Learner Experiences with Educational Technology

6

Chapter Outline

- Experience and learner experience
- Elements of learner experience with educational technology
- Indicators to evaluate learner experience.

By the End of This Chapter, You Should Be Able To

- Describe general experience and learner experience
- Define learner experience and characterize varieties of learner experience
- List and elaborate the elements of learner experience
- Describe indicators of and their use in analyzing learner experience.

Main Learning Activities

1. Think about what constitutes learner experience and why learner experience is important for educational technology. How would you characterize your experience in reading this chapter? What might be done to improve your learning experience with regard to this chapter?
2. Think about what element is most important for a meaningful learner experience. Which element of this chapter has been most meaningful to you? Why? Of the five elements discussed above, which of them can you identify in this chapter?
3. Choose a type of educational technology according to four categories (tools, resources, environments, and methods) of the educational technology discussed in this chapter. Pick a technology with which you are familiar. Identify the elements of the learner experience involving educational technology and also indicate relevant principles to guide design, development, and effective use of the technology.

6.1 Introduction

In Chap. 5, the essential points of user experience were introduced. Learner experience is a notion derived from user experience in software engineering and is a kind of general experience. The subject of a learning experience is the learner, just as the subject of a user experience is the user. Learner experience is important to instructional design and the development and refinement of learning environments just as user experience is important for software design, development, and refinement (Dutton, 2017). Effective learner experiences result in engaging and memorable educational experiences. In fact, learner experience is a key factor in keeping instructional design relevant. There is now a great variety of learning technologies as well as many different learning environments, learning spaces, and learning situations available to designers and developers. While many people are involved in designing, developing, and deploying these technologies, in this chapter, the focus is primarily on learners' experiences with these technologies, as those experiences have implications for design, development, and deployment.

For more than a hundred years, the classroom has been a major element in support of teaching and learning processes. A typical classroom is designed to accommodate various things such as chairs, desks, shelves, cabinets, a blackboard or whiteboard, and audiovisual equipment (Udin & Rajuddin, 2008). In the mid-1990s, schools began to implement programs to bring digital technologies into classrooms. These technologies included desktop computers, laptop computers, interactive whiteboards, digital projectors, Internet access, productivity and curriculum-related software, and printers. More recently, 3D printers and virtual and augmented reality equipment have been introduced in some classrooms.

Educational technologies impact learner experience. The focus of this chapter is on determining how well technologies fit learners' needs and expectations. One issue to be elaborated is the concept of learner experience. The second issue to be elaborated is the evaluation of educational technology from the perspective of learner experience.

6.2 Experience and Learner Experience

Every day, people go to school, participate in classes and school activities, and have learning experiences. The idea that students have learning experiences seems simple enough, but what is meant by a learning experience?

We all know that a singular experience is made up of an infinite amount of minor experiences, relating to contexts, people, and products. Moreover, the experience can be divided into different stages. Please think of your experience of camping on a huge mountain, which might be made up of smaller experiences, such as seeing the trees, rivers, feeling the breeze, and you recognize it appreciated and the climb from the bottom to the ascent, during the process you have interactions with products such as one's tent and cook stove, and interactions with companions on

the trip. Moreover, when you come back from the camping, you tell the story of climbing the mountain to your peers, which you may refer it as "a terrific experience."

Often, the word "experience" and the concept of "user experience" are used during product design and development processes. We want initially to create a systemic way to talk about the experience broadly. Our understanding of existing theories of experience has led to three ways that we speak of experience: cognitive experience, an experience, and experience as a story (see Table 6.1).

Definition of Experience

The purest form of reference is **experience**, the constant stream that happens during moments of consciousness. Self-talk or self-narration is often the way that people acknowledge the passing of this kind of experience (Forlizzi & Ford, 2000). This definition is based on cognitive scientist Richard Carlson's theory of consciousness known as Experienced Cognition (Carlson, 1997). The above example mentioned that "one sees the beautiful landscapes, and feel pleasant" is an example of such experience.

Table 6.1 Three ways of understanding the concept of "Experience" (adapted from Forlizzi & Ford, 2000)

	Cognitive experience	An experience	Experience as story
Concept	The constant stream that happens during moments of consciousness The experience that required us to think about what we are doing	The experience that has a beginning and an end, and changes the user, and sometimes, the context of the experience as a result	Stories are the vehicles that we use to condense and remember experiences and to communicate them in a variety of situations to certain audiences
Example	Interactions with new products, interactions with confusing or unfamiliar environments, or tasks that require attention, cognitive effort, or problem-solving skills	Witness a story that allows us to feel powerful emotions, assess our system of values, and possibly make changes in our behavior A powerful selection of stories leading us through an experience as we read them	Experience as story plays an important role in events as diverse as legal testimony and fantasy gaming Relevance for sharing user findings with a design team of various disciplines
Representatives	Richard Carlson's theory of consciousness known as Experienced Cognition	John Dewey's *Art as Experience* and *Experience and Education*	Roger Schank's *Tell Me a Story: Narrative and Intelligence*

Another way to talk about experience is to talk about having **an experience**— what philosopher John Dewey referred to in his book Art as Experience (Dewey, 1938). This type of experience has a beginning and an end, and changes the user, and sometimes, the context of the experience as a result. **For example**, your experience of climbing the mountain. **Another example of an experience** is witnessing a story that allows us to feel powerful emotions, assess our system of values, and possibly make changes in our behavior. The University of Pennsylvania Oncolink Web site (http://www.oncolink.upenn.edu) has a powerful selection of stories written by those who have experienced cancer themselves, or through loved ones, leading us through an experience as we read them.

A third way to discuss experience is to talk about **experience as a story**, an idea that has been discussed at length by Schank (1990). Stories are the vehicles that we use to condense and remember experiences and to communicate them in a variety of situations to certain audiences. Experience as the story plays an important role in events as diverse as legal testimony and fantasy gaming. Because experience as the story is naturally communicative, it has relevance for sharing user findings with a design team of various disciplines.

At present, the definition of user experience given by ISO is widely recognized. According to the ISO. 9241-210 standard, "user experience is the cognition and response generated from the use of a product, system or service and expected use" (ISO FDIS 9241-210, 2009).

The definition of the learning experience is close to the user experience in that both involve cognitive processing and subsequent responses. Learning experiences represent the user experience from a learner's specific perspective in the interaction with an educational product or learning environment (Huang, Hu, & Yang, 2015).

Learning Experience

Learning experience is a notion derived from user experience and is also a general kind of experience that may have associated feelings and biases. The subject of a learning experience is the learner, just as the subject of a user experience is the user. Learning experiences can be understood as a variety of experiences through the learning process, and in the learning environment (see http://edglossary.org/learning-experience/).

According to the previous discussion, learning experiences can be defined as learners' perceptions, responses, and performances through interaction with a learning environment, educational products, resources, and so on. Information processing learning theory can be used to explain such a process (Anderson, Matessa, & Lebiere, 1997; see http://act-r.psy.cmu.edu/). Likewise, Gagné pointed out that the learner perceives various things and, after a series of information processes, the learner forms a conceptualization and then reacts (Gagné, 1985).

Learners' perception of learning environment mainly refers to their perception of the people and the things, including resources, tools, learning community, community education, learning styles, and teaching methods (Huang, Yang, & Hu, 2012). Perception enables a person to carry out actions in an environment (Elnaga, 2012). According to Mahlke's user experience model (2008), learner perceptions

can deepen cognitive processes and impact emotions and feelings. Perceptions can lead to follow-up actions, attitudes, and emotional experiences. A response to a learning experience can include emotional reactions and other kinds of responses.

Performance in a learning experience mainly refers to the learner's behavior, including associated constructs such as learning effectiveness, efficiency, and achievement. Learning effectiveness refers to the degree to which intended outcomes were attained; learning efficiency refers to the time and effort to attain those outcomes; learning achievement not only emphasizes the achieving intended outcomes, but includes satisfaction and other related subjective experiences, such as confidence and continued interest in the subject area.

As devices, products, software, systems, and services are increasingly included in learning, it is important to view learner experience in a holistic manner that includes all aspects of experiences. For example, in a healthy classroom learning environment, the students, teachers, and designers will be turning to concepts of sustainable design to address comfort-related issues such as hygiene, safety, acoustics, and availability of space, natural daylight and natural ventilation (OECD, 2006). For a technology-rich classroom, the learning technology in a classroom encompasses virtual technologies, such as online presence and online resources, installed appliances, such as media presentation systems, remote interaction systems, and room-scale peripherals, and mobile devices (Milne, 2006). So the learner experience in a classroom includes the experience of the learner in using furniture, equipment, devices, software systems, and services.

6.3   Elements of Learner Experience with Educational Technology

6.3.1   Categories of Educational Technology

Educational technologies can be divided into the following four categories: learning tools, educational resources, learning environments, and learning methods.

(1) Learning tools are those digital and non-digital media used for the purpose to facilitate learning through interactions between people and systems, such as learning applications, multimedia devices ("learning tools," 2017). Examples of learning tools include flash cards, mind maps, blogs, electronic dictionaries, expert systems, Web 2.0 tools, electronic performance support systems (EPSSs), mobile educational apps, table computers, and so on.

(2) Learning resources are materials that can be used to support teaching, learning and research, such as textbooks, course readings, and other learning content. Examples of learning resources include educational video clips, open educational resources, massive open online courses (MOOCs), and online libraries and repositories.

(3) Learning environments refer to the diverse locations, contexts, and cultures in
     which students learn, such as classroom, cyberspace (Learning Environment,
     2013). Learning environments include traditional classrooms as well as online
     learning management systems.
(4) Method is "a way, technique, or process of or for doing something". (Definition
     of Method, n.d.) Learning method stands for the way of presentation of the
     specific contents of a subject that may be properly grasped and understood by
     learners. Examples include drill and practice, memorization, inquiry-based
     learning, collaborative learning, competency-based learning, and so on.

6.3.2   Principles for Meaningful Learner Experience with Educational Technology

Learner experience with educational technology includes learners' perceptions,
responses, and performances of the learning environment, resources, and methods.
The structure and elements of user experience can reveal the connotation and
extension for the definition, which could enlighten us the structure and elements of
learner experience with educational technology. Morville (2004) proposed a con-
ceptual framework called user experience honeycomb (see Chap. 5) to describe the
elements of user experience in designing Web sites.

   In order to create a meaningful and valuable user experience, the information in
a Web site should be:

(1) Useful: the content should be original and fulfill a need;
(2) Usable: the Web site should be easy to use;
(3) Desirable: image, identity, brand, and other design elements should evoke
     desirable emotion and appreciation;
(4) Findable: the content should be navigable and locatable onsite and offsite;
(5) Accessible: the content should be accessible to people with disabilities;
(6) Credible: users should trust and believe what they see, hear, or read; and
(7) Valuable: the Web site should deliver something valued by the user.

   Rubinoff (2004) also proposed that user experience was made up of four inter-
dependent elements: branding, usability, functionality, and content. Branding
includes all the aesthetic- and design-related items within a Web site. Branding
refers to the site's projection of the desired organizational image and message.
Functionality includes all the technical and behind-the-scenes processes and
applications. It entails the site's delivery of interactive services to all end users, and
it is important to note that this sometimes means the public as well as adminis-
trators, instructors, and learners. Usability entails the general ease of use of all site
components and features. Subtopics beneath the usability banner can include
navigation and accessibility. Content refers to the actual content of the site

(text, multimedia, images) as well as its structure, or information architecture. We look to see how the information and content are structured regarding defined user needs and client business requirements.

To help define the objectives and scope of user experience efforts, as well as enable their meaningful measurement, Guo (2012) suggested a conceptual framework that describes four distinct elements of user experience, including value, usability, desirability, and adoptability, and how they interact with one another in driving better product designs.

Learner experience in a learning environment with educational technology needs to consider classroom as an integrated system with classroom furniture, equipment and devices, software systems, and services. The four elements of user experience for products can be used to express the learner experience with educational technology. While learner experience should consider the diversity of learners in a learning environment, we use "adaptability" to replace "adoptability" to show the diversity of needs from students. Also, the physical environment factors, such as light, temperature, and acoustics, play a major role for experience. So "comfortability" is also included in learner experience. Through the above analysis, the elements of learner experience include value, usability, desirability, adaptability, and comfortability, shown in Fig. 6.1.

As shown in Fig. 6.1, value is the core element for learner experience with educational technology, which focuses on whether an educational product meets the needs of learners and whether it is effective for learning. Usability deals with the issue whether it is easy to use an educational product, services, resources, device, etc. Adaptability focuses on the flexibility of an educational technology and deals with the issue whether it adapts to learners' different needs. Desirability asks for whether an educational technology is fun and engaging for learners; and comfortability focuses on whether learners feel comfortable with the technology.
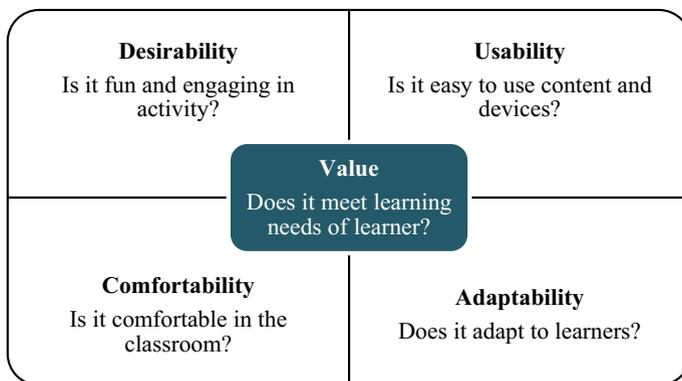

Fig. 6.1 Five elements of learner experience with educational technology

Based on the above-proposed element, in the following section, technology-rich classroom would be illustrated as an example to show what indicators should be used to evaluate whether an educational technology is suited for learning.

6.4   Indicators to Evaluate Learner Experience

Learner experience with educational technology could be designed, improved, and assessed by considering the five elements of learner experience shown in Fig. 6.1. Value is the most core indicator of learner experience, and the other four elements should support and contribute to value. Services, equipping, and furnishing are the main factors in a technology-rich classroom, of which the indicators of learner experience derived from.

Figure 6.2 depicts a technology-rich classroom at Beijing Normal University called a smart classroom, because it can adapt to the learner's needs. The learners in the picture are freshman majoring in educational technology. Learners are using their smart phones to scan the QR Code shown on the screen to get access to course resources.

Fig. 6.2 A real classroom picture with learners interacting with multiple educational devices (Original photograph used with permission)
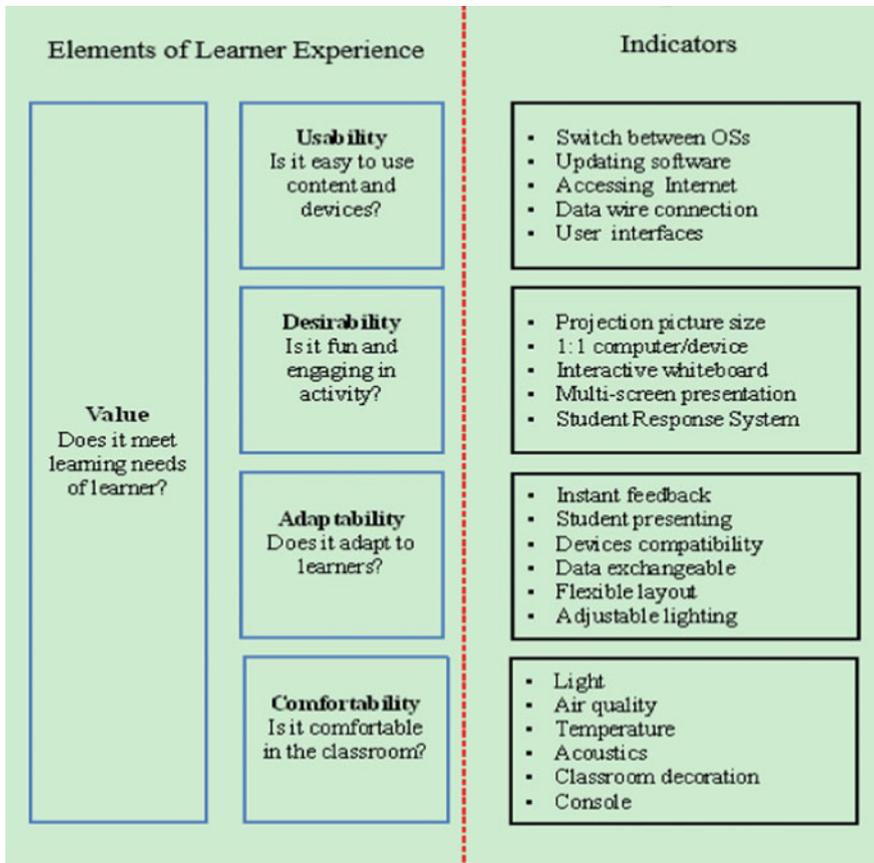
Fig. 6.3 Framework for analyzing learner experience with educational technology

Figure 6.3 presents a framework for analyzing learner experience with educational technology. The indicators proposed are suitable for the evaluation of general educational technologies, such as educational software, systems, products, devices, and educational resources and services.

6.4.1   Value—Do Learners Value the Technology?

From the holistic perspective, the value of learner experience refers to the positive or negative quality that renders the changes of the classroom, such as classroom furnishings and layout changes, the use of equipment, desirable or valuable for the learners.

What drives an educational technology's value to the student? Educational technology features must be in alignment with learning needs. If a classroom

change is designed to support learning needs, teacher and learners may consider the layout changes and equipment valuable. Learning needs encompass more than just their explicit needs—things that learner know they want, but to include learners' implicit needs—things that learners do not express as needs, which might be hidden in learning activities and be recognized by their teacher. To meet learners' unexpressed needs, educational technology should not only be easy-to-use products, such as devices and software, but also services that add much value to student learning.

6.4.2   Usability—Do the Learners Find the Technology Easy to Use?

Usability refers to the ease of use and learnability of educational technology, which is composed of:

(1)   Learnability: how easy is it for teachers and students to accomplish basic tasks the first time they encounter the educational technology?
(2)   Efficiency: once teachers and students have learned the design of educational technology, how quickly can they perform teaching and learning tasks?
(3)   Memorability: when teachers and students return to the design after a period of not using it, how easily can they establish proficiency?
(4)   Errors: how many errors do teachers and students make, how severe are these errors, and how easily can they recover from the errors?
(5)   Satisfaction: does the educational technology meet the needs of learners?

The design factors of an educational technology include systems, facilities, and software which have a significant influence on usability. Operating systems provide a software platform for the application programs to run. Microsoft Windows, Mac OS X, GNU/Linux are examples of popular operating systems being used in personal computers. Operating systems, with diverse features, provide different software to support various resources and learning activities. The facilities include devices, audio–video control system, projector, interactive whiteboard, student response system, and access to the wireless network. Software systems include learning management systems, resources providing system, and collaborative learning platform. Classroom network tools offer new possibilities for classroom interaction; they present ways of rapidly distributing information, exchanging ideas, and constructing shared artifacts that can support a variety of engaging and mathematically rich activities that would be more difficult or even impossible to implement in conventional classrooms (White, 2013). Within the context of learning tasks, a large part of desirability is attributable to innovative and recognizable design in user interface and interaction. User interface design includes well-organized navigation, nice-looking graphics, and sleek designs. Meanwhile,

interaction design includes the convenient, smooth, and multiple operations. More important, a desirable educational technology must engage the learner in their purpose of using.

Based on the above analysis, the following indicators for evaluating the usability of technology-rich classroom are proposed: (1) Is it easy to switch to another operating system? (2) How difficult is it to update the software and hardware involved? (3) Is it easy to access the Internet? (4) Are data connections available for different types of devices, such as USB, VGA, HDMI, etc.? (5) Are the user interfaces friendly and intuitive?

6.4.3   Desirability—Do Learners Enjoy Engaging with the Technology?

Desirability refers to the attractiveness and engagement of the activities in educational technology or the pleasing perception from teachers and students. A pervasive goal in education is to engage students in learning so that they are attentive and mindful (Lavigne & Mouza, 2013).

Engagement involves three dimensions (Fredricks et al., 2004):

(a) behavior (e.g., participation in activities such as the number of times students interact with virtual world characters, embedded tools, objects),
(b) cognitive-motivational (e.g., putting forth the effort, the belief of competence in the content area or self-efficacy, desire to be optimally challenged),
(c) emotions (e.g., interest, curiosity, sense of belonging, and affect). Engagement in an educational technology depends on the content presentation methods, the digital resource, software systems, and interactive design.

Vahey et al. (2013) listed four key benefits when using dynamic-representation technologies in mathematics classrooms: (a) providing rich representations for the student to understand some difficult concepts, (b) providing an opportunity for the student to focus their attention on the same point, (c) supporting the utilization of narrative as a type of representation, and (d) engaging students in the class. Dynamic-representational environments have also been shown to increase student engagement in mathematics. In order to promote young children's collaborative communication and thinking skills in science learning activities, Kershner et al. (2010) suggested that the interactive white board can be used collaboratively in a variety of science activities closely related to common classroom practice, for that whiteboards provide the opportunity for children to interact with learning content, and it can satisfy the needs of more desirable vivid interaction for children.

The indicators for desirability in a technology-rich classroom could address the following questions: (1) Does the size of projector screen match the classroom? (2) Do 1:1 computers/devices match the content? (3) Do interactive whiteboards match the activities? (4) Is the content presented on the screen using multi-screen technology? (5) Does the student response system provide active learning?

6.4.4 Adaptability—Do Learners Find the Technology Personally Adaptive?

Adaptability of an educational technology deals with the diversity of students and their learning preferences which result in a need to treat learners as individually as possible. Room layout should be flexible to meet the teacher's instruction and learner's collaboration; a software system should adapt to learning styles of the learners; and physical environment factors, such as lighting, temperature, and ventilation, should be adjusted to suit learners.

Hill (2008) recognized that flexible, modern learning environments have potential to encourage students to participate in activities with peers as they acquire knowledge for themselves. About classroom layout, Lippman (2002, 2003) in studies of schools mentions that providing a variety of spaces within a single classroom may support child–adult/student–teacher interactions. Jamieson (2007) recognized that formal spaces such as lecture theaters, classrooms, and laboratories should have flexible layouts which support a diversity of teaching and learning approaches, although this is not always affordable or feasible.

From the above analysis, combined with the emerging technologies and the main furnishing elements, we propose these questions for evaluating the adaptability of technology-rich classroom (1) Does the software system provide instant feedback? (2) Can students present and share their learning outcome easily? (3) Are the systems compatible with common devices? (4) Do data between the student and teacher change easily? (5) Is the classroom layout flexible for different learning activities? (6) Can the lighting system adapt to learners needs and available daylight?

6.4.5 Comfortability—Do Learners Feel Conformable with Educational Technology?

Comfortability with educational technology focuses on providing physical and emotional well-being experience to learners when they are using educational technology, i.e., the user interface and environmental conditions consisting of various elements such as temperature, humidity, noise, thermal, air pressure, ventilation, air quality, acoustic, dust, vibration, lighting, airflows, radiation, and so on.

Due to the increased use of media and technology in classrooms, the design of easy-to-use, adjustable lighting systems is more critical than ever. Lighting needs to be designed to the standards proposed by Illuminating Engineering Societies and the National Electrical Code's current recommendations. Lighting should be designed to meet the special program requirements for each instructional space (Clabaugh, 2004). Also, some studies show that the following factors are important design considerations:

(1) Indoor air quality—mold and airborne bacteria have adverse effects on children's and teachers' health.

(2) Temperature and humidity—creates conditions which lead to Sick Building Syndrome, related absenteeism, and lowered mental acuity.

(3) Ventilation and airflow—is an occupational health and safety issue because children require more air than adults. Studies indicate that airflow from windows is inadequate in schools to remove or prevent the buildup of carbon dioxide. Poor airflow leads to poor performance of tasks.

(4) Thermal comfort—there is an optimum temperature for learning, retention, task performance, and job satisfaction.

(5) Acoustics—good acoustics (quality rather than the amount of noise) are fundamental to academic performance.

(6) Building age, quality, and aesthetics—affect student and teacher perceptions of safety and well-being. Building age is not as important as the quality of construction conditions. Students perform better in modernized or new environments, but it is hard isolating mediating factors, and therefore inconclusive.

(7) Furniture, carpets, dampness, and pollutants can lead to health problems such as asthma (see, for example, Filardo & Vincent, 2010).

(8) Based on the critical factors for comfortability, the following indicators for evaluating the comfortability in a technology-rich classroom are proposed: (1) Does the lighting system support reading healthy? (2) Does air in the classroom meet the air quality standard? (3) Is the temperature in the classroom suitable for learning? (4) Does the classroom have good acoustics? (5) Does classroom decoration meet the students' preference? (6) Is the learning device easy to operate?

Key Points in This Chapter

(1) With the fusion of technology, pedagogy, and space, learner experience with an educational technology gradually became essential for ensuring students' engagement and performance.

(2) Learning experiences can be understood as learners' perceptions, responses, and performances through interaction with the learning environment, educational product, resources, and so on.

(3) Value, usability, adaptability, desirability, and comfortability are the five elements in educational technology that will influence learner experience, which should be considered when build or rebuild learning space.

(4) Learner experience will change when the furnishing (providing an audiovisual system, computers, devices, and software) and equipping (decorating classroom and changing layout) in educational technology changed, and service was one of the most key factors for improving learner experience with educational technology.

Learning Resources

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