

# Learning Analytics: A case study of Adaptive Video Activities

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**Abstract:** Adaptive elements are integrated in activities to facilitate personalization of the learning process and provide learning analytics for each student. Following the digital storytelling trends, integrating adaptive activities in interactive videos facilitates student engagement in crucial topics and personalizes the learning path to each individual student's pace and learning ability. However, it is considered challenging for teachers to design an effective cluster of adaptive activities and to make sense of the learning analytics that are provided. A literature review was conducted to examine how teachers make use of user analytics in real circumstances. It showed that despite the variety of existing tools that can facilitate teachers in collecting learning analytics, the raw data require further analysis for the teacher to be able to understand the students' individual paths and more training is required so that teachers can effectively interpret these data. This paper is based on a case study conducted to examine how learning analytics are used and what tools can support teachers in making sense of their students' data. Moreover, it reveals how students perceive adaptive activities, in relevance to their flow and usability, as part of the overall goal of the activity, which focused on environmental awareness. To understand the processes involved around the implementation of adaptive activities, an interactive video with adaptive activities was designed and implemented in a classroom of 12 students (M=12.5 years old). The methodology followed a quantitative approach. A structured questionnaire was used to understand students' perspectives regarding the flow and usability of the adaptive activities. Considering students' perspectives on the flow of the adaptive-interactive video activity, students' level of absorption and the natural progress of the activities received scores of 3.8/5 and 4/5, respectively. The usability of the activity received an average of 75.4 as a System Usability Score (SUS), which is considered above average. The results reveal that both flow and usability are essential for the effective implementation of adaptive activities. This research study recommends further studies of the topic to understand how learning analytics can become manageable and/or better integrated in software enabling the creation of adaptive activities.

**Keywords:** learning analytics, data, adaptive activities, flow, usability, digital assessment

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## 1. Introduction and Literature Review

Learning analytics is an emerging field that focuses on analyzing learners' interactions with educational content (Nicolaidou et al., 2019). Following the teaching trends, adaptive elements are integrated in activities to facilitate personalization of the learning process and in this way, teachers are provided with learning analytics, which are specific for each student and indicate their learning state (Peng, Ma, & Spector, 2019). In an experiment carried out in 2013, students taught via an adaptive learning system - where their personal preferences, characteristics and needs were taken into account - had performed significantly better than students taught via a traditional learning system with no learners' personalization options; thus, it can be said that adaptive learning can facilitate the improvement of learners' performance (Yang, Hwang, & Yang, 2013). Kinshuk, et al. (2009) stress the importance of personalized learning through adaptive approaches. Considering the recent teaching trends, increasing students' engagement and scaffolding learning can both be enhanced through interactive digital storytelling techniques (Shelton, Warren, & Archambault, 2016). Thus, the creation of interactive videos that include adaptive activities could increase student performance and engagement in crucial topics as well as personalize the learning path to each individual student's pace and learning ability providing rich analytics for the teacher.

To facilitate the creation of digital adaptive activities, Rozo and Real (2019) created guidelines based on pedagogical models and suggested that the data provided by digital adaptive resources need to become manageable by integrating Artificial Intelligence and learning analytics that would facilitate the process based on pedagogical elements. Similarly, Atkinson (2015) argued that learning analytics are so complicated that they serve the learning providers rather than the teachers and learners using them, and he suggested that for the educational community to be able to benefit from learning analytics, there is a need for the purposeful integration of the pedagogical and andragogical theories of learning into technological solutions.

Despite the fast growth of the field, teachers do not adopt the use of learning analytics mainly due to technical difficulties and the lack of connecting learning analytics with pedagogical theory. Research for the development

of tools and frameworks to facilitate the use of learning analytics by the teachers reveals that the majority of those tools and frameworks are not validated, thus, they are not applicable in practice (Kaliisa, Kluge, & Mørch, 2022). Following this, it is considered particularly challenging to incorporate learning analytics effectively in technologically supported applications for learning (Nicolaidou et al., 2019) and it is considered challenging for teachers to design an effective cluster of adaptive activities and to make sense of the learning analytics that are provided.

The aim of this study is to explore how students perceive adaptive activities integrated in interactive videos based on pedagogical theory in relevance to the adaptive-interactive video activity flow and usability. The study attempts to highlight the importance of creating and implementing such activities in classroom settings and stress their benefits for the students to encourage the better integration of learning analytics into software facilitating their creation.

## **2. Methodology**

### **2.1 Research question**

This paper is based on a case study conducted to examine how students perceive adaptive activities, in relevance to their (a) flow and (b) usability, as part of the overall goal of an environmental awareness activity.

### **2.2 Sampling, participants, and context of the study**

To understand the processes involved around the implementation of adaptive activities, an interactive video with adaptive activities was designed. Firstly, two videos of three different scenes were created to enable the personalization of the learning path for each student. One of the videos was simple and did not contain any scaffolding, while the other was enhanced with subtitles and other supporting elements to facilitate the learners' understanding of its meaning. Then, using the interactive video platform PlayPosit, the two videos were combined using interactive activities and assessment scores. The enhanced video was only available to students who struggled to find 60% of the correct answers. The students were directly forwarded to this video based on their success score. Students with a score over 60 % kept on watching the video without any supporting information. Learning analytics were provided by the same platform after the students used the video and answered embedded questions.

The interactive video activity was implemented in a classroom of 12 students (M=12.5 years old) (convenience sampling). The implementation took place in a computer lab equipped with a laptop and projector for the teacher as well as a personal computer for each student. The initial, introductory whole-class activity involved projecting a video about people's relationship with the natural world as a way to start an environmental discussion. Then, the teacher (first author of the study) made some video-specific questions and asked the students to access the interactive video activity on their computers to practice at their own pace. The students were focused on the video trying to answer the questions. The teacher's role was limited to facilitating the process.

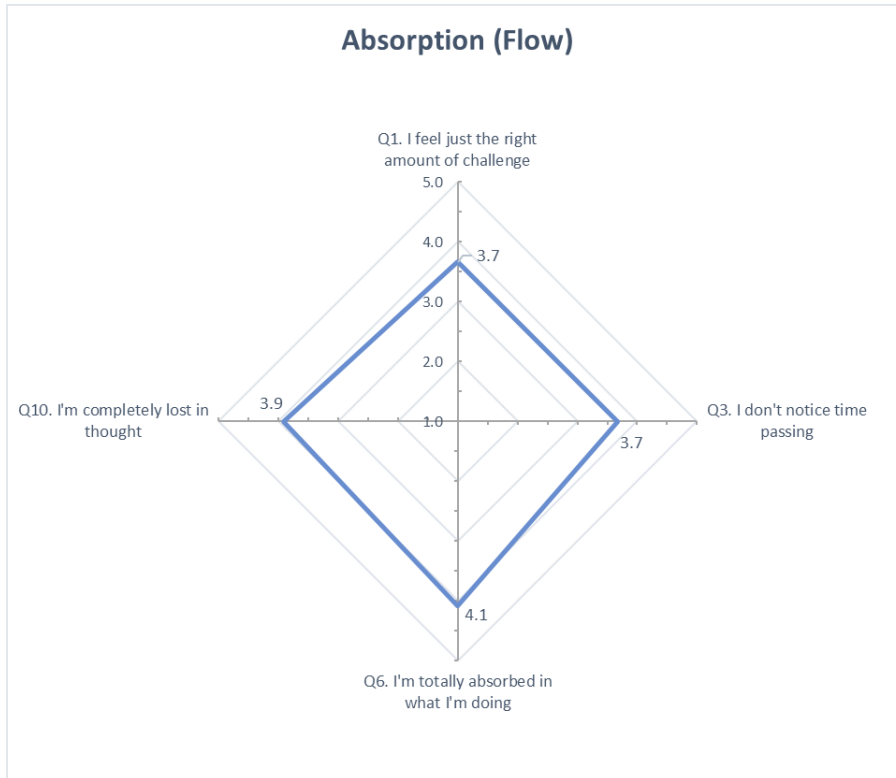
### **2.3 Data collection and analysis**

The methodology followed a quantitative approach. A structured questionnaire was used to understand students' perspectives regarding the flow and usability of the adaptive activities integrated in the interactive video (RQ). This questionnaire was given to the students to complete online after their use of the interactive-adaptive video activity. It consisted of 10 questions to measure Flow (FKS questionnaire) by Rheinberg, Vollmeyer and Engeser (2003) and 10 questions to measure usability of the activity (System Usability Scale SUS) (Bangor et al., 2008). All questions were measured on a 1 to 5 Likert scale from 1=Completely disagree to 5=Completely agree.

## **3. Results**

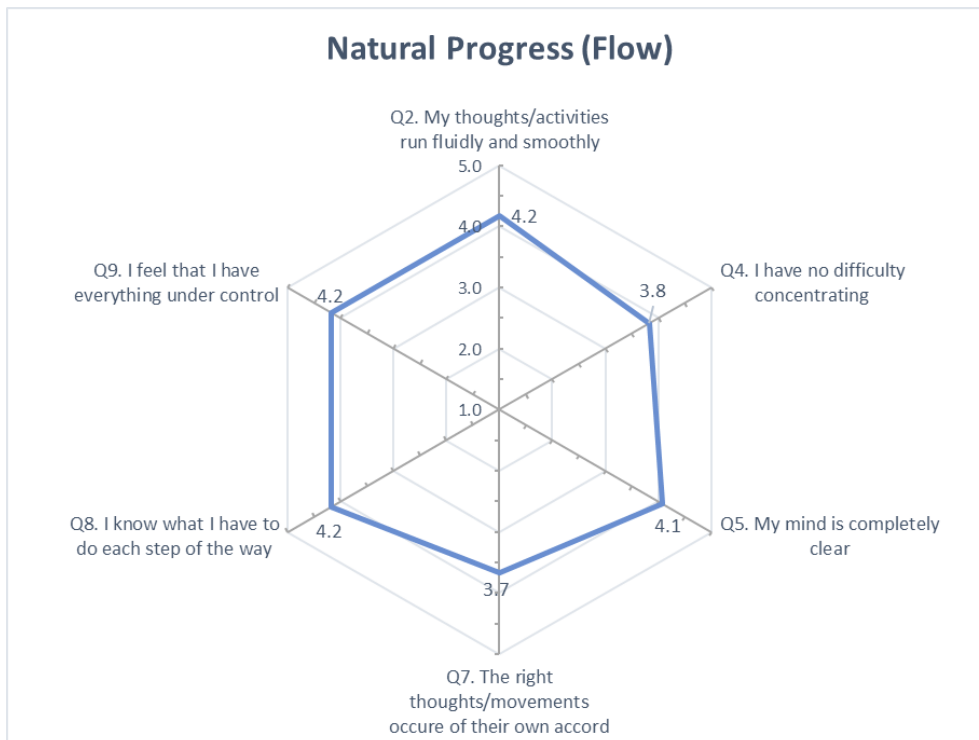
### **3.1 How do students perceive adaptive activities, in relevance to their (a) flow and (b) usability, as part of the overall goal of an environmental awareness activity?**

Measuring students' perspectives on flow using the FKS questionnaire (Rheinberg et al., 2003), Figure 1 shows the level in which the students were absorbed (Q1, Q3, Q6, Q10) in the interactive video activity on a scale 1 to 5. Students rated their level of concentration in the activity with average scores ranging from M=3.7 (SD=1.3) to M=4.1 (SD=1.1) out of 5. The overall absorption level score was M=3.83 (SD=1.2).



**Figure 1:** Students' level of absorption in the interactive video activity

Considering students' answers regarding the natural progress of the interactive video activity, Figure 2 reveals that students feel like the activity runs smoothly (Q2:  $M=4.2$ ,  $SD=0.7$ ), they have everything under control (Q9:  $M=4.2$ ,  $SD=0.8$ ), they know what comes after each adaptive activity (Q8:  $M=4.2$ ,  $SD=1.0$ ) and they have a clear mind during the activity (Q5:  $M=4.1$ ,  $SD=1.0$ ). The items receiving a score below 4 refer to the students' level of concentration (Q4:  $M=3.8$ ,  $SD=1.3$ ) and the natural occurrence of students' right thoughts (Q7:  $M=3.7$ ,  $SD=1.1$ ). The overall score for the factor of natural progress is  $M=4.01$  out of 5 ( $SD=1.0$ ).



**Figure 2:** Students' natural progress level in the interactive video activity

The usability of the interactive video activity received an average of 75.4 as a System Usability Score (SUS). Considering that the general average SUS score is 68, Figure 3 indicates that 8 out of 12 participants in the study have rated the interactive activity with scores above average.

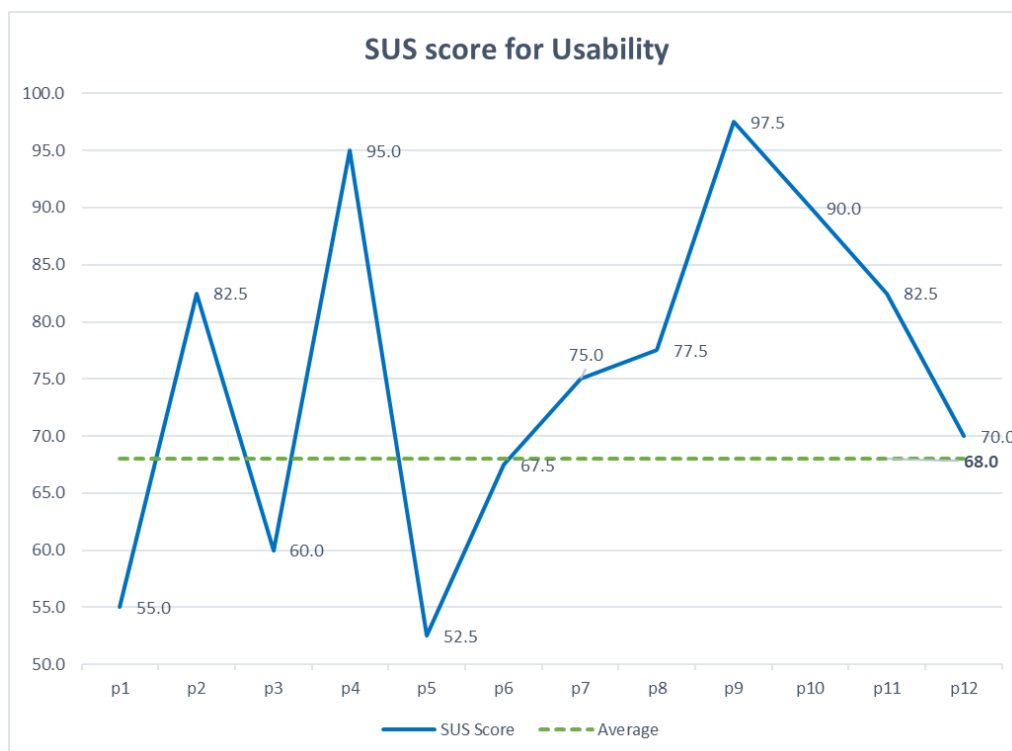


Figure 3: SUS score graph for the interactive video activity

#### 4. Discussion and future research steps

There is a gap between learning analytics and teaching practice thus not much research exists on the effective use of learning analytics by teachers particularly in the context of adaptive video activities. Adaptive activities show great potential for personalizing instruction, yet how the data they produce can be used in real time for the benefit of instruction remains to be seen. The results reveal that both flow and usability are essential for the effective implementation of adaptive activities. This research study recommends further studies of the topic to understand how learning analytics can become manageable and/or better integrated in software enabling the creation of adaptive activities.

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