A Framework of Learning Activity Design for Flow Experience in Smart Learning Environment

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Abstract. With the progress of technology, the smart learning environment focusing on technology enhanced learning has been concerned by more and more researchers. By combining the key elements of smart learning environment with flow theory, this study proposed a framework of learning activity design that can be applied in smart learning environment. It is hoped that the framework could increase the chance of the appearance of flow experience in the learning process of smart learning environment. They could obtain an enjoyable learning experience as well as enhance their immersion and engagement. Hence, learners would learn pleasantly and effectively in the activity, thus promoting their personal development.

Keywords: Learning Activity Design ; Flow Experience ; Smart Learning Environment.

1 Introduction

There is a great deal of literatures on the study of teaching strategies based on Smart Learning Environment (SLE). In current situation of SLE, Li et al., [1] found that learning experience in SLE becomes more visualized and abundant. However, Gong et al., [2] found that learners in primary SLE have six non-engagement behaviors such as "gain advantage by trickery", distraction, change of learning goals, out of focus, careless, laziness and cheating. In 1982, Pace [3] found that learners with high learning engagement were more likely to obtain high achievement and diagnostic for understanding various relationships. Shi and Salamonson et al., [4,5] also believed that learning engagement can influence learners' ability to get knowledge and self-

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learning, and then influence learners' development. Therefore, the study of learners ' experience and learning engagement in SLE is in the request of the digital generation learners, and it is also an important direction of SLE in the future for a long time [2]. The focus of learners' learning experience and engagement is to enable teachers to make full use of the advantages of SLE to design appropriate and effective learning content and learning activities. Consequently, learners can devote themselves to a learning space with the intelligent technologies. They could also study enjoyably and effectively, and then promote their personal development.

It has been a long time since the appearance of flow which focus on learners' experience. Many scholars have done a lot of research based on Csikszentmihalyi's study, including the application of flow in the field of education [6,7]. Qin [6] found that flow can effectively solve or alleviate the contradiction and improve learning performance. Qian [7] also proved that flow experience can improve learners' cognitive ability, language ability and communication competence in some degrees. Flow experience is an enjoyable experience with deep concentration which would make learners ignore external interference, enjoy the enjoyment of the learning task in classroom. Hence, the theory of flow is also widely used in educational games [8,9]. Kiili [8] hold that the aim of educational games was to facilitate learners' experience so that learners would be engaged to activities to enhance learning. In another empirical study, Li et al., [9] chose an educational game based on the knowledge of security first aid, it was also found that there was a significant positive correlation between flow experience and learning performance.

Through the previous studies of SLE and flow experience, it is found that the aim of both them are to enhance learners' learning experience and promote learners' learning performance. There seem have many literatures about SLE and flow experience, but the effect of improving learners' learning experience is not significant. In order to solve the problem of low immersion and low engagement of learners in learning activities, we combine the six elements of SLE (Learning resources, Intelligent tools, Learning community, Teaching community, Learning style and Teaching method) [10] with the three antecedent conditions of flow experience (Goals, Feedback, Skills match challenges) [11,12] to design a framework of learning activities, hoping to effectively meet the learners' demand for learning experience and high engagement. As a result, learners could make full use of the convenience provided by educational technology tools in SLE, eliminate the interference from external, focus on the value of activities themselves, and get an enjoyable and involved learning experience.

2 Literature Review

2.1 Flow Experience

The conception of flow was originally presented by Csikszentmihalyi in 1960. Through a study of a few hundred experts, artists, athletes, musicians, chess masters

and surgeons, Csikszentmihalyi discovered that they are almost engrossed in their work, ignoring the passage of time and the surrounding environment, fully involved in the context with deep concentration. Csikszentmihalyi (1990) has described flow as follows: *"Flow is the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it."*

Csikszentmihalyi described eight conditions of flow in 1990 [11] and later updated it to nine [13]: 1) Goals Are Clear; 2) Feedback Is Immediate; 3) Skills Match Challenges; 4) Concentration Is Deep; 5) Problem Are Forgotten; 6) Control Is Possible; 7) Self-Consciousness Disappear; 8) The Sense of Time Is Altered; 9) The Experience Become Autotelic. Novak et al., [12] summed up first three conditions which considered to be the antecedent conditions to generate flow experience. In the subsequent empirical research, some scholars [14-16] proved that these three antecedent conditions have an important influence on learners' ability to get flow experience and achieve better learning performance. So, we're going to describe flow mainly from these three antecedent conditions.

- Goals Are Clear & Feedback Is Immediate

One of the things that people will feel happy about when they really get into something is that they know very clearly what they have to do from one moment to the next. Clear goals help to make learner's actions more involved in the task and increase the chance of the generation of flow experience. However, a clear goal is not enough, learners also need to know what they are going to do, whether they are doing the right thing, and whether there is a need to correct their practices and behavior. Consequently, teachers need to immediately feedback to learners of their learning condition. It's because of the clarity of goals and immediate feedback that the attention keeps getting carried and focused. If learners do not get feedback and do not know how well they are doing, then they might start getting distracted. Their mind has a chance to pay attention to other things because it doesn't have to monitor the information coming back [13].

- Skills Match Challenges

To achieve a better learning performance, learners need to be provided challenges that match their existing skills. Csikszentmihalyi said that if the degree of challenge is much higher than the level of skill [13], learners may feel a sense of strain, and the effect would be less than expected. Learners would likely generate a sense of anxiety, thereby reducing the immersion and engagement of learning and motivation to continue learning. And then they may begin to distract from other issues unrelated to this task. Conversely, if learners were provided a learning task that is lower than their skill level, they would finish it quickly with little think and little time and after a while they would feel bored, begin to distract and lose their desire to continue

learning. Because a learner thought his/her skills was not being used, that there was no opportunity for him/her to express his/her skills. A research by Tuss [17] shows that only when the degree of challenge is equal to or slightly higher than the level of skill, learners' quality of subjective experience would be optimal and then generate flow experience, finish the task with enjoyment and deep concentration.

The three antecedent conditions for the appearance and generation of flow experience are to drive learners to be highly involved in the learning process, concentrate on the tasks and then learn more new knowledge and skills. In this process, learners' behaviors and consciousness are integrated, they only respond to the clear goals and definite feedback of the activity, and generate a sense of potential control through the manipulation of the environment. They concentrate deeply and devote themselves to what they are doing, generating an enjoyable learning experience while acquiring knowledge and skills. In this experience, learners are able to filter out external obstacles, disappear from self-consciousness, alter the sense of time and their experience become autotelic.

2.2 Smart Learning Environment（SLE）

Smart learning environment is also known as a learning environment with intelligent or educational technologies. For its definition and characteristics, different scholars from their own point of view put forward different ideas. Huang et al., [10] believes that SLE is a learning place or activity space that can perceive learning scenarios, identify learners' characteristics, provide appropriate learning resources and convenient interactive tools, automatically record the learning process and evaluate learning results, so as to promote learners ' effective learning. Huang combined the views of scholars [19-22] and the condition of using technology enhanced learning, concluded that SLE is mainly composed of learning resources, intelligent tools, learning community, teaching community, learning style and teaching method. Jelena Jovanović et al., [18] hold that SLE can be broadly defined as computer-based educational systems that rely on diverse Artificial Intelligence (AI) techniques to improve learners' learning experience, and help them reach their learning objectives.

The "Smart" in the Smart learning environment is mainly embodied in using intelligent technologies to support learners' learning and practice [23]. In SLE, teachers can provide learners with abundant learning resources through the network and various intelligent devices, record learners' learning conditions and behaviors data and then send to cloud. The intelligent technologies can facilitate teachers to design appropriate learning content and activities according to learners' data, and provide them with immediate guidance and feedback and make individualized learning possible. At the same time, learners can use the synchronous communication tools such as QQ, WeChat and Skype, and asynchronous communication tools such

as Weibo, Facebook and virtual learning community to actively participate in learning activities. In addition, teachers can use augmented reality technology to create a real context, so that learners can involve themselves and enhance their learning motivation and interest. Now, we have various intelligent tools that teachers can choose according to learning content to promote learners' performance and enhance learning experience.

3 Framework of Learning Activity Design

3.1 Proposed Framework

Based on the above theories, this research proposes a framework of learning activity design by considering the flow experience in smart learning environment. As shown in Figure 1.

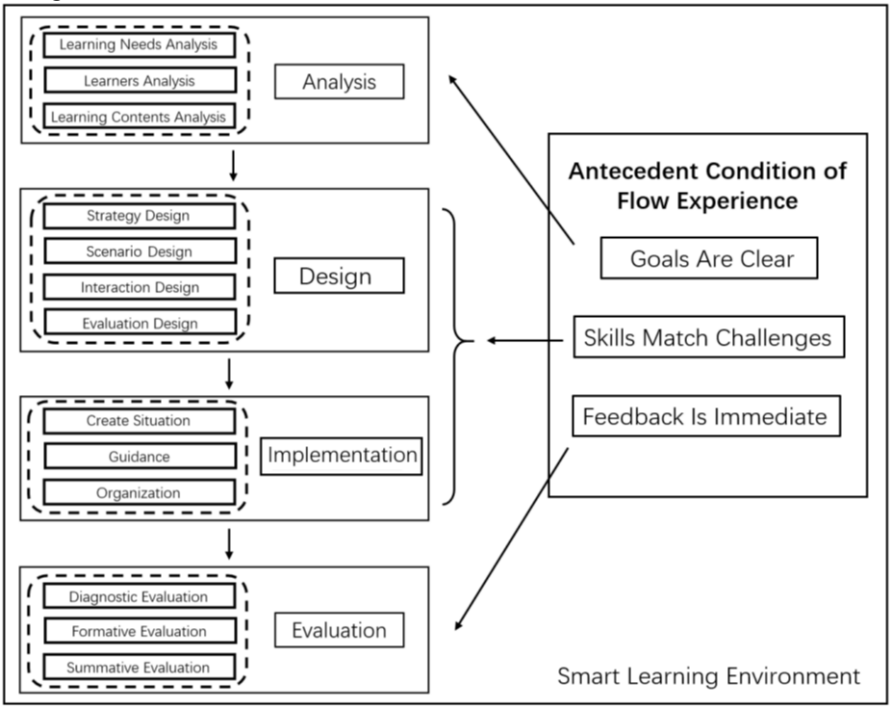

Fig. 1 Framework of Learning Activity Design

By combining the actual analysis with the flow experience, this framework restores the four steps that teachers should pay attention to in teaching, analysis, process design, implementation and evaluation. This study mainly illustrates the teaching

process, which aims to achieve the optimization of teaching effect by analyzing and combing the interaction and activities between two major elements in the process of learning, as shown in Figure 2, and designing the new teaching mode under the perspective of flow experience. There will be a detailed explanation of Figure 2 In the next paragraph.

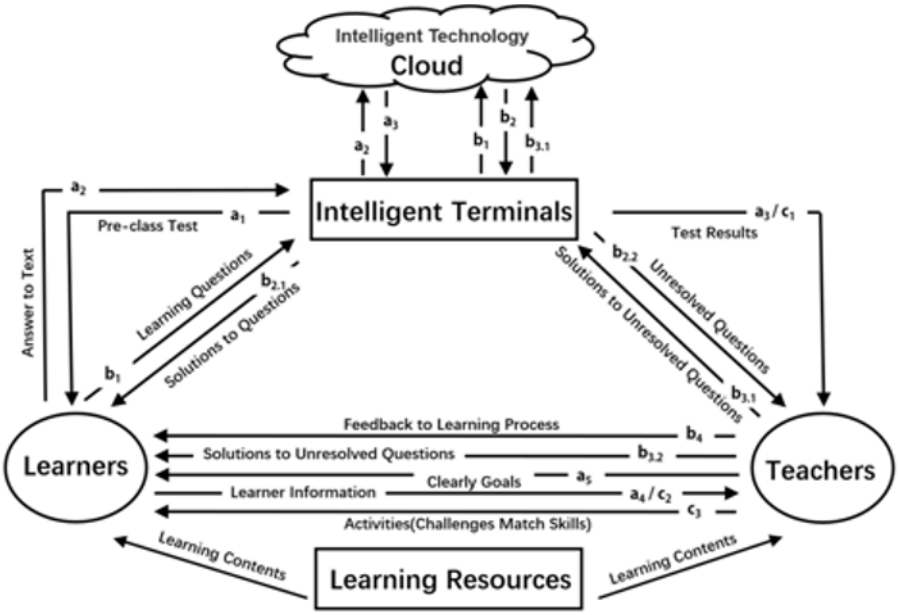

Figure 2 Learning Processes in Proposed Framework

3.2 Interpretation of the proposed framework

In order for learners to have a flow experience in SLE, there are generally three conditions, A Clear Goal, Immediate Feedback, and Skills Match Challenges. Through the actual teaching process of teachers, the four teaching steps to be carried out are combed out.

Analysis. The first step is three analyses, which include learning needs, learners and learning contents. The learning needs analysis is to analyze the knowledge the learners already have and the syllabus the learners will learn in order to reduce the gap between them. In the learner analysis, intelligent terminals would send a pre-class quiz (Figure 2, a_1) to learners when they start to learn a course in SLE. Once the learners finish the quiz and then submit their answers (a_2), which would be sent from terminal to cloud. (a_3). Subsequently, the test results would be analyzed and deliver to teachers via cloud-based technology. Based on the analyzed results (a_3) and the observed learners' behavior information in SLE (a_4) including learning

interests, learning styles and learning willpower, the teacher will obtain a personalized report and characteristics about the learners. According to learner's personality characteristics, teachers could divide learners into different groups, so as to provide individualized teaching services for them. Final, teachers could combine the syllabus with textbook contents to analyze the difficult and important points of course in the learning contents analysis. Combining above three analyses with learners' personalized characteristics in SLE, teachers could formulate different learning goals for learners of different personality (a_5).

Design. Teachers would set a clear goal matching different learners after three analyses, then the design step becomes the next key point which mainly includes the design of strategy, scenario, interaction and evaluation. In the strategy design based on the learning contents analysis, learner's learning ability as well as other factors, learning contents would be divided into different levels in order to provide personalized teaching strategies. By the way, the level here needs to be divided carefully by teachers. Skills match challenges, which is the second condition of generating flow experience, is essential and indispensable point in learning activities design. It would directly determine whether the teaching strategies are appropriate, whether learning goals are suitable and whether learners are immersed and involved. Based on the pre-test results (a_3/c_1) and learners' information (a_4/c_2), teachers could design a series of learning activities that meet learners' ability on the basis of a balance in challenges and skills (c_3). In the scenario design, teachers need to combine the above designed learning strategy with learner's individual characteristics in order to design a scenario which is matched with specific learning contents. In this situation, every learner has his/her suitable role to engage the learning activity. Immediate feedback, which is the third condition of generating flow experience, is essential and indispensable for learners to interact with other participant in a timely and effective manner. In a process of learning, learners' questions could be transmitted through intelligent terminals to the Cloud (b_1). Then, intelligent technologies in cloud would summarize and find the answer immediately, and then feedback learners via the terminal (b_2). It may cause two branches for this case. First, if there have already existed answers for the question in the cloud, it would transmit the answers directly to the learner ($b_{2.1}$) through intelligent terminals to meet the request of feedback in the timeliest manner. Second, when it comes to a question that could not be solved by searching answer in the cloud, the cloud would send it to the teacher ($b_{2.2}$). After the teacher has solved the question, he/she would return the solutions and techniques of the question to learners ($b_{3.2}$) and storage it in the cloud ($b_{3.1}$) as well. At the end of the process design step, the evaluation should be designed, which will be illustrated in detail in the evaluation.

Implementation. Completed the analysis and design step, teachers could create interesting learning scenarios in SLE, such as a game. These scenarios would guide and organize learners to learn by integrating relevant information, and recording the

teaching process if the learners have a new problem, then teachers can feedback to learners' questions or correct their misunderstandings immediately.

Evaluation. The evaluation step has a role that cannot be neglected. It can be divided into three parts according to time lapse: diagnostic evaluation, formative evaluation and summative evaluation. The results of diagnostic evaluation in this framework will be transmit to teachers to make learning goals, design teaching strategies and realize individualized teaching services. Formative evaluation will be carried out in the teaching process, teachers could find the learner's problems and then feedback them immediately. Summary evaluation could be a periodic summary of each class or each week, each month or the school year, etc. The purpose is to enhance learners' learning performance.

Based on the above four steps for learning progresses using flow experience in SLE, the design of learners' learning activities and teachers' teaching activities are having strong interactions and relationships. All of steps interact and influence each other to jointly improve learners' learning experience and enhance their performance.

4 An Example for this Framework

The following is an example of the learning activities for role-playing game in a mathematic course about addition and subtraction.

A teacher will give a math quiz to the learners by intelligent terminal for diagnostic evaluation while the learners start learn addition and subtraction in their learning environment. The purpose of this work is to identify learners' prior knowledge and cognitive status of learners. Meanwhile, it can also understand other individual learning characteristics of learners by observing learners and recording the results of one-to-one conversations. Then, the information will be sent to the Cloud, and then it will form a report of individual characteristics for learners. For one situation, according to the report, the teacher may know some of learners already have the ability to understand the number, know that which number is bigger or smaller, some could do simple addition operations, and some could do both addition and subtraction operations. According to the results of this difference ability, the learners could be divided into three groups. The teacher would formulate suitable learning objectives for different groups. For the first groups, learners do not perform addition and subtraction well, the main goal of learning is to perform simple addition operations. For the second group, learners who have learned to add operations better, learning goal for them is to more focus on the subtraction operations. For the third group, learners who could use both addition and subtraction operations, the learning goal is to provide some mixed and complex operations with addition and subtraction. Such different learning goals can meet the various levels of learners. At the same time, the

clear goals can let the learners clearly know what learning achievement they need to achieve after the class.

Then, it is easy to create a game-like scenario which is similar to Sim City game. In this scenario, learners play different roles to learn addition and subtraction. There may have three types of roles that learners could choose: supermarket bosses, consumers and bank clerks. We assume that the supermarket bosses only need to sell the goods and make money without consuming process, which means the bosses only do the addition operation. Then, the learners who have to learn the addition operation will be assigned to this role. For the second role, we assume that the consumers have a certain wealth. They would consume money in the supermarket, so that the learners who have to learn subtraction will be assigned to this role. It means that the role of consumers is only to do the subtraction operation. For the role of bank clerks, the learners who will learn complex operations will be assigned for doing both of addition, subtraction and mixed operations. Obviously, it will attract the learners' interest by creating the game-based learning scenario, and matching different skills and challenges, which may help the learners to generate the flow experience in their learning processes.

The evaluation process can be based on the different roles of learners, such as the learners who play supermarket bosses can evaluate them by comparing the incomes. The learners who plays the consumer can check their own remaining money to see if there is any money are miss calculated because of the incorrected arithmetic in the game. The learners who act as bank clerks can be evaluated them by comparing the number of trades and the correction of calculations.

5 Conclusion

From the perspective of flow experience, this study considers the steps of learning activity in the smart learning environment and then propose a framework of learning activity design for flow experience. An example of teaching addition and subtraction in a mathematic course is designed to use this framework into a game-based learning scenario. For the future study, we will provide further evidences to prove this framework could really help the learners to gain a good flow experience as well as guide teachers to design their activities with flow experience in a smart learning environment. This study is just a theoretical framework, not a practice. We and follow-up researchers could conduct empirical research based on this framework to find more evidence to prove the significance of our research in learning activity.

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