identify the utility (or relative lack of utility) in an item's measure of the latent construct (Lawshe, 1975) by identifying how many evaluators assessed the item as essential to the construct they had identified. Any items lacking a majority of the evaluators rating the item as totally relevant would result in zero or negative values of CVR and would result in elimination due to being unessential to measuring the construct of interest.

Table 4-1

Summary of Validity Analysis of Items

Item Number	Statement	Alignment Agreement Ratio	Certainty Aggregate	CVI	CVR
1	***The subject matter in the program was important to me.***	**1.000**	**0.833**	**1.000**	**0.33**

2	*I am inspired to further study the subject matter that was addressed in this program.*	0.500	0.778	1.000	0.33
3	*Class participants were challenged in this program to perform.*	1.000	0.778	0.833	-0.67
4	*Participants were respectful of each other's opinion in the program.*	0.833	0.667	1.000	-0.67
5	*My level of experience and subject matter expertise in this area was less than the other students in the program.*	0.667	0.500	0.833	-1.00
6	***I enjoyed this instructional program.***	**1.000**	**1.000**	**1.000**	**0.33**
7	*I benefited from interacting with others in the instructional delivery.*	0.833	0.833	1.000	0.00
8	***Interacting with others in the program was an important part of the instructional experience.***	**0.833**	**0.944**	**1.000**	**0.33**
9	***I was intellectually challenged in this program.***	**1.000**	**0.944**	**1.000**	**0.67**
10	*The instructor presented the learning content in ways that helped me to learn.*	0.833	0.778	0.833	-0.33
11	*I benefitted from collaborating with others in the activities in the program.*	0.667	0.778	0.833	-0.33
12	***I enjoyed participating in the instructional program.***	**1.000**	**0.944**	**1.000**	**0.67**
13	*I felt the class worked well together in the instructional program.*	0.833	0.778	0.833	-0.33
14	***This instructional program has provided me with an opportunity for personal development.***	**0.833**	**0.833**	**1.000**	**0.33**
15	***Something another participant did or said compelled me to provide my own opinion/input.***	**0.833**	**0.833**	**0.833**	**0.33**
16	***I participated effectively in the instructional delivery.***	**0.833**	**0.833**	**1.000**	**0.33**
17	***I felt encouraged to volunteer opinion in the program.***	**0.833**	**0.833**	**1.000**	**0.33**
18	*The instructional team provided me with individual support during a session in this instructional program.*	0.500	0.833	1.000	0.33

19	***Enrollment in this program was an investment in my personal development.***	**1.000**	**0.833**	**1.000**	**0.33**
20	*After completing this program, I plan on staying in touch with some of the participants from this program.*	0.667	0.444	0.667	-0.67
21	***The diversity of opinion in the program was beneficial to my learning.***	**1.000**	**0.889**	**1.000**	**0.33**
22	*I felt very involved in the discussions and/or activities in the program.*	1.000	0.833	1.000	0.00
23	***I learned something new in the subject area from the instructor.***	**1.000**	**0.889**	**1.000**	**0.33**
24	*The instructor responded effectively to questions and feedback from participants.*	0.833	0.778	1.000	0.33
25	*While in the program, I had to be completely focused on the learning experience and material.*	0.500	0.611	0.333	-1.00
26	*The instructor was very effective at eliciting input from the participants during the session.*	1.000	0.889	1.000	0.00
27	***The instructor demonstrated extensive knowledge about the subject matter.***	**0.833**	**0.889**	**1.000**	**0.67**
28	*I learned something new in the subject area from the other participants.*	0.833	0.889	1.000	-0.33
29	*I know what was expected of me when I participated in this program.*	0.500	0.667	0.833	-0.33
30	*I had opportunities to participate in the discussions and activities in this program.*	1.000	0.833	0.833	0.00
31	*The instructional program required me to interact during the delivery.*	0.833	0.667	0.500	-0.33
32	***I changed my opinion on an issue/concept addressed in the program based on my interaction with the instructor and/or participants.***	**0.833**	**0.833**	**1.000**	**0.33**
33	*I felt my understanding of concepts presented in the program were similar to most other participants.*	1.000	0.667	0.667	-0.33

34	*The materials and references provided me everything I needed to perform well in this program.*	0.833	0.889	0.667	0.00
35	***I chose to participate in the instruction because of what someone else said or a comment I read in the session.***	**1.000**	**0.833**	**1.000**	**0.33**
36	***I received recognition for my participation in the activities or discussions in this program.***	**1.000**	**0.833**	**1.000**	**0.33**
37	***The materials and concepts presented in this program were well suited to my level of expertise.***	**1.000**	**0.889**	**1.000**	**0.67**
38	*This instructional program required me to demonstrate I learned something.*	0.667	0.944	0.667	0.00
39	*I prefer to listen to others rather than actively participate during the instructional delivery.*	0.833	0.778	0.667	-0.67
40	*My answer to a question posed by the instructor during the program changed because of what another participant said.*	1.000	0.889	1.000	-1.00
41	***I understood a concept better when another participant asked a question about it, and the concept got discussed in a different way.***	**1.000**	**0.889**	**1.000**	**0.33**
42	*I was initially hesitant to ask a question or participate, but once other participants started asking questions or commenting, I felt better about doing so myself.*	1.000	0.833	1.000	0.00
43	*I liked the ability to interact with others through multiple methods (chat, direct message, raising hand and talking, poll voting, etc.)*	0.667	0.889	1.000	0.33
44	*I felt my opinions and experience reflected the majority of the participants in the program.*	0.500	0.611	0.333	-0.67
45	***I felt good about participating in the discussions and activities of this program.***	**1.000**	**0.889**	**1.000**	**0.33**
46	*I participated in the activities in the program because it was easy to do so.*	0.833	0.944	0.833	0.00

47	***This program is important for my personal or professional development.***	**0.833**	**0.944**	**0.833**	**0.33**
48	*The subject matter in this program was very relevant to my personal goals.*	0.667	0.889	1.000	0.00
49	*I was able to interact in a variety of ways with the others in my instructional program.*	0.500	0.944	1.000	0.33
50	*When one person offered a strong opinion, most of the class tended to "go along" with that position.*	1.000	0.667	0.333	-1.00
51	*When I disagreed with a point made in the program, I expressed my disagreement.*	0.833	0.778	0.667	-0.67
52	*I got out of the instruction what I expected to.*	0.833	0.889	0.667	0.00

Note. Items satisfying all inclusion criteria for the draft learner engagement instrument are highlighted in boldface. Items shaded in red were found to have unacceptable performance and were redacted from candidate pool of items for the draft instrument.

Applying this methodology to the draft instrument, 11 items were eliminated for failure to load as unidimensional items. An additional ten were eliminated for uncertainty in assignment to factor. Nine additional items were eliminated for failing meet a positive value of validity ratio (indicating that more than half of the evaluators believed the item was important to measure the latent construct). Lastly, three items were eliminated from the candidate pool as being redundant with some minor reworking of the stem (items #14 and #9 replicated the concept of item #47 and items #15 and #35 were reduced to item #15) (McCoach et al., 2013). Of the seventeen remaining items in the instrument, five items were presumed to measure the ALE factor, six items were presumed to measure the CLE factor, and the remaining six items were presumed to measure the SLE factor. Final item characteristics are detailed in Table 4-2.

Table 4-2

Items Characteristics in Learner Engagement Instrument

Latent Factor	Number of Items	Mean Alignment Agreement	Mean Certainty Aggregate Score	Mean CVI	Mean CVR
Affective Learner Engagement	5	0.97	0.90	1.000	0.40
Cognitive Learner Engagement	6	0.97	0.90	0.97	0.50
Situated Learner Engagement	6	0.90	0.87	0.97	0.33

Lastly, detailed qualitative comments from the experts led to revisions in items, especially with an emphasis on the wording of affective terminology and tense of the statements for consistency.

Phase II – Pilot Instrumentation

Purpose. The instrumentation developed in Phase I of the study was implemented to address the final research question (RQ4) directed at the development of a measure of a latent construct of learner engagement for the population of interest. The Phase II portion of the study consisted of operationalizing the instrument for the population of interest to permit an EFA of the resulting data.

Sample. The sample of respondents for the phase II study was drawn from a population of working adults (n=300) who had participated in an instructional program related to professional development in the past twelve months. Respondents were screened against several criteria (Table 4-3) to collect response data only from the population of interest, and several demographic and organization items were included before response data was collected to develop a complete picture of the respondent population and instructional context that formed the basis of the response data collected. A summary of the composition and demographics for the sample used in the EFA are

provided in Appendix D.

Table 4-3

Respondent Demographic Screening Criteria

Criterion	Acceptable Range	How Verified
Age	25-65	1. Sampling Profile on Survey Platform (Amazon Mechanical Turk) 2. Demographic Item in Instrument
Education	Post-Secondary	Sampling Profile on Survey Platform (Amazon Mechanical Turk)
Employment Status	Full-Time (> 32 hours/week)	Sampling Profile on Survey Platform (Amazon Mechanical Turk)
Participant in Professional Training Program	Yes	1. Sampling Profile on Survey Platform (Amazon Mechanical Turk) 2. Demographic Item in Instrument
Region	North America	Sampling Profile on Survey Platform (Amazon Mechanical Turk)

The survey for the Phase II EFA study consisted of the 17 Likert-scale items relating to learner engagement, two demographic questions, two questions regarding self-reported organizational questions to provide an operational context for the learner intent upon entering the instructional program providing the basis for the response data. Convenience sampling was employed through an online data platform (Amazon Turk) to qualify respondents in alignment with the population of interest and desired screening criteria. Small financial incentives[1] were offered to the respondents in return for the completion of a survey. All responses were obtained anonymously, and IRB-mandated consent obtained through the format of the instrument for online participation which required consent before participation. All rights of the subjects were protected such that no one person's response could be identified, either through survey code markings or any other method.

[1] The author paid for the company service at the rate of $1 U.S. dollars per participant, plus costs for the online platform. The company, not the author, compensated participants who completed the survey, according to the company's internal policy.

Measurement Methodology. The web-based instrument included the 17 items developed and satisfying initial validity analysis. Additional demographic information was collected to provide the opportunity for follow-on analysis, refinement of the instrument, and additional research in the subject area. The measurement methodology for all respondents used a five-element Likert scale of agreement to positively worded statement. All items are positively worded to elicit a degree of agreement or disagreement across the ''expected degree of variation'' on the construct (Crocker & Algina, 1986; Kimberlin & Winterstein, 2008). The instrument was administered over a period of eight days and resulted in a total of 300 responses.

Exploratory Factor Analysis

The data from the pilot study were subjected to an EFA to "explore the dimensionality of an instrument by finding the smallest number of interpretable factors needed to explain the correlations among set of items" (McCoach, et al., 2013, p.111). Most generally, EFA is an analytic approach used to evaluate the existence of a "smaller set of *k* latent factors to represent the larger set of *j* variables" (Henson & Roberts, 2006, p. 395) while retaining the fidelity of the original data. The analysis approach in this study consisted of screening for missing or miscoded data, evaluating the data for EFA, and conduct of a two-stage process for factor identification and further analysis.

Data Screening: The data were screened for univariate outliers and list-wise missing data. Due to the data collection platform used, participants were unable to provide incomplete responses or out-of-range responses (the system would prompt until the instrument was completed successfully and completely), providing a ratio of 17.6 cases per variable. Initially, the factorability of the seventeen items was examined. Preliminary analysis focused on determination of the appropriate number of factors for formal EFA.

Suitability for EFA: To evaluate the appropriateness of conducting EFA, some basic statistical analyses were conducted. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.934 - "marvelous", and above the commonly recommended value of 0.6 (McCoach et al., 2013). This test evaluates the partial correlations between items after controlling for all other items on the off-diagonal partial correlations in an anti-image correlation matrix. As McCoach et al. (2013 succinctly notes, "if the sum of the partial correlations is large relative to the sum of the correlations, KMO is small and EFA may be inappropriate) (p.133). Bartlett's test of sphericity was significant (χ^2 (300) = 5395.850, $p < .05$). Bartlett's Test of Sphericity compares the observed item correlation matrix to the identity matrix. The null hypothesis of this test is that the item data is orthogonal (thus uncorrelated). In rejecting the null hypothesis, the analysis is that they item data are correlated enough to where the correlation matrix diverges significantly from the identity matrix. Applying criteria from Lackey et al. (2003), Measures of Sampling Adequacy (MSAs) were evaluated in the anti-image correlation matrix. The diagonals of the anti-image correlation matrix ranged from 0.908 to 0.959, indicating excellent pattern coefficients on one or more factors, and off-axis partial correlations absolute values averaged 0.061. Finally, the communalities for all items ranged in value from 0.698 to 0.887, with a mean of 0.825, indicating good correlation of items with each other such that EFA is appropriate (McCoach et al., 2013). Given these results, factor analysis was deemed to be appropriate with all seventeen items.

Number of Factors to Extract: With suitability for EFA established, a preliminary analysis was conducted on the data to determine the number of factors to extract from the data (McCoach, et al., 2013). Factor extraction analysis considered several criteria, including Kaiser's criterion (eigenvalue (λ) > 1.0), Scree Plot Evaluation, Parallel Analysis (both Principal Component Analysis (PCA) and Principal Axis Factoring (PAF)), and Minimum Average Partial

Procedure (MAP) (McCoach, et al., 2013). With multiple methods of factor extraction, commentators often identify one method over another stressing characteristics ranging from using statistical modeling accuracy to data fidelity to operational simplicity as favoring one method over another (van Assen, 2017). This study chose to apply a "holistic" approach recommended by McCoach et al. (2013) to assess the variability in the factors identified by the various approaches.

Kaiser's criterion (Kaiser, 1960) suggests extracting all factors with eigenvalue above or at 1.0. Operationally, this rule implies that a factor is retained if it explains more variance than could be explained by randomly constructed factors under the null hypothesis that no true underlying factor exists (so the data is accurately represented by an identity n x n matrix with 1's along its principal diagonal and 0's everywhere else. As noted by van Assen (2017), "The "eigenvalues greater than one" rule, often attributed to Kaiser (1960), is implicitly linked to this null model and states that the number of factors to retain should correspond to the number of eigenvalues greater than one (i.e., deviating from the null expectation). Intuitively, one can motivate this rule by stating that an eigenvalue that represents a "true structural dimension" should at least explain more variance than contained in a single variable." In the present research data, Kaiser's criterion suggested three factors to retain (Table 4-4).

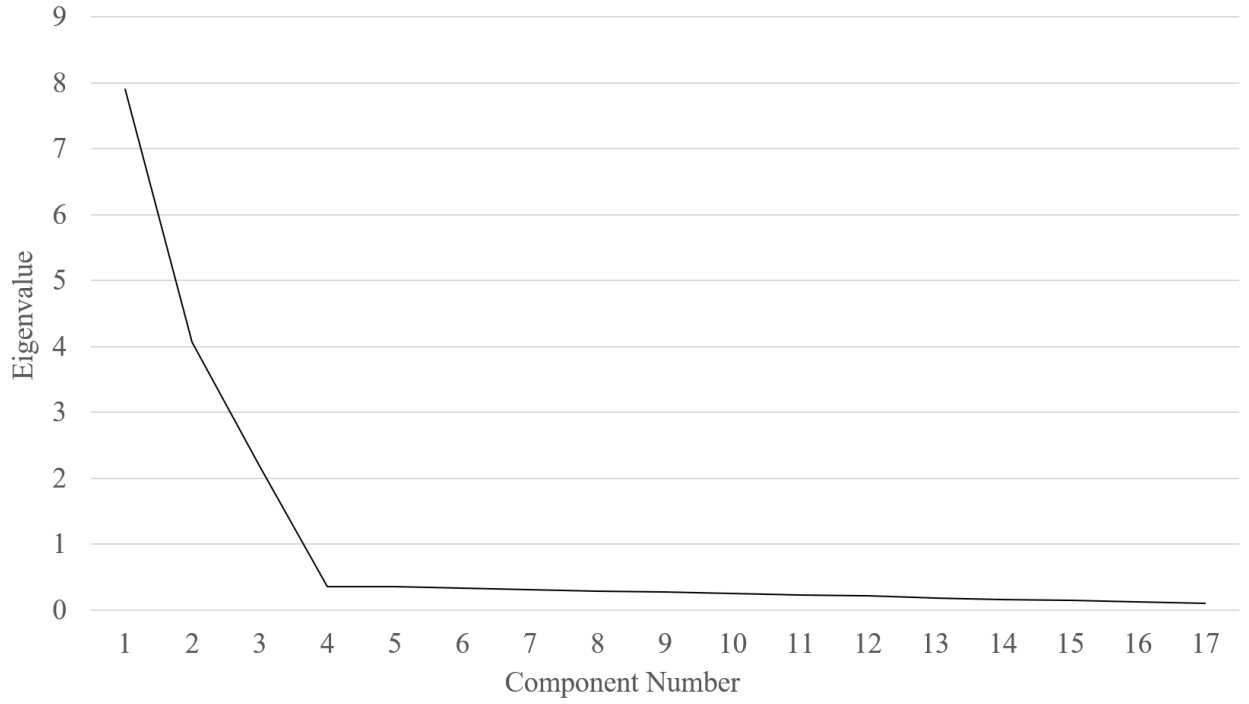
Table 4-4

Total Variance Explained by Extracted Factors

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.835	46.089	46.089	7.835	46.089	46.089
2	4.017	23.627	69.717	4.017	23.627	69.717
3	2.177	12.807	82.523	2.177	12.807	82.523
4	.375	2.209	84.732			
5	.312	1.837	86.569			
6	.299	1.759	88.328			
7	.279	1.642	89.970			
8	.241	1.415	91.385			
9	.223	1.312	92.698			
10	.218	1.285	93.983			
11	.184	1.080	95.063			
12	.182	1.069	96.133			
13	.158	.931	97.063			
14	.150	.884	97.947			
15	.127	.750	98.697			
16	.116	.684	99.381			
17	.105	.619	100.000			

The scree plot analysis suggested by Cattell (1966) is a simple visual analysis of the eigenvalues that seeks to identify the point at which the drop of slope of scree plot ceases and flattens. This point indicates the number of factors to be retained and reflects a notional “point of decreasing return” in adding factors in explaining data variance. The scree plot analysis suggested four factors (Figure 4-2).

Figure 4-2 Scree Plot for EFA Data



The Principal Axis (PA) method (Fabrigar & Wegener, 2012) uses an approach that generates a random dataset of the same dimensionality as the research data and compares eigenvalues of the two data sets. The number of eigenvalues from the observed data that have larger values than the eigenvalues from the created random data indicates the number of factors to extract. In this analysis, PA using principal components analysis (PCA) indicated three factors to extract and PA using principal axis factoring (PAF) also suggested three factors to extract. The PA using PAF generally tends to over extract factors (McCoach et al., 2013).

Velicer's (1976) Minimum Average Partial (MAP) test "involves a complete principal components analysis followed by the examination of a series of matrices of partial correlations" (p. 397) of off-axis correlations of each potential factor with the off-axis elements. The squared correlations for each step partial out the variance explained in the previous step for *k-1* iterations. In 2000, the MAP test for PCA was revised with the average squared off-diagonal correlation

($MAPr^2$) raised to the fourth power ($MAPr^4$) (Velicer, Eaton, & Fava, 2000). In both MAP analytic methods, the number of factors to extract is determined by the point where the smallest average of the squared partial correlations is obtained. PCA thus accounts for all of the variance in the correlation matrix and unique variance of an item is not factored out. The number of factors to extract is determined by the point where the smallest average of the squared partial correlations is obtained. The analysis in this study used O'Connor's (2000) macros in SPSS to conduct MAP for both original ($MAPr^2$) and revised MAP ($MAPr^4$) procedures (Velicer, Eaton, & Fava, 2000), both of which indicated four factors to extract. The results of these analyses are detailed in Table 4-5 (Henson & Roberts, 2006).

Table 4-5

Recommended Factor Extraction – Multiple Indices

Analysis	Number of Factors to Extract
Kaiser's Criteria	3
Scree Plot	4
Parallel Analysis	
PA-PAF Mean	3
PA-PAF (95% Percentile)	3
PA-PCA Mean	3
PA-PCA 95% Percentile	3
MAP	
Original Criteria (ρ^2)	4
Revised (ρ^4)	4

Based on the results of the analyses, three factors were extracted for subsequent EFA. This result was determined after careful consideration of the various results and their relative precision, coupled with the underlying principal that while both over-extraction and under-extraction are problematic, McCoach et al. (2013) noted that under-extraction is more likely to lead to less meaningful and interpretable factor structure and model, terming underextraction "the more grave

error than overextraction" (p. 121). Of the eight analyses performed, most suggested extracting three factors. Of those that indicated more factors to extract, the scree test has been noted by several researchers (Velicer & Zwicjk, 1986) as tending to over-extract, and in this present analysis the eigenvalue corresponding to the fourth factor is less than 1. In evaluating both MAP outcomes, the proximity of eigenvalues for the raw score compared to the hypothetical means score at more than three factors ($\Delta\ \lambda_{Raw,Mean} = 0.84$) gave relatively weak evidence to support an analysis of more than three factors. However, a four-factor solution was developed and evaluated. The additional factor solution had only one pattern coefficient above 0.20 ($\lambda_2 = 0.252$), and several items had secondary loadings greater than 0.450 on other factors. Moreover, the addition of the fourth factor only increased total variance explained by less than 1.0% ($\Delta\sigma^2 = 0.007$). In consideration of the entirety of the data and results, it was determined that three factors were appropriate for extraction and analysis under EFA.

EFA Analysis Results: In the EFA for these data, Principal Axis Factoring (PAF) was employed to model the data under EFA. This approach was deemed more appropriate to model the underlying constructs against which the researcher developed the instrument (Bandalos & Finney 2010; McCoach, et al., 2013). Initial eigenvalues indicated that the first three factors explained 44.9%, 22.3%, and 11.7% of the variance respectively, for a total variance explained of 78.9% (Table 4-6).

Table 4-6

Model Total Variance Explained [1]

Factor	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total
1	7.633	44.902	44.902	5.722
2	3.790	22.297	67.198	5.421
3	1.990	11.708	78.907	5.955

[1] *Extraction Method: Principal Axis Factoring.*

Direct Oblique (Minimized) was selected as the rotation method to permit the factors to be correlated – this approach results in generally higher eigenvalues but introduces the potential for diminished interpretability of the factors. In the context of this research, it is generally expected for the factors to moderate the effects of the other two factors within the learner experience (e.g. a learner who is frustrated with an inability to interact in an environment will also likely develop a negative emotional response to the experience). An OBLIMIN rotation was used, with moderate correlation ($\rho_{1,2}$ = 0.174, $\rho_{1,3}$ = -0.448, and $\rho_{2,3}$ = 0-.425) noted between each of the composite scores, and thus direct interpretation of the factors was deemed to be justified (Table 4-7) (McCoach, et al., 2013).

Table 4-7

Correlation of Factors in 3-Factor Engagement Model [1]

Factor	1	2	3
1	1.000	.174	-.448
2	.174	1.000	-.425
3	-.448	-.425	1.000

[1] *Extraction Method: Principal Axis Factoring.*

[1] *Rotation Method: Oblimin with Kaiser Normalization.*

The communalities for all items in the rotated solution ranged in value from 0.624 to 0.869, with a mean of 0.789, indicating acceptable change in R^2 from each item with all extracted factors (Table 4-8).

Table 4-8

Communalities of 3-Factor Engagement Model [1]

Item	Initial	Extraction
1	.824	.860
2	.745	.752
3	.846	.869
4	.838	.859
5	.802	.830
6	.815	.867
7	.614	.624
8	.702	.731
9	.754	.787
10	.738	.758
11	.718	.739
12	.769	.793
13	.691	.707
14	.773	.790
15	.802	.824
16	.782	.795
17	.799	.831

[1] *Extraction Method: Principal Axis Factoring.*

Lastly, composite scores were created for each of the factors, based on the mean of the items which had their primary loadings on each factor. In reviewing the results, items had primary pattern coefficients ranging from 0.784 to 0.950. The three-factor model solution exhibits high unidimensional pattern coefficients and possesses simple structure (McCoach, et al., 2013). The factor pattern matrix for the solution is presented in Table 4-9.

Table 4-9

Pattern Matrix for of the Learner Engagement Model [1]

	Factor		
	Situated Learner Engagement	Cognitive Learner Engagement	Affective Learner Engagement
Q15 - I changed my opinion or understanding of an issue/concept based on my interaction with the instructor and/or participants.	.929		
Q17 - Interacting with others in the program was an important part of the instructional experience.	.904		
Q12 - Something another participant did or said compelled me to provide my own opinion/input.	.896		
Q14 - The diversity of opinion in the program was beneficial to my learning.	.885		
Q16 - I understood a concept better when another participant asked a question about it.	.878		
Q13 - I participated effectively in the instructional delivery.	.822		
Q6 - The subject matter in the program was important to me.		.950	
Q9 - The instructor demonstrated extensive knowledge about the subject matter.		.878	
Q11 - The materials and concepts presented in this program were well suited to my level of expertise.		.870	
Q10 - This program is important for my personal or professional development.		.865	
Q8 - I learned something new in the subject area of the instruction.		.826	
Q7 - I was intellectually challenged in this program.		.784	
Q1- I felt encouraged to volunteer opinion in the program.			-.946
Q5 - I felt good about participating in the discussions and activities of this program.			-.917
Q3 - I enjoyed participating in the instructional program.			-.910
Q4 - I enjoyed this instructional program.			-.904

Q2 - I received recognition for my participation in the activities or discussions in this program.		-.864

[1] *Extraction Method: Principal Axis Factoring.*

[1] *Rotation Method: Oblimin with Kaiser Normalization.*

The structure matrix from PAF extraction indicates moderate bivariate correlations between the factors on most items (ρ ranged from 0.104 to 0.445), reflecting a moderate level of correlation between the factors themselves (Table 4-10).

Table 4-10.

Structure Matrix of Learner Engagement Model [1]

	Factor		
	Situated Learner Engagement	Cognitive Learner Engagement	Affective Learner Engagement
Q17	.912	.159	-.422
Q15	.906	.118	-.365
Q16	.891	.182	-.423
Q12	.889	.103	-.383
Q14	.888	.188	-.406
Q13	.839	.191	-.408
Q6	.166	.930	-.357
Q9	.136	.887	-.392
Q10	.214	.868	-.377
Q11	.105	.858	-.339
Q8	.171	.853	-.414
Q7	.127	.789	-.344
Q3	.407	.444	-.930
Q1	.422	.347	-.926
Q4	.403	.445	-.925
Q5	.411	.373	-.911
Q2	.411	.348	-.866

[1] *Extraction Method: Principal Axis Factoring.*

[1] *Rotation Method: Oblimin with Kaiser Normalization.*

Item/Instrument Revision

In order to determine which items to retain or revise from the EFA results, McCoach et al.'s (2013) guidance was applied - well designed and functioning items "have high pattern coefficients on one primary factor and near zero pattern coefficients on all other factors" (p.143). To judge whether an item contributes to the interpretation and description of a latent factor, McCoach et al. (2013) suggests a pattern coefficient of an item should ideally be equal to or greater than .50. To assess item multidimensionality (i.e. when an item provides unique information on more than one latent factor), McCoach et al. (2013) suggests eliminating any item with a second pattern coefficient of greater than 0.30. Applying these criteria to our pattern matrix coefficients, all 17 items were retained from the EFA instrument. Among them, three items were reworded (items #9, item #10, and item #11) to standardize the terminology ("instructional program" substituted for "program") and 3 items (item #2, item #7, and item #14) were paraphrased for clearer representation of the key concept. This revision was undertaken with an expectation to avoid the potential of multidimensionality caused by inconsistency of terminology when the instrument is administered to a broader population.

Subscales Analysis/Internal Reliability & Structural Validity. The EFA produced three factors which closely corresponded with the design of the items and initial validity analysis. While initial scale development reflects conceptual and operational definitions of the latent construct based on a review of literature and grounding in a theoretical framework (McCoach, et al., 2013) reliability analysis seeks to evaluate how the items "hang together" within the context of the response data collected. In evaluating the results, analysis began with a thorough review of the aggregations of items suggested by the EFA loadings (Fabrigar, Wegener, MacCallum, & Strahan, 1999). The first factor corresponds to the interaction between the learner and the environment

during the instructional experience, in particular as they relate to the *in situ* and post-instructional utility and sense of functional/effective participation derived during the instructional experience. The second factor relates to the perceived value or importance of the subject matter of the instructional experience to the learner's intentional trajectory and his/her interaction with it. In the original design, all of the items loading on this factor were designed to load on the factor originally titled "Cognitive Learner Engagement" (CLE). The third factor that emerged from the EFA corresponds with the affective response of the individual and attitude towards the instructional experience. This factor retains the original title "Affective Learner Engagement" (ALE) from the initial design. As initially designed, this factor is titled "Situated Learner Engagement." In evaluating the results, analysis consisted of a thorough review of the aggregations of items suggested by the EFA loadings (Fabrigar, Wegener, MacCallum, & Strahan, 1999), and factor definitions were refined and further defined in the model (Fabrigar & Wegener, 2012).

Reliability & Descriptive Statistics Analysis: Reliability of the subscales was tested by conducting an Item Analysis and calculating Cronbach's α and developing sum scores and descriptive statistics around those scores. Cronbach's Alpha (α) coefficients was calculated for each of sub-scales, evaluating both the value and the Confidence Interval to ensure adequate reliability, applying McCoach et al. (2013) guidance that the entire CI for Cronbach's Alpha should be > 0.80. In addition, Cronbach's Alpha was evaluated for instruments with each item within each subscale removed to further assess proper item performance and correlation within each subscale. The subscales all demonstrate acceptable levels of reliability as all lower limits of the CI of Cronbach's Alpha (α) below the minimally acceptable 0.80 (Cortina, 1993).

Table 4-11.

Cronbach's Alpha and Confidence Intervals of the Three Sub-Scales of the Final Measurement Model with the Phase II (EFA) Sample (N = 300)

Subscale of Interest	Cronbach's Alpha (α)	Confidence Interval (Lower Limit)	Confidence Interval (Upper Limit)
Affective Learner Engagement (ALE)	0.961	0.953	0.967
Cognitive Learner Engagement (CLE)	0.946	0.936	0.955
Situated Learner Engagement (SLE)	0.957	0.948	0.964

A corrected item-total statistic models revised correlation of the instrument and subscale with the item deleted. Acceptable item performance is indicated when reliability of the subscale is reduced when the item is removed (McCoach et al, 2013). All items demonstrate acceptable performance under this criterion. Additionally, no item-total correlations were below a cut-off criterion of 0.20 (Thompson, 2004), indicating no items should be redacted from the instrument. Lastly, values and variance of Inter-Item Correlations were evaluated to determine the level of redundancy between items and ensure that the variance/standard deviation of these statistics is low (preferably $\sigma < 0.1$) (Table 4-13).

Table 4-13

Inter-Item Correlation, IIC Variance, and IIC Standard Deviation of the Three Sub-Scales of the Final Measurement Model with the Phase II (EFA) Sample (N = 300)

Subscale of Interest	Inter-Item Correlation Average	Inter-Item Correlation Variance	Inter-Item Correlation Standard Deviation
Affective Learner Engagement (ALE)	0.831	0.001	0.031
Cognitive Learner Engagement (CLE)	0.746	0.002	0.048
Situated Learner Engagement (SLE)	0.787	0.001	0.030

In addition, mean scores and standard deviation of the response data within each sub-scale were evaluated for normality and appropriate distribution of response data (skew/kurtosis) and deemed acceptable. The final definition of the factors for the model and the associated subscales are defined as follows:

Factor 1 – Situated Learner Engagement (SLE): Based on the EFA, this factor relates to the perceived utility and perception of the learning environment itself as an affordance facilitating learning, and closely relates to both design and delivery of an instructional experience within a particular learning environment (Merriam, 2002). A person scoring high on this dimension would attribute meaningfulness to activities, value interaction with peers as a contribution to the instruction, value the professionalism of the materials and instruction, and assess the utility of materials/concepts/practices outside of the learning experience. A low score on this dimension indicates the learner finds the materials or interactions frustrating or irrelevant, demonstrates dismissiveness or contrariness within the learning experience, or simply "checks out" of designed interactions with either peers or the instructor.

Factor 2 – Cognitive Learner Engagement (CLE): This dimension of the construct of learner engagement relates to the perceived degree of alignment between the learner's intent and the design and delivery of the instructional experience. This factor measures the degree to which the learner intends to advance mastery, learn from others (including both peers in the classroom and the instructor), and sense of accomplishment stemming from achievement both within the learning experience, and/or anticipated esteem for enhanced expertise. Such accomplishment often contributes to a sense of relevance and applicability of the subject matter to the more universal inset of intentions of the learner (Young, 2004). Activities that might exemplify this aspect of learner engagement would include asking sophisticated questions ("follow-on" questions that build on a point made earlier in the same discussion), sense of self-worth that comes from achievement, and sense of alignment of subject matter with task and performance (Cooper, 2010) – they may make frequent comparisons to practices "in the field", and questions from such a person would be directed at question of real-world implementations of theoretical or activity-based concepts presented in the learning experience. A person scoring high on this dimension would demonstrate inquisitiveness, curiosity, and engage in supplemental investigation into the subject area during or after the instructional experience. A low score on this dimension indicates the learner finds the material (including the opinions and information indicates the learner finds the material (including the opinions and information from others) to be irrelevant, boring, or unimportant.

Factor 3 – Affective Learner Engagement (ALE): This dimension reflects a direct emotional (or visceral) reaction to the learning experience, membership in the

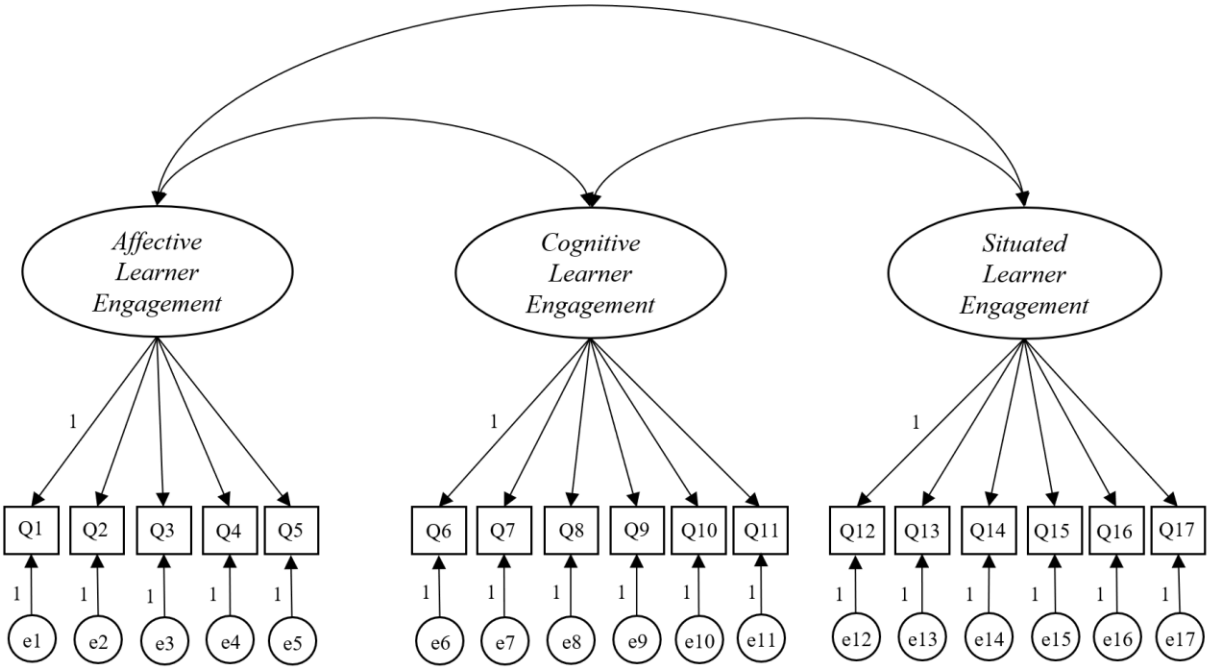
community of learning, and sense of safety and willingness to participate in the context of learning. ALE facilitates *emotional involvement* of the learner in the learning experience (Parimalam & Mahadevan, 2012). Activities that might exemplify this aspect of learner engagement would include positive collaboration with peers (Calvani, et al., 2010; McDonald & MacKay, 1998), articulation of shared experience and social modeling (Bandura, 1986), scaffolded development/demonstration of skill/expertise with an instructor (Vygotsky, 1986), and the sense of self-worth that comes from participation in a learning experience (Cooper, 2010). A person scoring high on this dimension would demonstrate frequent discussions with others, active contribution and integration of discussion with others, and establishment of relationships with others within the environment during or after the instructional experience – they would appear gregarious and respectful within the learning environment. A low score on this dimension indicates the learner finds the opinions of others distracting, finds collaborative exercise loathsome (because it requires interaction with others, not because the task is unimportant), and participates/contributes only when mandated by the expert/instructor.

Confirmatory Factor Analysis

In the second part of phase II of the study, CFA was conducted to further evaluate the performance of the Learner Engagement Instrument in the population of interest using an independent sample. A summary of the composition and demographics for the sample used in the CFA are provided in Appendix D In contrast to EFA, CFA requires definition of the latent model *a priori* to assess model fit to a new sample drawn from the same population. The initial model of the CFA consisted of 17 items selected from EFA, revised as noted to use consistent

terminology and provide additional clarity to respondents (Figure 4-3).

Figure 4-3 Final Learner Engagement Construct Model specified a priori in phase II CFA study [1]



[1] *Item numbers are those used in the revised instrument used for CFA. Items were randomized in instrument delivery.*

Each item was aligned as an indicator of only one factor. Items #1, #2, #3, #4, and #5 were specified as indicators of Affective Learner Engagement (ALE). Items #6, #7, #8, #9, #10, and #11 were specified as indicators of Cognitive Learner Engagement (CLE). Lastly, items #12, #13, #14, #15, #16, and #17 were specified as indicators of Situated Learner Engagement (SLE). Analysis of model fit included both a review of several fit indices as well as an evaluation of path coefficients for determining the strength of relationship between an item and its associated latent factor (McCoach et al., 2013).

Fit Indices - Measures of model fit (such as Chi-Square) evaluates the degree to which the Model-Implied Variance/Covariance matrix matches the population Variance/Covariance matrix

estimated by the data. In this case, the goal of CFA is a departure from the typical null-hypothesis approach – the research instead seeks a Chi-square that provides insufficient data to reject the null hypothesis – that is, that the Model-Implied covariance matrix from the Model detailed in Figure 4-1 is statistically indistinct from that estimated by the response data. In this case, to evaluate the goodness of fit of the model to the data, a variety of fit indices were evaluated, including Chi-Square, CMIN, Standardized Root Mean Square-Residual (SRMR), Root Mean Square Error of Approximation (RMSEA), Tucker-Lewis Index (TLI), and Normed/Comparative Fit Index (NFI/CFI), which can be further categorized as "absolute fit indices" or "incremental fit indices".

Absolute fit indices "evaluate how well an *a priori* model reproduces the sample data" (Beauducel & Wittmann, 2005) with the underlying presumption that a model that perfectly reproduces the data observed would have a fit of zero (absolute fit). Thus, deviation from zero reflect the "degree of badness" of fit for the model (Kenny, 2015). Incremental fit indices, in contrast, use zero as the worst-fit standard (called the *independence model*), and measure improvement in fit when the specified model is compared to the independence model (Hu & Bentler, 1998). In the present study, the Chi-Square/CMIN unsurprisingly indicated the specified Learner Engagement Model is not a good fit for the data (χ^2 = 276.602, df = 117, Sig. = 0.000, CMIN/DF = 2.364). However, χ^2 is sensitive to sample size and the number of degrees of freedom in the model, and many commentators note that with large sample sizes will yield a statistically significant χ^2 even in the presence of a trivial amount of data misfit and thus provides little meaningful insight into model fit (McCoach, et al., 2013; Kenny, 2015). As such, additional absolute indices of fit (RMSEA and SRMR) were evaluated to provide a more accurate assessment of fit. RMSEA is a ratio of the Chi-Square adjusted for the degrees of freedom and for the proscribed model (RMSEA = 0.068) is within the generally prescribed limit of .08. Standardized

Root Mean Square Residual is calculated as the standardized difference between the observed covariances and the model-implied covariances and is largely unaffected by model complexity. Hu and Bentler (1999) notes that an SRMR value below .08 is indicative of good fit. In the present study, SRMR was calculated as 0.039, indicating good model fit.

Incremental fit indices compare the independence model with the model being analyzed using Chi-Square. There are a variety of indices available, and many suffer from particular sensitivity to one aspect of the data or another (e.g. sample size, model complexity, item factor loading, etc.), often in opposite effect. As recommended by several commentators, each index taken alone is thus unlikely to provide meaningful insight into the performance of the model in explaining data behavior. For this study, the guidance provided in Hu and Bentler (1999) has been followed and supplemented with newer indices that take advantage of advancements in SEM methodology/. The Normed Fit Index (NFI), Comparative Fit Index (CFI), and the Tucker-Lewis Index (TLI) were considered (Table 4-14).

Table 4-14

Absolute and Incremental Fit Indices for the CFA-Specified Model of Learner Engagement

Fit Index	Type	Acceptability Criterion	Observed Value	Notes
Chi-Square/CMIN	Absolute	$p > 0.05$	276.602 $p = 0.000$ $df = 117$	CMIN = 2.364
RMSEA	Absolute	< 0.080	0.062 CI_{90} [0.057-.078]	
SRMR	Absolute	< 0.080	0.039	
NFI	Incremental	> 0.90	0.940	
CFI	Incremental	> 0.95	0.964	
TLI	Incremental	> 0.95	0.958	
Hoelter	Incremental	>75	H=155 ($p < 0.05$) H=169 ($p < 0.01$)	

NFI and CFI both assess the model by comparing the Chi-square statistic against the independent model, with the CFI a revised form of the NFI to account for small sample sizes. Both indices were above the minimally acceptable criterion indicating the proposed learner engagement model provides adequate fit to the data in the sample. The Tucker-Lewis Index (TLI) provides a fit index comparing the theoretical independence model (with χ^2 =0) and the postulated model, and divides by the number of parameters being estimated (Hu & Bentler 1998). A TLI above 0.95 is generally acceptable as good model fit – here, the TLI of 0.958 indicates good model fit. Lastly, the Hoelter analysis for samples size greater than 200 where the Chi-Square statistic is significant postulates a sample size at which Chi-Square would not be significant (alpha = .05 or .01), with values above 75 indicating good model fit (Kenny, 2015). In this case, the Hoelter analysis indicates adequate model fit (H =155 and 169 for different thresholds of null hypothesis tested, $p < 0.05$ and $p < 0.01$ respectively).

Factor Loadings: The next step in evaluation of the model is to evaluate the path coefficients for the specified model. The path coefficients represent the strength of the relationship between the observed (exogenous) variables and the latent factors (endogenous variables comprising the learner engagement construct. In evaluating path coefficients, analysis begins with statistical significance. McCoach et al. (2013) note that is rare for an item to have a non-statistically significant path from its hypothesized factor, but if an item is unrelated to its factor, it should be redacted from the instrument or the model re-specified to align the item with another factor. In this analysis, we divide each unstandardized path coefficient by its standard error to compute a critical ratio (CR) (McCoach, et al., 2013). If this ratio is greater than or equal to |1:96| the path is considered statistically significant. If the ratio of the unstandardized path coefficient to its standard error is less than |1.96| the path is considered non-statistically significant (McCoach, 2003). Table 4-15 presents the CR for each of the items, indicating all path coefficients are statistically significant.

Table 4-15

Regression Weights for the CFA-Specified Model of Learner Engagement

Item	Factor Loading	Estimate	S.E.	C.R.
Q1	Affective_Learner_Engagement	1.000		
Q2	Affective_Learner_Engagement	.987	.052	18.973
Q3	Affective_Learner_Engagement	1.033	.047	22.153
Q8	Cognitive_Learner_Engagement	.979	.047	20.961
Q9	Cognitive_Learner_Engagement	.835	.043	19.463
Q11	Cognitive_Learner_Engagement	.887	.048	18.664
Q7	Cognitive_Learner_Engagement	.960	.047	20.228
Q10	Cognitive_Learner_Engagement	.944	.047	20.110
Q6	Cognitive_Learner_Engagement	1.000		
Q5	Affective_Learner_Engagement	1.056	.048	22.103
Q4	Affective_Learner_Engagement	.985	.048	20.556
Q12	Situated_Learner_Engagement	1.000		
Q14	Situated_Learner_Engagement	1.033	.053	19.652
Q16	Situated_Learner_Engagement	.975	.053	18.465
Q13	Situated_Learner_Engagement	.960	.054	17.776
Q15	Situated_Learner_Engagement	.875	.054	16.191
Q17	Situated_Learner_Engagement	1.046	.073	14.248

Table 4-16 presents factor loading estimates using standardized regression weights for all seventeen items indicate good to excellent relationships on one of the three factors, with primary factor loadings ranging from 0.712 to 0.907, with no multi-dimensional items.

Table 4-16

Standardized Regression Weights/Factor Loadings for the CFA-Specified Model of Learner Engagement

Item	Factor Loading	Estimate
Q1	Affective_Learner_Engagement	.861
Q2	Affective_Learner_Engagement	.837
Q3	Affective_Learner_Engagement	.908
Q8	Cognitive_Learner_Engagement	.853
Q9	Cognitive_Learner_Engagement	.823
Q11	Cognitive_Learner_Engagement	.805
Q7	Cognitive_Learner_Engagement	.839
Q10	Cognitive_Learner_Engagement	.836
Q6	Cognitive_Learner_Engagement	.897
Q5	Affective_Learner_Engagement	.907
Q4	Affective_Learner_Engagement	.874
Q12	Situated_Learner_Engagement	.851
Q14	Situated_Learner_Engagement	.876
Q16	Situated_Learner_Engagement	.845
Q13	Situated_Learner_Engagement	.825
Q15	Situated_Learner_Engagement	.778
Q17	Situated_Learner_Engagement	.712

The error residual (represented in the model as the residuals for each exogenous variable in the model) is also of interest, as it represents the unique variance in each item coupled with measurement error for each item. As McCoach et al. (2013) note, this analysis at first blush does appear counterintuitive as we seek to reduce measurement error in the pursuit of reliability and accuracy. However, this analysis seeks to address whether "at least some unique variance in each item that is not explained by the factor. Otherwise, the item and the factor are completely redundant, because the lack of error variance suggests that the factor completely explains the item variance" (McCoach, et al., 2013, p. 152). Shown in Table 4-17, it was observed that all error variances are statistically significant, with C.R. values ranging from 4.251 to 8.315. No Heywood cases (negative error variances) were noted, whose presence would indicate a structural solution error in the model (also called an *inadmissible solution,* McCoach et al., 2013, p.229) that would

make any interpretation of the model estimate suspect.

Table 4-17

Error Variances and Critical Ratios for the CFA-Specified Model of Learner Engagement

Item Error Residual	Estimate	S.E.	C.R.
e17	1.000		
e1	.322	.031	10.324
e2	.384	.036	10.681
e3	.210	.023	9.092
e11	.351	.032	10.820
e9	.273	.026	10.625
e7	.319	.031	10.409
e6	.199	.022	9.057
e8	.294	.029	10.172
e10	.315	.030	10.444
e4	.277	.027	10.076
e5	.222	.024	9.132
e12	.358	.037	9.794
e13	.404	.039	10.250
e14	.303	.033	9.158
e15	.467	.043	10.813
e16	.358	.036	9.921

The final step in evaluating the model was to evaluate the relationship between the latent factors in the proposed model. Ideally, factor correlations should be less than 0.85 between all factors in the instrument (McCoach, et al., 2013). The model does postulate some correlation between factors, as we would expect *a priori* that, for example, a negative situated response to the learning environment may also result in a negative emotional response, excessive correlation would indicate ambiguous definition of the factors that would allow overlap in the latent endogenous variables and may produce unreliable model performance. Here, the three factors in the postulated model (Affective Learner Engagement, Cognitive Learner Engagement, and Situated Learner Engagement) have a reasonable amount of correlation, ranging in value from 0.525 to 0.681 (Table 4-18).

Table 4-18

Factor Correlations for the CFA-Specified Model of Learner Engagement

Factor 1		Factor 2	Correlation Estimate
Cognitive_Learner_Engagement	↔	Affective_Learner_Engagement	.681
Cognitive_Learner_Engagement	↔	Situated_Learner_Engagement	.386
Affective_Learner_Engagement	↔	Situated_Learner_Engagement	.525

Item standardized residuals are the differences between the model-implied covariance matrix and the covariance matrix (McCoach et al., 2013) and provide a method of comparing the magnitudes of unstandardized residuals (Table 4-18). Generally, when there are large standardized residuals (criterion: *Cov* >2.0), this indicates that the model fails to reproduce that covariance between the items. In the present study, no items were noted as having excessive standardized error covariance.

Model Performance: In the aggregate, the CFA indicates that the postulated model does fit the observed estimates for variance in the data. The fit indices, particularly those adjusted for sensitivity to sample size or degrees of freedom uniformly indicate that the amount of variance present in the data is explained by the parsimonious model specified in the study. No items appear to be multidimensional or redundant, the degree of correlation between latent factors is acceptable (and expected), and error variances and item residual covariance satisfy criterion for acceptable model performance. Finally, modification indices were evaluated (Table 4-19), and none of them suggested any meaningful re-specification between the postulated factors and items (the only notable modifications indicated were between error variances, a nonsensical recommendation in CFA/SEM). As a consequence of observed model performance, model re-specification was not considered as the theoretical framework underpinning of the model is reflected in the *a priori*

model, the model is parsimonious, and model performance was acceptable.

Table 4-19

Modification Indices for the CFA-Specified Model of Learner Engagement

Residual		Factor	M.I.	Par Change
e15	<-->	Affective_Learner_Engagement	2.782	-.049
e14	↔	Affective_Learner_Engagement	2.046	.037
e12	↔	e17	8.166	.112
e5	↔	e13	5.286	.049
e5	↔	e12	2.806	-.034
e6	↔	e13	6.412	.052
e6	↔	e14	5.469	-.043
e6	↔	e12	3.810	-.038
e6	↔	e10	2.261	-.026
e7	↔	e13	5.368	-.056
e7	↔	e14	12.225	.077
e9	↔	e10	2.737	-.032
e9	↔	e7	3.134	.034
e9	↔	e11	3.111	.035
e8	↔	Situated_Learner_Engagement	2.099	-.043
e8	↔	Affective_Learner_Engagement	2.549	.038
e8	↔	e14	7.862	-.060
e8	↔	e6	4.542	.036
e8	↔	e7	3.001	-.035
e8	↔	e11	5.727	-.051
e3	↔	Cognitive_Learner_Engagement	2.402	.033
e3	↔	e5	14.663	.060
e3	↔	e4	4.050	-.034
e3	↔	e9	3.608	-.032
e2	↔	e15	2.974	-.048
e2	↔	e14	4.064	.048
e2	↔	e5	7.856	-.056
e2	↔	e4	3.255	.039
e2	↔	e3	4.361	-.041
e1	↔	Cognitive_Learner_Engagement	2.822	-.043
e1	↔	e15	3.340	-.047
e1	↔	e12	2.467	.037
e1	↔	e5	3.620	-.035
e1	↔	e7	3.282	-.039

Residual		Factor	M.I.	Par Change
e1	↔	e9	5.764	.047
e1	↔	e2	16.107	.093

Reliability Analysis

With the factor structure fully defined, reliability analysis of the items was conducted to evaluate the internal consistency and performance of the items within the instrument (McCoach et al, 2013). Several procedures were conducted in order to determine reliability and validity of Learner Engagement Instrument and related subscales. The data from the Phase II CFA was used for the reliability analysis. Data were screened for out-of-range or data entry error against the raw data and the number of cases evaluated for suitability of analysis. An item analysis was then conducted to examine the relevance of each item within the entire survey, using an Inter-Item Correlation to evaluate how the items "hang together" (McCoach et al, 2013). Next, Cronbach's Alpha (α) coefficients were calculated for the entire survey as well as for each of the sub-scales. Finally, mean scores and descriptive statistics relating to the distribution of the response data were evaluated for efficacy and coverage within each subscale. SPSS 25.0 was used for the analyses.

Item Analysis – For examination of the distributions of each item responses and the relations of each item with others and the entire survey, item analyses were conducted. In this context, the item-total correlations for each item were examined along with the Corrected Item-Total statistic (revised correlation modelling the instrument/subscale with the item deleted). In the aggregate, this information indicates the degree to which the items are related to each other, and to the aggregate sub-scale (McCoach et al., 2013). Then, the items whose item-total correlations were below a cut-off criterion of 0.20 (Thompson, 2004) were examined for modification in the Learner Engagement Instrument. Negative item correlations were also analyzed, as these are indicia of poor correlation with the desired sub-scale and/or need for reverse scoring or redaction.

Cronbach's Alpha – Cronbach's Alpha (α) coefficients were calculated for the entire survey as well as for each of sub-scales, evaluating both the value and the Confidence Interval to ensure adequate reliability (generally the entire CI for Cronbach's Alpha should be > 0.80). In addition, Cronbach's Alpha were evaluated for instruments with each item within each subscale removed to further assess proper item performance and correlation within each subscale. Raykov (1997) notes that this analysis may result in improper estimates of internal consistency when non-tau equivalent factors are modeled. In this analysis, Cronbach's alpha is deemed to be acceptable as an uncorrected estimate of internal consistency as the co-generic items along the three subscales resulted in very similar pattern coefficients (as noted in the CFA analysis, Table 4-11) with little inter-item correlation (McCoach et al, 2013), and item unidimensionality was established in both the EFA and CFA (one of the critical underlying assumptions of the validity of this analysis). Cronbach's alpha and 95% confidence interval for the three sub-scales of the Learner Engagement Model are detailed in Table 4-19. Generally, the subscales all demonstrate acceptable levels of reliability as all lower limits of the CI of Cronbach's Alpha (α) are below the minimally acceptable 0.80 (Cortina, 1993).

Table 4-20

Cronbach's Alpha and Confidence Intervals of the Three Sub-Scales of the Final Measurement Model with the Phase II (CFA) Sample (N = 300)

Subscale of Interest	Cronbach's Alpha (α)	Confidence Interval (Lower Limit)	Confidence Interval (Upper Limit)
Affective Learner Engagement (ALE)	0.944	0.933	0.953
Cognitive Learner Engagement (CLE)	0.936	0.924	0.946
Situated Learner Engagement (SLE)	0.935	0.923	0.946

Descriptive Statistics – Values and variance of inter-item correlations were evaluated to determine the level of redundancy between items and ensure that the variance/standard deviation of these statistics is low (preferably $\sigma < 0.1$). In addition, mean scores and standard deviation of the response data within each sub-scale was evaluated for normality (i.e. excess skew and/or kurtosis) to ensure it represents the population response pattern and is appropriate for analysis (Table 4-21). As no missed responses were recorded, no decisions regarding missing data replacement were necessary. Kurtosis was evaluated as acceptable for analysis, albeit slightly less than desired.

Table 4-21

Means, Standard Deviations, and Internal Reliability of the Three Sub-Scales of the Final Measurement Model with the Phase II (CFA) Sample (N = 300)

Name of Sub-Scale	No. of Items in Subscale	Valid Reponses (N)	Mean Score	Standard Deviation
Affective Learner Engagement (ALE)	5	300	3.765	1.005
Cognitive Learner Engagement (CLE)	6	300	3.973	0.876
Situated Learner Engagement (SLE)	6	300	3.490	0.991

No negative inter-item correlations were noted on any of the sub-scales. However, several individual items within each of the subscales were noted to be highly correlated with each other (within-scale correlations ranged from 0.640 to 0.855). High levels of correlation amongst items in a sub-scale may suggest that these items are providing redundant information relating to their respective underlying construct and reflect a narrow definition of the latent factors, and may fail to capture the "entire domain of the construct" (McCoach, et al., 2013, p. 265). Further evaluation may be appropriate to determine if some items should be redacted or revised to provide more clarity on the underlying concepts to distinguish them further. The subscales demonstrate an acceptable range of mean and standard deviation of Inter-Item Correlation (Table 4-22). The generally accepted upper limit for IIC standard deviation is $\sigma = 0.10$ to support reliability analysis.

Table 4-22

Inter-Item Correlation, IIC Variance, and IIC Standard Deviation of the Three Sub-Scales of the Final Measurement Model with the Phase II (CFA) Sample (N = 300)

Subscale of Interest	Inter-Item Correlation Average	Inter-Item Correlation Variance	Inter-Item Correlation Standard Deviation
Affective Learner Engagement (ALE)	0.772	0.001	0.033
Cognitive Learner Engagement (CLE)	0.709	0.001	0.036
Situated Learner Engagement (SLE)	0.705	0.002	0.038

Lastly, correlation among the subscale scores are shown in Table 4-23, and indicate moderate correlation amongst the scores, as expected based on the theoretical framework upon which the instrumentation was developed, predicted by the model, and confirmed by CFA analysis.

Table 4-23

Subscale Score Correlations of the Three Sub-Scales of the Final Measurement Model with the Phase II (CFA) Sample (N = 300)

Name of Sub-Scale	Affective Learner Engagement (ALE)	Cognitive Learner Engagement (CLE)	Situated Learner Engagement (SLE)
Affective Learner Engagement (ALE)	1.000	0.636	0.492
Cognitive Learner Engagement (CLE)	0.636	1.000	0.360
Situated Learner Engagement (SLE)	0.492	0.360	1.000

Summary

The four research questions addressed in this chapter were:

1. What are the perceived dimensions and characteristics of learner engagement? (RQ1)
2. What experiences and perceptions of the learner, and the interactions within the environment, affect learner engagement? (RQ2)

3. How can those experiences, perceptions, and interactions be used to develop a model of learner engagement? (RQ3)
4. What observable indicia exist of the learner-environment unit of analysis for the engagement of a learner in a particular environment? (RQ4)

Regarding these questions, qualitative data analysis and content validation suggested three general dimensions of learner engagement: Affective Learner Engagement, Cognitive Learner Engagement, and Situated Learner Engagement with associated behaviors or material indicia drawn from interviews with stakeholders in the instructional services industry. An instrument was developed and operationalized with a representative sample from the population of interest. Based on the EFA results, 17 items were retained in the instrument aligned to a construct with three latent factors. Basic reliability analysis indicated that each of three subscale items demonstrated satisfactory internal consistency and reliability. A second set of data was collected based on a slightly modified version of the instrument to evaluate model suggested by the EFA and the qualitative study. The final measurement instrument included the revised 17 items that demonstrated unidimensionality and effective loading on one of the three factors. The CFA results exhibited an acceptable level of model fit to the data collected. Results from the EFA, CFA, and reliability analyses confirmed that the three dimensions of the learner engagement model were statistically valid and robust. These findings indicated that the three dimensions of the learner engagement model can be meaningfully and practically measured to provide some indicia of the latent construct within the learning experience across various learning environments and instructional subject areas for the population of interest. The final version of the learner engagement instrument is presented in Appendix E.

Chapter 5 - Model & Theory

Introduction

This study considered the construct of learner engagement and applied a mixed method approach to develop a model based on affective instrumentation. The study sought to address four questions:

- What are the perceived dimensions and characteristics of learner engagement? (RQ1)
- What experiences and perceptions of the learner, and the interactions within the environment, affect learner engagement? (RQ2)
- What observable indicia exist of the learner-environment unit of analysis for engagement of a learner in a particular environment? (RQ3)
- How can those experiences, perceptions, and interactions be used to develop a model of learner engagement? (RQ4)

To date, research into the learner engagement construct had adopted either an Information Processing model (Reitman, 1965) focusing solely on within-the-learner constructs (Appleton et al., 2006) or a formulaic behaviorist model that leveraged earlier within-the-learner constructs coupled with observable indicia (Trowler, 2010). In contrast, this study adopted a situated cognition framework in light of the rapidly evolving nature of learning environments and the postulated and observed effects of these environments on learning and resulting learner trajectories. The unit of analysis is different than previous studies – rather than focusing solely on the learner, this study approached the construct as a dynamic inter-relationship of the learner and a particular learning environment, and extended the work of Trowler (2010) in identifying not just observable indicia, but seeking to identify the latent construct of interaction between a learner and the specific learning environmental affordances within a specific instructional experience. This approach was adopted largely to address the fairly significant shortcomings of even the most advanced behavioral models – namely, that different learning environments produce

fundamentally different learner experiences and opportunities to learn and must therefore produce differentiated outcomes.

To address the first three research questions, this study undertook a basic interpretive qualitative inquiry into the construct with representative samples from different stakeholder groups drawn from the population of U.S. working adults who periodically complete some form of professional or vocational training. A basic interpretive study was employed to avoid some bias stemming from the researcher's personal experience in the field and provide insights that otherwise might be missed as part of learner engagement model definition. Following the definition of a more clearly defined latent model structure, the fourth research question was addressed with a quantitative study that developed and operationalized the construct in an affective instrument. The instrument was developed and implemented, with two samples from the population of interest and subjected to validity analysis, reliability analysis, EFA (n=300) and a CFA (n=300). The remainder of this chapter is structured in four parts:

1. A summary and implications of the three-factor model for learner engagement as developed in the basic interpretive inquiry and refined in the quantitative study;
2. A discussion of the validity evidence for the learner engagement instrument;
3. A discussion of the limitations of the study;
4. A discussion of recommendations for further research.

Summary and Implications of the Learner Engagement Model

The present study advances the understanding of learner engagement as a formal construct by adopting a situated cognition theoretical framework. The latent factors hypothesized and developed through qualitative inquiry were, in turn, empirically validated through sampling of the population of interest. In contrast to earlier efforts, the framework as developed in this study is sensitive to the dynamic nature of learning within different learning environments and is a foundational step in developing a methodology to provide the optimal learner trajectory based on

instructional need and learning environment. With respect to the first research question, the study hypothesized a three-factor latent construct for learner engagement based on an affective, a cognitive, and a situated dynamic interaction between the learner and the learning environment. The basic interpretive inquiry into the construct through interviews and a review of instructional artifacts from a variety of professional development contexts and stakeholders provided several common themes from which the factors were further refined. The situated learner response, in particular, changed its definition extensively as a consequence of the qualitative inquiry – the interaction of learner with the environment extended far beyond the scope of that considered by previous research or this study as it was proposed. Situated learner engagement includes not just the learning environment immediately evident during delivery but includes all of the remaining operational context of the training both for the learner and the organization. The qualitative inquiry also provided extensive data detailing key characteristics of the current state of professional training in the United States.

The present study developed the learner engagement construct based on a comprehensive cognitive framework, qualitative inquiry, and applied extensive psychometric procedures for instrument development. The learner engagement model that emerged from this study has two key implications. First, that the moderation of effect implicated by the partial correlations of the three latent factors suggests that any one factor of learner engagement is insufficient in and of itself to result in an engaged learner. This characteristic of the latent construct is of profound importance for both instructional design and delivery in the context of professional training of adults. With the advent of a myriad of new learning environments in instructional treatments and techniques, the requirement to place a learner in an effective and supportive learning environment and deliver relevant and authentic instructional content is critical to engaging the learner. While this may seem

self-evident, discussions with the programmatic stakeholders during the basic interpretive inquiry indicated that those considerations were secondary or ignored in the fielding of an instructional program for organizational development.

The second implication of this model is that the perception of the learner of both the training program and the alignment of intent between the learner in the instructional program being delivered is critical to learner engagement. This characteristic of the model is what distinguishes learner engagement from motivation or intellectual interest, because it is dynamic within the learning experience. The alignment of instructional intent (stemming from, *inter alia*, an organizational need or objective) with that of the learner is the responsibility of both the designer and the instructional delivery, and no stakeholder or instructor interviewed expressed any experience in explicitly attempting to do so during an instructional delivery. This practice is borne out by research noting the modern trend of shifting responsibility for learning and professional development from the organization to the individual (Kamoche at al., 2011; Pang et al., 2009). In such cases, learners in the professional development are expected to align themselves with the perceived intent of the instructional program with little or no guidance, resulting in some likelihood that some learners will get it wrong and consequently not engage with the program.

The learner engagement model has profound implications in the design and delivery of professional development training in the U.S. workforce. As noted in the introduction to the study, the resources expended in industry and workforce professional development are both extensive and, in many cases, wasted. Attrition in organizationally mandated instructional programs can be as high as 80%, a statistic borne out by the qualitative inquiry of the study. By focusing on the complicated and dynamic *in situ* processes of learning based on a mixed-method approach, a methodologically sound construct of learner engagement was developed (Creswell, 2012).

Coupled with learner analytics collected during delivery, the construct and related instrumentation can provide a more complete picture of the mechanism and dynamics of learner engagement, and ultimately provide expansive capabilities in assessing and remediating a disengaged learner before attrition.

Validity Evidence for the Learner Engagement Instrument

Developing validity evidence for an instrument is a Sisyphean task – population demographics change, learning is affected by profound new technological advances and instructional methodologies, and thus an instrument must continually be subjected to validity review against new data, theoretical review, and sampling to develop additional validity evidence. As noted by McCoach et al. (2013), validity is never completely established for an instrument, but rather "an ongoing process of accumulating various sources of evidence" in support of instrument data interpretation (McCoach et al., 2013, p. 91). In this study, extant research coupled with a situated cognition theoretical framework suggested a three-factor latent construct for learner engagement and a different unit of analysis (learner-environment interaction) in developing instrumentation (Young et al., 1997). The literature review provided directly related studies to learner engagement construct (albeit with different theoretical frameworks) and provided excellent references to related fields of inquiry that informed the development of the factor definitions (Clark & Watson, 1995).

With respect to the qualitative inquiry, the data that provided the basis of the factor structure of the construct followed a protocol to enhance the trustworthiness and credibility of the data (Shenton, 2004), analogous to reliability and internal validity in quantitative studies and sought to ensure that the findings were congruent with reality (Merriam, 2008). Transferability was optimized to the extent possible by purposeful sampling of different stakeholder populations

to produce maximum variation in the qualitative sample and elicit different perspectives to achieve theme saturation (Merriam, 2009). Once collected, the data were collected and analyzed in a multi-step axial coding approach to develop categories and then themes that formed the basis of the factor definitions in the quantitative study and triangulated where possible. The findings were then member-checked to confirm interpretations and both positive and negative cases were investigated. Finally, axial coding was also conducted by a peer researcher with extensive experience in the industry and held an advanced degree in a related field, and the results integrated into the overall coding taxonomy. With themes developed, conceptual and operational factor definitions were reviewed by two researchers with expertise in cognition and instruction whose formative feedback was used to refine the definitions (McKenzie et al., 1999). Items were developed to fully explore potentially relevant criteria related to each of the factors in the construct of interest (Clark & Watson, 1995), drawing both from the quantitative data and informed by the literature review where scales of a factor were similar to the construct investigated in this study.

In the quantitative portion of the study, construct validity was central (Moss, 1992). Construct validity refers to "the validity of inference about the higher constructs that represent sampling particulars" (Shadish, Cook, & Campbell, 2002, p. 38). To establish construct validity evidence, candidate items were subjected to screening for redundancy, wording, and clarity, before being evaluated for content validity by a panel of six instructional and cognition experts (Lawshe, 1975; McKenzie et al., 1999). For items meeting acceptable criteria, a draft instrument was developed to measure the latent construct to assess if an adequate level of content validity was demonstrated for the three dimensions of the construct – ALE, CLE, and SLE. The EFA results confirmed a three-factor structure explaining nearly 80% of variance in the sample and demonstrating acceptable item reliability before advancing to CFA, which demonstrated

acceptable model fit and requiring no model respecification. Lastly, the three factors demonstrated excellent unidimensional behavior and strong pattern coefficient loading. In both the EFA and CFA samples, mild correlations between the three dimensions of the three factors were observed indicating acceptable discriminant validity of the latent construct.

Limitations of the Study

The most notable limitation to this study is the nature of instrumentation as a summative measure and its ability to effectively measure the dynamic learner engagement construct as defined. Learner engagement is best described as resulting from the interaction of a particular learner within a particular learning environment – it changes over time within that learning experience. Instrumentation such as the affective instrument developed in this study are implemented post-delivery and are summative in nature and require the learner to provide insights based on recall. As such, this instrument provides no insight into the moment-to-moment changes of the construct during the learning experience. Saunders and Gero (2004) and Rømer (2002) and related research indicate that the rate of dynamism is high, with individual factors within the construct changing multiple times per second as learner perception focuses on different elements within the learning environment. The instrument, instead, is a first step to addressing the actual measurement of learner engagement *in situ* by establishing scales for the construct and detailing some observable criteria that can be investigated more thoroughly for real-time measurement through learner analytics and more advanced analysis methods. Notwithstanding its limitations, the instrument is a foundational step in developing a measurement protocol of engagement within learning environments, as both the relevant observable criteria and structurally valid subscales were developed as part of the instrument development process.

A second limitation of the study is the population of interest used for data collection. Starting with the qualitative inquiry and through the operationalization of the instrument, the population of interest in this study is fairly limited in comparison to the potential applicability of the construct to other instructional domains (K-12, Post-Secondary, etc.). Moreover, items were generated from a qualitative study based on a limited number of participants and literature review, and generalizability can reasonably be questioned (Creswell, 2012). This study, however, sought only to address the construct of learner engagement in adults for three reasons:

1. The problem statement of this research was directed at the resource and operational inefficiencies currently extant in professional training (e.g. Kaufmann, 2015);
2. Adults learning in a professional development context have similar intentional trajectories with respect to construct-irrelevant factors, and so error can be assumed as normally distributed (making EFA and CFA analysis more valid) (McCoach et al., 2013); and
3. Professional development instructional treatments in industry and government expose far larger populations to more diverse learning environments and instructional treatments than those in primary or secondary education (see, e.g., Hurato et al., 1999, in contrast to Boud et al., 2000; Assoc. for Talent Development, 2018). This diversity of learner experience will permit subsequent research on the relationship between different learning environments, content, and levels of engagement.

While the present study has no applicability to different populations of learners, aside from the one in the study, application of the same methodology will permit similar investigations into other instructional contexts and populations.

This study is the first of its kind to employ a situated cognition theoretical framework to investigate the construct of interest. Situated cognition is foundationally different from an information processing or behavioral theoretical framework that formed the basis for previous research on measuring learner engagement. As a consequence, this research has the potential to provide adaptive measures based on the particular affordances and perceptions of the learner within any given experience. Situated cognition, however, will require extensive adaptation by practitioners in the field to evaluate operational or conceptual definitions of the resulting construct. The experts solicited for conducting item validity and review of the operational and conceptual factor definition were carefully selected based on their expertise in both situated cognition theory and instrument development process. There may therefore be limitations in the qualitative study in terms of credibility, consistency, and transferability (Merriam, 2009). To maximize credibility of qualitative data, qualitative data was axially coded, member checked, and compared with the results from an independent researcher coding the same data (Golafshani, 2003).

Notwithstanding the processes applied in the development of the learner engagement instrument and the subsequent item and subscale performance observed, the construct validity evidence supporting use of the instrument is limited (McCoach et al., 2013; Moss, 1992). Construct validity conceptually is about whether an instrument *actually* represents what it claims to represent. In this study, construct validity was established based on a validation analysis conducted by a panel of experts in both academia and in the industry. The validity for internal structure of the learner engagement construct was statistically established through EFA and CFA across two independent online convenience samples (each n=300). For its part, online convenience sampling itself has been the subject of some research to identify any sampling biases and adverse respondent behaviors with mixed results (e.g. Hamby & Taylor, 2016), further limiting generalizability and

validity. As noted earlier, the evidence on the use of these sampling methods is mixed, but generally the threat of data validity through satisficing and similar sources of data inaccuracy have been found to be no worse than traditional methods (Hamby & Taylor, 2016).

In addition, although both samples provided sufficient power to resolve a solution and assess model fit, many of the items within the three subscales demonstrated moderate to high correlation that may reflect under representation of the entirety of each of the factors. The characterization of the factors under the theoretical construct of interest is limited to the structure of this study, and both the naming and the precise latent traits being measured is still very much a subject for further research. Due to this limitation, the results of this study (e.g., the instrument) should be generalized with caution to other learner populations or situations beyond those conditions covered by this study. Finally, it will be necessary in subsequent research to develop additional validity evidence to support that the proposed factors actually measure the dimensions of interest by analyzing the relationship of respondent data to relevant external variables such as observable criteria and other related constructs and measures (McCoach et al., 2013; Moss, 1992; Raykov & Marcoulides, 2011). Notwithstanding these limitations to construct and criterion validity, the learner engagement construct and potential for integration with learner analytics necessary to develop that validity evidence provides clear next steps for this line of research.

Recommendations for Future Research

The results from this study and a review of its extant limitations direct future study to address three important issues:

1. A more expansive qualitative inquiry to develop a Grounded Theory of learner engagement for diverse populations of learners;

2. Development of additional items and versions of the learner engagement instrument for diverse populations of learners from that Grounded Theory; and
3. A quantitative inquiry into the effects of engagement on learner trajectory/learning outcomes; and
4. A quantitative inquiry to explore functional relationships and statistical relationships between learner engagement and other variables impacting learning outcomes.

Grounded Theory Qualitative Study: For subsequent full-scale study, a qualitative inquiry to develop a Grounded Theory of Learner Engagement is a promising approach to develop additional methodology in measurement of the learner engagement construct. Data from such a study will ultimately contemplate experiences from additional online program administrators, instructors, and participants, seeking variance in relevant cultural dimensions (e.g., gender, race/ethnicity, technical background, motive for participation in online learning). This study will therefore seek a robust qualitative data set to include observational, interview, focus group, and artifact data that will be open coded to contextualize the data into categories that will subsequently permit development of concepts (Charmaz, 2006). Axial coding and some supplemental theoretical sampling for data (where required) will be performed to facilitate the identification and refinement of categories into concepts and defining how these concepts are related. The constant comparison method of analysis (Strauss & Corbin, 1998) will be employed to identify the central concept by persistent review of all data from all sources to establish and refine the relationship of the central concept to other concepts that are identified. Concepts will then be integrated through memoing and sorting using a taxonomy-based approach, from which the theory will emerge. At every stage, qualitative data will be validated through triangulation method, reviews for internal consistency within item responses, member checks, and inter-rater approaches for observational

data (Shenton, 2004). The overall goal of the analytic method is to develop a robust, complete Grounded Theory of learner engagement in different learning environments, and concurrently develop more comprehensive categorical data on other indicia correlated with learner engagement for capture by automated learner analytics within a learning environment.

As a methodology, Grounded Theory is particularly appropriate when viewed against the situated cognition theoretical framework of the research – the theory emerges from, and is validated against, the data, rather than "forcing the data into preconceived categories" (Charmaz, 2006). Situational cognition theory similarly relies on individual perception and development of realities within a particular environment (Brown et al., 1989; Charmaz, 2006). A full-scale study would include a combination of facilitated focus groups, individual researcher participation in online courses, interviews, and artifact collection as data collection methods to fully capture both individual and group data in a variety of learning environments. As one characteristic of interest in the learning environment is the dynamic between individuals, both emic and etic observational data would assist in the development of the Grounded Theory. Similarly, diversity of participants and contexts will facilitate the emergence of persistent categories within the data (Merriam, 2002). A Grounded Theory develop is highly likely to be transferrable to other contexts, and by design would satisfy Glaser and Strauss (1967) quality criteria of fitness, understanding, generality, and control.

Fully Develop the Learner Engagement Subscales: With a more robust Grounded Theory of learner engagement, additional items and versions of the learner engagement instrument will be developed and operationalized to identify more generalized subscales applicable to different learner populations. As noted earlier, the learner engagement *construct* is the key to future research, as the subscales within that model will allow quantitative studies into causal relationships

between environment, content area, instructional treatment, and learner outcome. To more fully develop the construct, the learner engagement instrument developed in this study will be revised to provide more complete representation of all aspects of the fully defined learner engagement construct and variety of possible learning environments (online live, online self-paced, live classroom-seminar, live classroom–lecture, simulation, VR/AR, etc.) through purposeful sampling. With more varied instructional environments controlled in an experiment, item performance can be more fully explored, including higher order factor analysis (McCoach et al., 2013) and CFA-based item performance analysis (Raykov & Marcoulides, 2011).

Catalog Observable Criteria: As part of the qualitative study, artifacts from a variety of instructional experiences were reviewed as part of the directed interview process, both to aid in advancing the interpretive inquiry and theme development and to develop a taxonomy of criteria and observable indicia that correlate to factors within the learner engagement construct. Fredericks et al. (2004) provided one of initial efforts along these lines framed in a behavioral context, and as noted earlier, this line of research has continued using analytics derived from learning systems to assess learner engagement using behavioral measures as part of its calculus, albeit within only one specialized learning environment and instructional treatment (Kahn, et al, 2017; Manwaring, et al, 2017). The key distinction from earlier research is that in the framework suggested by this study, meaningful data collection needs to look beyond the simple "did-or-did-not" behavioral approach in favor of one looking at a more sophisticated assessment of change. Certainly, observable indicia of the learner remain important, but it is more important to assess the contextualized changes and *why they occurred* based on the learner-environment interaction in order to determine the engagement of a learner (Rømer, 2002). To that end, refined measures of data collection should be implemented to more robustly measure learner engagement, to include

neurological measures of learner, eyesight tracking, response latency, dialogic analysis of conversations, and advanced learner analytics for attention tracking via whatever environmental affordances are present. Correlation of this data with the evolving learning environment during the experience will provide more expansive insight into how dynamic learner engagement is and how it might be managed during instructional delivery.

Affects and Effects: In reviewing research related to learner engagement, it is almost universally true that the researchers in those studies assume that learner engagement results in enhanced learner outcomes. In some cases, such an assumption, viewed contextually, is tautologically valid because the limited definition of engagement adopted in the study (e.g. engagement is measured by reduction in attrition, Angelino, Williams, & Natvig, 2007). In other research the study methodology was too summative in nature to examine the effects of learner engagement on outcomes in a meaningful time domain (e.g. GPA outcomes against self-reported "levels of engagement", Carini, Kuh, & Klein, 2006). There are two profound and critical issues to this assumption that must be investigated by research derived from this study:

1. There is no established causal relationship between environment, content domain, instructional treatment method, and learner outcome (*What affects learner engagement?*); and
2. There is no established causal relationship between learner engagement and learner outcome (*What are the effects of learner engagement?*).

With a stable and internally consistent instrument with more robust subscales coupled with extensive data on what related observable data and learner analytics to collect, research will focus on repeatability of instrument data and leveraging the instrument in a collection of studies to evaluate the causal relationships between learning environment, content domain, instructional

treatment method and learner engagement. These series of studies will vary one aspect of the learning experience and focus on the dynamics of individual learner engagement with the particularized learning environment, content domain, and treatment and to determine to what extent engagement affects individual and aggregate cohort performance. The factors identified in the basic interpretive qualitative inquiry will be measured throughout the learning experience and used to model learner performance as a function of engagement within the learning environment. In a systematic way, the causal relationships between learning environment, content domain, treatment methodology, and the changes in learner engagement can be investigated to evaluate effects on different learner populations.

The second, and perhaps most important line of quantitative inquiry, is the effect of learner engagement on learner outcome/trajectory. With controls in place relating to the learning environment, content domain, and treatment methodology, this study will seek to measure learner engagement through an instructional experience and assess the effects of variance in learner engagement on outcome (Shadish, Cook, & Campbell, 2002). This line of research is fraught with some potential ethical issues and must be approached once the effects of varied engagement can be anticipated with appropriate remediation capabilities in place. Once the effects of learner engagement are well understood, the construct can be used predictively to develop an expansive instructional framework that seeks to optimize instructional outcomes based on the anticipated effects learner engagement. The potential impact a meaningfully measurable learner engagement protocol cannot be understated in the context of learning and development – optimized instructional treatments and tailored individualized learning would foster a workforce learning-centric culture that would save industry billions of dollars, anaconda worker productivity, and

provide a means for advancement currently denied to those who have found professional training wanting.

From a validity perspective, this line of research seeks to address a long–standing shortcoming of most previous research that had limited applicability beyond the experiment to other populations of interest, learning environment, or instructional treatment methods (really a threat to the external validity of those studies as a consequence of setting); one specific measurable effect in one domain using one technology has produced little in the way of a model of broader effects imposed by the adoption of different technologies all at once, tailored for optimal performance at the enabling-objective level. Certainly, there exists an opportunity for a meta-analysis of such studies (Hedges & Vevea, 1998; Raudenbush, Hedges, & Cooper, 1994) but there is a potential of confounding the construct – combining too many variables, as well as introducing construct-irrelevant variance based on the changeability of each specific study methodology requiring a random effect modeling approach with difficult to interpret results. This research approach, however, will allow a greater degree of generalizability to other populations. In addition, some chance of selection bias may be present (Cheung, Burns, Sinclair, & Sliter, 2017), but given the large multisite nature of running several studies against multiple instructional settings, this is not a viable threat but may, as a result, raise an external validity threat (e.g. attrition in one study may be precluded based on operational context of a particular learning experience, whereas in another it is not).

In this postulated line of research, outcomes would be measured quantitatively by utilizing highly reliable standardized tests or rubrics with large control groups referenced against the same population of interest. In the interests of completeness, the observed reliability of every instrument will be assessed, reviewed against historical measures, and reported as part of the analysis. To

remove any external validity threat stemming from treatment variation, a large enough sample of classes would be chosen to accommodate such variance – in fact, it is expected that each treatment instance will have extensive variance in learner experiences across the variables of interest that can be accommodated by a MANOVA analysis. Little in the way of participant expectancy could be asserted in this design, as much of the measurement is transparent or reasonably expected in any instructional experience in the study by a typical learner. The potential threats to statistical conclusion validity are principally heterogeneity of participants and extraneous variance in the experimental setting, which can be addressed by conducting the experiments across different populations and learning environments.

Conclusion

This sequential mixed-method study focused on the development and operationalization of a learner engagement construct (Creswell, 2012). This approach was adopted on the guidance of Creswell and Plano-Clark (2018) who noted that a sequential exploratory design is most appropriate "when the need for a second, quantitative phase emerges based on what is learned from the first, qualitative phase" (p.89) and is "best suited for exploring a phenomenon" (p.84). Based on the rapid expansion in learning environment diversity within the instructional domain for professional development, a situated cognition theoretical framework was adopted to address the fundamental differences in learner experience resulting from the profound differences in externalities, affordances, and interactions in such environments. Purposeful sampling was used to elicit qualitative data from three principal sub-populations related to the professional training domain to develop data saturation and permit theme development using an open-inquiry format interview protocol.

Analysis of the qualitative data permitted the development of candidate

subscales/construct factor conceptual and operational definitions that, in turn, were used to develop items for a draft affective instrument directed at post-delivery measurement of learner engagement. Both the construct and items were reviewed in succession by a panel of experts in cognition and instruction, resulting in refinement of both the definitions and revision or redaction of items from the instrument. The resulting draft instrument was operationalized against a sample (n = 300) to collect response data to permit an EFA. Following both the EFA and reliability analysis, items were revised, and the instrument was operationalized against a second sample (n = 300) to permit a CFA. Model fit and item performance were found to be acceptable, but additional research was deemed appropriate to ensure the construct is properly represented by the subscale developed.

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Appendix A

Interview Protocol

University of Connecticut

Principal Investigator: Dr. Scott Brown
Student Researcher: Charles Dye
Study Title: Qualitative & Quantitative Inquiry into Learner Engagement
Sponsor: University of Connecticut, Neag School of Education

Introduction

You are invited to participate in a research study to participate in an interview regarding the learner experience and engagement. I am a graduate student at the University of Connecticut, and am conducting this interview as part of my doctoral research. I am interested in finding out your opinions and experience in corporate training and development, and in particular your take on learner engagement – what is it, and why it matters to you and your organization.

Why is this study being done?

The purpose of this research study is to explore the concept of learner engagement in learning environments in modern professional/occupational training programs. The Government, industry, and academia spend billions of dollars annually attempting to enhance learning through the use of different instructional approaches. This research seeks to better understand the effect of these approaches on the learner's experience, performance, and achievement.

Sponsor: University of Connecticut, Neag School of Education

Date : _____
Time: _____
Location: _____
Interviewer: Charles S. Dye

Interviewee: _____

Release form signed? YES/NO (Circle One)

Notes to interviewee:

1. Thank you for your participation.
2. The purpose of this interview is to begin a research study on the effects of educational technology on learner experience – we will begin with the investigation of "learner engagement" – a term often used in the field, but poorly (if ever) defined.
3. Based on the professional background and experience of the interviewee, his/her input will be invaluable to this research and in helping grow the community of practice in post-

secondary professional development and the implementation of educational technology as a tool for instruction and learner support.

4. The confidentiality of responses is guaranteed.
5. The approximate length of interview will be 30 minutes, and consist of six (6) primary questions.

Introduction (May vary from Script, key points above): I'd like to open this interview by thanking you for taking the time to participate in this study on the effects of educational technology on adult learner experience. You were selected for the study based on your extensive experience and professional reputation in the field.

As a first step, we need to address some research protocol - please review the Confidentiality Form and let me know if you have any questions.

To assist me in the analysis of our interview and its results. May I record our interview using this device (iPad loaded with SoftNote™ software)? (Check One)

☐ Yes
☐ No

Research Question(s)

1. What is learner engagement?
2. What experiences and perceptions of the learner affect learner engagement?
3. How can those experiences and perceptions be used to develop a model of learner engagement?
4. What observable indicia exist for engagement of a learner in a particular environment?

Purpose of Research:

The purpose of this interview is to record your thoughts, impressions, and experience as it relates to the implementation of distance education generally, and the uses educational technology and their individual/collective effects on learner experience. We then turn to the effects of that learner experience on "learner engagement", and the effects of engagement on successful instructional outcomes. The learner audience we will be focusing on is adult learners – that is, those learners ages 25 and up, in the U.S., pursuing post-secondary professional training or other form of education.

Interview Questions:

1. What environmental elements define a learner "experience" in an online learning environment?
   Possible Probes (Check if Used/Planned for Use – Note Time):
   - ☐ Are educational technology elements in some fashion "different" from traditional element in the decision to include them?
   - ☐ Why is environment important to the outcome of the program?

2. What learner perceptions define a learner "experience" in a learning environment?
   Possible Probes (Check if Used/Planned for Use – Note Time):

- ☐ What do you think are prevalent perceptions relating to this instructional program?
- ☐ What trends have you observed in corporate training/talent development relating to learner perceptions and participation?

3. How would you define "Learner Engagement"?
   Possible Probes (Check if Used/Planned for Use – Note Time):
   - ☐ How is motivation different than "engagement"?
   - ☐ What types of skills are required to be successful in this instructional program?
   - ☐ How is self-efficacy or confidence different than "engagement"?
   - ☐ What other factors do you think influence "engagement"?
   - ☐ What is the relevance of engagement in distance education?

4. Turning to your personal experience in distance education as a participant, what elements of the instructional program were notable?
   Possible Probes (Check if Used/Planned for Use – Note Time):
   - ☐ Why were these factors notable?
   - ☐ How has your experience changed your practice in participation (learner) or delivery (instructor, administrator) of programs?

5. To what extent do particular elements in an instructional delivery affect "learner engagement"?
   Possible Probes (Check if Used/Planned for Use – Note Time):
   - ☐ Why are these elements notable?
   - ☐ How has your experience changed your practice in participation (learner) or delivery (instructor, administrator) of programs?
   - ☐ How important is the inclusion of these elements in the success (or failure) of a instructional program?
   - ☐ Why are these elements not always included in instructional programs?

CLOSE

I'd like to thank you for the time and opportunity to discuss learners and engagement in distance education. My next steps will include transcription of our discussion here today, and I'll provide you a copy of the transcript for you to review/comment/discuss with me no later than November 10th.

In the meantime, as I transcribe our discussion, if I have any questions, would it be acceptable for me to contact you for clarification? (Check One)

- ☐ Yes
- ☐ No

How would you like me to contact you? (Check All that Apply):

- ☐ E-Mail
- ☐ Phone Call
- ☐ Visit/Face-to-Face

Appendix B

Content Validation Survey

University of Connecticut

Principal Investigator: Dr. Scott Brown
Student Researcher: Charles Dye
Study Title: Qualitative & Quantitative Inquiry into Learner Engagement
Sponsor: University of Connecticut, Neag School of Education

Introduction

You are invited to participate in research relating the learner experience and engagement. I am a graduate student at the University of Connecticut and am developing an affective instrument as part of my doctoral research. As part of the validity analysis in the development of this instrument, I am requesting your qualitative review of the attached instrument items as part of the development and validation process. Attached to this page are draft instrument items meant to measure adult learner engagement – a construct that relates to adults' reactions to the process of learning within the learning environment (classroom, online environment, virtual instruction, ER/VR, etc.).

Research Purpose

This program of research is directed at a situated cognition construct of the individual within the learning environment and the dynamics of individual learner engagement throughout the learning experience. This research will be conducted in several stages:

1. Develop a construct of learner engagement as it relates to enhanced outcome in instructional programs that employ educational technology;
2. Develop an affective instrument to develop a measure learner engagement (self-declared from the learner);
3. Develop a set of observable learner data and environmental changes associated with self-declared level of learner engagement from the instrument; and
4. Conduct a quantitative study of the relationship between learner engagement and learning outcome.

The purpose of this line of research seeks to determine the relationship between learner engagement and improved learner outcomes in instructional programs – a tacit assumption in current research and trade journals. It is the position of this research that given the wide variety of learning environments available today that that leverage educational technology and a variety of affordances for the learner, this explicit assumption cannot be presumed. This theoretical framework examines the situated experience of the learner and its impact on the ultimate success of the learner in achieving the particularized outcomes desired by that learner *and the organization*

through alignment of intentional trajectory.

Theoretical Framework

Gibson (1969) details a theory of situated cognition particularly apropos to this study. For situated cognitivists, the task of learning is the confluence of a set of personal motives with a particular environment that provides affordances to which the learner attunes his/her perception. Action and response to stimuli in the learning process is based on those invariances of the environment that invite action (Gibson, 1969). Each individual's experience is thus unique to their perceptions and the affordances within a particular learning environment that are both present *and perceived* in a constructivist context (Mills, Bonner, & Francis (2008) – previous studies eschew the perception and motivation of the individual learner in favor of merely cataloging environment factors and measuring outcomes at a superficial level (Hodges, 2009).

Situated cognition as a theory of learning has potential in understanding the process of becoming engaged as a learner in a particular learning environment to achieve a particular learning outcome, Central to a situated cognitivist model is that the interaction between action and environment in the learning process is real time and ongoing – in the context of this study, the teacher takes action, prospectively perceives the effect of action on the environment and learners within the timeline of goals/objectives in that moment, the subsequent environmental response, and takes subsequent action. A central tenet of this theoretical framework thus focuses on the interaction perception, action, and environment that forms and dissolves minute by minute while in the learning process. "A perceiving/acting agent is coupled with a developing/adapting environment and what matters is how the two interact" (Young, Kulikowich, and Barab, 1997) - a participant in a particular learning environment, by definition, adapts perception and interaction based on the environmental affordances and outcomes in question. As this process continues, the educator refines his/her perception to the environment, the instructional practice enhanced, learners interact, and the learning environment is changed. "The environmental consequences of actions produce new experiences that can draw the attention of the perceiver to new affordances of the environment" (Young, 2003, p. 172).

This study is also heavily influenced by a constructivist lens – each participant in the learning environment (educator, learner, and administrator) constructs a different sense of the efficacy and consequences of adoption of pedagogical technique or technology in the classroom. These experiences and constructs are highly dynamic within the experience of the participants, and adoption of a constructivist lens in this context will allow the "claims, concerns, and issues of stakeholders serve as organizational foci (Guba & Lincoln, 1989, p. 50). These organizational foci will, in turn, be used for follow-on studies and additional purposed sampling to fully refine the theory (Charmaz, 2000, p. 524) in evaluating the learning environment and defining "new" pedagogies and technologies as elements of the learning environment. Situational Cognition and Constructivist theory relies on individual perception and development of realities within a

particular environment (Brown, Collins, and Duguid, 1989; Charmaz, 2006).

Construct of Interest

I. Factor Conceptual Definition

Construct of Interest – This instrument is developed to identify characteristics of:

- The emotional response of the learner to the instructional experience;
- The intellectual response of the learner to the instructional content; and
- The interaction of the learner with the environment and the resulting changes in the environment.

These factors are defined as follows:

Factor 1 – Emotional Response: This dimension is a direct emotional (or visceral) reaction to the learning experience, membership in the learning experience, and sense of safety and willingness to participate in the context of learning (Appleton, 2006). Affective reactions that might exemplify this aspect of learner engagement would include a sense belonging-ness within the learning environment and other participants, positive sense towards other learners and/or any instructor, collaboration, shared experience, skill development and the sense of self-worth that comes from being more skilled (and worthy as a member of a community), and/or participation in a learning community.

Factor 2 – Intellectual Response: The second dimension of the proposed construct of learner engagement is the degree of intellectual challenge perceived and accepted by the learner in the learning experience. Intellectual engagement involves the learner in the subject matter (Parimalam & Mahadevan, 2012). This factor seeks to measure the degree to which the learner is challenged to advance mastery, learn from others (including both peers in the classroom and the instructor), and sense of accomplishment stemming from academic achievement. Such accomplishment often contributes to a sense of relevance and applicability of the subject matter to the goals of the learner [CITE]. Activities that might reflect this aspect of learner engagement would include asking sophisticated questions, sense of self-worth that comes from achievement, and sense of alignment of subject matter with task and performance (Cooper, 2010).

Factor 3 – Environmental Interaction/Response: The third dimension of the construct of interest is the degree to which the learner perceives the environment, its effect on them as learners, and how the environment changes during the instructional experience. While current commentators have most recently adopted a behaviorist approach to measuring interaction, this factor is directed beyond simply measures observable data to *measuring the changes in the environment* when something changes e.g. one participant makes a controversial opinion, resulting in a heated debate. It is the evolution of the debate from simple back-and-forth to debate that is being measured here, not the simple expression of an opinion. Environmental engagement involves the

learner in the change of the environment as it happens and seeks to measure the changes perceived by the learner as they occur. Such changes and the participation of the learner in them often contributes to a sense of contribution and belongingness (Trowler, 2010). Activities that might reflect this aspect of learner engagement would include all observable activities of the learner, as well as the evolving sophistication of the discussion, dialogic response analysis in discussions, participating in polls, asking questions, sense of how the participant is being represented/advocated in the environment, and sense of alignment with the instructional outcome.

Directions

The statements/items contained in Addendum to this data sheet are being considered for inclusion in the final version of a Learner Engagement Survey. This instrument will ultimately be used as part of a body of research directed at determining and measuring differential learner outcomes as they relate to the learning environments and the use of particular instructional treatments/techniques. Please assist me in reviewing the content of these statements by providing two ratings for each statement. The specific tasks to perform this review are as follows:

1. Task 1 – Review the construct of interest. In this case, the construct is "learner engagement", and is being defined along three dimensions (or "factors") relating to emotional response to learner experience, intellectual response to learner experience, and environmental response relating to the interaction/change of environment and learner during the instructional experience.
2. Task 2 – Which factor? Review each statement in the instrument and evaluate it (based on your interpretation) as to whether the statement relates to one or more (or none) of the factors.
3. Task 3 – How certain are you? Evaluate the certainty you have in classifying this statement as relating to the factor you selected.
4. Task 4 – Is this statement relevant? Evaluate the statement for its relevance and importance to the factor you selected within the construct.
5. Task 5 – Any else? Please provide any comments you wish to make relating to a particular statement in the space provided next to each statement.
6. Task 6 – A few qualitative questions. Please answer the questions at the end of this survey that relate to your impression of the overall quality and function of the instrument as provided.

All comments are welcomed - your opinion is being sought because of your expertise in the field. A variety of domains inform the construct of learner engagement, and this is one of many steps in developing an effective measure of engagement effect within the learning experience.

ADDENDUM – ITEM REVIEW

Draft Instrument - A five-element Likert scale of agreement will be used in this instrument. All items are positively worded to elicit a degree of agreement or disagreement. Additional items will be included to preclude some variance resulting from respondent inattentiveness and satisficing (Thomas & Clifford, 2017; Buhrmester, Talaifar,& Gosling, 2018) – convenience sampling employing a crowd-based platform will be used to collect respondent data.

Statements	*Factor (Select One)*	*Certainty:* *How sure are you that this statement measures the chosen factor?* *1 – Not Very Sure* *2 – Strongly* *3 – Absolutely*	*Relevancy:* *How relevant is this statement to measuring the factor you have selected?* *1 – Irrelevant* *2 – Not Very Relevant* *3 – Somewhat Relevant* *4 – Totally Relevant*	*Comments*
The subject matter in the program was important to me.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I am inspired to further study the subject matter that was addressed in this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
Class participants were challenged in this program to perform.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

Participants were respectful of each other's opinion in the program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
My level of experience and subject matter expertise in this area was less than the other students in the program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I enjoyed this instructional program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I benefited from interacting with others in the instructional delivery.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
Interacting with others in the program was an important part of the instructional experience.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

I was intellectually challenged in this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The instructor presented the learning content in ways that helped me to learn.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I enjoyed collaborating with others in the activities in the program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I was excited to participate in this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I felt the class worked well together in the instructional program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

This instructional program has provided me with an opportunity for personal development.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
Something another participant did or said compelled me to provide my own opinion/input.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I participated effectively in the instructional delivery.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I felt encouraged to volunteer opinion in the program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The instructional team provided me with individual support during a session in this instructional program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

Enrollment in this program was an investment in my personal development.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
After completing this program, I plan on staying in touch with some of the participants from this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The diversity of opinion in the program was beneficial to my learning.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I felt very involved in the discussions and/or activities in the program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I learned something new in the subject area from the instructor.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

The instructor responded effectively to questions and feedback from participants.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
While in the program, I had to be completely focused on the learning experience and material.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The instructor was very effective at eliciting input from the participants during the session.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The instructor demonstrated extensive knowledge about the subject matter.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I learned something new in the subject area from the other participants.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

I know what was expected of me when I participated in this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I had opportunities to participate in the discussions and activities in this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The instructional program required me to interact during the delivery.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I changed my opinion on an issue/concept addressed in the program based on my interaction with the instructor and/or participants.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I felt my understanding of concepts presented in the program were similar to most other participants.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

The materials and references provided me everything I needed to perform well in this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I chose to participate in the instruction because of what someone else said or a comment I read.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I received recognition for my participation in the activities or discussions in this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The materials and concepts presented in this program were well suited to my level of expertise.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
This instructional program required me to demonstrate I learned something.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

I prefer to listen to others rather than actively participate during the instructional deliver.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
My answer to a question posed by the instructor during the program changed because of what another participant said.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I understood a concept better when another participant asked a questions about it, and the concept got discussed in a different way.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I was initially hesitant to ask a question or participate, but once other participants started asking questions or commenting, I felt better about doing so myself.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I liked the ability to interact with others through multiple methods (chat, direct message, raising hand and talking, poll voting, etc.)	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

I felt my opinions and reflected the majority of the participants in the program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I felt good about participating in the discussions and activities of this program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
I participated in the activities in the program because it was easy to do so.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
This program is important for my personal or professional development.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
The subject matter in this program was very relevant to my personal goals.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

I liked being able to interact in a variety of ways with the others in my instructional program.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
When one person offered a strong opinion, most of the class tended to "go along" with that position.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	
When I disagreed with appoint made in the program, I expressed my disagreement.	☐ I - Emotional Response ☐ II – Intellectual Response ☐ III – Environmental Response ☐ Neither	☐ 1 ☐ 2 ☐ 3	☐1 ☐ 2 ☐ 3 ☐ 4	

Final questions:

1. Do you believe this instrument is complete? Why or why not?

2. Do you believe this survey (which will be comprised of some of these items) is easy to answer? Why or why not?

Appendix C

Learner Engagement Instrument for EFA

University of Connecticut

Principal Investigator:	Dr. Scott Brown
Student Researcher:	Charles Dye
Study Title:	Qualitative & Quantitative Inquiry into Learner Engagement
Sponsor:	University of Connecticut, Neag School of Education

Note: This instrument version is for review purposes only, survey will be administered online, with item order randomized.

What is your age (round to the nearest year)?

In what industry classification most closely describes where you currently work?

- Manufacturing
- Pharmaceutical
- Finance
- Energy
- Technical
- Education
- Medical
- Government
- Other

How frequently do you attend some form of professional development or training related to your job?

- Multiple time a week
- Weekly
- Monthly
- Annually
- Less frequently than annually

To complete the rest of this survey, please think about a recent instructional experience you had relating to professional development or certifications for your employment that included other participants (e.g. NOT one-on-one coaching, mentoring, or individualized development).

What type of instructional treatment/experience are you referring to for this survey?

- Live In-Person Delivery/Traditional Classroom (≤50 participants)
- Large Scale Conference/Presentation/MOOC (> 50 participants)
- Live Online (via Web Conference or Virtual Classroom (e.g. WebEx, Zoom, Skype, etc.))
- Self-Paced/Directed (either online, computer-based, correspondence, or other method)
- Blended Program (a combination of some or all of the above)
- Other: _____

Approximately how long was the instructional experience that you are referring to in this survey (in hours)?

Please rate how strongly you agree or disagree with each of the following statements by placing a check mark in the appropriate box.

1. I felt encouraged to volunteer opinion in the program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

2. I received recognition for my participation in the activities or discussions in this program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

3. I enjoyed participating in the instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

4. I enjoyed this instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree

- Strongly disagree

5. I felt good about participating in the discussions and activities of this program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

6. The subject matter in the program was important to me.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

7. I was intellectually challenged in this program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

8. I learned something new in the subject area of the instruction.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

9. The instructor demonstrated extensive knowledge about the subject matter.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

10. This program is important for my personal or professional development.

    - Strongly agree

- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

11. The materials and concepts presented in this program were well suited to my level of expertise.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

12. Something another participant did or said compelled me to provide my own opinion/input.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

13. I participated effectively in the instructional delivery.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

14. The diversity of opinion in the program was beneficial to my learning.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

15. I changed my opinion or understanding of an issue/concept based on my interaction with the instructor and/or participants.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree

- Somewhat disagree
- Strongly disagree

16. I understood a concept better when another participant asked a question about it.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

17. Interacting with others in the program was an important part of the instructional experience.

- Strongly agree
- Somewhat agree
- Neither agree nor disagree
- Somewhat disagree
- Strongly disagree

Appendix D

EFA and CFA Sample Composition & Demographics

EFA Sample Descriptive Statistics and Industry Classifications

The sample collected for the EFA analysis was conducted through Amazon Mechanical Turk. The sample of adult learners (*n=300*) were recruited from a population of adult workplace learners and stakeholders coupled with a coordinated campaign of social media recruitment. All responses obtained through the blind online platform were screened for employment status and residency as meeting the criteria for participation.

Age – Respondent age descriptive statistics align with that of the general U.S. workforce. Median response age for the sample (43) closely corresponded to the U.S. median work workforce (42.7), supporting the assertion from Hamby & Taylor (2016) that the convenience sampling approach provides a sufficiently diverse data sample with respect to measured demographics. The age distribution demonstrated modest skew towards a younger population youth versus the U.S. workforce (see Figure D-1 and Figure D-2).

Figure D-1 Respondent Age Distribution

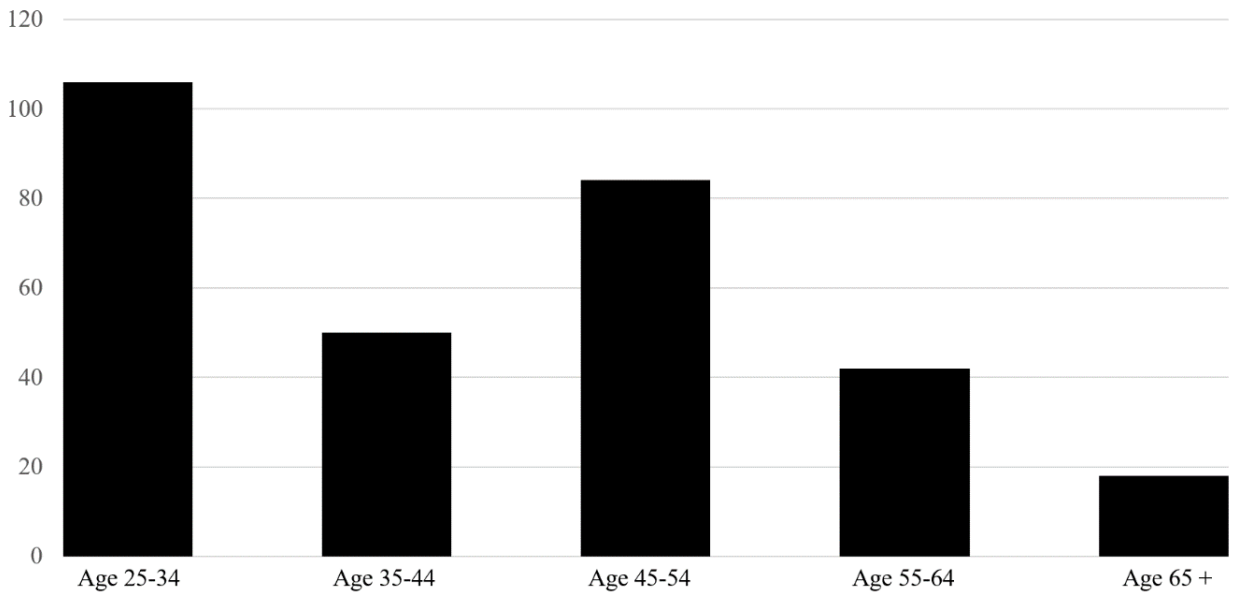
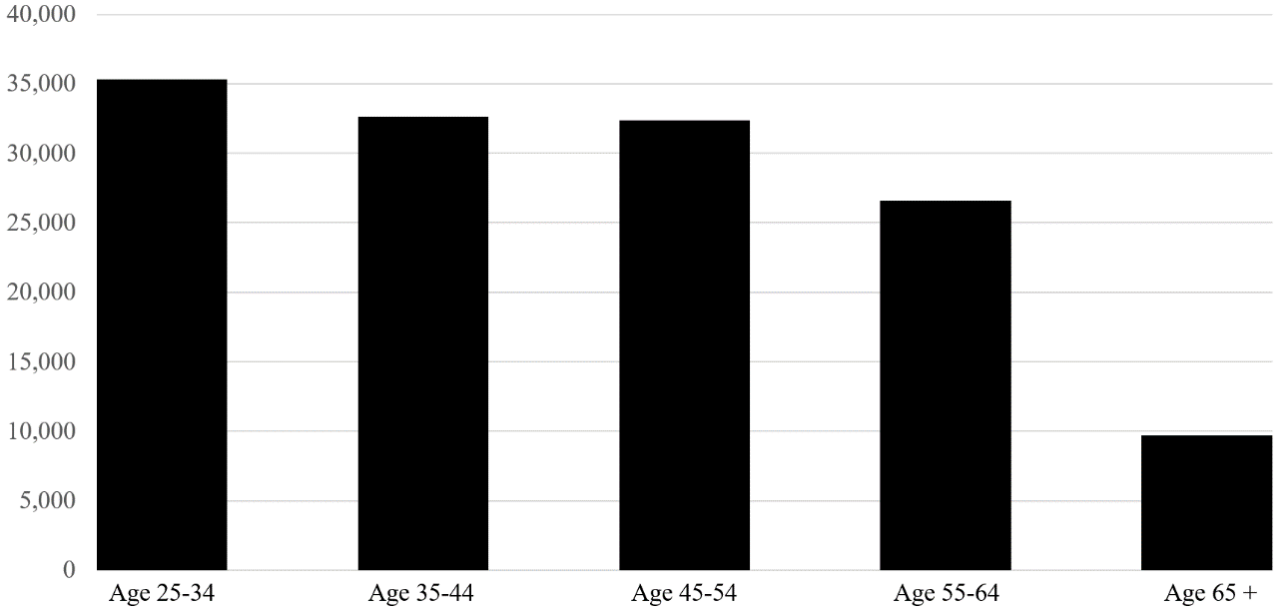


Figure D-2 U.S. Workforce Age Distribution[1]



[1] U.S. workforce data in thousands. U.S. data retrieved from Bureau of Labor Statistics. (2017). Employed persons by detailed industry and age [Time series]. Generated December 13, 2019.

Instructional Treatment – Respondents in the EFA sample indicated a wide variety of instructional formats that informed their response to the EFA instrument (see Table D-1), and reflected industry trends noted in the 2018 AST State of the Training Industry Report (ATD, 2019) that traditional classroom had been supplanted by a variety of methods for instructional delivery.

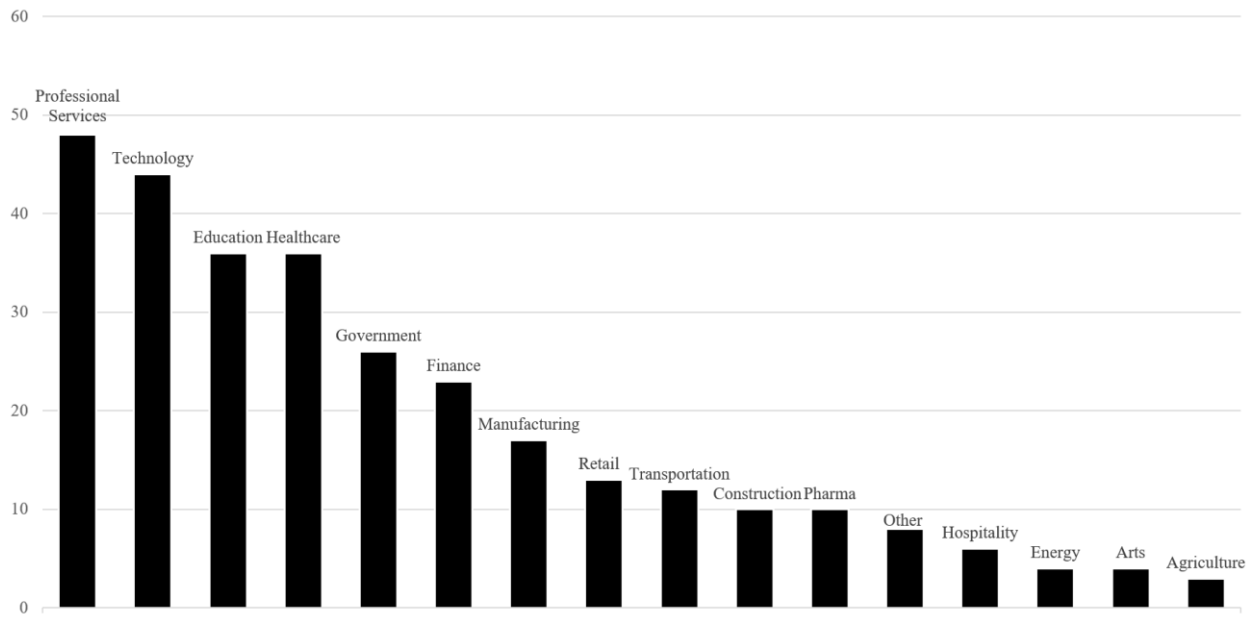
Table D-1

Instructional Format for Respondents in the EFA Sample

Type of Training Attended	Frequency	Percent of Total Responses
Traditional Classroom	9	3.0
Large Audience Presentation	112	37.3
Live Online	38	12.7
Self-Paced (Online or Correspondence)	44	14.7
Blended	65	21.7
Other	32	10.7
Total	300	100.0

Industry Sector – Respondents in the EFA sample represented 20 separate and distinct industries that included 15 formally selected categories (see Figure D-3). Response data for respondents selecting "Other" as an industry classification were reviewed, and 96 responses were re-coded where indicated using the U.S. Bureau of Labor Statistics taxonomy of industries and sub-classifications that corresponded to the industry classifications of the EFA instrument. By way of comparison, the U.S. Bureau of Labor Statistics distinguishes 568 labor categories among 22 industries (Bureau of Labor Statistics, 2017). Future implementations of the LEI will use these industries if comparative analysis is desired in follow-on research.

Figure D-3 Industry Sector Distribution of Respondents



Instructional Experience – Within the EFA sample, the mean instructional experience was 2.61 hours, with a total range of one hour to one workday (7 hours), and a standard deviation of 1.37 hours (see Table D-2). Through varying extensively by industry, the type of industry sector provided no significant insight as a predictor of training length for any individual ($p = 0.987$), a result not surprising given the lack of sample size and power amongst sixteen industry sectors (producing 15 degrees of freedom within the analysis).

Table D-2

Mean Instructional Experience Length by Industry Sector

Industry	N	Mean	Std. Deviation
Agriculture	3	1.00	.000
Arts	4	2.25	.957
Energy	4	1.50	.577
Hospitality	6	4.50	1.761
Other	8	2.38	.744
Pharma	10	2.50	1.354
Construction	10	2.80	1.135
Transportation	12	2.33	1.614
Retail	13	3.15	1.772
Manufacturing	17	2.59	1.622
Finance	23	2.61	1.373
Government	26	2.81	1.266
Healthcare	36	2.61	1.178
Education	36	2.53	1.298
Technology	44	2.48	1.438
Professional Services	48	2.60	1.300
Total	300	2.61	1.368

Learner engagement factor mean differences by industry – Means and standard deviations of the three factor scores by industry are presented in Table D-3.

Table D-3

Means and Standard Deviations of Learner Engagement Factors Across Industry (N = 300)

Industry	N	Affective Learner Engagement		Cognitive Learner Engagement		Situated Learner Engagement	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Agriculture	3	3.53	0.31	3.61	0.59	3.61	0.48
Arts	4	2.95	0.90	4.13	0.34	3.08	0.55
Energy	4	2.80	0.16	3.37	0.63	3.00	0.14
Hospitality	6	4.23	0.84	4.36	0.73	4.22	0.74
Other	8	3.73	0.83	3.75	0.77	3.77	0.88
Pharma	10	2.96	1.59	4.03	1.06	3.43	1.48
Construction	10	3.72	1.30	4.13	0.69	3.37	1.07
Transportation	12	3.30	1.15	4.26	0.80	2.76	1.28
Retail	13	3.68	1.35	4.06	1.09	3.45	1.16
Manufacturing	17	3.68	1.23	3.84	1.22	3.25	1.21
Finance	23	3.79	1.10	4.22	0.69	3.24	1.24

Government	26	3.78	1.04	4.06	0.67	3.26	1.07
Healthcare	36	3.57	1.13	3.95	0.95	3.69	1.00
Education	36	4.01	0.91	4.00	0.97	3.57	1.20
Technology	44	3.69	1.08	4.23	0.75	3.39	1.07
Professional	48	3.87	0.97	4.03	1.04	3.35	1.06

Further analysis was conducted of the composite score means by industry sector to assess where the differences in means were statistically significant (see Table D-4) using a one-way ANOVA with a Bonferroni adjusted alpha of .0167 (i.e., typical *p*-value of significance /number of groups = .05 / 3 = .0167). The results of ANOVA indicated that despite the variability in industry sector, there was no significant difference in means for affective learner engagement, cognitive learner engagement, or situated learner engagement across all industry sectors.

Table D-4

One-way ANOVA for testing differences in Learner Engagement Factors Means Across Industry Sector

Variable		Sum of Squares	*df*	Mean Square	*F*	*p*
ALE	Between Groups	20.46	15	1.36	1.17	0.296
	Within Groups	331.57	284	1.17		
	Total	352.03	299			
CLE	Between Groups	7.82	15	0.52	0.64	0.837
	Within Groups	229.71	284	0.81		
	Total	237.53	299			
SLE	Between Groups	16.86	15	1.12	0.91	0.549
	Within Groups	349.37	284	1.23		
	Total	366.23	299			

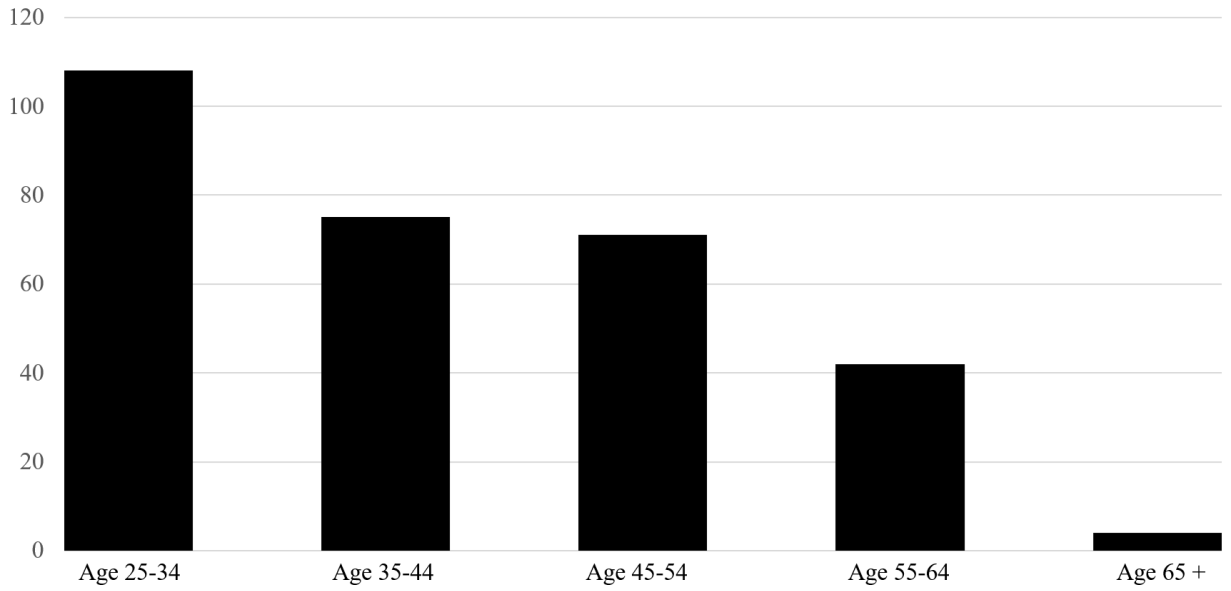
CFA Sample Descriptive Statistics and Industry Classifications

The sample collected for the EFA analysis was conducted through Amazon Mechanical Turk. Like the EFA sample, the sample of adult learners (*n=300*) for the CFA analysis were recruited from a population of adult workplace learners and stakeholders coupled with a coordinated campaign of social media recruitment. All responses obtained through the blind online platform were screened for employment status and residency as meeting the criteria for participation. Two additional items were included in the instrument relating to the learner experience to determine if the training was mandated and whether the learner completed the

instruction.

Age – Respondent age distribution in the CFA sample aligns with that of the general U.S. workforce. Median response age for the sample (40) closely corresponded to the U.S. median work workforce (42.7), supporting the assertion from Hamby & Taylor (2016) that the convenience sampling approach provides a sufficiently diverse data sample with respect to measured demographics. The age distribution demonstrated modest skew towards a younger population youth versus the U.S. workforce (see Figure D-3).

Figure D-4 Respondent Age Distribution



Instructional Treatment – As in the EFA sample, respondents in the CFA sample indicated a wide variety of instructional formats that informed their response to the instrument (see Table D-5), and reflected industry trends noted in the 2018 AST State of the Training Industry Report (ATD, 2019) that traditional classroom had been supplanted by a variety of methods for instructional delivery.

Table D-5

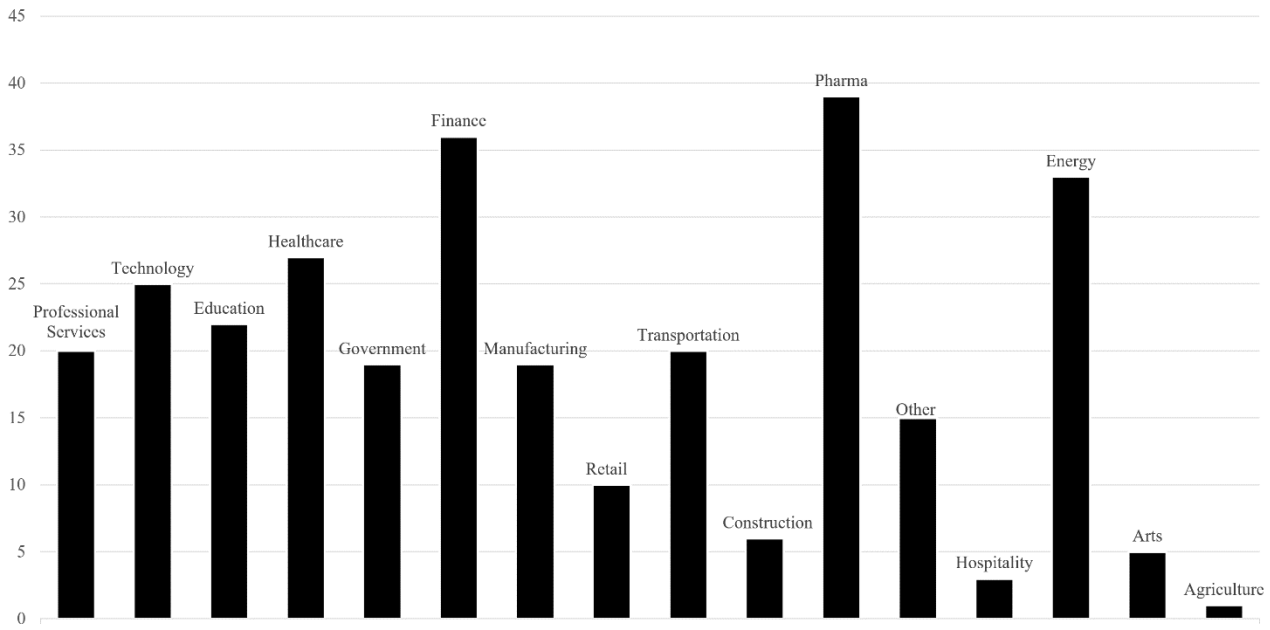
Instructional Format for Respondents in the CFA Sample

Type of Training Attended	Frequency	Percent of Total Responses
Traditional Classroom	8	2.7
Large Audience Presentation	103	34.3
Live Online	51	17.0

Self-Paced (Online or Correspondence)	49	16.3
Blended	59	19.7
Other	30	10.0
Total	300	100.0

Industry Sector – Respondents in the EFA sample represented 24 separate and distinct industries that included 15 formally selected categories (see Figure D-5). Response data for respondents selecting "Other" as an industry classification were reviewed, and 74 responses were re-coded where indicated using the U.S. Bureau of Labor Statistics taxonomy of industries and sub-classifications that corresponded to the industry classifications of the CFA instrument.

Figure D-5 Industry Sector Distribution of Respondents



Instructional Experience – Within the CFA sample, the mean instructional experience was 2.44 hours, with a total range of one hour to one workday (7 hours), and a standard deviation of 1.37 hours (see Table D-6). Through varying extensively by industry, the type of industry sector provided no significant insight as a predictor of training length for any individual ($p = 0.487$), a result not surprising given the lack of sample size and power amongst sixteen industry sectors (producing 15 degrees of freedom within the analysis).

Table D-6

Mean Instructional Experience Length by Industry Sector

Industry	N	Mean	Std. Deviation
Agriculture	1	2	-
Arts	5	1.8	1.10
Energy	33	2.61	1.44
Hospitality	3	2.33	0.58
Other	15	2.13	0.74
Pharma	39	2.62	1.74
Construction	6	1.5	0.55
Transportation	20	2.55	1.00
Retail	10	2.50	1.18
Manufacturing	19	2.21	1.23
Finance	36	2.83	1.48
Government	19	2.74	1.15
Healthcare	27	2.48	1.60
Education	22	2.27	1.08
Technology	25	1.84	1.07
Professional Services	20	2.50	1.762
Total	300	2.44	1.371

Learner engagement factor mean differences by industry – Means and standard deviations of the three factor scores by industry are presented in Table D-7.

Table D-7

Means and Standard Deviations of Learner Engagement Factors Across Industry (N = 300)

Industry	N	Affective Learner Engagement		Cognitive Learner Engagement		Situated Learner Engagement	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Agriculture	1	2	-	3.83	-	3	-
Arts	5	3.44	0.67	3.97	0.64	3.27	0.19
Energy	33	3.63	1.14	4.04	0.87	3.57	1.05
Hospitality	3	3.60	0.40	3.78	0.25	3.39	0.35
Other	15	3.72	1.11	4.09	0.75	3.67	1.05
Pharma	39	3.69	1.18	3.99	0.98	3.69	1.06
Construction	6	4.03	0.41	4.22	0.51	3.39	0.89
Transportation	20	3.70	1.13	4.13	1.07	3.03	1.16
Retail	10	4.12	0.69	3.93	0.72	3.47	0.77
Manufacturing	19	3.96	0.72	3.96	0.62	3.40	0.69
Finance	36	3.63	1.12	3.95	1.01	3.33	1.06
Government	19	4.13	0.76	4.18	0.48	3.78	0.98
Healthcare	27	3.87	0.97	3.98	0.89	3.69	1.05
Education	22	3.80	0.92	3.95	0.77	3.36	1.07
Technology	25	3.61	1.04	3.59	1.02	3.40	0.86
Professional	20	3.70	1.12	4.13	1.07	3.02	1.16

Further analysis was conducted of the composite score means by industry sector to assess where the differences in means were statistically significant (see Table D-8) using a one-way ANOVA with a Bonferroni adjusted alpha of .0167 (i.e., typical *p*-value of significance /number of groups = .05 / 3 = .0167). The results of ANOVA indicated that despite the variability in industry sector, there was no significant difference in means for affective learner engagement, cognitive learner engagement, or situated learner engagement across all industry sectors.

Table D-8

One-way ANOVA for testing differences in Learner Engagement Factors Means Across Industry Sector

Variable		Sum of Squares	*df*	Mean Square	*F*	*p*
ALE	Between Groups	11.16	15	0.74	0.73	0.757
	Within Groups	290.75	284	1.02		
	Total	301.91	299			
CLE	Between Groups	5.87	15	0.39	0.49	0.941
	Within Groups	223.69	284	0.79		
	Total	229.56	299			
SLE	Between Groups	11.57	15	0.77	0.78	0.703
	Within Groups	281.91	284	0.99		
	Total	293.48	299			

Lastly, with the addition of two additional items on the CFA instrument, additional ANOVA analysis was done to evaluate whether the mandatory nature of the instructional program was predictive of the engagement of the learner under the theoretical model, a point made frequently during the qualitative inquiry. Mandatory training was found to be a significant predictor of engagement under the theoretical model of the study (see Table D-9).

Table D-9

Mandatory Attendance as a Predictor of Learner Engagement under the Theoretical Model

Variable		Sum of Squares	*df*	Mean Square	*F*	*p*
ALE	Between Groups	21.68	1	21.68	23.05	<.001
	Within Groups	280.23	298	0.94		
	Total	301.91	299			
CLE	Between Groups	10.73	1	10.73	14.61	<.001
	Within Groups	218.84	298	0.73		
	Total	229.57	299			
SLE	Between Groups	3.76	1	3.76	3.87	0.05
	Within Groups	289.71	298	0.97		
	Total	293.47	299			

Appendix E

Learner Engagement Instrument for CFA

University of Connecticut

Principal Investigator:	Dr. Scott Brown
Student Researcher:	Charles Dye
Study Title:	Qualitative & Quantitative Inquiry into Learner Engagement
Sponsor:	University of Connecticut, Neag School of Education

Note: This instrument version is for review purposes only, survey will be administered online, with item order randomized.

What is your age (round to the nearest year)?

In what industry classification most closely describes where you currently work?

- Manufacturing
- Pharmaceutical
- Finance
- Energy
- Technical
- Education
- Medical
- Government
- Other

How frequently do you attend some form of professional development or training related to your job?

- Multiple time a week
- Weekly
- Monthly
- Annually
- Less frequently than annually

To complete the rest of this survey, please think about a recent instructional experience you had relating to professional development or certifications for your employment that included other participants (e.g. NOT one-on-one coaching, mentoring, or individualized development).

What type of instructional treatment/experience are you referring to for this survey?

- Live In-Person Delivery/Traditional Classroom ($\leq$50 participants)
- Large Scale Conference/Presentation/MOOC (> 50 participants)

- Live Online (via Web Conference or Virtual Classroom (e.g. WebEx, Zoom, Skype, etc.))
- Self-Paced/Directed (either online, computer-based, correspondence, or other method) with some form of Interaction with other Participants (Chat, Message Board, etc.)
- Blended Program (a combination of some or all of the above)
- Other: _____

Approximately how long was the instructional experience that you are referring to in this survey (in hours)?

Did you choose to attend this training, or was it mandated to you to attend?

- Chose to attend
- Training was mandated

Did you complete the training?

- Yes
- No

Please rate how strongly you agree or disagree with each of the following statements by placing a check mark in the appropriate box.

1. I felt encouraged to volunteer opinion in the program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

2. I received good feedback on my participation in the activities or discussions in this instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

3. I enjoyed participating in the instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree

- Strongly disagree

4. I enjoyed this instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

5. I felt good about participating in the discussions and activities of this program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

6. The subject matter in the instructional program was important to me.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

7. I was intellectually interested in the subject matter presented in the instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

8. I learned something new in the subject area of the instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

9. The instructor/instructional software provided extensive accurate and meaningful information about the subject matter.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

10. This instructional program is important for my personal or professional development.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

11. The materials and concepts presented in the instructional program were well suited to my level of expertise.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

12. Something another participant did or said compelled me to provide my own opinion/input during instructional delivery.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

13. I participated effectively in the instructional delivery.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

14. The diversity of opinion evident during instructional delivery was beneficial to my learning.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

15. I changed my opinion or understanding of an issue/concept based on my interaction with the instructor and/or participants during the instructional program.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

16. I understood a concept better when another participant asked a question about it.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree

17. Interacting with others in the instructional program was an important part of the experience.

    - Strongly agree
    - Somewhat agree
    - Neither agree nor disagree
    - Somewhat disagree
    - Strongly disagree