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Learning Experience Design: Challenges for Novice Designers

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Instructional Design | Design Thinking | Learning Experience | Design Expertise | Problem Solving Process | Human-centered

Learning Experience Design (LXD), defined as the practice of designing learning as a human-centered experience leading to a desired goal, poses many challenges to novice designers. This chapter presents common challenges experienced by novice learning designers through the lens of design problem solving as well as expert suggestions on how to address the challenges. Without expert knowledge and schema, novice designers experience difficulty conceptualizing and analyzing complex learning problems. An insufficient or erroneous definition of the learners and contextual needs poses further challenges in drawing effective design solutions grounded in learning theory and design principles that flexibly accommodate multiple learning experiences. It is important that novice designers develop their identity as a designer as they learn to think and problem-solve as one.

1. Introduction

The way we conceptualize, define, and practice learning design has changed over the decades in relation to social and cultural demands for educational or training needs, technology, and learning theories (Clark, 2002). Different assumptions about how people learn and how to best support it have transformed (Boling & Smith, 2018; Jonassen, 1991; Molenda, 1997; Wilson, 2005), including the epistemological foundation such as constructivism and instructional design practice such as aesthetic design. Learning design is conceptualized as a scientific approach, a systematic process, or development of creative and informed solutions around possibilities and constraints within the design space towards concrete goals (Reiser, 2001).

In the traditional field of learning design, Instructional Design (ID), over hundreds of ID models have been developed in the last five decades which represents our struggle to understand, define, and shape the way we effectively design learning (Boling & Smith, 2018). Despite the overwhelming number of diverse ID models developed to describe and inform practice, the actual practice is still dominated by the ADDIE (Analysis, Design, Development, Implementation, Evaluation) Framework which many practitioners implement as a systematic, linear, and rule-based procedure (Hokanson & Miller, 2009; Silber, 2007). Such approaches lead to generalized learning goals and experiences that well accommodates behaviorist or cognitivist learning, but leave little flexibility to address the diverse needs of learners and the learning context, as emphasized by current understanding of how people learn (Ertmer & Newby, 2013; Hokanson &

Miller, 2009; Silber, 2007). A number of researchers called for the need to revise how we conceptualize, teach, and practice ID (Boling & Smith, 2018; Jonassen, 2008; Kirschner et al., 2002; Nelson et al., 1988; Silber, 2007).

Learning Experience Design (LXD) is an attempt to integrate design practice from related design fields such as human-computer interaction (HCI), architecture, product design, and software design with instructional design (Boling & Smith, 2018). Specifically, LXD has its roots in user-experience design (UXD). While there is no consensus on how to define UXD (Kou & Gray, 2019; Law et al., 2009), it is commonly conceptualized as an interaction between the user, the system, and the context of experience (Lallemand et al., 2015). Similarly, the practice of LXD from the UXD perspective focuses on ensuring the functionality of the system, as well as the ease and satisfaction of the experience. This approach addresses the limitations in current practice of ID where there is relatively less emphasis on the experience of learning (Boling & Smith, 2018). However, with a lack of consensus around the definition of UXD, much less LXD, there is a need to provide a concrete definition of LXD to guide the conceptualization and practice of learning design.

Novice designers in the learning domain commonly exhibit difficulties understanding how learning occurs through different perspectives (i.e., learning theories) and how to best support learning through design. For example, novice designers experience difficulties engaging in the complex design process that entails understanding the underlying needs of the learners in the given learning context, drawing design solutions based on appropriate design principles, as well as evaluating and iterating the design solution (Ertmer et al., 2009; Rowland, 1992, 1993; Silber, 2007). A clear framework to understand the nature and process of learning design and concrete suggestions to implement during the design practice is needed.

As a response to challenges facing novice LX designers, the goal of this chapter is to (a) present a working definition of LXD and (b) offer suggestions for novice learning experience designers on how to approach LXD based on the expertise literature. The chapter approaches LXD as a complex, ill-structured problem-solving endeavor for multiple reasons. Design is studied as a problem-solving process in multiple disciplines including engineering design (Crismond & Adams, 2012), learning design (Jonassen, 2008), and design in general (Cross, 2004), with a wealth of research on problem solving to support the inquiry. Most importantly, problem-solving can provide a concrete framework to articulate and guide the practical challenges that novice designers experience beyond a conceptual understanding of the field. The assumption is that LXD challenges are ill-structured problems that necessitate flexible, creative solutions to address the dynamically emerging needs of the learners in relation to the learning context (Nelson et al., 1988). The chapter first presents a working definition of learning experience design. The implications of the defining characteristics of LXD on the practice of design are discussed especially in comparison to traditional perspectives of instructional design. Then, commonly observed challenges as experienced by novice LX designers are discussed with expert suggestions on how to address the challenges.

2. Defining Learning Experience Design

The chapter presents a working definition of *learning experience design* as a practice of designing learning as a human-centered experience that leads to a desired goal. The defining characteristics of LXD are not exclusive but are equally important components of ID and UXD. However, those constructs are conceptualized, defined, and practiced differently under LXD.

2.1. Learning Experience

Under LXD, the focus of design is the learning experience rather than the learning tools or materials. Learning experience includes the cognitive engagement with the learning tasks, as well as the affective response and subsequent engagement with the learning context (Parrish, 2009).

ID focuses on the design of learning tools or materials around subject matter, instructional methodology, learners, and the learning context as part of the carefully constrained instructional system (Parrish, 2009). Instead, LXD expands the design and recognizes multiple, equally effective learning experiences to support diverse and emerging needs of the learners and the learning context (Mager, 1997). LXD draws the designer's attention to the quality of the learning experience, not just the goals accomplished as a result.

2.2. Human-Centered

Understanding the varied parameters people carry into a learning endeavor and how those variables affect learning are the considerations of traditional ID. However, LXD extends such considerations with learner-centered design, shifting focus from instruction to learner-driven construction of a human experience that is meaningful, engaging, and satisfying (Wilson, 2005). Human-centered LXD includes empathetic understanding of the learner, the sociocultural and technical context in which they are embedded, and the individual and socially mediated meaning making process as driven by the learners.

Creating such personal experience for learners requires imagination and empathy by the designers (Parrish, 2009), and integration of research from the HCI/UX fields. The focus of LXD should go beyond providing the actionable options according to the learners' preferences (Garrett, 2010). It should allow such satisfaction through personally meaningful learning experiences. The resulting design is a complex system consisting of bidirectional and reciprocal interaction between multiple factors that allows for meaningful, authentic, and learner-directed experience (Domagk et al., 2010). Therefore, LXD should provide opportunities and support for highly personal experiences, empathy towards the learners, and human-centeredness that considers not only what the learners want, but what they actually need in order to deeply engage with the learning experience to accomplish the learning goals.

2.3. Goal-Oriented

Outcome goals are important, but equally important are goals that guide the design to ensure that learners find meaning and relevance in those outcomes. The purpose of design in LXD is to connect the goals of the individual with the contextual learning goal through meaningful engagement led by the learners. That is, each learner should come to understand why and how the process they are engaged with relates to their own motivations, goals, and values.

When a process engaging a learner aligns with the trajectory of their individual purpose, learning is enhanced and results in longer, more profound learning outcomes (Bransford et al., 2000; National Academies of Sciences, Engineering, and Medicine, 2018; Parrish, 2009). As learners negotiate between personal and contextual learning goals, the designer must be attuned to the complex and dynamic interactions that take place between the learner's internal influences (e.g., cognitive, emotional, social, cultural, political and aesthetic qualities) (Wilson, 2005), their behaviors, and the learning environment.

In comparison, traditional ID emphasizes contextually assigned learning goals to promote acquisition of knowledge and skills as learning outcomes. Consequently, ID takes a rule-based approach by following linear paths as prescribed by ID models, leaving less room for personally meaningful experiences.

2.4. Design

At heart, learning design is an ill-structured problem-solving activity (Ertmer et al., 2008, 2009; Jonassen, 1997; Silber, 2007; Tracey & Boling, 2014). According to Jonassen and Tessmer (1996), ill-structured problem-solving such as LXD is not only the application of domain and structural knowledge, but also the application of knowledge to solve design problems and articulation of connected ideas through the creation of arguments, analogies, and inferences. Designers should have a developed sense of self as problem solver, through control and understanding of their personal motivations, attitudes, biases, and ideas.

Thus, the responsibility of the LX designer is considerable. LX designers must identify, define, and design opportunities to engage learners in meaningful and varied learning experiences. Also, they must reason how to provide supporting scaffolds as learners engage in multiple paths to arrive at their own relevant understandings (Bransford et al., 2000).

LX designers do not fully determine or control the learning experience. Rather, they design, prepare and integrate appropriate resources and design elements that support diverse but equally effective learning experiences. The design elements may include tools and materials of diverse media, social interactions, and making of artifacts to support and challenge their meaning making process. LX designers: a) understand the opportunities and constraints of the learning problem through analysis of the learners, learning contexts, and the learning tasks; b) make decisions based on empirical evidence on how learning experiences emerge through interaction amongst these factors; and c) test and iterate the design decisions (Jonassen, 2008; Silber, 2007).

3. Novices and Experts: Problem-Solving and LXD

Several decades of research on instructional design expertise distinguishes some fundamental differences between novice and expert designers. Novice instructional designers often make fundamental and recurring mistakes that challenge their design practice (Ertmer et al., 2008, 2009; Ertmer & Stepich, 2005; Rowland 1992, 1993; Silber, 2007). Alternatively, expert designer thinking processes share many similarities across domains (e.g., instructional design, architecture, engineering, etc.) (Haupt, 2015; McMahon, 2009; Silber, 2007; York & Ertmer, 2016).

The complex and holistic approach to LXD poses added challenges to the novice designers regarding their prior assumptions and practice of design. With the assumption that LXD is about ill-structured problem solving, this section presents relevant findings from empirical research on design expertise, contextualized as implications for key aspects of LXD. The challenges and suggestions are discussed along the main components of problem solving: a) problem generation, b) problem-solving process, and c) solution generation and the implications under a working definition of LXD.

We open the section with two visual stories, caricatures of the novice (Figure 1) and expert (Figure 2) designer, followed by a discussion that highlights key moments in relation to different problem-solving approaches and our working definition of LXD. These stories are meant to depict common challenges designers face, how they might approach them, and how different thought processes manifest as design decisions and actions, without the intention of being definitive. Designers at various stages in their professional development are expected to bring different understandings, insights, abilities, strengths, and weaknesses to the design process.


BEGINNER COMPUTER PROGRAMMING COURSE FOR GIRLS TO PROMOTE ENGINEERING INTEREST?
COOL!
I SHOULD START WITH ADDIE. EASY PEASY!
[Analyze, Design, Develop, Implement, Evaluate]
ADDIE
STEP ONE. ANALYZE! THIS COURSE IS ABOUT PROGRAMMING SO...
VARIABLES?
<Code;>
IF-ELSE STATEMENTS?
FUNCTIONS?
<Style`x'>
OTHER INTRO LEVEL COURSE TOPICS?
WHAT ABOUT GENERATING INTEREST IN ENGINEERING!
I REMEMBER LEARNING CODE. SO MUCH MATH!
I THOUGHT PROGRAMMING WAS SO -- BORING!
THAT'S IT! STUDENTS NEED TO BE ENGAGED!
IF I MAKE THIS FUN
STUDENTS WILL LEARN BY PRACTICING MORE!
KIDS LOVE VIDEO GAMES!
IT'S A GREAT WAY TO LEARN CODING!
VR EXPERIENCE
BRIDGE BUILDING
WHAT ARE TEEN GIRLS INTERESTED IN?
BOYS LIKE GAMES (DUH)
OH!
A STORY GAME!
THAT'S IT!
THE STORY CAN BE ABOUT HOW GIRLS CAN BE ENGINEERS TOO!
YES!
THEY'RE GONNA LOVE IT!
LET'S REVIEW!
CHECK LIST:
Target to teen girls
Learn to code
Generate interest in engineering!
IT CAN START WITH A FEMALE ENGINEER
SHE'LL HELP PLAYERS VIRTUALLY BUILD...
A BRIDGE!
AS THEY PROGRESS IN CODE.
THEY GET MORE CUSTOMIZATION PIECES + OPTIONS
SO THEY CAN BUILD COOLER BRIDGES!

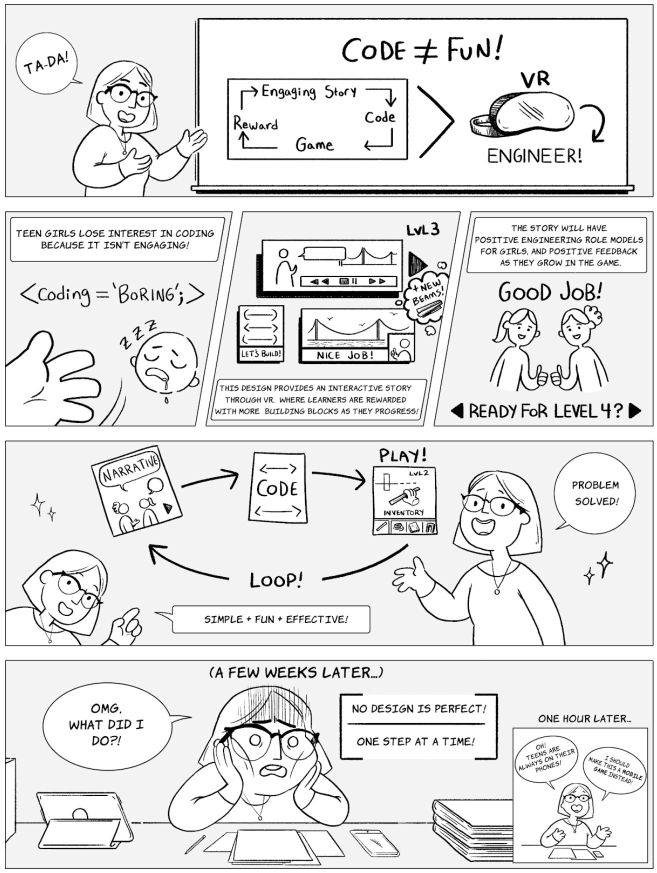
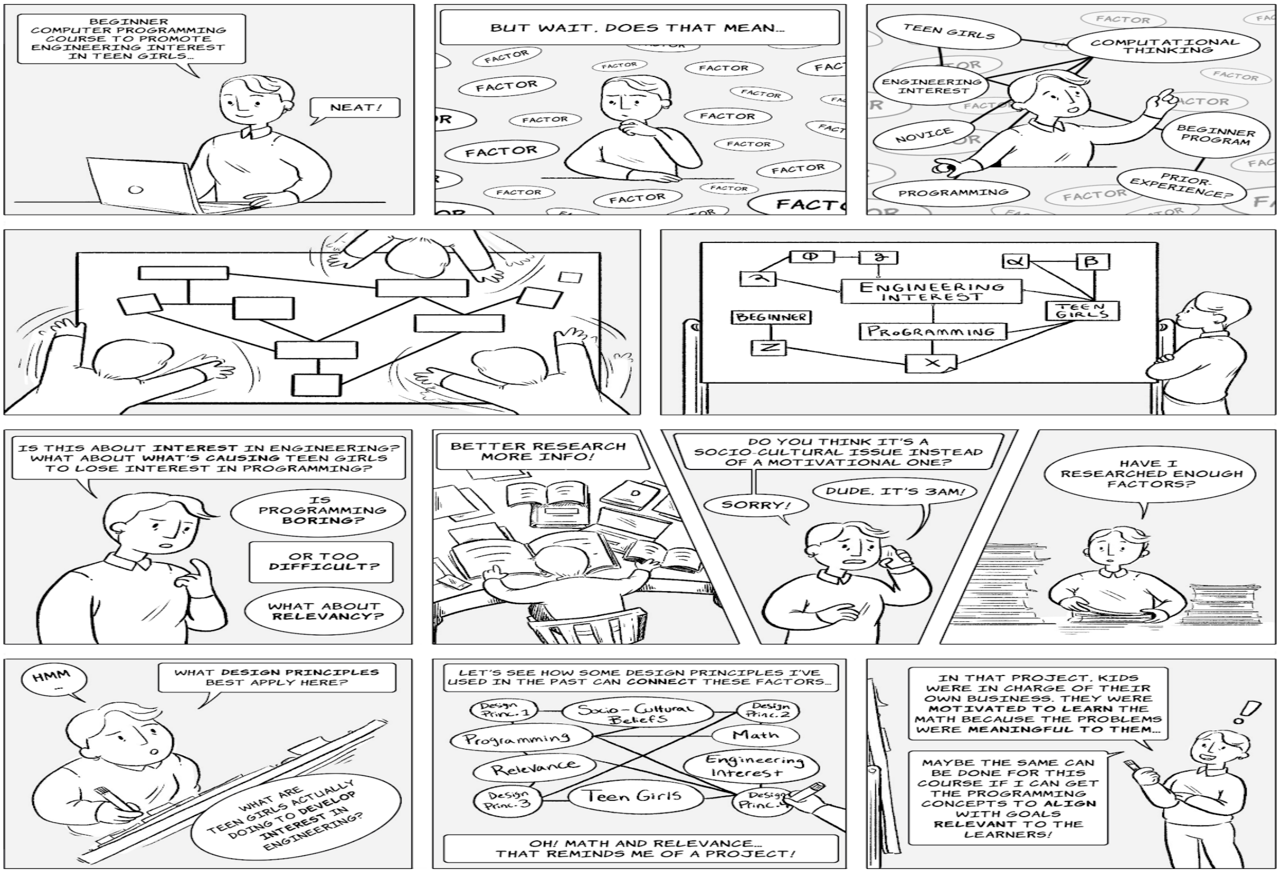


Figure 1

The Novice Story: How Novice Designers Problem-Solve Learning Designs


BEGINNER COMPUTER PROGRAMMING COURSE TO PROMOTE ENGINEERING INTEREST IN TEEN GIRLS...
NEAT!
BUT WAIT. DOES THAT MEAN...
FACTOR
TEEN GIRLS
COMPUTATIONAL THINKING
ENGINEERING INTEREST
NOVICE
BEGINNER PROGRAM
PROGRAMMING
PRIOR-EXPERIENCE?
ENGINEERING INTEREST
BEGINNER
TEEN GIRLS
PROGRAMMING
IS THIS ABOUT INTEREST IN ENGINEERING? WHAT ABOUT WHAT'S CAUSING TEEN GIRLS TO LOSE INTEREST IN PROGRAMMING?
IS PROGRAMMING BORING?
OR TOO DIFFICULT?
WHAT ABOUT RELEVANCY?
BETTER RESEARCH MORE INFO!
DO YOU THINK IT'S A SOCIO-CULTURAL ISSUE INSTEAD OF A MOTIVATIONAL ONE?
SORRY!
DUDE. IT'S 3AM!
HAVE I RESEARCHED ENOUGH FACTORS?
HMM ...
WHAT DESIGN PRINCIPLES BEST APPLY HERE?
WHAT ARE TEEN GIRLS ACTUALLY DOING TO DEVELOP INTEREST IN ENGINEERING?
LET'S SEE HOW SOME DESIGN PRINCIPLES I'VE USED IN THE PAST CAN CONNECT THESE FACTORS...
Design Princ. 1
Socio-Cultural Beliefs
Design Princ. 2
Programming
Math
Relevance
Engineering Interest
Design Princ. 3
Teen Girls
Design Princ. 4
OH! MATH AND RELEVANCE... THAT REMINDS ME OF A PROJECT!
IN THAT PROJECT, KIDS WERE IN CHARGE OF THEIR OWN BUSINESS. THEY WERE MOTIVATED TO LEARN THE MATH BECAUSE THE PROBLEMS WERE MEANINGFUL TO THEM...
MAYBE THE SAME CAN BE DONE FOR THIS COURSE IF I CAN GET THE PROGRAMMING CONCEPTS TO ALIGN WITH GOALS RELEVANT TO THE LEARNERS!

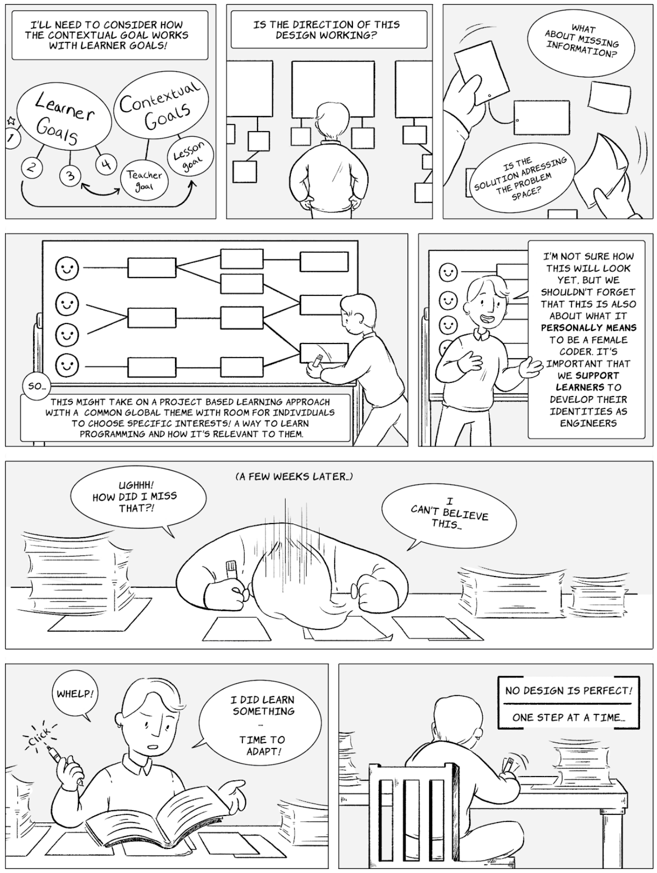


Figure 2

The Expert Story: How Expert Designers Problem-Solve Learning Designs

3.1. Problem Generation

LXD requires designers to create *learning experiences*, defined as experiences through which learners construct meaningful understanding. The nature of the problem that designers must solve goes beyond identifying and sequencing the summative parts of knowledge and understanding necessary to reach the end learning outcome. The problem-space that needs to be generated and articulated in the designer's mind is fundamentally more sophisticated. It necessitates understanding that exhibits both depth and breadth of the complex and dynamic factors that influence learners. The learning problem shifts from "What do learners need to know and do?" (i.e., learning outcome) to "How do we support learners in negotiating meaning?" (i.e., learning experience). To achieve this, designers are challenged to see and identify relationships between the myriad of influences that learners' confront, to define the parameters of the problem, to carve out their working space, and to remain mindful of the nuances that make each learner unique.

Novice designers exhibit difficulty identifying and defining meaningful problems comprehensively, deeply, and accurately (Ellis & Levy, 2010; Ertmer et al., 2008, 2009; Mosely et al., 2018). Novices tend to summarize and repeat given information (Ertmer & Stepich, 2005), without diving beyond the surface features or considering important issues and qualities of the problem (Sugar, 2001; York & Ertmer, 2016). They interpret givens as fixed in-boundaries of their problem-solving endeavors (Rowland, 1992) without questioning the accuracy of information.

In our caricature of the novice designer (Figure 1) the ability to focus only on the literal/surface elements (i.e., programming, interest, engineering, and demographics) limits: a) areas that the novice will pursue analysis, b) recognition of the different conceptual learning issues at hand, and c) the depth of cohesion between important factors. Consequently, this impacts how our novice defines the problem space. For example, a novice designer's analysis and definition of the problem space may not consider the learning experience despite its importance among factors such as the learner, learning context, and design. Similarly, a narrow understanding of the learners beyond generalizable traits and characteristics may result in a one-size-fits-all solution that lacks considerations for the human-centeredness of LXD. Our novice relies on sparse domain knowledge and personal experiences, instead of further investigation with experts or external resources, introducing biases and unfounded insights to the problem.

In contrast, experts approach problem generation differently (Figure 2). They analyze given information skeptically as both inaccurate and inadequate (Rowland, 1992). They synthesize their own conceptualizations of a problem space consisting of features and information patterns bounded by coherent relationships, based on their prior knowledge and experience (Bransford et al., 1999; Ertmer & Stepich, 2005; Haupt, 2015). Subsequently, they use this information to see beyond the surface of a problem, by making inferences that not only fill in the missing gaps of a problem, but elucidate the underlying conceptual principles that govern the present phenomenon (Ertmer & Stepich, 2005; Haupt, 2015; Mosely et al., 2018; Rowland, 1992). That is, experts challenge their assumptions and aren't bound by original, literal, and perceived constraints which help them see the deep-structures of a given problem.

In the story, our expert designer conceptualizes an array of different factors and connections that may be of importance to the resulting learning experience. The expert also questions specific parameters (e.g., interest), to deliberate over the deeper nature and meaning behind the phenomenon, leading to human-centered inquiries. This subsequently allows for flexible learning paths as part of the forthcoming designed experience. The expert synthesizes the problem-space primarily in reference to the theoretical and practical knowledge gained from prior experience. However, the expert remains both vigilant and resourceful in challenging their own assumptions and developing new understandings and insights.

3.2. Problem-Solving Process

LXD emphasizes the importance of *human-centered* considerations for diverse learners' needs, such as dynamic, flexible, multiple pathways to learn. It also calls for a *goal-oriented* design (e.g., a design that accounts for the nuances of individual motivations and values as they align with the learning and contextual goals). This design approach requires that designers see a diverse range of factors around learners and learning, the sociocultural and technical contexts, and socially mediated meaning making process. Designers must articulate the relationships and connections between these factors, as well as define and organize this knowledge in ways that can be drawn when appropriate. Mental representation of the problem space and information is crucial in connecting relevant evidence and resources to generate solutions. Expert knowledge consisting of both abstract knowledge as well as personal experience (Ellis & Levy, 2010; Ertmer et al., 2008; Rowland, 1992; Stepich, 1991) plays an important role in cognitively organizing problem knowledge for effective and efficient design process (Bransford et al., 2000; Chi et al., 1981; Glaser & Chi, 1988; Stepich & Ertmer, 2009). The difference in how novices and experts organize and structure their knowledge has implications for the process by which they solve learning design problems.

Novice designers lack a clear understanding of the problem and they process the problem and related information less effectively. Novices see only the superficial layers of a problem, seem to mentally represent problems as mere summaries of provided information (Rowland, 1992), and create lists of issues in no particular order, relations, or coherence with each other or the problem itself (Ertmer & Stepich, 2005). Despite a premature or non-existent understanding of the problem, novices complete problem analysis hastily, commit to rigid solutions early, and are less receptive to change even when new and important insights are introduced (Ertmer & Stepich, 2005; McMahon, 2009; Rowland, 1992).

In the caricature, we see our novice is limited when drawing relevant information to synthesize a comprehensive and cohesive picture of the problem along with how to address it. They are restricted by their own personal experiences. This could lead to incomplete and erroneous understanding of the problem, particularly if their experience carries biases and misconceptions. For example, the novice designer projects their own experience around programming (e.g., boring) to define both the problem itself and the learning audience. Assumptions are plentiful around the types of technologies that their learners will enjoy, the genres in which the content should be delivered, and the mechanisms by which motivation relates to engagement and learning. Consequently, this gives our novice a rather narrow view of the problem, resulting in an arguably hasty design direction catering to a generalized profile of a learner with insufficient support for human-centered and goal-oriented considerations.

In comparison, experts construct conceptual models of problem spaces as networks of related parts organized deliberately by hierarchy, causality, chronology, and operational priorities (Ertmer & Stepich, 2005; Larken et al., 1980; Rowland, 1992) by matching features of new problems they encounter with their expert knowledge (Bransford et al., 1999; Tawfik et al., 2019; Tawfik et al., 2020). Complex mental representations of the problem space set the foundation for their future problem-solving process (Rowland, 1992) and allow experts to selectively retrieve highly relevant cases with possible solutions (Bransford et al., 1999; Chi et al., 1988; Ericsson & Staszewski, 1989; Glaser, 1999). Consequently, by investing more time in defining and refining the problem, experts find solutions faster and solutions are more effective (Chi et al., 1981).

In our expert caricature, the designer is able to process and structure the problem in a substantially richer manner. The designer relies on their mental repository of highly organized knowledge, by referring to relevant information from external resources when necessary. Guided by principles and heuristics accumulated over time, our expert makes reasoned connections to possible learner goals, motivations, and values. By exploring the relationships between different principles, concepts, and mechanisms in direct reference to the problem that includes the learner, the expert solution is much more flexible than the novice's and leaves room for learners to take varying pathways and room for the design to evolve as more understanding is gained.

3.3. Solution Generation

Ill-structured problems, such as learning design problems, are by nature without single algorithmic solutions. The LX elements of learning experience, human-centeredness, and goal-orientedness serve as guides in our efforts to navigate the ambiguity. As LX designers generate and process their design problems, they are challenged to contemplate multiple problem features whereby the solutions contribute toward addressing the diverse cognitive and motivational needs of the learners. To that end, the designer must determine how to address, prioritize, and integrate the parts as a cohesive and interdependent system. In LX, design culminates in a product that represents our reasoning of how the LX elements work together.

A solid foundation must be established to generate reasoned solutions. As one might expect, without this foundation, novice designers find generating solutions difficult. Yet despite their underdeveloped problem space, novices hastily jump to solution generation (Rowland, 1992). Without a working conceptualization of the problem, they refer to original materials often, focus on prescribing content and instruction (McMahon, 2009; Rowland, 1992), and produce singular solutions of instructional type. Novices have difficulty managing multi-step paths; they don't consider varying possibilities and when they do are quick to eliminate them (Kerr, 1983; Rowland, 1992; Tracey & Boling, 2014). Further, novices believe solutions to be the end purpose of design instead of as a means to further understand the problem (Lawson, 2012; Tracey & Boling 2014). When novices reach that end they commit to the point of inflexibility and resist changes to solutions even in the face of new information (Ertmer & Stepich, 2005; Rowland, 1992). Novice designers rarely, if at all, engage in testing and iterating their design solution. Novice designers who reactively respond with content-focused, instructional, single solutions will likely fail to address the variety of learners, goals, motivations, and values that are important considerations for human-centered, goal-oriented, learning experiences.

In our novice caricature, we can see how the designer conceptualizes the design as a single, linear, dictated, instructional path for all learners. From content (i.e., coding exercises), to attitudes (i.e., narrative), to motivation (i.e., playful interaction), the designer envisions a series of cyclical tasks for the learner to follow, presumably until the end instructional objectives are reached. While this novice designer does consider learner beliefs and motivations to some degree, the consideration is meager and implementation remains superficial. The resulting design is static with little room for learners to truly find personal meaning and relevance outside what's currently accorded.

Expert designers are cautious and intentional in their progression toward solution development, proceeding only after they're satisfied with their problem-space comprehension (Perez & Emery, 1995). They perceive solutions as a means to further understand the problem, as opposed to the ends of design (Lawson, 2012; Tracey & Boling, 2014). They use preliminary solutions to identify critical information about the learner and flexibly adapt (Cross, 2007). This has implications for how they address the complex factors and interactions imbued in the human-centered, goal-oriented, learning experience. Iterative in their approach, experts continually integrate new information through multiple design cycles (Perez et al., 1995). This allows them to use new insights to continually develop and enrich support for multiple kinds of learners in relevant, targeted ways.

In the expert narrative, our designer spends a considerable amount of time establishing the foundational base of the design problem in preparation for the design solution. While the low-level specifics of the design are not detailed in this particular story, at a higher level the design strategy (i.e., project-based learning) is employed for a human-centered, goal-oriented, learning experience. Of key importance is how the expert's design approach addresses various considerations and interrelations around the important identified factors and maps them against the larger design structure. This isn't to say that the expert design is flawless. In fact, both designers discover issues with their final implementations. However, in contrast to the novice, the expert uses this as another benchmark for their continued and iterative design work.

4. Conclusion

Learning experience design, defined as designing learning as a human-centered experience that leads to a desired goal, is a complex, ill-structured, problem-solving endeavor (Crismond & Adams, 2012; Cross, 2004; Jonassen, 2008). Conceptually understanding the nature and process of LXD and engaging in the complex design practice poses challenges to the novice designers. LX designers must take a holistic approach to identify diverse interacting factors, opportunities, and constraints that define the problem space, to provide creative solutions to address the dynamically emerging needs of the learners in relation to the learning context (Nelson et al., 1988). To conclude this chapter we provide practical suggestions and reflection questions to support novice designers through the challenges they may encounter.

4.1. Suggestions for Practice

To solve learning problems one needs extensive knowledge and know-how that is not readily available to the novice designer. One particular learning method recommended in ID, cognitive apprenticeships, is predicated on the concept that experts mentally see and think in ways that novices cannot. This underscores the importance of having experts explicitly articulate their perceptions and cognitions for the novice to access (Collins et al., 1989). Through collaboration with senior designers as envisioned in cognitive apprenticeship, novices can model how to generate problems, select and apply appropriate learning principles, test, and evaluate their design solution. As senior designers articulate what they see and how they think through the planning, development, and testing of design, they reveal to the novice the implicit and complex network present in the problem space. This provides opportunities for novices to build their working knowledge of LXD and develop understanding of oneself as a designer. It's important for novices to accumulate understanding not just directly, but vicariously in order to eventually draw from these experiences when faced with new situations (Ertmer et al., 2008; Tawfik et al., 2019). Conscientious effort to reference empirical research to check one's assumptions about the nature and factors underlying the problem can also be helpful.

Another challenge for novice LX designers is mentally organizing and selecting pertinent information when creating design solutions. Without expert knowledge and schema, this process poses challenges in considering the elaborate, multi-faceted nature of the learners. It is recommended that novice designers take time to organize different information (e.g., theories, concepts, principles, heuristics, cases, personal experiences, etc.) in effective, expert ways.

Using tools to visualize their problem definition could be helpful in identifying and connecting underlying features of the problem, finding gaps and misconceptions about the problem space, and drawing relevant principles. In addition, novice designers are encouraged to contextualize information about the problem space into varied, authentic situations so as to produce nuanced, retrievable schemas when the information is granular (i.e., principles, heuristics). When information is broad (e.g., abstract: theories, concepts; concrete: cases, personal experiences), novices should work to extract the principles or heuristics that define the situation so as to better index their understanding of the problem.

New design situations will introduce variations that challenge our assumptions and expectations. Therefore, it's important for novice LX designers to deliberately test their design solution, revise their problem space based on the evaluation, and iterate the processes of problem redefinition and solution generation. This will allow for gradual understanding of complex problems in LX as well as opportunities to evolve one's own perceptions and attitudes around LXD.

Finally, to become experts in LXD novice designers need to shift from *learning about* design to *learning to be* a designer. This requires deep reflection and questioning on their own assumptions, beliefs, attitudes, and values about learning and design. These personal positions determine the methods designers use (Nelson et al., 1988; Sheehan & Johnson, 2012) and ultimately develop into design skills (Anderson, 1980). We recommend that novice LX designers face the very ideas espoused in this chapter head-on and negotiate what this new perspective means in light of what we already know from past traditions and our prior experiences. Novice designers need to find a unique path that balances their stance on the field with the domain constraints imposed on them.

To incorporate the values embedded in LXD, we invite the novice to reflect on their own internal beliefs, attitudes, and values—to challenge oneself not just to think about what they must do as designers, but what kind of designer they want to become. Tables 1 - 4 summarize the suggestions and reflection questions for novice LX designers in terms of learning experience, human-centered, goal-oriented, and design.

Table 1

Learning Experience: Summary of Suggestions and Reflection Questions for Novice LX Designers

LX Element Challenge	Suggestions for Practice and Development
LEARNING EXPERIENCE In LXD the learning experience that helps learners construct personally meaningful understanding of the learning process, rather than the instructional materials alone, is paramount. Shifting the focus of design may pose challenges in identifying and defining important features of the problem and drawing relevant information to construct solutions.	When defining and representing problem spaces during problem generation, refer to expert knowledge to see problems as experts, seek expert advice and empirical literature.
	In order to support the problem-solving process use tools to externalize and visualize multiple factors and their relationships underlying the problem space.
	To allow efficient and effective retrieval of guiding cases and principles, organize and connect design-problem and relevant information by meaningful characteristics during the problem-solving process.
REFLECTION	

- Recall your past practices of learning design: How did you conceptualize learning experience vs. learning outcomes?
- In reference to the visual stories: How does the story of how you conceptualize learning experience, compare and contrast to those of the novice and expert designer?
- In light of the LXD suggestions: What are the biggest challenges you need to personally address and how would you change the way you conceptualize learning experience in order to support meaningful understanding through design?

Table 2

Human-Centered: Summary of Suggestions and Reflection Questions for Novice LX Designers

LX Element Challenge	Suggestions for Practice and Development
HUMAN-CENTERED LXD supports personally meaningful learning experience emerging through dynamic interactions of multiple factors in relation to the learners' needs. Designing for dynamic, flexible, multiple pathways to learn may pose challenges in defining, organizing, and designing for diverse cognitive and motivational needs of the learners.	As you generate and solve design problems, define and empathize with learners beyond generalizable traits and characteristics.
	When problem-solving, draw design solutions from a wide array of principles contextualized to the needs of the learner and the learning context during the problem-solving process.
REFLECTION • Recall your past practices of learning design: How did you go about understanding the needs of your learners? • In reference to the visual stories: How do the novice and expert empathize with learners and how might you have approached the same situation? • In light of the LXD suggestions: Going forward, in what new ways do you intend to understand learner needs and how do you imagine the subsequent insights might influence your design decisions?	

Table 3

Goal-Oriented: Summary of Suggestions and Reflection Questions for Novice LX Designers

LX Element Challenge	Suggestions for Practice and Development
GOAL-ORIENTED LXD recognizes that learners enter the learning context with personal goals, motivation, and values that might not align directly with the contextual learning goals. Supporting learners' negotiation and adoption	Be mindful of the complex and dynamic interactions that occur between the learner and the context that they are embedded in. As you generate a design

of the contextual goal in relation to personal goals may challenge novice designers.	solution, recognize, define, and design for multiple goals in the learning context.
REFLECTION • Recall your past practices of learning design: In what ways might your learners' goals have differed from the learning (i.e., lesson) goals you established and why? • In reference to the visual stories: How does the novice and expert differ in the way they define their respective design goals and how do you think each goal influenced the ensuing design strategy? • In light of LXD suggestions: How will you define and conceptualize the goals of the learner and how might you negotiate possible tensions that can arise in relation to contextual goals?	

Table 4

Design: Summary of Suggestions and Reflection Questions for Novice LX Designers

LX Element Challenge	Suggestions for Practice and Development
DESIGN In LXD, the role of designers is to provide flexible and dynamic learning contexts and resources that allow multiple learning experiences. Novice designers are challenged in conceptualizing the interaction amongst the multiple problem features as an interdependent system, due to their limited knowledge and past experiences which inevitably carries their assumptions and biases.	When generating design problems test your underlying assumptions and add sophistication to the design solution through cycles of iteration.
REFLECTION • Recall your past practices of learning design: In what ways might your learners' goals have differed from the learning (i.e., lesson) goals you established and why? • In reference to the visual stories: How does the novice and expert differ in the way they define their respective design goals and how do you think each goal influenced the ensuing design strategy? • In light of LXD suggestions: How will you define and conceptualize the goals of the learner and how might you negotiate possible tensions that can arise in relation to contextual goals?	

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