ABSTRACT

Mathematical abilities involve both verbal (numerical knowledge, arithmetic, and reasoning) and nonverbal components (math notation, time, space thinking, and computing). Teachers’ ability to adopt and implement a unique perspective to mathematics instruction in the classroom may prove crucial to the improvement of their students’ mathematical abilities. The aim of this study was to analyze the effectiveness of a hyper video-based intervention meant to improve students’ mathematical performance. The effects of the hyper video content were compared between an experimental and a control group using a quasi-experimental design. According to the findings, the utilization of hypermedia can lead to improvements in student performance.

Keywords: Hyper Video, Mathematics, H5P, Interactive Lesson.

I. INTRODUCTION

Many educators are confused about how to assist their students in developing number sense because the concept has never been fully defined. Teachers sometimes present mathematics as a collection of unrelated processes rather than a set of interconnected principles. Numerous educators learned mathematics by following a set of techniques. Good number sense is characterized by proficiency in estimating and comparing magnitudes, the capacity to detect an unreasonable conclusion, the ability to express an answer in multiple ways, and the flexibility to execute mental computations (Faulkner & Cain, 2009). According to Hamzah et al. (2021) students commonly find difficulties in learning mathematics involving calculations, and conceptual and methodological comprehension. It is crucial that educators employ the most effective ways of teaching students’ mathematical abilities (Huang et al., 2010). The use of technology, such as smartphones and interactive content, has unquestionably altered the way students think and absorb information (Ge & Ifenthaler, 2018). Many studies have proved the efficacy of employing digital games or electronic games at all levels of formal education, as teacher educators have generally accepted the potential of games to engage students and aid learning (Camilleri & Camilleri, 2017; Dickey, 2011; Burguillo, 2010). The use of technology in primary school classrooms improves the quality of instruction and affords the possibility to enrich students’ learning experiences (Chien et al., 2014). This study examines the use of hyper videos as an additional approach for teaching mathematics. The study addresses the following research question:

RQ.1: Can hyper video enhance students’ mathematical performance?

II. LITERATURE REVIEW

Hyper video, also known as hyperlinked video, is a video stream that is shown with integrated, interactive anchors, allowing navigation between video and other hypermedia elements (Smith & Stotts, 2002). The Aspen Movie Map from 1978 is an early example of a hyper video system that allows users to navigate through the city of Aspen by selecting video sequences (Lippman, 1980). In 1996, Shawney et al. introduced HyperCafe, a hyper video implementation based on a virtual café environment in which the user can actively walk-through various dialogue situations and therefore experience his or her own narrative. Shipman et al. (2003) introduced the hyper video editing system Hyper-Hitchcock, which permits the non-linear connectivity of programs that utilize sensitive zones or hotspots to interlink external resources. Hyper video became the focus of research in the disciplines of education and knowledge building (Locatis et al., 1990), and these fields eventually became the primary hyper video research area (Finke, 2005; Schwan & Riempp, 2004; Zahn, 2003; Guimarães et al., 2000). Unlike other hypermedia-concepts, the fundamental example of hyper video is always a video-sequence. The fact that even the briefest sequence is always linear imposes certain restrictions (Zahn, 2003). As shown in Fig. 1, a hyper video structure is composed of time-based internal and external links that combine to generate a non-linear overall notion.
III. METHODOLOGY

A. Research Design

Utilizing a quasi-experimental design, pre and post-tests were administered using the Mathematics Competency Test (MCT), which contained 30 questions on the topics of fractions, algebra, geometry, and probability. Four primary classrooms taught by the same math teacher were divided into experimental and control groups. At the beginning of the semester, both the experimental and control groups were given a thirty-question MCT test. The experimental group received hyper videos in addition to traditional classroom training throughout the semester whereas the control group received standard classroom instruction without any additional resources.

B. Sample and Data Collection

A total of 30 students from the fifth grade were enrolled in the study at a public high school in Albania: 15 students from the experimental group (\(M_{\text{age}} = 10.13\) years, 46.6% girls) and 15 students from the control group (\(M_{\text{age}} = 10.26\) years, 60% girls). Before participants were allowed to participate, they were selected according to non-random factors, their parents were provided with an accurate description of the study, and their oral consent was obtained.

C. Procedure and Measures

Hyper video elements were added to the regular lesson explanation and exercises for the experimental group, which meant that every student in the class may play them during class time and engage with the topic. The hyper video content was divided into four categories: (a) fractions, (b) algebra, (c) geometry, and (d) probability.

At the conclusion of all topics, the teacher administered a post-test to both the experimental and control groups to determine whether the additional materials provided to the experimental group had a statistically significant impact on performance relative to that of the control group, which did not receive these additional materials. H5P (https://h5p.com/) was the platform on which the hyper videos were created and played. H5P is a free, open-source framework for content collaboration that allows anyone to develop, distribute, and reuse interactive HTML5 content.

IV. RESULTS

Two separate t-tests were performed in the first and second stages to compare the outcomes of the control and experimental groups. Since the selection method was not completely random, the first stage involves an initial pre-test examination prior to the intervention of the additional materials delivered to the experimental group for the purpose of observing the level difference between the two groups. In the second phase of the study, researchers carefully assess the data to determine if the additional materials — hyper videos — had any effect on the performance of the experimental group compared to the performance of the control group. Table 1 displays the results of each of the pre and post-tests.

The t-test, with an initial alpha value of .05, was used to compare the performance of the experimental and control groups on the pre-test to determine whether there was a significant difference in the level of the students before to the intervention. Initially, there were no significant differences between the experimental (\(M = 18.06, SD = 6.04\)) and control (\(M = 18.13, SD = 3.64\)) groups, according to the results from the first stage. After the initial evaluation of performance between the two groups, extra materials (hyper videos) were delivered to the experimental group, and a second independent t-test was conducted between the experimental and control groups at the end of the semester. The second phase of the study revealed a statistically significant difference between the experimental group mean score (\(M = 22.73, SD = 5.09\)) and the control group mean score (\(M = 18.86, SD = 5.09\)), \(t(30) = -2.231, p = .016\). These results of the second phase indicate that the additional materials provided to the experimental group were highly effective, as their performance was higher compared to the beginning of the semester and higher than the performance of the control group, which completed the lesson as usual without any additional hyper video materials.

V. CONCLUSION

The present contribution sought to encourage teachers to enhance their teaching resources by utilizing more technological platforms to enhance the delivery of lessons and the performance of students. Our findings confirm the
benefit of the use of hyper video in education as observe by other researchers (Perini et al., 2019; Cattaneo et al., 2018; Cattaneo et al., 2016; Tiellet et al., 2010). Although the provided hyper video content was in addition to the typical teaching process, it was found to be of great interest to the students, who are more inspired to explore and play when interacting with technology, whether it be a video, text, or other kinds of interaction. The fact that students were able to explore independently through the interactive video was deemed a positive interaction by the teacher, who observed that most students were extremely focused and determined to complete the interactive video without making any complaints. In a recent study, Koliasa et al. (2021) determined that the primary benefits of hypermedia technologies are: the ease with which students can navigate from one topic to another, the variety of forms and modes of behavior, and the adaptability of the shared content that the teacher provides to students. The results of the study indicated that the experimental group comprised of 15 fifth graders who received hyper video materials in addition to the standard lesson materials outperformed the control group. Comparing the pre and post-tests, their mathematics performance was statistically distinct, and their understanding of scientific concepts improved. Since technology promotes the creation of creative educational experiences that aid in the acquisition of scientific concepts, the implications of this study should motivate teachers to update their practice and activities within and outside the classroom through technology.

VI. RECOMMENDATIONS

This study could be improved by including a varied sample of participants and a variety of teachers, as well as by collecting data from the views of teachers throughout the execution of such interactive activities.

VII. LIMITATIONS

First, most teachers who were offered the opportunity to participate in the study declined since there is no time to complete and cover curricular elements, let alone add additional materials. Second, the implementation of such hypermedia necessitates that each student has access to a computer, which in certain situations is not feasible, therefore students share a computer in groups of three.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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Klea Cuka, teacher of mathematics, has obtained both her Bachelor's and Master's Degrees in Mathematics at University of Tirana. Klea is a certified secondary education instructor who has a genuine interest in working with elementary and middle school students. (ORCID ID: https://orcid.org/0000-0002-0844-0540).

Ergi Bufasi is an Early-Stage Researcher on the SellSTEM project, a Marie Skodowska-Curie Innovative Training Network investigating the role of spatial ability in and for STEM learning. He is also a visiting researcher at the Interdisciplinary Centre for Educational Innovation, University of Latvia. Ergi's research interests include the improvement of physics teaching methodology and the development of spatial skills in primary schools. (ORCID ID: https://orcid.org/0000-0002-0356-2732).