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Practical Note

Effectiveness of *Ecosystemforkids.com* and *Quizizz.com* in Learning Human Organ Systems

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The use of ICT in education paved the way for online teaching. Though online teaching faces the challenge of engaging students, various strategies help to overcome it. The present study is a single group pre-test and post-test quasi-experiment that examines the effects of the interactive and gamified e-quizzes in teaching five human body systems, namely the digestive system, the excretory system, the respiratory system, and the male and female reproductive systems, in online science classes. In the study, thirty-two sixth-grade students participated in the classes and two gamification tools, *Ecosystemforkids.com* and *Quizizz.com*, were used. Both the tools helped to improve the performance of students. Interactive quizzes provided by *Ecosystemforkids.com* were found to be effective in remembering the names and understanding the functions of various organs, making it a valuable homework resource. *Quizizz.com* was found to be effective as a formative assessment tool as well as providing fun competition-based learning. Both tools had a positive impact on student performance.

Keywords: Ecosystemforkids.com*, formative assessment, gamified e-quizzes, human body systems, online education,* Quizizz.com

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INTRODUCTION

Background

The use of information and communication technology (ICT) can help teachers instruct students in an interesting way whereby students are not bound to limited resources or curriculum. It helps students to broaden the area of their knowledge. According to Flores (2015), today's learners process information in different ways, yet the educational system does not cater to their needs. Hence, by using ICT, "digital natives" will learn the way they want to learn which will prepare them to face the challenges of a fast-transforming information-driven society (NCERT, 2006). Various researches show the positive impact of using games in education. According to Sahin and Namli (2016), games increase enjoyment for students by providing rewards and feedback, which improves students' attitudes towards learning in traditionally challenging subjects like mathematics or science. In school science, learning several biological functions and phenomena are particularly difficult for students to grasp (Fokides and Mastrokoukou, 2018). Younger children often have naive ideas regarding the organs which make up the digestive and respiratory systems and they sometimes associate the stomach with respiration (García-Barros *et al*., 2011).

The present study was conducted during the COVID-19 Pandemic when online teaching became a challenge for engaging the students (Dhawan, 2020). One of the present authors, as a teacher, observed that students faced difficulties in

remembering the names and functions of organs related to various human body systems. Taking this into account, in the present study, we used two online tools, *Ecosystemforkids.com* and *Quizizz.com*, in online 6th-grade science classes. *Ecosystem-forkids.com* was used for homework as an out-of-class activity. *Quizizz.com* was used for administrating pre-tests and post-tests as a formative assessment gamification tool (Permana and Prematawati, 2020) since gamification tools are better for assessing the learning performance of the students specifically in terms of formative assessment (Areed *et al.*, 2021). We examined the effects of using interactive and gamified e-quizzes on students' achievement on the topics of five human body systems, namely the digestive system, the excretory system, the respiratory system, and the male and female reproductive systems.

The questions that the research is going to address, and the null hypothesis are as follows:

RQ1: What are the effects of using *Ecosystem-forkids.com* as a homework tool for learning about the five human body systems on student achievement?

RQ2: What are the effects of using *Quizizz.com* as a formative assessment tool?

Null Hypothesis (H_0): There is no significant difference in student achievement scores regarding the five human body systems before and after using *Ecosystemforkids.com* for homework.

METHODOLOGY

Methods

In the present study, a single-group pre-test and post-test quasi-experimental design (Cranmer, 2017) was adopted, in which all participants are given the same treatment and the effect of the treatment is determined by calculating the difference between pre-test and post-test scores. In this study, one e-quiz was developed on each of five human body systems and used for both pre-test and post-test. Each e-quiz composed of 10 multiple-choice questions with each correct answer awarding one mark. The content validity of the e-quizzes was checked by three biology teachers before the e-quizzes were utilized as formative assessments. Based on the comments and suggestions raised by them, several modifications were made to the questions. The test reliability was obtained by using the test-retest method. The reliability correlation coefficient was determined to be 0.82.

Sample

A purposive sampling technique which can be used for both qualitative and quantitative research (Tongco, 2007) was used. Participants in this study consisted of 32 students, 18 girls and 14 boys of 6th-grade from the age group 12-14 years from the same school. The students attended all the online sessions, completed the online homework on *Ecosystemforkids.com*, and answered pre-tests and post-tests.

Online class design

Seven online sessions of one hour each were conducted as an intervention programme via the Zoom platform. In the first session, the students were given hands-on practice in using *Quizizz.com* and *Ecosystemforkids.com*. From the second session onwards, online classes were conducted for teaching the five human body systems. A pre-test was conducted at the beginning of teaching each topic and after the completion of the homework related to the topic post-test was conducted.

Though *Quizizz.com* allows the student to make as many attempts as possible, only a single attempt was allowed in the present case. To facilitate communication with students for out-of-class activities, we used *WhatsApp* (https://www.whatsapp.com/?lang=en) as a communication tool.

Following the explanation of each topic, we shared a link to an interactive game quiz from

Ecosystemforkids.com in the group chat. Students solved the quiz by labeling the diagram. Their performances were automatically evaluated.

Figure 1 shows a game quiz on the diagram of the human respiratory system from *Ecosystem forkids.com*. Students were asked to label the organs by dragging and dropping. They could check whether their answers are correct by clicking on the check button below the diagram.

Figure 2 shows a screenshot of a question from *Quizziz.com*. Students were instructed to select an answer tab, and they received one mark for each correct response. The quiz additionally provided the correct answer in the case where a student had chosen an incorrect option.

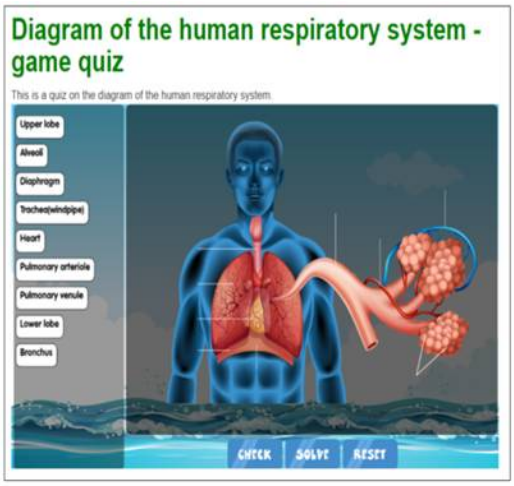

***Figure 1: Screenshot from* Ecosystemforkids.com**

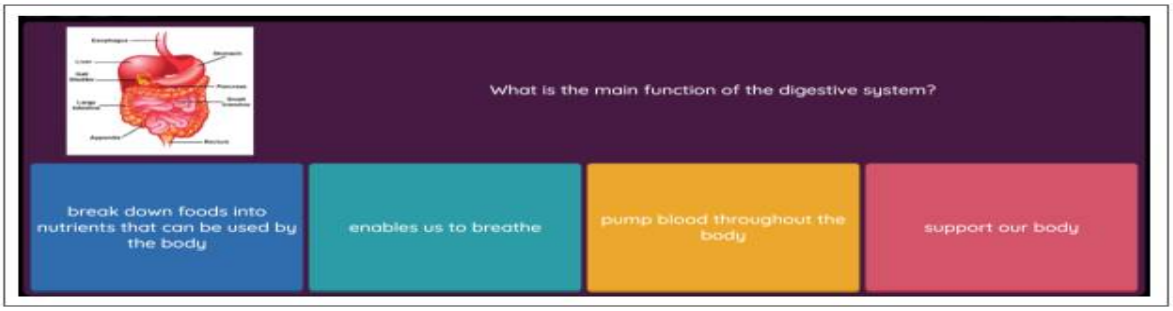

***Figure 2: Screenshot from* Quizziz.com**

RESULTS and DISCUSSION

The results of descriptive analysis of the study for the first research question, RQ1, are shown in Table 1 which gives the highest and lowest scores, mean and SD on each pre-test and post-test. The mean score of post-test on each e-quiz was higher compared to the respective average pre-test score.

Before verifying the null hypothesis, we first assessed the normality of pre-test and post-test data. The results of Shapiro-Wilk Test (Shapiro and Wilk, 1965) of normality are shown in Table 2. The significant (Sig.) value for each of the pre-tests and post-tests was less than 0.05. The results imply that the pre-test and post-test data for all five human body systems were not normally distributed.

As the normality of data was rejected, the non-parametric Wilcoxon Signed Rank Test (Sarty, 2022) was used to analyze the data. This test is used to verify the hypothesis of whether there is a difference in the mean score of students' achievement before and after a given treatment. For example, this test was used by Putri *et al.* (2018) in an experimental study to examine the difference between two data pairs in modified flipped classroom approach.

Table 1: Results of pre-test and post-test on each topic

Human Body System	Pre-test score				Post-test score			
	L*	H**	Mean	SD	L*	H**	Mean	SD
Digestive	1	7	3.5	1.35	5	10	6.8	1.39
Excretory	0	5	2.5	1.32	4	10	6.5	1.34
Respiratory	2	5	3.2	0.89	5	10	7.0	1.50
Male Reproductive	0	4	2.1	1.13	4	10	6.6	1.36
Female Reproductive	0	4	2.1	0.90	4	9	6.4	1.32

*: Lowest score; **: Highest score

Table 2: Shapiro-Wilk Tests of normality for pre-test and post-test

Human Body System	Pre-test			Post-test		
	Statistic	df	Sig.	Statistic	df	Sig.
Digestive	0.89	32	0.004	0.91	32	0.012
Excretory	0.91	32	0.011	0.93	32	0.035
Respiratory	0.87	32	0.001	0.91	32	0.013
Male Reproductive	0.88	32	0.003	0.93	32	0.034
Female Reproductive	0.89	32	0.005	0.88	32	0.002

Table 3 shows the results of the Wilcoxon Test for all the pre-test and post-test scores. There were significant differences at the $p = 0.05$ level between the pre-test and post-test scores for each topic.

Hence, the null hypothesis is rejected, and the alternative hypothesis, *i.e.*, there is a significant difference between the students' achievement before and after a given treatment, is accepted for all the e-quizzes. Therefore, it can be concluded that the use of *Ecosystemforkids.com* for homework improved each student's learning performance in the five human body systems.

While learning about the human body systems, students find it challenging to remember the organ names of each organ system and its related functions. This problem is compounded in an online classroom. Hence, the present study

Table 3: Result of Wilcoxon Signed Rank Test

Human Body System	Mean	SD	Z.	*P* Value
Digestive	264	53.48	-4.87	<.00001
Excretory	248	51.03	-4.86	<.00001
Respiratory	264	53.48	-4.94	<.00001
Male Reproductive	248	51.03	-4.86	<.00001
Female Reproductive	248	51.03	-4.86	<.00001

investigated the effects of interactive quizzes on students' achievement while learning five human body systems. The data from each formative assessment indicate a remarkable gain in students' knowledge after every session.

The possible reasons for this result are as follows:

1. *Ecosystemforkids.com* might be useful as a platform which facilitates interactive quizzes.
2. Interactive quizzes as homework might have engaged students. Hence, they might have become interested and actively involved in each topic.
3. Immediate automatic validation might have motivated students to reattempt the quiz even though the results of reattempt were not a part of the post-test scores. Thus, multiple attempts and timely feedback might have helped students to practice, relearn and perform better.
4. The "Ready Notes" available on *Ecosystem-forkids.com* might have helped students to consolidate the topic.

In the following paragraphs, the students' impressions of using the gamification tools are presented, and the benefits of using *Quizizz.com* as a formative assessment tool are discussed in detail.

Students' experiences of using the gamification tools

Below are some of the experiences shared by the students which support the findings of the study:

Student 1: I found it interesting to answer the test in a play-way mode; it allowed me to compete with my classmates.

Student 2: Ranking on the leaderboard motivated me to prepare for the topic.

Student 3: I enjoyed learning using online tools.

Student 4: Novelty in homework created interest; it helped me to identify and name the parts of five human body systems which I thought difficult to remember.

Student 5: It helped me to practice the in-class material at my own pace and place.

Student 6: Interactive quizzes gave me the opportunity to relearn and practice using multiple trials; it helped me perform better.

What are the effects of using Quizizz.com as a formative assessment tool?

Improvement in achievement can also be attributed to the gamification tool *Quizizz.com* which is used as a formative assessment tool in the study. The students actively participated in solving the e-quizzes.

They found it interesting to attempt the e-quizzes in play-way mode by competing with their classmates. Leaderboard provided by *Quizizz.com* fostered a sense of competition in them and motivated them to prepare for the tests. In addition to the leaderboard, badges and points which are also provided by *Quizizz.com* might have interested students and encouraged them to prepare for the test of each topic and to strive for a higher position on the leaderboard by putting forth their best efforts (Zainuddin *et al*., 2020). Immediate feedback helped them quickly identify and correct any misunderstandings they might have. Automated grading saves the teacher's time.

The present study showed an increase in students' achievement. However, it was conducted on a small sample. Therefore, it is vital to examine the effects on a larger sample, incorporating more quantitative data for the generalization of the findings.

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REFERENCES

Areed, M. F., Amasha, M. A., Abougalala, R. A., Alkhalaf, S. and Khairy, D. (2021) Developing gamification e-quizzes based on an android app: the impact of asynchronous form. *Education and Information Technologies* **26**: 4857-4878. https://link.springer.com/article/10.1007/s10639-021-10469-4

Cranmer, G. A. (2017) One-group pretest–posttest design. *In*: Allen, M. (ed.) *The SAGE Encyclopedia of Communication Research Methods*, pp. 1124-1126. SAGE Publications, Inc., CA. https://dx.doi.org/10.4135/9781483381411.n388

Dhawan S. (2020) Online learning: A panacea in the time of COVID-19 crisis. *Journal of Educational Technology Systems* **49**(1): 5–22. https://doi.org/10.1177/0047239520934018

Flores, J. F. F. (2015) Using gamification to enhance second language learning. *Digital Education Review*: 32-54. https://files.eric.ed.gov/fulltext/EJ1065005.pdf

Fokides, E. and Mastrokoukou, A. (2018). Results from a study for teaching human body systems to primary school students using tablets. *Contemporary Educational Technology* **9**(2): 154-170. https://doi.org/10.30935/cet.414808

Garcia-Barros, S., Martínez-Losada, C. and Garrido, M. (2011) What do children aged four to seven know about the digestive system and the respiratory system of the human being and of other animals? *International Journal of Science Education* **33** (15): 2095–2122. https://doi.org/10.1080/09500693.2010.541528

National Council of Educational Research & Training, NCERT (2006) *Position Paper: National Focus Group on Teaching of Science*. https://ncert.nic.in/pdf/focus-group/science.pdf

Permana, P. and Prematawati, I. (2020) Using Quizizz as a formative assessment tool in German classrooms. *Proceedings of the 3rd International Conference on Language, Literature, Culture, and Education (ICOLLITE 2019)*, pp. 155-159. Atlantis Press SARL. https://doi.org/10.2991/assehr.k.200325.073

Putri, M. D., Rusdiana D. and Rochintaniawati, D. (2018) Students' conceptual understanding in modified flipped classroom approach: An experimental study in junior high school science learning. *Journal of Physics: Conference Series* **1157**(2): 022046. https://iopscience.iop.org/article/10.1088/1742-6596/1157/2/022046/meta

Şahin, M. C. and Namli, N. A. (2016) Gamification and effects on students' science lesson achievement. *International Journal on New Trends in Education and Their Implications* **7**: 41-47. http://www.ijonte.org/FileUpload/ks63207/File/04.mehmet_can_sahin_.pdf

Sarty, G. E. (2022) 16.5 Paired Wilcoxon signed rank test. *Introduction to Applied Statistics for Psychology Students*. University of Saskatchewan, Canada. https://openpress.usask.ca/introtoappliedstatsforpsych/chapter/16-5-paired-wilcoxon-signed-rank-test/

Shapiro, S. S. and Wilk, M. B. (1965) An analysis of variance test for normality (complete

samples). *Biometrika* **52**(3-4): 591–611. https://doi.org/10.1093/biomet/52.3-4.591

Tongco M. D. C. (2007) Purposive sampling as a tool for informant selection. *Ethnobotany Research & Applications* **5**:147-158. https://scholarspace.manoa.hawaii.edu/bitstream/10125/227/4/I1547-3465-05-147.pdf

Zainuddin, Z., Shujahat, M., Haruna, H. and Chu, S. K. W. (2020) The role of gamified e-quizzes on student learning and engagement: An interactive gamification solution for a formative assessment system. *Computers & Education* **145**(C): 103729. https://www.academia.edu/40802741/The_role_of_gamified_e_quizzes_on_student_learning_and_engagement_An_interactive_gamification_solution_for_a_formative_assessment_system

APPENDIXIES

Ecosystemforkids.com

Ecosystemforkids (https://www.ecosystemforkids.com/) is a free website with interactive materials for kids and educators. It is systematically structured according to science topics and science branches.

Each topic is covered with a variety of resources like games, quizzes, worksheets, flash cards, etc. Some topics covered here include, ecosystems, classification of plants and animals, scientific names, electricity and magnetism, heat flow and waves, force and energy, the earth and the solar system, etc. These interactive science activities and enjoyable e-learning games on multiple topics help science teachers to make the class interesting and fun. It provides teachers with worksheets and tests in the form of multiple-choice questions for the assessment.

Quizizz.com

Quizizz (https://quizizz.com/) is a user-friendly interface, a gamified student engagement platform. It is used in classes for group assignments, pre-test review and formative assessments. It offers multiple features to make a classroom fun, interactive and engaging.

It is also a formative test tool that is suitable for getting information about the overall class condition in understanding the content of the topic being taught. It helps to assess the performance of the students (Permana and Permatawati, 2020). Teachers have access to the students' performance reports and can see the overall class performance on a particular quiz, or progress of the individual student. Students can attempt each quiz repeatedly; it helps them to practice and improve their scores.