Doctoral Colloquium—The Relationship between Presence, Flow and Interest in Immersive Learning Applications for Higher Education

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Abstract. Interest can be an important factor influencing the success of a learning application. It can be defined as "psychological state characterized by focused attention, increased cognitive and affective functioning, and persistent effort". This definition shows some similarities with the concepts of flow and presence, both of which can occur in immersive applications. This would make immersive media a perfect fit for learning applications. In order to investigate the advantages of immersive media for learning this doctoral colloquium paper presents a research plan for investigating the relationship between the concepts of flow, presence and interest in immersive learning applications and how this relationship may vary between different applications.

Keywords: Presence, Flow, Interest, Higher Education.

1 Introduction

In the last years virtual reality (VR) has become more and more prevalent in education. It has been shown to have several different ways in which it can benefit learning [8]. One of the most important benefits is it can increase interest in learners. Interest has been shown to have a positive effect on learning outcomes [18]. One of the characteristics of interest is focused attention on a task [2]. This shows some similarities to the concept of flow where one is completely absorbed in a task as well as presence which is an important factor for the experience of VR. These similarities may indicate that there is a strong relationship between those concepts. That would mean that immersive learning applications could increase the users' interest by enhancing their presence and flow.

Understanding how these factors interact could help to define guidelines on how to design immersive learning experiences, that can not only convey their learning content but also increase learners' motivation by fostering interest. While there already is some research investigating the relationship between some of these variables, there currently is not enough research looking at how all three factors influence each other. Therefore, we present a research plan for systematically investigating the following research question:

"What is the relationship between presence, flow and situational interest in immersive learning applications for higher education?"

This plan includes multiple studies testing different applications for a variety of subjects with university students measuring presence, flow and situational interest.

2 Related Work

2.1 Interest

Interest in general can be defined as "a psychological state characterized by focused attention, increased cognitive and affective functioning, and persistent effort" [2]. This state has already been shown to increase learning outcomes [18].

Different types of interest can be differentiated. Individual interest is a person's predisposition to focus on certain activities [16]. Topic interest which is interest in a specific topic and can be affected by learners' individual interest as well as situational interest [1]. Situational Interest is defined as interest, which is evoked by certain features or characteristics of stimuli [14] Situational interest can be helpful when teaching about topics that students do not have much individual interest in [5].

Since the goal of this research is to find out how immersive learning applications need to be designed to increase interest, it makes to focus on the type of interest that can be invoked directly by these applications. That is why in this research design we primarily focus on situational interest.

2.2   Flow

Flow is a concept that was first defined by Csikszentmihalyi in 1990 [7]. It is a state of being completely absorbed in an activity which also affects one's perception of time [12]. This has similarities to the "focused attention" mentioned in the definition of interest and may indicate a relationship between both variables.

2.3   Presence

Presence is defined by Skarbez [20] as the feeling of "being there" in a virtual environment. Witmer and Singer [23] define presence as "the subjective experience of being in one place or environment, even when one is physically situated in another". This "sense of being there" has also sometimes been called Place Illusion [21].

There are a lot of different definitions of presence [20] and different types of presence can be differentiated, like social presence [6] for example. These different definitions may sometimes even contradict each other. This can make it difficult to discuss this topic. Lombard [15] therefore advises to choose one definition and stick to it instead of making up new ones.

Presence has already been shown to influence learning outcomes in immersive learning environments [11]. It is therefore not unlikely that it also can influence interest.

2.4   Relationships between Variables

There are some theoretical frameworks that try to describe the relationship between relevant factors for immersive learning, like the EFIL framework by Dengel and Mägdefrau [10], but they also do not fully represent the interaction between interest, presence and flow.

A first look at literature shows that when looking for research into how these factors individually affect immersive learning (search term:("Presence" OR "Flow" OR "Situational Interest") AND ("Immersive Learning")) 11200 results can be found on google scholar. This shows that all three factors individually have already been considered for immersive learning research.

Searching for research that investigates all three factors instead (search term: "Presence" AND "Flow" AND "Situational Interest" AND ("Immersive Learning" OR "VR" OR "Virtual Reality")) leads to only 355 results. This shows that there is less research into how all of these factors interact to influence learning.

Another search term that includes studies only comparing either presence or flow with situational interest (search term: ("Presence" OR "Flow") AND "Situational Interest" AND ("Immersive Learning" OR "VR" OR "Virtual Reality")) leads to 916 results.

All in all, these results seem to indicate that the relationship between those concepts could still be further researched.

3   Planned Research Design

Our goal therefore is to investigate the relationship between interest, flow and presence through several studies. These studies will use different applications for a variety of subjects in order to produce generalizable results that are valid independent of the subject content of the application. Most of these studies will be performed with university students.

3.1   Sample

Most of the studies will be conducted with university students as a sample. There are several reasons for this. Firstly VR hardware is not yet commonly used in schools while universities already may use this technology for

teaching, especially in computer science courses where the topic is also covered. This means that higher education is at the moment a more realistic use case for VR than schools. It is also an advantage that students are more easily accessible for testing the developed applications for researchers working at a university making it easier to test a wider variety of applications.

This restriction may limit the broader generalizability of this research, but it might be helpful to first focus on one target audience and expand the investigation to a broader population depending on the first results. Additional preliminary studies might be conducted with school students and adults.

3.2   Instruments

For comparing the concepts of interest, flow and presence it is important to choose the right measuring instruments. Careful consideration has to be given to which instrument should be used for this research. Since the goal is to compare a wide variety of applications across multiple studies the right instruments have to be chosen early in order to keep the results comparable across studies.

While there are a lot of different questionnaires to measure all three constructs it may not be easy to find ones that are suitable for comparison between all three since some questionnaires may overlap in which construct, they measure which may lead to confounding in the results.

There are several questionnaires for situational interest which may vary depending on which kind of medium is used. In first preliminary evaluations a situational interest questionnaire by Baumgartner [4], which was adapted from a previous questionnaire by Ferdinand [13], will be used.

To measure flow the flow short scale [17] will be used. It may also be possible to measure flow with physiological measurement, but this may be harder to execute in our studies.

There are several different questionnaires that can be used to measure presence. The Igroup Presence Questionnaire (IPQ) [19], the Witmer Singer presence questionnaire [23] and the Slater Usoh Steed (SUS) questionnaire [22] are among the most common instruments for measuring this concept. But there are also many more questionnaires measuring different facets and types of presence. For the first preliminary study the IPQ will be used.

Based on the results of the first preliminary evaluations, the measurements used in subsequent studies might be changed.

3.3   Applications

As already mentioned, a broad variety of applications shall be investigated. These applications will focus on different subjects and be developed in cooperation with experts from these subjects in order to ensure that the learning content is correctly conveyed.

These applications will be developed by different groups of people. On the one hand applications developed by university students themselves in courses focusing on immersive learning will be used [9]. On the other hand, applications will also be developed by researchers of the university themselves. To increase the number of applications that can be tested some commercially developed immersive learning applications may also be tested.

The applications will be developed with different tools ranging from common game engines like Unity or Unreal Engine to simpler tools that can be used with little technical knowledge like CoSpaces.

4   Next Steps

A first preliminary study will be conducted with applications developed by students during a university course. These applications will be implemented with Cospaces and will focus on a wide variety of different subjects. This first study will be conducted with other course participants as testers. The main goal of this study is not to collect usable data yet but to test the methodology and gather feedback and improvement ideas for further studies. This might also decide which instruments will be used for each variable in future studies.

Another important step is investigating the research that has already been done on this topic more thoroughly in a detailed scoping literature review [3]. This will also help to guide any further investigations and show gaps in current research that should be focused on.

5 Conclusion

In this paper we have shown that the relationship of the factors situational interest presence and flow in immersive learning application is worth investigating and there are still gaps in his research. We therefore presented a plan to fill these gaps in the future and laid out the first steps that are being taken in this investigation. These steps include a preliminary study to test the research design and gather first feedback as well as a literature review of previous research which already looked at some of the mentioned factors. The results of this research may be used to derive guidelines for designing immersive learning applications that can foster interest in learners.

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