Lecture Notes in Educational Technology

Maiga Chang · Elvira Popescu ·
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Foundations and Trends in Smart Learning

Proceedings of 2019 International Conference on Smart Learning Environments

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Preface

Smart learning environments are emerging as an offshoot of various technology-enhanced learning initiatives that have aimed over the years at improving learning experiences and outcomes by making learning more efficient through creating learning space and atmosphere that meet the individual needs of learners, while still enabling learners to access digital resources and interact with learning systems at the place and time of their choice.

The concept of what constitutes smart learning is still in its infancy, and the International Conference on Smart Learning Environments (ICSLE) is organized by the International Association on Smart Learning Environments and has emerged as the platform to bring together researchers, practitioners, and policy makers to discuss issues related to the optimization of learning environments to enhance learning. The focus is on the interplay of pedagogy, content knowledge, technology and their interactions and interdepencies towards the advancement of smart learning environments.

ICSLE will facilitate opportunities for discussions and constructive dialogue among various stakeholders on the limitations of existing learning environments, need for reform, innovative uses of emerging pedagogical approaches and technologies, and sharing and promotion of best practices, leading to the evolution, design and implementation of smart learning environments.

The focus of the contributions in this book is on the challenges and solutions in smart learning and smart learning environments that researchers have faced and proposed. Various components of this book include but are not limited to:

- Assessment in smart learning environments
- Innovative uses of emerging and existing technologies
- Learning analytics, technologies and tools to support smart learning environments.

ICSLE 2019 received 45 papers, with authors from 16 countries. All submissions were peer-reviewed in a double-blind review process by at least 3 Program Committee members. We are pleased to note that the quality of the submissions this year turned out to be very high. A total of 10 papers were accepted as full papers (yielding a 22.22% acceptance rate). In addition, 9 papers were selected for presentation as short papers and another 7 as posters.

Furthermore, ICSLE 2019 features joint activities with US-China Smart Education Conference and presents 3 distinguished keynote presentations. An Ed Tech Ascend Pitch Competition, a tutorial on Observational Studies and Learning Analytics and a panel of Academia-Industry Collaboration are also included in the program. One workshop is also organized in conjunction with the main conference, with a total of 2 accepted papers (included in this volume).

We acknowledge the invaluable assistance of the 62 Program Committee members from 23 countries, who provided timely and helpful reviews. We would also like to thank the entire Organizing Committee for their efforts and time spent to ensure the success of the conference. And last but not least, we would like to thank all the authors for their contribution in maintaining a high quality conference.

With all the effort that has gone into the process, by authors and reviewers, we are confident that this year's ICSLE proceedings will immediately earn a place as an indispensable overview of the state of the art and will have significant archival value in the longer term.

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Contents

A framework for designing an immersive language learning environment integrated with educational robots and IoT-based toys

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Abstract. In view of the benefits of and success in acquiring multiple languages in an immersive learning environment while young, this research aims to create an immersive language learning environment for young children to acquire multiple languages utilizing robots and IoT (Internet of Things) -based toys. This paper presents the results from the first two stages of this project aiming to develop a design framework to guide the development of such an immersive environment. Our extensive review of the relevant literature indicates that the framework should, at least, consist of five main pedagogical considerations: language input, activity design, interaction design, toy design and robot design. In each of the five dimensions, a number of key factors should also be addressed in creating an effective learning environment. The development of the design framework is to serve as a road map providing design principles and guidelines for educators and researcher to create an immersive learning environment.

Keywords: Design framework. Educational robot. IoT-based toys. Immersive language learning environment

1 Introduction

Being multilingual offers benefits beyond communication. A large body of research in language education has been devoted to learning a foreign or second language. These studies have proposed important pedagogical strategies and have demonstrated the learning benefits obtainable by with the support of technology. But learning a second language through such a conscious learning process [1, 2] is known to result in less accuracy and lower proficiency in comparison to acquiring one's own native language [3-5]. Consequently, many have investigated the advantages of acquiring multiple languages the same way as learning a mother tongue when young.

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Immersion education is an educational model in which the target language is used for instruction in the class for students to learn specific subject matters. The purpose of immersion education is to immerse young children in a target language and culture, providing them with opportunities to use the target language as a pathway to become bilingual. In actuality, however, most children lack access to an immersive multilingual environment during their critical period of language development. Moreover, creating an immersive language environment for young children in a non-target language culture is challenging in many aspects.

This study proposes to create an immersive multilingual environment utilizing robotic and IoT technology for preschool children, who are in the critical period of language and cognitive development, to become bi- or multilingual. As studies have pointed out that play is essential to toddlers' daily life and that play has significant positive effects on enhancing children's cognitive development, including language skills [6-8], it is proposed that the immersive language environment be implemented in a play scenario at home. In such an environment, while children play with their toys, the robot plays the role of a companion or a caregiver, interacting with the children and providing linguistic feedback as parents would do, but in a target language.

However, the development of an immersive language environment is complicated in that many factors need to be taken into consideration. Therefore, the need for a comprehensive design framework is urgent. The purpose of this study is to develop a design framework for young children's immersive language acquisition through incorporating robots and IoT-based toys. In this study, literature reviews on five important areas concerning children's cognitive and language development have been carried out, to identify critical design factors, to propose a design framework and some key design guidelines. This study aims to answer the following questions:

Q1: What are the dimensions that should be taken into consideration in designing an immersive learning environment through the incorporation of a robot and IoT-based toys?

Q2: What are the factors at play in each dimension?

2 Method

This study adopts a design-based research (DBR) approach for the development of the framework. We have completed phase 1, in which we identified the practical issues in acquiring a second language and the need for an immersive language learning environment. We are now in phase 2, proposing a design framework for immersive language learning utilizing robots and IoT-based toys This framework will be evaluated in an iterative cycle of testing and refining in phase 3 and 4. However in this paper, we will focus on phase 1 to 2 only, that is, needs assessment and development of the design framework.

This study collected data regarding the design factors and principles though literature review on language acquisition, children's language development, children's cognitive development, robot-child interaction, child-toy interaction and immersive language education. The data were categorized by three researchers.

3 Preliminary results

3.1 Results of research question 1

Figure 2 shows that the framework has learners' needs and characters as its core, which include age, gender and cognitive style and capacity among others. The five dimensions to be considered are all centered around learners' needs and characters. They are: language input, activity design, interaction design, toy and robot design. The immersive language learning environment is proposed to be designed in the following order: selecting the application domain (language input), designing learning content including activity and interaction, and designing hardware that is, toys and the robot.

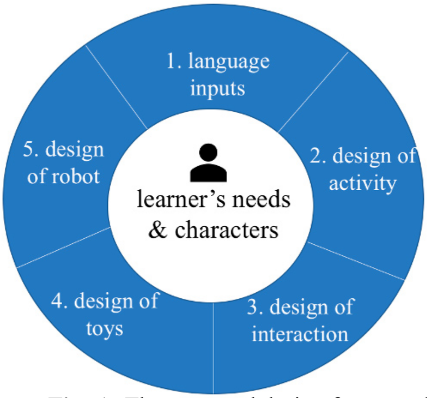

Fig. 1. The proposed design framework

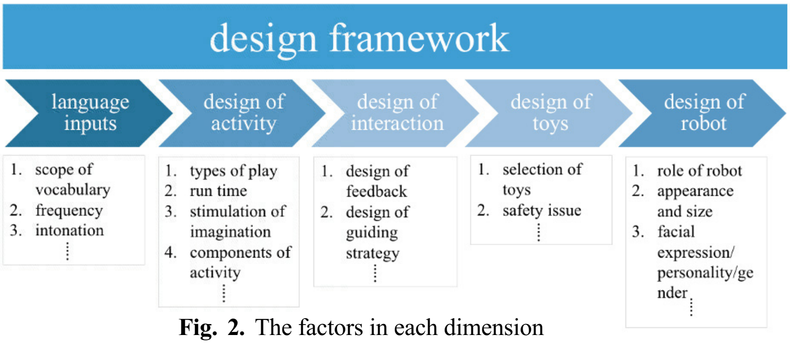

Fig. 2. The factors in each dimension

3.2 Results of research question 2

Figures 2 shows the main dimensions of the framework and the main factors in each dimension. Language input includes the following factors such as scope of vocabulary, the input frequencies and intonation. The activity design could include the principles and factors that contribute to the design of a successful learning activity, including selecting types of play that fit learners' cognitive development, how long the run time should be, the important components to be included in the activity. Interaction design concerns with the principles that help to engage learners in interacting with the robot and the toys. Design of toys should consider the selection of toys and principles for hardware and software selection and design. The design of the robot should focus on the roles of the robot, the appearance, size and facial expressions in relation to the different roles that the robot is going to play. All the above considerations should be informed by learners' needs and characteristics.

4 Conclusion remarks

The research presented in this paper is still in the developmental stage, and more research is underway to explore other factors that facilitate or impede such a technology-supported immersive language environment. Further data will be collected when this framework is implemented, to facilitate the cycle of testing and refining.

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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