



Online Tests in the Trend of Education 4.0: An Empirical Study in Mathematics at High Schools of Can Tho City

Tuan Anh Bui¹,
Nghia Huu Nguyen^{2,+},
Thao Thi Thu Tran¹,
Anh Ngoc Phuong Nguyen¹

¹Department of Mathematics Education, Teachers College, Can Tho University, Can Tho City, Vietnam;

²Can Tho Department of Education, Can Tho City, Vietnam

⁺Corresponding author • Email: nguyenhuunghia@cantho.edu.vn

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ABSTRACT

In the trend of Education 4.0, the assessment of learning results through online tests is increasingly widespread and important because of its usability and mobility. In addition, it is also adaptable in the volatile situations of today's society such as natural disasters, epidemics, war, etc. The paper presents the results of an empirical study in Mathematics at high schools in Can Tho city on the comparison of outcomes between online tests and paper tests. The initial statistical analysis results show that the evaluation of learning results by online tests has high consensus among the experimental group. Furthermore, the advantages and suggestions for improvement are also pointed out and discussed in this work.

1. INTRODUCTION

In the digital age, the integration of Information & Communication Technology (ICT) into teaching and learning process has a great impact on the innovation of teaching methods in many educational institutions, in which online tests play a meaningful and crucial role in training quality accreditation (Alexander et al., 2001). According to Rogers (2016), online courses are one of the viable options for numerous universities because of their spatial and temporal expansion. With multimedia support via World Wide Web, learners take distance learning courses via email, complete requests on schedule and pass a test of completing the program in a live form. In the United States, National Center for Education Statistics (NCES) has launched a technology-based assessment project and has received a lot of participation (Bennett et al., 2007). The OECD offers several options to promote the use of Information & Communication Technology (ICT) in education, including the application of technology in its flagship project, PISA. In 2006, PISA Program introduced the first online test administration in the framework of computer-based scientific assessment.

According to Csapó (2009), the assessment process is only significant when learners receive prompt, timely and regular feedback. On the other hand, in the context of personalized education, with online tests, teachers collect data about learners' learning outcomes that can be collected more conveniently through communication channels. In addition, Taherbhai et al. (2012) point out that online tests form are not different from reality in terms of knowledge, but it is more outstanding because it saves printing costs, flexibility in managing exam results compared to the version on paper-pencil tests. The use of online tests assessment flourished and really exploded in 2013 when at least one online course was attended by 6.7 million students. In this course more than 80% of the materials has been delivered online, of which the instructor may also choose to use the online tests delivery method in blended and web-enabled courses (Allen & Seaman, 2013).

During an outbreak like COVID-19, schools shut down and switch to online learning or self-learning support for students (Verawardina, 2020). As in Mahalakshmi and Radha (2020), in order to cope with the complicated epidemic diseases, creating virtual classrooms and conducting online assessments are necessary to maintain the continuity of the learning process. At that time, the tests are converted from paper-pencil tests through software such as Zoom

cloud meeting, Google Classroom, or the media to survey students' knowledge in the online learning process. It is seen as the first step in the process of transitioning from direct to online learning in high school.

In order for the online testing process to be widely and smoothly applied, this study proposes the design of online tests (OT) by using Google Forms (GF). This approach can be tested regularly in the classroom as well as a resource for students to review knowledge after each unit of knowledge. On the other hand, the transition from paper-pencil tests (PT) to OT was reflected through a survey conducted from June to August 2020 at high schools in Can Tho city.

2. LITERATURE REVIEW

2.1. Definitions of online tests

Online tests usually take the form of a database with several forms such as quizzes, fill, concatenation, essay, etc. It is posted on the Internet with secure access (Alexander et al., 2001). According to Veanes (2005), online tests are viewed as a program designed with the available tests. Veanes et al. (2006) continue to define OT as a form of testing based on model based testing in which the OT lesson is designed based on a number of tools, learners will use it with some technical manipulations on the media to access and complete within a specified time. OT are presented by a computer via an online connection to feed questions and receive students' answers (Moon, 2013).

From there we can see that a huge difference from the tests that use paper to present questions and another piece of paper to collect students' answers. Boitshwarelo (2017) uses the term "online tests" to refer to an IT-based assessment with the main purpose of guiding learning or summarizing a certain piece of knowledge with automation. Through the above studies, a generalized definition of online tests is given as follows: "*Online tests are considered as tests to evaluate learning outcomes in an online form in the teaching and learning process and are communicated to learners through media connections such as E-learning courses, social networks, email, etc.*"

2.2. The outstanding features of online tests compared to paper-pencil tests

Puhan et al. (2007) offer some arguments about the differences between OT and PT. The results of this study show that OT both show students' knowledge and skills to use computers. Paek (2005) presents a number of reasons for using OT instead of PT as it reduces time lag, reduces paper usage and effort in responding to tests. The results of each individual participating in the assessment with OT are flexible according to the teacher's intentions and are confidential, responsive immediately, after moderation, based on media support.

In addition, Wang et al. (2007) point out that it depends on the grade level, type of test and the purpose of the assessment process. Then the OT lesson is distributed via computer to the learner, ensuring no difference between OT scores compared to PT. Meanwhile, Larsen (2004) has argued that the duration of the OT can be extended depending on the purpose of the assessment. Based on this feature, OT aims to practice knowledge, allowing learners to have time to search for resources, to plan themselves to complete the assigned tasks with a more comfortable mentality (Bayazit & Aşkar, 2012).

Pennebaker et al. (2013) show that using OT on a daily basis can help make the process of reviewing learners' knowledge more frequent; this is confirmed by the end-of-course performance compared to a regular classroom with instruction from the same instructor. Stowell & Bennett (2010) demonstrate that the transition from PT to OT has some positive effects on learner psychology. With a sample of 69 subjects and using counterweights for comparison, the research results confirm that learners can reduce the burden of worrying about scores and at the same time improve test scores.

Meanwhile, Rogers (2006) concern about "digital fraud", a term used to describe how learners use the World Wide Web to aid cheating while participating in OT. It includes accessing other websites, communicating with others via instant messaging tools or email. Nevertheless, Veanes et al. (2006) argue that OT could dynamically adjust test times while others could block unauthorized search spaces to avoid exam fraud. It has been seen that the transition from PT to OT should be paid attention to the security settings.

2.3. Conversion between two forms of assessment, Paper-pencil tests and Online tests

According to the study of Csapó et al. (2009), PT should be designed and accredited before moving to OT with the help of multimedia technology. Next is the security setting step, and for the program to run to predict the OT process in order to promptly fix if any problems arise. OT also needs to be carefully calculated in choosing a bank of questions, the test format to suit the purpose and ability of learners to participate in a particular context (Boitshwarelo et al., 2017). Based on research by Harmon et al. (2010) and Varble (2014), this article proposes a number of measures to improve the quality of OT articles, temporarily called "security keys" as follows: (1) Preferred using a bank of questions verified by PT; (2) Create a unique quiz for each student; (3) Set up automatic scoring and

feedback for students; (4) Set a limited time mode from start to finish to manage participants on schedule but feel mentally comfortable; (5) Easy access to mobile devices, tablets, and laptops; (6) Set up safe access, anti-fraud and confidentiality for OT such as collecting full name information, for a Gmail address used only for one learner; can only take the test once (for assessment purposes) and do many times (for knowledge review); a disturbing sequence of test questions, etc.

Additionally, cheating in online testing also depends on learning needs and purpose, attitude toward assessment. Therefore, if the pressure on grades is removed, the OT instead of just being used for testing purposes, is also seen as a regular feedback form of students about their learning to teachers.

2.4. Designing online tests with Google Forms

To design OT to meet the requirements of digital fraud and assessment, Google Forms (GF) is a preferred choice with many outstanding features and completely free. GF was developed by Google along with Google Docs, Google Sheets, Google Slides, capable of supporting Online learning (Valentin et al., 2009). Gehringer (2010) suggested that GF can also evaluate learning results in courses.

Chaiyo & Nokham (2017) recently pointed out that through GF, the awareness of students will be effectively reflected through surveys, statistics, and visual charts. From there, it has been seen that it both saves time and costs, and besides that it can be automatically backed up on cloud technology. Furthermore, GF is created and put to use simply with a Gmail address. Thus, it can be observed that the application of GF in education, especially the use of students' learning performance assessment is one of the appropriate options. (Mansor, 2012; Djenno et al., 2015; Agrawal et al., 2016 and Murphy, 2018. The test settings are Google included in the GF as shown in Figure 1 below.

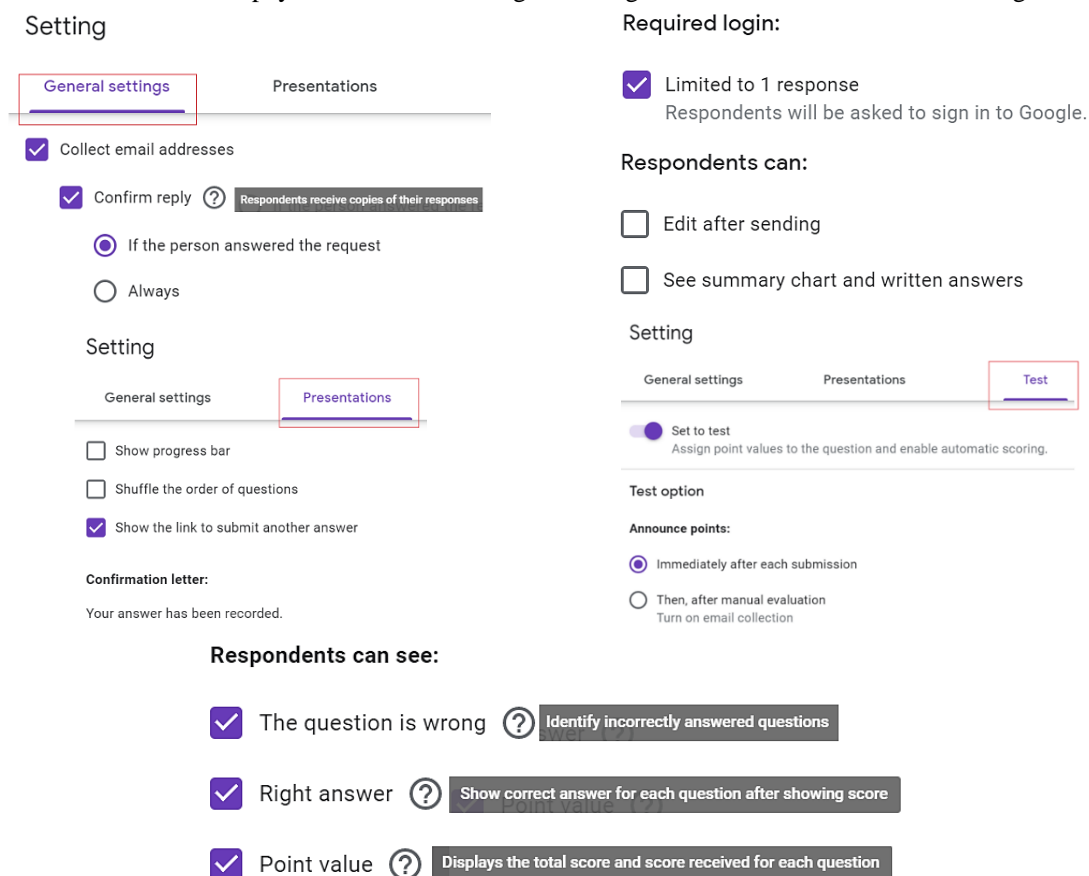


Figure 1. The setting of Google in GF

As can be seen in Figure 1, each question in GF has its own settings for the question format (Short answer, Paragraph, Multiple-choice, Check box, Drop-down menu, Upload the file, Linear range, Multiple choice grid, Grid Check box, Day, and Hours). Besides, it also has Obligatory mode setting (required), with detailed description of the question, mode to switch to the corresponding part of the answer. Moreover, it also shuffles the order of the answers

of the questions (also in the general setting is to shuffle the questions of the Test), import questions directly or insert pictures, insert Youtube video and response mode for each question.

Specially, GF can be adjusted test start and end times, potentially limited number of visits (corresponding to the number of classes). It can also be customized interface to more interesting and attractive GF, preview mode, share with many people via Gmail address or link, have the function of collaborator and create copy. From this, it can be seen that GF meets the requirement to design a test in combination with OT. For Mathematics, GF is often used to format multiple-choice questions and insert pictures because Google does not yet support inserting Equation or MathType formulas (Astuti, 2020).

3. RESEARCH METHODS AND RESULTS

3.1. Research methods

To set the design model OT from learning resources PT, we have collected feedback when using OT in learning, the research progress is done as in Figure 2 below:

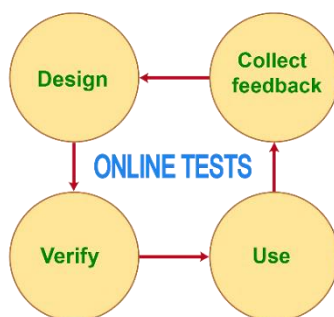


Figure 2. The Procedure of Establishing Online tests (PEOT)

- At the “**Design Online tests**” step, the questions in PT are compiled based on a detailed matrix that shows the knowledge, skills, attitudes and abilities that students need to achieve. For Mathematics and subjects using MathType or Equation formulas, the questions need to be converted to images. Then, the OT can be divided into numerous parts, each part represents a content to be evaluated. From there, establish security conditions, OT test with preview mode and adjust to suit the purpose of evaluation.

- In the step “**Verify Online tests**”, the questions used in the OT were checked with the IATA software. According to Cartwright (2007), IATA software has a number of advantages such as free access, language options, simple operations, input data can be performed with Excel files. Furthermore, IATA also has a full range of advantages such as: analysis of multiple-choice questions for students’ difficulty and differentiation, and so on.

- Next, in “**Use Online tests**”, OT is sent to learners via a link or sent directly to the student’s Gmail address or into a class like Google Classroom, Shub Classroom. In addition, using the feature of dividing into separate content sections, OT can be used to create a survey form to collect the feedback of students. The survey was conducted Online with GF on students in high schools in Can Tho city. The most important thing is how students are when approaching OT; the relevance of the OT test in assessing learning results in Mathematics compared with PT and ideas for improving OT.

- The final step is “**Collect feedback**”. Based on the results of the survey OT and the feedback of students, teachers need to improve and conduct archives to use for other tests or to review knowledge. Moreover, with the function of storing results by Excel file, OT can verify with IATA a second time.

3.2. Research results

- *A preliminary analysis of the survey feedback of students:* In this study, the sample of students’ feedback survey on the use of OT in the assessment test of Mathematics learning results includes 08 questions from Q1 to Q8, of which Q1 to Q5 is derived from Bayazit et al. (2012), described as in Table 1:

Table 1. Survey form

Code number	Content	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Q1	I feel more relaxed at Online tests compared to Paper-pencil tests	1	2	3	4	5
Q2	I prefer Online tests to Paper-pencil tests	1	2	3	4	5

Q3	I think the testing tool was easy to use	1	2	3	4	5
Q4	I think Online testing environments have more advantages compared to Paper-pencil testing environments	1	2	3	4	5
Q5	I would like to recommend the Online testing tool to my friends	1	2	3	4	5

To facilitate comparison between of PT and OT, improved OT, the questionnaire should be added three questions: Q6: In your opinion, what are the advantages in Online testing compared to paper-pencil testing?; Q7: In your opinion, what are the disadvantages in Online testing compared to paper-pencil testing?; Q8: What suggestions do you have for improving the Online test?

In questions 1 and 2, the primary purpose is to assess the liking and comfort level of taking Online tests. Questions 3 and 4 aim to assess the positive aspects of Online testing. Question 5 is to know the user's opinion about recommending Online testing tool to a friend. All five questions are designed on a 5-step Likert scale to evaluate the quantitative results of the answers. The questions were coded to score as follows: Strongly disagree = 1; Disagree = 2; Neither agree nor disagree = 3; Agree = 4; Strongly agree = 5.

Meanwhile, questions 6, 7, and 8 are open-ended questions to evaluate the advantages and disadvantages of Online testing compared to paper-pencil testing. In addition, it is intended to record suggestions for improving the Online checkout form from users.

- *A preliminary analysis of the survey feedback of students:*

The study has collected 121 handouts and collected 121 votes (100%) from 10 high schools in Can Tho city, which are listed in Table 2 as follows:

Table 2. Table of data from High Schools in Can Tho city

Number	Name of the High School	Number of male students	Number of female students	Total
1	Ly Tu Trong	11	17	28
2	Bui Huu Nghia	0	2	2
3	Chau Van Liem	16	14	30
4	Luu Huu Phuoc	2	1	3
5	Nguyen Viet Dung	0	1	1
6	Nguyen Viet Hong	7	2	9
7	Phan Ngoc Hien	2	1	3
8	Phan Van Tri	0	1	1
9	Thot Not	1	0	1
10	Practice Teachers	16	27	43
Total		55	66	N = 121
Proportion		45.5%	54.5%	100%

Student feedback on reliability Cronbach's Alpha was analyzed by using the SPSS version 24 and presented in Table 3 and Table 4:

Table 3. Analysis of student opinion survey data based on Cronbach's Alpha

Cronbach's Alpha	N of Items
.683	5

Table 4. Item-Total Statistics

Code number	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	12.66	6.193	.447	.629
Q2	13.03	6.032	.491	.610
Q3	12.18	6.267	.376	.660
Q4	12.40	5.593	.479	.614
Q5	12.26	6.479	.400	.648

As in Table 3, the correlation coefficients of the observed variables are quite appropriate (both greater than 0.3). Besides, the coefficient of Cronbach's Alpha is $0.683 \geq 0.6$, this shows that it meets the requirements for reliability, proving the questions are consistent with the opinion survey.

Here the question arises, are the mean values of the questions equal to 3? Hypothesis analysis of the population mean with significance level $\alpha = 0.05$, i.e. 95% confidence level are presented in Table 5 and Table 6.

Table 5. Hypothesis test for the overall mean (95% confidence) - One-Sample Statistics

Code number	N	Mean	Std. Deviation	Std. Error Mean
Q1	121	2.98	.861	.078
Q2	121	2.60	.861	.078
Q3	121	3.45	.922	.084
Q4	121	3.23	.998	.091
Q5	121	3.37	.828	.075

Table 6. One-Sample Test

Code number	Test Value = 3					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval Difference	
					Lower	Upper
Q1	-.317	120	.752	-.025	-.18	.13
Q2	-5.068	120	.000	-.397	-.55	-.24
Q3	5.423	120	.000	.455	.29	.62
Q4	2.551	120	.012	.231	.05	.41
Q5	4.941	120	.000	.372	.22	.52

As seen in Table 6, Q1 question has the value of Sig. (2-tailed) = 0.752 > 0.05, so we can conclude that the mean is equal to 3. That is, the answers were chosen “Neither agree nor disagree”, this could lead to many different reasons such as the time or environment in which the Online tests are not really good for students. Q2 to Q5 have the value of Sig. (2-tailed) < 0.05; therefore, it can be rejected that the mean values are equal to 3. Meanwhile, from Q3 to Q5, the average values are between 3 and 4 with 95% confidence; this means the answers revolve around from “Neither agree nor disagree” to “Agree”; and Q2 has a mean value of 2.60, which is lower than the theoretical mean of 3.

The analysis showed that the Online testing tool as well as its positives, including recommending it to others, are actually above average. Nevertheless, students are still not really familiar with the manipulations of using Online tests fluently. In addition, it is also possible that they still have not used many test questions on the interface of Google Form and are confused in how to choose the answer.

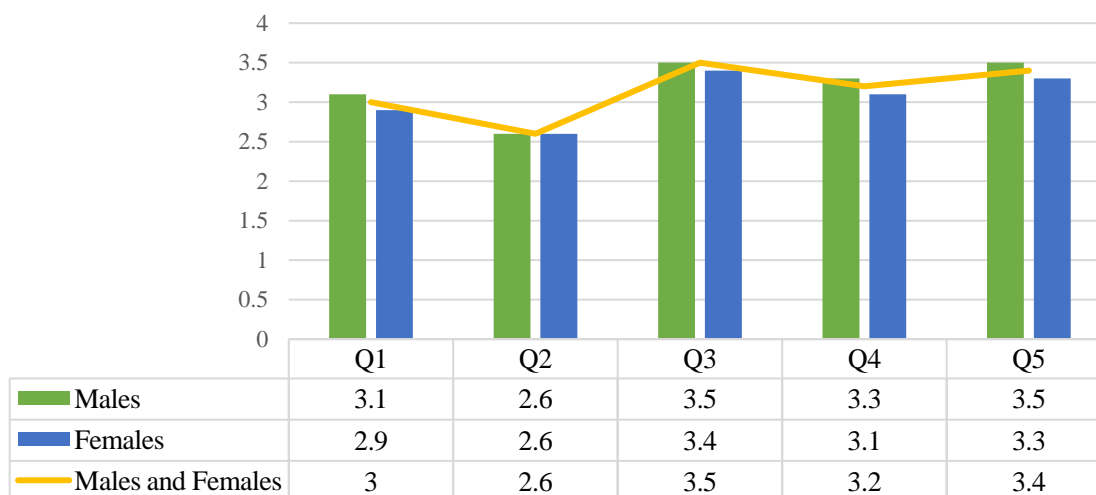


Diagram 1. Things needs to be improved for Online tests

Based on Diagram 1, it can be seen that the proportion of male and female students participating in Online testing and interest in this form is not much different from each other. But the average of male students is always slightly higher than the percentage of female students in all 5 questions. This also partly reflects the male students’ interest in technology, especially with Online testing.

Analytical results for Q6 to Q8 are presented with the following details:

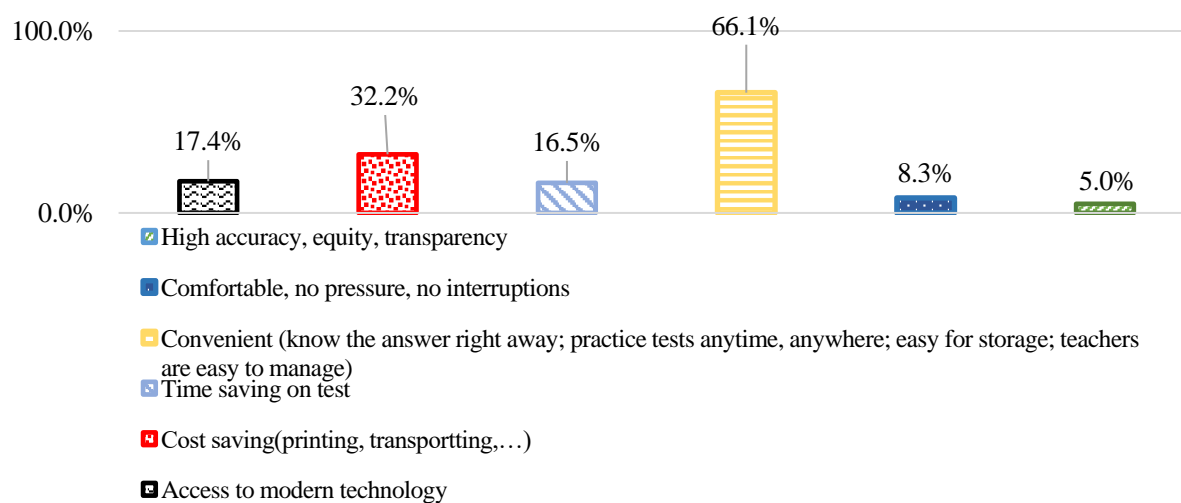


Diagram 2. Advantages of Online tests compared to Paper-pencil tests

It can be observed in Diagram 2 that, up to 66.1% of the survey respondents said that the advantage of Online tests over the convenient of Paper-pencil tests, including ideas like knowing the answers right away. Moreover, it can be tested wherever you are; easy to store; teachers are easy to manage are also the most outstanding advantage of Online tests. The ratio of printing cost savings of 32.2% shows that students have a high sense of environmental protection, then the move from home to school will be significantly reduced. In addition, when taking Online tests, students will have access to the current world’s development trends and advanced technologies help students develop their thinking and ability to seek information.

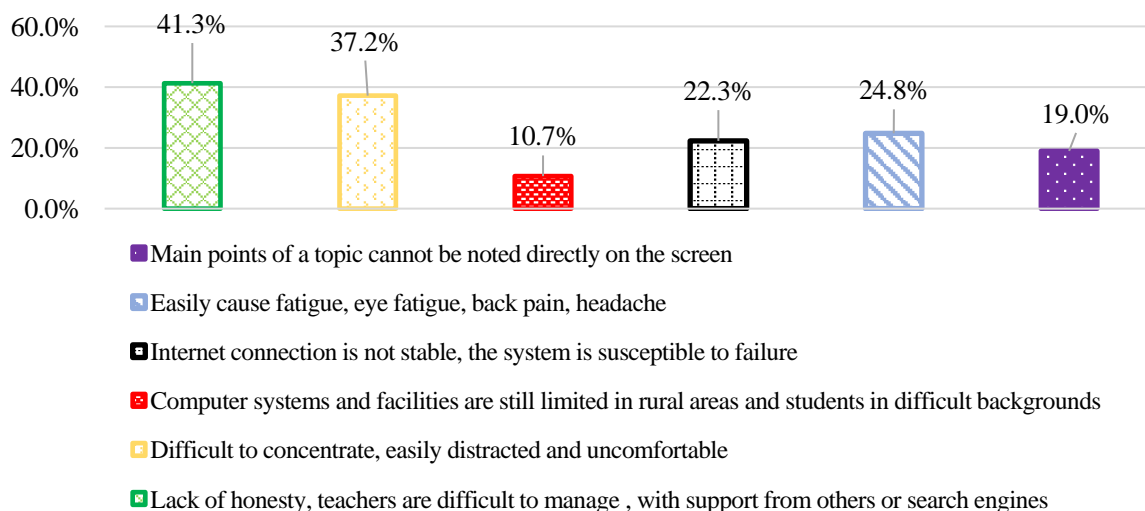


Diagram 3. Disadvantages of the Online tests compared to the Paper-pencil tests

It can be seen in Diagram 3 that the percentage of students choosing the options on the downside of the Online tests compared to the Paper-pencil tests was 50% lower, showing that the form of Online tests did not have too many restrictions for students. However, the main disadvantages are due to “lack of honesty, difficult teachers to manage, with support from others or search engines”, accounting for 41,3%. This shows that Online tests do not really guarantee fairness and lead to incorrect assessment of students’ abilities.

In addition, when students take Online tests, they can be distracted from social networks, which leads to difficulty in concentrating on completing the test on time, so 37,2% of the survey votes choose this idea. Moreover, the limitations of the Internet connection, the management system and the Online testing system make students easily tired, mainly eye problems are also issues that need attention.

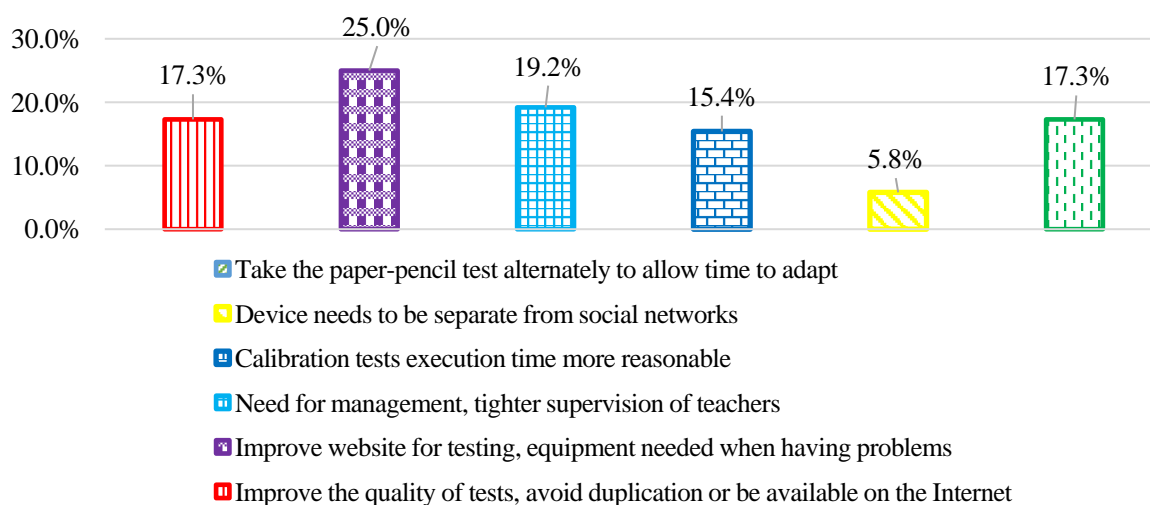


Diagram 4. Things needs to be improved for Online tests

As can be seen in Diagram 4, the website needs improving; checking the necessary equipment in case of trouble is the most essential thing when doing Online tests. Besides, it is necessary to improve the quality of pictures, diagrams, and clear word sizes, which will help children to read easily and reduce eye strain. Another very important thing is the management and supervision of the teachers to avoid the situation of students asking each other or using search engines to look up the results. Some students need time to adjust to Online tests by alternating Paper-pencil tests so that they will not be embarrassed and confused.

4. DISCUSSION AND CONCLUSION

The research results show that Online tests have a meaningful role in supporting the performance test in several different educational contexts. Online tests can be used for a variety of purposes from being included in regular assessments, reviews by comments, or into knowledge lessons. Particularly it has numerous advantages in the educational situation affected by the COVID-19 such as pandemic, natural disasters and war. It should be noted that, Online tests are not only applied to Mathematics but they can also be executed in other subjects, especially suitable for the social sciences, or subjects with open knowledge. In addition, using Google Forms to design Online tests has many outstanding features in terms of test formats, secure access modes, and timers. The PEOT setup process is initially pertinent for the high School Online teaching conditions about facilities and ICT level of students. In the near future, it is possible to use Online tests for extensive testing in a secondary education environment geared towards Online tests. However, the obtained results also demonstrated that Online tests need to be improved to increase security and prevent digital fraud.

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