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Technology Based Assessment and Enhancement of Thinking Skills: A Case Study of the Educational System Development in Palestine

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Abstract

The study aimed to identify the added value of computer based on students' thinking skills and performance. The study approached the literature as a multi-dimensional phenomenon which addressed both theoretical and applied research. The study presented computer games software features that do not exist in the traditional tools. Several researchers' demonstrated game-based learning active role as a useful learning tool. There are few studies that enhanced and assessed thinking skills based on their own developed instruments. However, no similar instruments were found to exist in Palestine, although the Palestinian educational system is shifting towards digitizing the educational environment. Academic performance emerged as a significant predictor of computer based assessment. Implications of the study for practice are highlighted.

Keywords: Computer based, game-based, thinking skills, assessment, performance.

Introduction

Computers can be used nowadays in education and in several approaches including e-learning and edutainment. These ways take the chance to gain the advantage from traditional methods which is based on "drill and practise" (Brom et al., 2009). Educators and researchers are concerned about digital game-based learning regarding its advantages in enhancing students' involvement and mixing education with entertainment (Prensky, 2007). Positive effects on higher order thinking skills like creativity and learning motivation have been observed (Yang & Chang, 2013). Yuda (2011) found out two major positive influences that game applications, i.e. digital education materials, have on elementary students including fostering their spatial thinking and widening their views. Besides, he emphasised the importance of games on computers and their role in mixing enjoyment with education.

There are no doubts that there are several advantages for implementing technology in education. Also, the use of computer games are also considered as a modern and attractive way of teaching since traditional tools do not have the value as it is in the computer games

(Bottino et al., 2007). A lot of educational experts pointed out to the need of measuring and developing thinking skills in everyday school context (Adey et al., 2007). Subsequently, the target group should be early school years since their low level of cognitive abilities might work as an obstacle in understanding subject materials. Therefore, it is advisable to do efficient early interventions since it could significantly return in later school years (Nagy, 2008). To be able to implement efficient interventions, the spotlight should be directed toward the familiarity of the structure, nature and development of different abilities as well as the ability of being able to use the available instruments for everyday application in educational practise to assess and foster thinking skills.

Purpose and Scope

Several countries around the world are developing their educational systems by involving technology in it. Thus, Palestine is seeking to be one of these countries by establishing a digitized educational system (Affouneh, 2014). Until the present time, there is no evidence or overview of the development of higher order thinking skills on Palestinian school students. Hence, this article aims to find out the added value of computer based assessment on students' thinking skills and performance. The study, considered to be the first to the author's knowledge and leading of its kind, revealed that there is no precise instrument for assessing thinking skills using computer based assessment in the Palestinian educational system which remains unclear. Therefore, this is a qualitative research study using a content analysis, and is appropriate to the exploratory nature of the research.

Technology Based Assessment and Enhancement

Paper-pencil tests have been used for educational assessment for about a century. Later, computers were used for testing students' knowledge. The courage to replace traditional forms of assessment is increasing in favour of computer based assessment. There are several factors motivating the use of technology including developing the assessment of already established assessment domains (Csapó et al., 2012). Subsequently, the measuring constructs is difficult to do without the means of technology (Csapó et al., 2014). Limitation of paper based assessment and expanding of the assessment process to cover new areas including general thinking skills such as problem solving which now is being assessed by PISA since 2013, increases the interest in developing technology based assessment systems, and made these systems available for everyday use (Csapó et al., 2012).

Over the last two decades, scholars set questions extensively in their computer based and paper-pencil test comparison studies. The advantages of computer based over the traditional ways works as an incentive factor to switch and be able to benefit from this new modern technology. Csapó et al. (2014) illustrated these advantages which first includes, tailoring tests (like adaptive testing) which are suitable for the individual characteristics of learners. Second is an automated scoring and immediate feedback. Third, it includes innovative item formats such as multimedia elements: sounds, animation, video, simulation items etc. Fourth, it gives a full accurate control over the presentation of test stimuli. Finally, the cost of test administration is reduced (Price et al., 2009).

Program for International Student Assessment (PISA) is one of the international assessment of the reading, science, and mathematical literacy of 15 years old students. The main aim of this programme is to evaluate education systems worldwide. Over a half million students from 72 countries attended the internationally agreed two-hour test in 2015. However, this test covers several subjects including science, mathematics, reading, collaborative problem solving, and financial literacy. This programme is one of the examples of educational assessment programmes that are shifting gradually from paper-pencil to computer based assessment. For the first time ever in 2006, the PISA assessment of science included a computer based test. The results pointed out by shifting from paper based to computer based in regards to the importance of analysing the validity issues. Again in 2009 and 2012, PISA offered computer based test in a specific field. In 2015, PISA released computer based items and the major fields (reading, mathematics and science) were assessed using computerised tools.

This shifting encouraged several scholars to conduct studies in different knowledge and competence domains. These studies rely on several educational tests which aim to find out the effects of the new mode of tests on pupils' performance (Clariana & Wallace, 2002; Kingston, 2008). The differences between paper-pencil and computer based test performance covered several aspects i.e. advantages and disadvantages, validity and reliability, and the effects of background variables (gender, race/ethnicity, and technology-related factors, like computer familiarity) (Csapó et al., 2009; Gallagher, et al., 2000). Therefore, these differences have been extensively studied and well documented (Csapó et al., 2014). Paper-pencil and computer based testing are comparable according to recent media effect studies, and students are in favour of computer based test rather than the traditional ones. By that

time, computers are becoming more broadly accessible at schools which decrease the comparability problems (Way et al., 2006). In other words, technology based assessment, or to be more precise, computerised testing is the most rapidly developing area of educational evaluation (Csapó et al., 2012). Technology revolutionizes all aspects of assessment in order to facilitate data processing and banking as well as vitalizing testing situation, increasing motivation, and may improve validity (Csapó et al., 2012).

Software Features Support Students' Cognitive Processes

Computer games software has several features that do not exist in the traditional tools. Bottino et al. (2007) pointed out the crucial role played by the software:

1. Direct feedback on the player's action. One of the basic features is giving participants immediate right/wrong assessment and this supports students in error comprehension (Werts et al., 2003). The form of the feedback has different shapes: it could be visual, audio etc.
2. Backtracking: Most software programmes gives the trainers a possibility (the way differs from one programme to another) to retrace one's step. For instance, some programmes give the user another chance to correct a previous wrong choice. This works as a feedback to the students. It also supports adaptive testing by presenting the actual item depending on the success of student in solving the previous one (Csapó et al., 2012).
3. Support in the detection of the most favourable cases. Different programmes give clear advices about the tasks.
4. Support the anticipation. It works as a motive to encourage students to think of current and future steps.
5. Support for memorization or for performing specific actions.
6. Graduation in the level of difficulty. The level of difficulty could be controlled by the teacher or it can be developed automatically regarding students' progress in the tasks.
7. Specific tips regarding the next move.

Most of these characteristics can be found in both technology based assessment and digital game based learning. This makes the unification between them possible (Csapó et al., 2012; Pásztor, 2015).

Game Based Enhancing Thinking Skills

Game based learning has been identified as a form of student centred learning that places problem solving scenarios within the context of play (Ebner & Holzinger, 2007). Also, it encourages active learning and evokes satisfaction and engagement (Yang & Chang, 2013). Prensky (2007) presents several sectors that digital game based learning interferes in. Firstly, it implements a media enhanced narrative for creating interest and it fosters student involvement; secondly, it is easier to complete the tasks with clear directions provided; thirdly, it integrates interaction and immediate feedback from the digital environment; next, it offers the potential for adaptive learning based on student capabilities; finally, problem solving and creativity enhancement are possible.

Scholars have analysed games and their outcomes and impacts from different dimensions to help in giving a better understanding of games. The primary function of the game gives an idea of the purpose behind it which consequently helps in categorizing game as a game for entertainment, or as a game for learning or as a serious game. Entertainment, fun and reaction, are the main aims of digital commercial games, while learning and behaviour change are the basic goals for games based learning and serious games (Connolly et al., 2012). Serious games and games based learning are being used for the same function and they can be considered as synonyms (Corti, 2006). However, the link between playing games and learning is increasing, and several models which were developed indicated that playing digital games can have a clear learning outcome (Connolly et al., 2012). Garris et al. (2002) divided skills based learning outcomes (including technical and motor skills), cognitive outcomes (including declarative, procedural and strategic knowledge), and affective outcomes including beliefs or attitudes which help players to learn by changing their emotions.

Game based learning have several benefits including stimulating their learning motivation and enhancing the interaction with students (Chen & Huang, 2013). Digital games, for instance, give players the possibility to construct their own understanding naturally (Dormann & Biddle, 2006). It was argued that they can be considered as helpful learning tools (Iacovides et al., 2012). Also, they leave positive effects on student learning (Pivec, 2007). These positive effects cover two principal areas: learning effectiveness and learning motivation (Chen & Huang, 2013).

Consequently, studies have been done in this field with investigations on the effects of game based learning on fields as science self-efficacy and science content learning. The development of students' knowledge in science content has been noticed (Meluso et al., 2012). Self-efficacy on the other hand has also been developed and noticed on learning achievements of students with game based learning compared to other students with a traditional learning environment (Cheng & Su, 2012). Next to that, another study by Yang (2012) explored the relationship between students' achievements and digital game based learning. The results were quite positive regarding the enhancement of learning motivation and improvement in promoting student's problem solving skill.

The Palestinian Educational System

Ministry of Education and Higher Education (MoEHE, 2017)[1] are responsible for all regulation related to public schools. It also interferes in the regulatory overview of private and UNRWA[2] schools. The same case is observed with the Palestinian universities and community colleges where MoEHE set the regulatory overview with the higher education sectors.

Furthermore, the Palestinian general education system is divided into three different sub-sectors:

1- Kindergarten Education: Local and international institutions provide services in this sector for children in the age of 4 – 5 years old.
2- Primary Education: It starts from the first grade until the tenth grade. This sub-sector is divided into two levels:
A- The first level is grades 1 – 4 called (first graders) the lower basic stage.
B- The second level is from grade 5 – 10 called upper basic stage.
3- Secondary Education: It starts from grade 11 – 12, and it includes two streams: academic and vocational education. Students are able to choose between these two streams.

[1] All information provided under the title "How does the Palestinian system look like?" is collected from the official website of the Ministry of Education and Higher Education. It was referred to in the references (MoEHE, 2017).
[2] UNRWA stands for The United Nations Relief and Works Agency for Palestine Refugees. It is funded almost entirely by voluntary contributions from United Nations (UN) member states. It runs schools under the name of UN. For more info, see UNRWA (2017).

At grade 12, students attend the general examination which is based on the final result. Students who pass the exam are able to apply to universities and colleges.

The Palestinian system is being developed regarding the implementing of technology in education (Shihab, 2014). Implementing technology at schools in Palestine covers several areas: first, offering training courses for teachers. Second: connecting all schools with internet. Third: digitizing the materials (e-books) and providing the courses with educational videos and computer games as well. Finally, each teacher and student will have their own tablet according to 2017-2020 plan (Alhadath, 2016). It should be kept in mind that some schools have already started using tablets; thus, 35 thousand tablets have been handed out to students (Shihab, 2014). Therefore, it will be beneficial to find out students' response using Information and Communication Technologies (ICT) in education since ICT is considered as a powerful tool regarding developing logical abilities (Riel, 1994). Later, it might be possible to find out what values can modern technologies bring to the Palestinian educational system.

Subsequently, there are some studies which analysed the Palestinian curriculum regarding higher order thinking skills. These studies emphasised the visibility of these skills in the curriculum on an average level (AbdulKader, 2014). There are also other studies that explore the educational curriculum and enhance thinking skills. The findings highlight weaknesses in the curriculum and in teaching and assessing students' thinking skills enhancement (Barbak, 2012).

Conclusion and Recommendations

Technologies offer new opportunities for both instructional and developmental processes in education on one side and assessment on the other side. Computer based assessment is overcoming the traditional paper based assessment regarding the facilities that it provides to the examiners. Therefore, this expanded the assessment process to cover more areas which played a role as well. Computer based advantages work as an incentive factor for educational systems to switch to this modern technology in order to benefit from its advantages. Game based learning is also under the spotlight. Also, several researchers demonstrated their active role as a useful learning tool.

Regarding implementing technology at schools in Palestine, the educational system is shifting towards digitizing the educational environment. In addition, there is no precise instrument for

assessing thinking skills using computer based assessment. However, such instruments were never developed nor tried in the Palestine context.

Some of the research on ICT focuses mainly on describing the development of modern technologies, describing how people use a new technology, showing that people like using a new technology, or presenting its functionality. In some cases, researchers seek to show that a modern technology fosters learning, but they do not have appropriate learning measures and assessments. Instead, what is needed is high-quality and scientific research to measure students thinking skills abilities using ICT. More importantly, a reliable assessment tools is needed as well to fulfil this gap in the Palestinian system in particular.

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