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RESEARCH ARTICLE

Impact of EDpuzzle Use on the Assessment and Measurement Course Achievement

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Abstract

This study investigated the impact of a Web 2.0 tool that enables technology-enhanced assessment in an undergraduate-level course on academic achievement. The study was designed as exploratory research and employed pre- and post-test control group design approach. The experimental group watched instructional videos before classes while the control group received in-class lectures. Two achievement tests were conducted for both groups at the beginning and end of the course. In addition, a total of five quizzes were conducted throughout the semester. The performance task that was assigned to the groups was evaluated using a rubric. The results indicated that the Web 2.0 integrated into the experimental group's courses increased their academic achievement. Yet, there was not a substantial difference between groups on the performance task. Log record data indicated that there was a significant relationship between the duration of watching instructional videos on Edpuzzle and academic achievement.

Keywords: Academical achievement, assessment and measurement, feedback, technology-assisted teaching, Web 2.0

Introduction

Due to Covid-19 outbreak that was identified as a pandemic in March 2020, emergency distance education and instruction have been launched through multimedia platforms, including videos. Yet, instructors could not obtain concrete evidence if the students are really watching the instructional videos. This resulted in seeking technological tools for tracking student engagement with the instructional videos as well as attracting them. As UNESCO (2015) stated, mobile technologies have significant potential in supporting 21st century instruction and assessment (as cited in Nikou & Economides, 2018). As technology-enhanced instruction has turned out as an obligation for today's teachers (Shah, 2013), it is suggested that Web 2.0 tools should be covered in teacher education programs and teacher candidates should receive training on using these tools (Fırat & Köksal, 2019; Kurt et al., 2019; Ulu Kalın & Birişçi, 2018).

Web 2.0 tools are practical for technology-enhanced assessment and instruction since they do not require coding skills and are feasible in analysis and reporting. They enable dynamic environments by allowing interaction between users and content (Rosen & Nelson, 2008). Users can create new content or edit existing content based on their objectives (Holland, 2019).

Technology-based assessment processes have been labeled as 1.0, 2.0, and 3.0 by Elliott (2008). Assessment 1.0 includes paper and pencil tests, while assessment 2.0 includes digital tools, and assessment 3.0 involves artificial intelligence and adaptive testing (as cited in Oral, 2019). With the advantages provided by technological developments, the meaning of assessment has started to be discussed. For example, smart learning systems that are able to provide scaffolding to students enlarged the function of assessment to instruction. Particularly, formative assessment has started to be identified as "assessment for learning" or "assessment as learning" (Bayrak & Yurdugül, 2016; Black, 2008; Black & Wiliam, 1998; Earl & Katz, 2006; Lee, 2012). Web 2.0 tools which have many advantageous functions such as immediate scoring, providing meaningful reporting, and feedback for both learners and instructors (Shute & Kim, 2012; Vasilyeva et al., 2000), created a learning atmosphere grounded on assessment. One of these tools is EDpuzzle.

EDpuzzle

EDpuzzle is a web-based tool that enables teachers to prepare instructional videos for students (EDpuzzle, 2017). It consists of three main sections: content, grade book, and class. Detailed information is provided in Figures 1–5.

Options and steps for creating an online class can be found under the class section. An instructional video archive from Khan Academy, TED, and other educational websites is categorized and presented to the users under the content section. Instructor can trim, edit, and voice over the selected videos for adding interpretations and comments (EDpuzzle, 2017). One of the most important aspects of EDpuzzle is that instructors can embed quizzes into the videos for assessing students' knowledge

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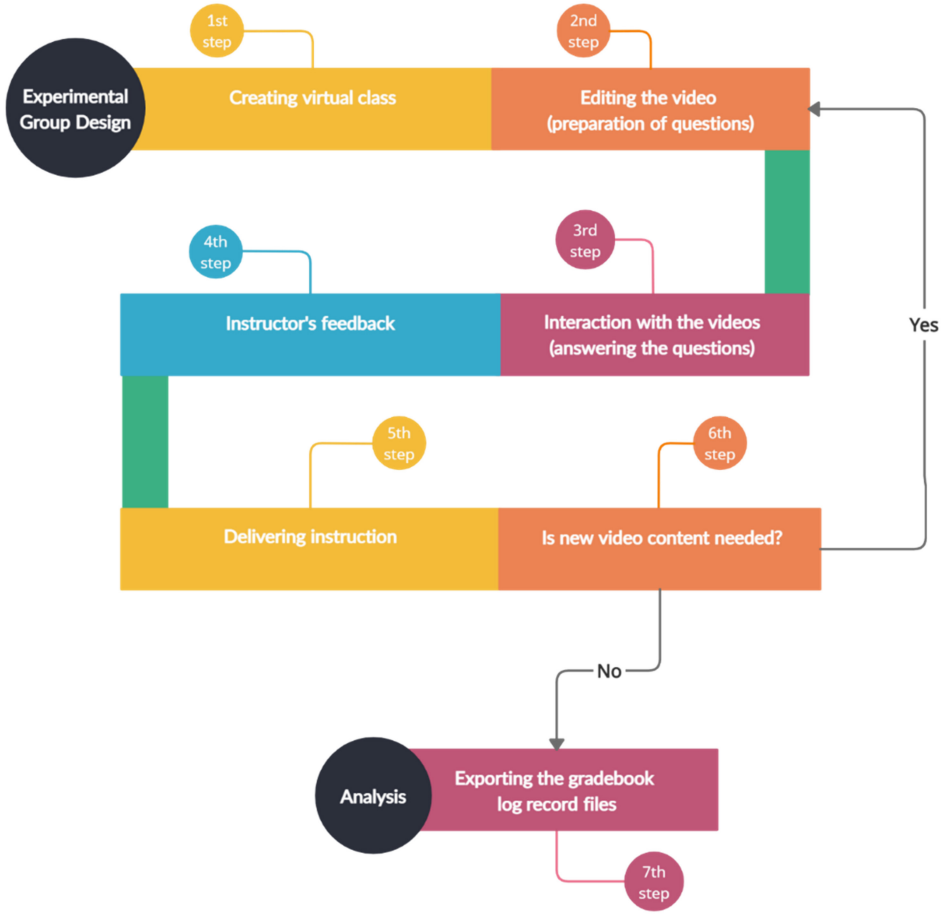

Figure 1.
Instruction Process in EDpuzzle.

and attention. Multiple-choice questions that are embedded in the videos can be used for providing immediate feedback and visual clues (scaffolding) to the students. Feedback which can be provided by a teacher, peer, or through a web platform is an important method for alleviating the difference between a student's current performance and expected performance (Hattie & Timperley, 2007). EDpuzzle enables one to provide different feedback types. In this study, a response-based feedback approach has been used. Response-based feedback is an approach that includes explaining reasons for correct and incorrect responses provided by students in detail (Shute, 2008).

A log file that saves details about user interaction with the videos is provided under the grade book section. This file includes information about when the student logged into the system, how long she/he stayed online, and how much she/he interacted with the video. As seen in Figure 5, EDpuzzle provides various reports for each class. These reports inform instructors on which students in the class have watched the assigned video, if the students watched the video before the deadline, and how they performed in the quiz that was embedded in the video. The reports can be downloaded as CSV format and can be uploaded to a different learning management system (Mischel, 2019). In addition, the instructor evaluates the student's responses to the embedded quizzes in this section. This feature of EDpuzzle allows conducting formative assessment while using it for a virtual class. Each student can also receive individual feedback based on her/his needs through EDpuzzle's adding comment menu. Another advantage of EDpuzzle is saving student response data and video interaction data under *Grade book*. This data can also be integrated into learning management systems. Yet, it

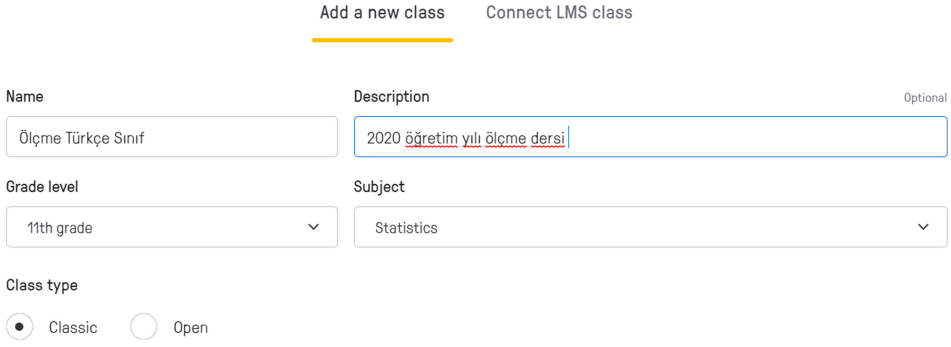

Figure 2.
Virtual Class Creation Menu.

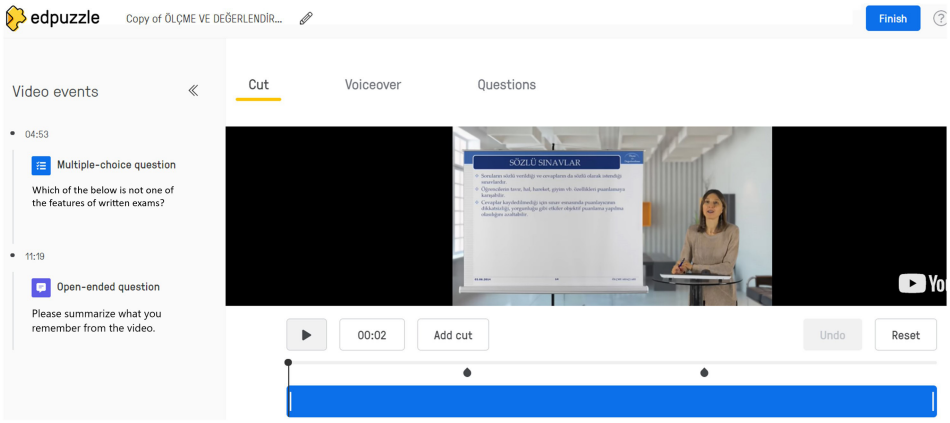

Figure 3.
Video Editing Menu.

should be noted that EDpuzzle does not function as a learning management system itself. Despite the mentioned advantages, EDpuzzle has few limitations. For example, it is not suitable for live commenting and interaction of students with peers and instructors (Mischel, 2019).

The purpose of this study is to explain how EDpuzzle can be utilized in a Assessment and Measurement course for creating video-enriched course content, providing timid and formative feedback, and tracking student performance, as well as investigating the impact of using EDpuzzle on student performance and achievement.

Literature Review

There are many reported advantages of using EDpuzzle in the literature. It increases student motivation (Julinar & Yusuf; 2019; Turan, 2015; Turan & Göktaş, 2016), helps students construct conceptual knowledge (Turan & Göktaş, 2016), improves academic achievement (Ekmekçi, 2014; Sezer, 2015; Turan, 2015) while reducing the cognitive load (Karaca & Ocak, 2017). It also supports self-regulation skills (Giita Silverajah & Govindaraj, 2018) and was found useful with the quizzes embedded in the videos (Giita Silverajah & Govindaraj, 2018). Reportedly, it was found more effective than other Web 2.0 tools (Yesyika, 2017, as cited in Hidayat & Praseno, 2021). In another study, EDpuzzle was integrated into a biochemistry course to analyze its impact and was used as a substitute for lab preparatory methods in undergraduate lab courses (Shelby & Fralish, 2021).

Research that was conducted about other Web 2.0 tools also found that they positively impacted academic achievement (Caviglia-Harris, 2016; Hursen, 2020; Korkmaz et al., 2019; Malinina, 2016). In a similar exploratory study by Hursen (2020), it was found that Web 2.0 tools supported students' academic achievement in an undergraduate Measurement and Evaluation course. There are a handful of studies suggesting that Web 2.0 tools are effective and should be used more frequently in higher education programs (Allen, 2008; Estrada,

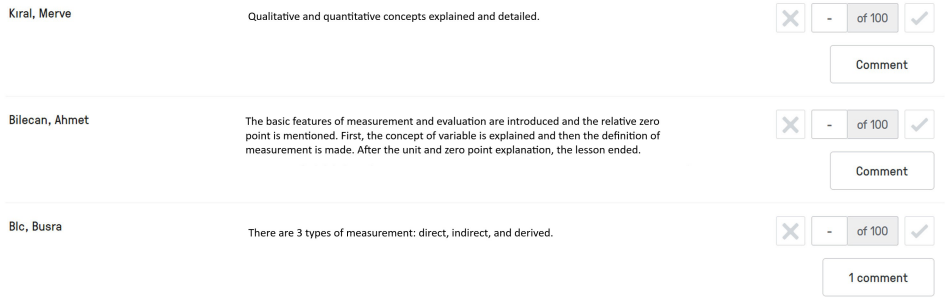

Figure 4.
Grade Book Menu.

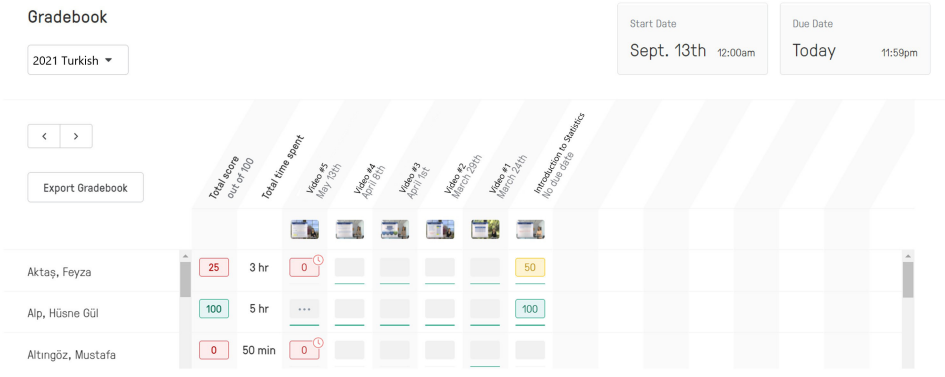

Figure 5.
General View of Grade Book Menu.

2012; Fahser-Herro & Steinkuehler, 2009; Huang et al., 2013). In this study, the impact of using EDpuzzle, which is a Web 2.0 tool, has been elaborated.

Method

Research Design

This study employed pre- and post-test-matched control groups design approach. In this design, individuals are not assigned into control and experimental groups fully randomly, but the groups are matched based on certain characteristics (Fraenkel et al., 2012). The groups are matched based on their teaching areas being in quantitative and qualitative fields and are randomly assigned as control and experimental groups.

Population and Sample

The population of this study included junior undergraduate students (3rd grade) who are enrolled in a college of education in a public university. More specifically, the students who are enrolled in teacher education programs in Turkish Language, Science and Social Studies, and Mathematics. A convenient sample of 166 students were selected and randomly assigned to control and experimental groups. The control group comprised Science Education and Social Studies teacher candidates while the experimental group comprised Mathematics Education and Turkish Language Education teacher candidates.

Data Collection Instruments

Achievement Test in Assessment and Measurement Course

This instrument was developed to assess student's achievement in the Assessment and Measurement course based on course objectives. The 45 items in the test had also appeared in a nationwide public personnel selection exam (KPSS) in earlier years. The number of items from each topic was determined based on course objectives which resulted in 20% of the items being on reliability, 20% of the items being on validity, 15% of the items being on item analysis, 10% of the items being on performance assessment, and 5% of the items being on evaluation. According to cognitive classification, four items were from remembering, 18 items were from understanding, four items were from application, and 14 items were from the evaluation level of Bloom's taxonomy (Bloom, 1956).

Quizzes

The quizzes were prepared for each topic in multiple-choice and short-response open-ended question format. The topics covered in the videos and quizzes are presented below:

- Fundamentals: A 10-item quiz that covers fundamental concepts in assessment and measurement.
- Statistics/central tendency: This part was composed of open-ended items in remembering, understanding, and application levels of the taxonomy, and the topics covered are statistics and central tendency.
- Statistics/central dispersion: This part includes five open-ended items that cover central tendency measures in understanding and application levels of the taxonomy.
- Reliability: Four open-ended items are included in remembering and understanding the reliability topic.
- Validity: Five open-ended items are included in remembering and understanding on the validity topic.

Rubric

The rubric was constructed to evaluate students' performance on a performance assessment that includes writing items on a selected topic and constructing an achievement test. The rubric was designed in an analytical format. In addition, interrater reliability coefficient was calculated. Following are the criteria that have been scored on a three-point rating scale based on the developed rubric: alignment to the item writing rules, calculating item difficulty and separation indices, distractor analysis, and identifying reasons for problematic item functioning. In order to obtain reliable evidence for the rubric, the correlation coefficient between two experts' ratings was calculated. A coefficient value of 0.86 supported sufficient reliability for the developed rubric.

EDpuzzle Log Records

Each student's records in time and duration of interaction with videos were saved and used for analyses.

Experimental Design

A pre- and post-test control group design was used for the study. In this approach, students are randomly assigned into a control and an experimental group. Both groups were measured before and after the experimental group was exposed to a treatment. Details about the design are presented in Figure 6.

Using Edpuzzle, a pre-test was applied to both groups before the experimental intervention was started. The experimental group watched instructional videos and took quizzes in EDpuzzle every week. Based on student's performance in EDpuzzle quizzes, the topics in which students displayed learning gaps were identified before the classes. Each student in the experimental group also received feedback based on the incorrect responses to the quizzes. In addition, students in the experimental group were exposed to alternative instructional strategies including group activities, presentations, discussions, peer learning, and question–answer sessions. In the control group, the instructor lectured in a traditional way. None of the alternative instructional strategies were used in the control group. A quiz was conducted in both groups after each course. A performance assessment task was assigned to each group and a post-test was conducted at the end of the semester. These tasks concluded the experiment.

Data Analyses

First, the normality assumption was checked to determine the most appropriate statistical test. Since the data of both groups were not distributed normally, non-parametric ANCOVA and Mann–Whitney *U*-test was run. In addition, the correlation coefficient was calculated. Statistical packages named *dpylr* (Wickham et al., 2021), *ggplot2* (Wickham, 2016), *ggpubr* (Kassambara, 2020), and *gridExtra* (Auguie, 2017) were used in the R software (R Core Team, 2021) for data analysis and visualization.

Results

The normality results and distributions of scores are presented in Table 1, Figures 7 and 8.

As the histogram and Q-Q plots were examined, it was seen that the groups' data on pre- and post-tests was not distributed normally. This resulted in the use of non-parametric tests. Mann–Whitney *U*-test was run to examine if there was a significant difference between pre- and post-test scores of the groups. The results are presented in Tables 2 and 3.

While there was no significant difference between control and experimental groups on their pre-test scores ($p > .05$), there was a significant difference between groups on their post-test scores ($p < .05$). When Cohen's d effect size was calculated for assessing the difference, a value of 0.564 was obtained. This value indicates a medium-level effect size. In order to examine the difference between groups on their post-test scores by controlling the effect of pre-test, Quade test, the non-parametric version of ANCOVA, was run. The results are presented in Table 4.

As seen in Table 4, the experimental group performed significantly better than the control group on post-test ($p < .05$). As a supporting

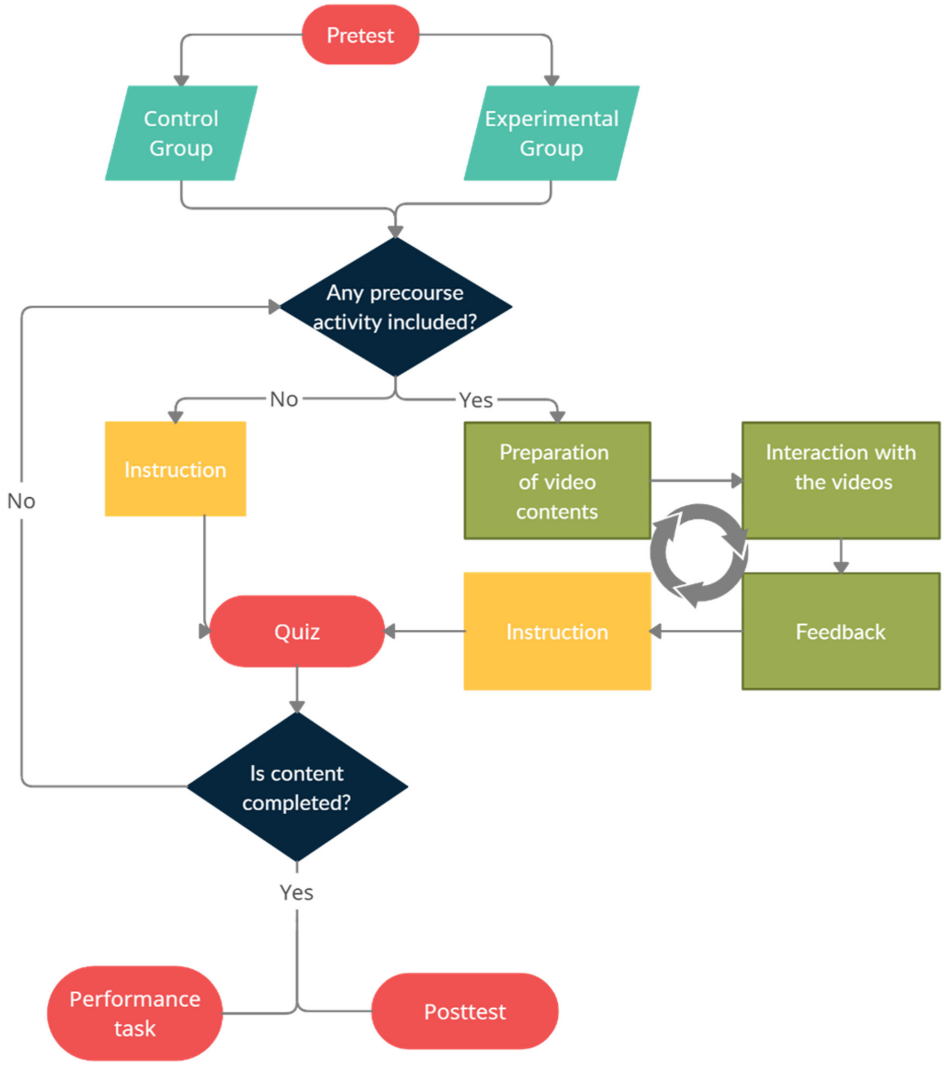

Figure 6.
Design of the Study.

evidence, violin plots of the groups on their pre- and post-test scores can be examined. As seen in Figure 9, the statistical results complement with the graphical findings.

As a part of the experiment, the groups received quizzes at the end of each unit. The data collected from quizzes did not distribute normally as seen on the histogram (Figure 10). The statistical analyses results of the quizzes data are presented in Table 5.

As seen in Table 5, the experimental group performed significantly better than the control group on the topics of fundamental concepts, central tendency, central dispersion, and validity ($p < .01$, $p < .001$, $p < .05$, and $p < .05$, respectively). The groups did not differ significantly in reliability topic ($p = .167$). Similarly, the groups did not perform significantly differently in the performance assessment task ($p = .228$).

Discussion, Conclusion, and Recommendations

The study results suggested that the group that utilized EDpuzzle as a Web 2.0 tool achieved significantly better results than the group that did not use EDpuzzle. This finding was supported by previous studies in the literature (Caviglia-Harris, 2016; Ekmekçi, 2014; Hursen, 2020; Korkmaz et al., 2019; Malinina, 2016; Sezer, 2015; Silverajah & Govindaraj, 2018). More specifically, Hursen (2020) investigated the impact of EDpuzzle use on academic achievement in an Assessment and Measurement course and obtained similar results. Contrary to the study findings, Shelby and Fralish (2021) also found a significant difference in student success between groups who used and did not use EDpuzzle when performance assessment tasks were used.

In the research, the performance task was done as a group work. Group performance is likely to overtake individual performance.

Table 1.
Results of Normality Tests

		Kolmogorov–Smirnov			Shapiro–Wilk		
	Group	**Statistics**	***df***	***p***	**Statistics**	***df***	***p***
Pre-test	Control	.105	96	.011	.976	96	.081
	Experimental	.130	70	.005	.941	70	.002
Post-test	Control	.084	96	.093	.958	96	.003
	Experimental	.138	70	.002	.912	70	.000

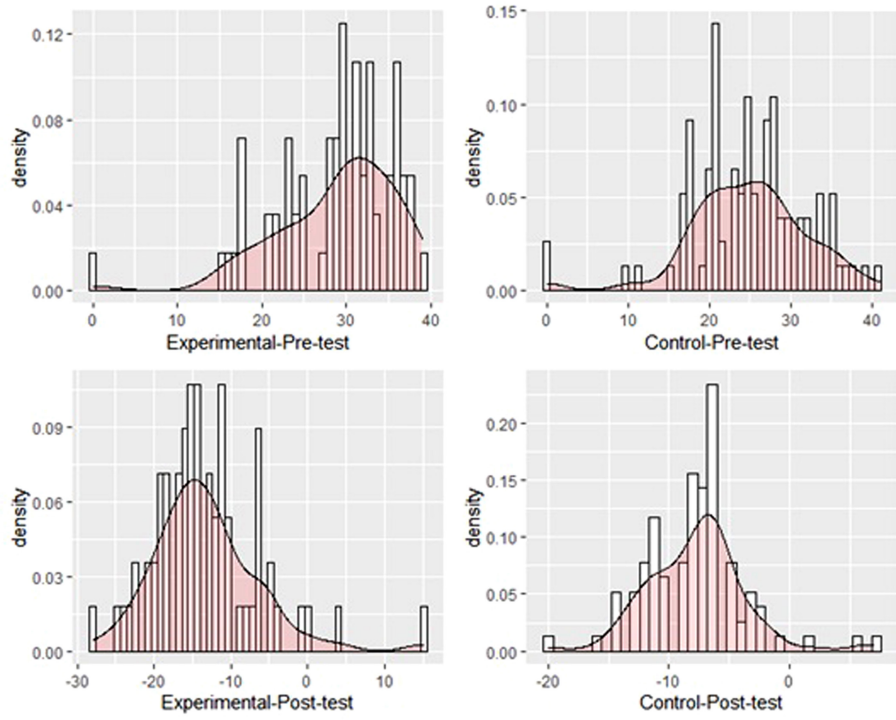

Figure 7.
Histogram of the Pre- and Post-test scores of the Experimental and Control Groups.

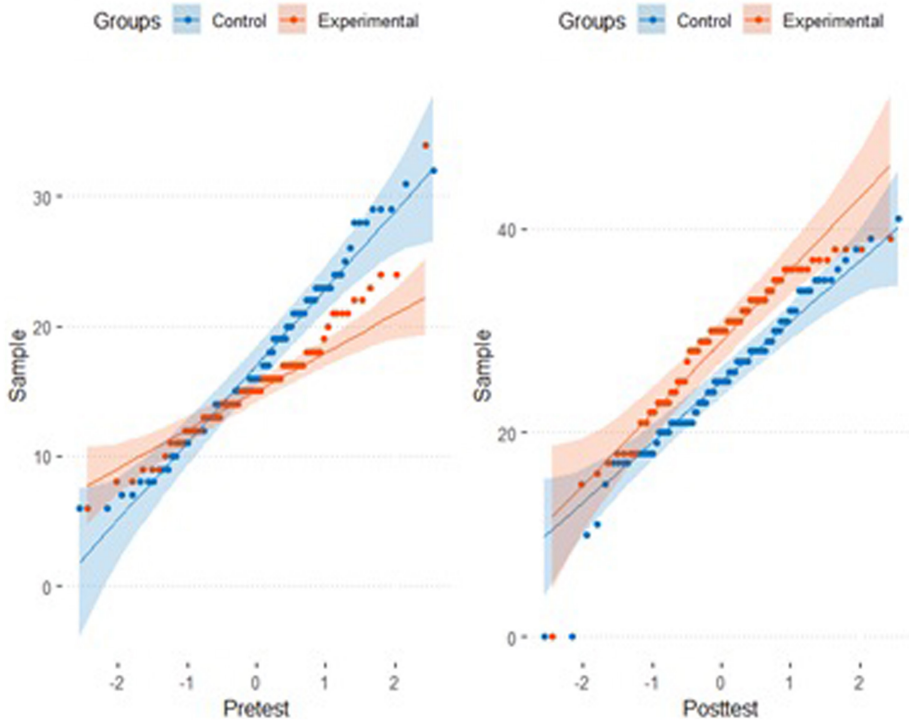

Figure 8.
Q-Q Plots of the Pre- and Post-test Scores of the Experimental and Control Groups.

Table 2.
Mann–Whitney U*-Test Results on Pre-Test Scores for the Experimental and Control Groups*

Group	*N*	Mean Rank	Mann–Whitney *U*-Test	*Z*
Experimental	70	76.81	2891.5	−1.535
Control	96	88.38		

Table 3.
Mann–Whitney U*-Test Results on Post-Test Scores for the Experimental and Control Groups*

Group	*N*	Mean Rank	Mann–Whitney *U*-Test	*Z*
Experimental	70	100.74	2153.5	−3.95
Control	96	70.93		

Table 4.
Quade Test on Post-Test Data for the Control and Experimental Groups

Variance Source	Sum of Squares	*df*	Mean Squares	*F*
Between Groups	53641.61	1	53642	43.29
Residual	203203.29	164	1239	

Individual differences within the group may be completed, as a practice-based performance task is given. In addition, it is necessary to use a computer program to do the task. In the activities done with Edpuzzle, explanations about the use of this program were not made, and a sample application was made in the course in both groups. The aforementioned situations can be considered as the reason why there is no difference in performance evaluation.

This study has some limitations. First, no analysis was conducted using feedback data. Further studies should investigate the impact and effectiveness of feedback provided through Web 2.0 tools on student achievement. In addition, this study does not include analyses on the

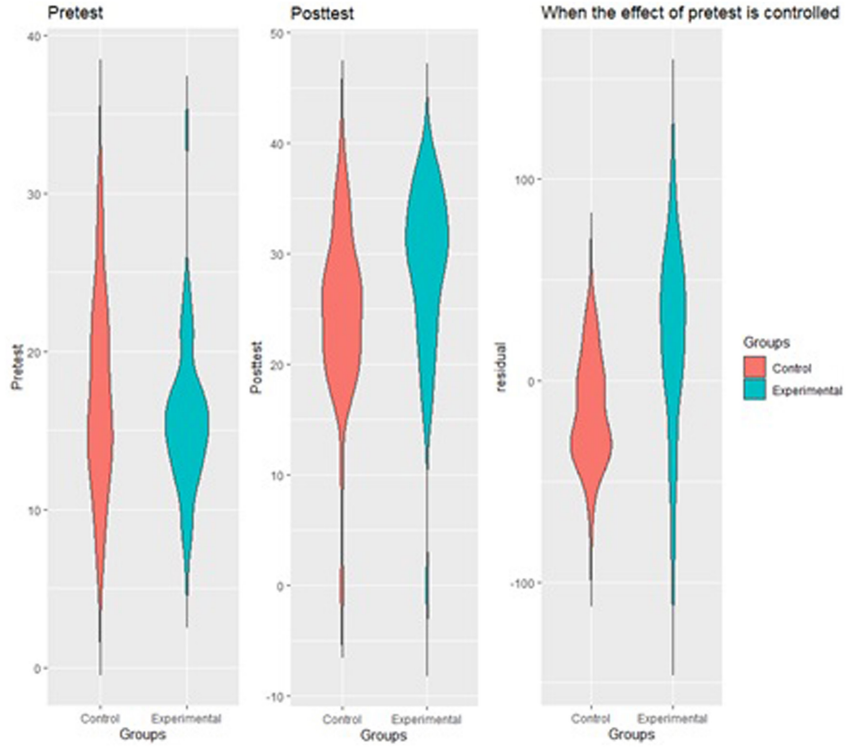

Figure 9.
Violin Plots of the Control and Experimental Groups.

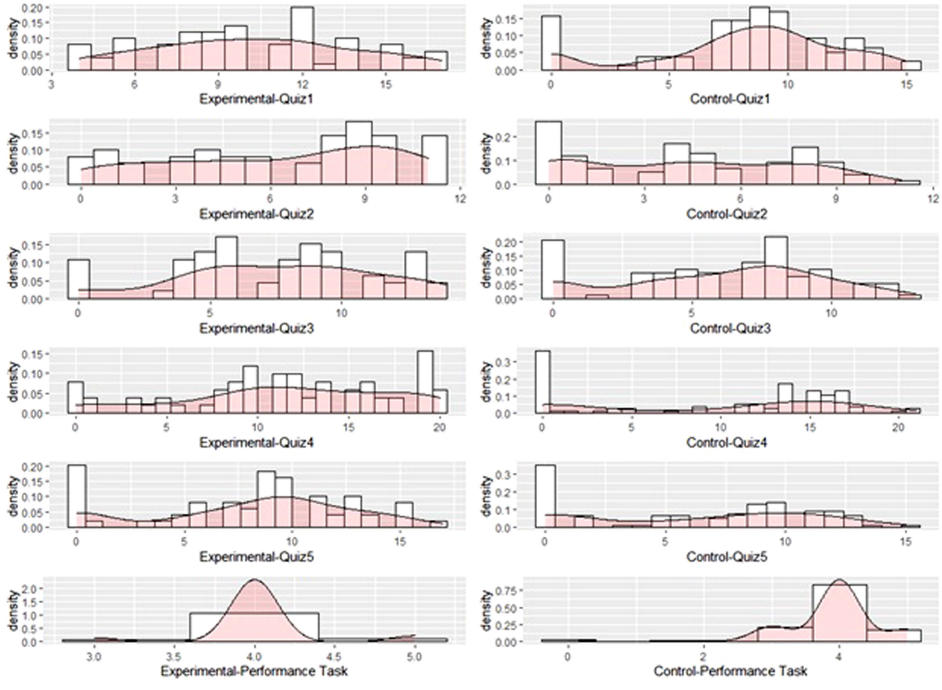

Figure 10.
Histogram of the Quiz Data for Both Groups.

Table 5.
Statistical Analyses Summary on the Quiz Data

Task	Group	*N*	Mean Rank	Mann–Whitney *U*-Test	*Z*
Quiz 1	Experimental	70	92.24	3795	−2.726
	Control	96	71.97		
Quiz 2	Experimental	70	95.73	3892.5	−3.602
	Control	96	69.02		
Quiz 3	Experimental	70	88.47	3420.5	−2.385
	Control	96	70.87		
Quiz 4	Experimental	70	86.67	3467	−1.384
	Control	96	76.39		
Quiz 5	Experimental	70	89.23	3579	−2.167
	Control	96	73.22		
Performance task	Experimental	70	87.51	3641	−1.207
	Control	96	80.57		

items embedded into the EDpuzzle videos. Further analysis can be conducted on the item data. Lastly, potential reasons of non-significant difference on student achievement on the performance tasks might be elaborated further in future studies.

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