



Contents lists available at ScienceDirect

## Computers in Human Behavior

journal homepage: [www.elsevier.com/locate/comphumbeh](http://www.elsevier.com/locate/comphumbeh)

## Full length article

## The impact of paper-based, computer-based and mobile-based self-assessment on students' science motivation and achievement

Stavros A. Nikou\*, Anastasios A. Economides

Interdepartmental Programme of Postgraduate Studies in Information Systems, University of Macedonia, Egnatia Street 156, 546 36 Thessaloniki, Greece

## ARTICLE INFO

## Article history:

Received 7 January 2015

Received in revised form

28 August 2015

Accepted 21 September 2015

Available online xxx

## Keywords:

Mobile learning

Self-assessment

Mobile-based assessment

Computer-based assessment

Motivation

STEM

## ABSTRACT

The present study focuses on the implementation of a self - assessment procedure in a Physics class, extended during a seven weeks period in a European secondary level school. The researchers used three modes of assessment based on paper and pencil, computer-web and mobile devices respectively. The aim of the study is to investigate the effect of each mode of assessment on students' motivation and achievement. Analysis of pre- and post-motivation tests revealed a more positive motivational orientation of students towards computers and mobile devices as assessment delivery mediums. Also, student evaluation implemented after the phase of the experimental procedure showed a significant increase in learning achievement for low-achieving students who participated in the mobile-based and computer-based assessment. The positive effects of computers and mobile devices on students' learning motivation suggest that they can be used as a promising alternative to paper and pencil assessment procedures.

© 2015 Elsevier Ltd. All rights reserved.

## 1. Introduction

Science, Technology, Engineering, and Math (STEM) education is gaining more and more importance lately due to the growing demand in Science and Technology jobs from one side and the decline in student interest to follow STEM careers from the other (DPE, 2013; U.S. Department of Education, 2013). Different pedagogical approaches along with appropriate educational technologies need to be employed in order to enhance students' motivation towards STEM disciplines (Kearney, 2010; OECD, 2008). Assessment is one fundamental issue in every educational ecosystem. Different assessment delivery media (paper and pencil, computers or mobile devices) lead to different assessment modes: Paper-Based Assessment (PBA), Computer-Based Assessment (CBA) or Mobile devices-Based Assessment (MBA) respectively. One way to enhance students' learning motivation can be accomplished through appropriate assessment practices and conditions (Stefanou & Parkes, 2003). According to Wenemark, Persson, Brage, Svensson, and Kristenson (2011) testing mode has an impact on test-taking motivation and hence testing performance.

The present study investigates the impact of different

assessment media (paper-based, computer-based and mobile-based) on students' motivation and achievement towards learning high-school Physics. Since Physics is in the heart of STEM, investigating the impact of different assessment modes onto learning motivation and performance may lead to further enhancement of student motivation, engagement and achievement. The study starts with a brief theoretical background about learning motivation and self-assessment. Then, it proceeds with the experimental method (participants, instruments, procedure). Results section follows along with discussion and conclusions as well as limitations and future research.

## 2. Theoretical background

Motivation is "the process whereby goal-directed activity is instigated and sustained" (Pintrich & Schunk, 2002, p. 5). Motivation to learn is "a student tendency to find academic activities meaningful and worthwhile and to try to derive the academic benefits from them" pp. 205–206 (Brophy, 1988) and it is a critical factor affecting learning (Lim, 2004). Many theories provide frameworks to study learning motivation. The current research uses the work of Glynn and Koballa (2006) as the theoretical framework to study the construct of Science learning motivation. The exploratory factor analysis by Glynn, Taasobshirazi, and Brickman (2009) provided insight into how students

\* Corresponding author.

E-mail addresses: [stavrosnikou@sch.gr](mailto:stavrosnikou@sch.gr) (S.A. Nikou), [economid@uom.gr](mailto:economid@uom.gr) (A.A. Economides).

conceptualized their motivation to learn science. According to this framework, the current study considers the following sub-components of Science learning motivation: intrinsic motivation, extrinsic motivation, self-efficacy, self-determination, personal relevance and anxiety. Intrinsic motivation refers to doing something because it is interesting and enjoyable while extrinsic motivation refers to doing something because of external rewards (Deci & Ryan, 1985). Self efficacy refers to students' belief that they can achieve well in science (Lawson, Banks, & Logvin, 2007). Self-determination refers to the control students believe they have over their learning of science (Black & Deci, 2000). All the above motivational components influence self-regulatory learning (Glynn & Koballa, 2006). In order to provide the appropriate learning conditions for self-regulatory learning we implemented a series of self-assessment tasks. During the process of self-assessment, students have the ability to monitor and evaluate the quality of their own learning. Research shows that self-assessment improves student motivation, engagement and learning (McMillan & Hearn, 2008).

Self-assessment can be delivered through paper-and-pencil, computers-web or internet-connected mobile devices. Despite the ongoing shift from traditional paper-and-pencil towards computer-based assessments (Scherer & Siddiq, 2015), the impact of computers and mobile devices vs. paper-and-pencil delivery modes on students' performance and motivation has not been fully explored yet. Comparisons of test scores across different assessment types produced contradicting results (Nikou & Economides, 2013). In some studies students scored higher on computer versus paper administration (Clariana & Wallace, 2002; Wallace & Clariana, 2005), while in others no difference in test scores were found (Chua & Don, 2013; Jeong, 2012).

There is an interesting line of research that focus on investigating different delivery mediums with respect to students' attitudes (Chen & Jang, 2010; Deutsch, Herrmann, Frese, & Sandholzer, 2012; Huff, 2015; Hwang & Chang, 2011; Macario, 2009; Macedo-Rouet, Ney, Charles, & Lallich-Boidin, 2009; OECD., 2010; Sun, 2014), motivation (Chua, 2012; Chua & Don, 2013; Romero, Ventura, & de Bra, 2009; Shih, Chu, Hwang, & Kinshuk, 2011; Timmers, Braber-van den Broek, & van den Berg, 2013) and

learning achievement as well (Cakir & Simsek, 2010; Chen & Chung, 2008; Looi, Sun, & Xie, 2015; Looi et al., 2011; de-Marcos et al., 2010; Song, 2014). Most studies show mixed results. However, there are a considerable number of studies providing evidence that technology mediated delivery modes have a positive impact on attitudes and performance. Table 1 presents an overview of the results. There are studies revealing the positive impact that computer-based assessments have on student motivation and learning (Chua, 2012; Wilson, Boyd, Chen, & Jamal, 2011). Also, other studies show that mobile-based assessments can promote learner's motivation both inside the classroom boundaries e.g. classroom response systems (Sutherlin, Sutherlin, & Akpanudo, 2013) as well as in ubiquitous learning scenarios outside the classroom (Chu, Hwang, Tsai, & Tseng, 2010; Shih et al., 2011). Usually, studies focusing on the impact of technology mediated assessment on learning motivation and performance deploy a single learning or assessment strategy. To our knowledge, no studies exist that comparatively investigate the effect that paper-and-pencil-, computer- or mobile-based self-assessments have on the motivational orientation and learning achievement of high-school students towards learning science. In the context of STEM secondary education, the current study adds to the existing literature by comparatively and simultaneously investigating both motivational factors and performance issues in respect to all three self-assessment delivery modes (paper-, computer- and mobile-based).

### 3. Methodology

#### 3.1. Participants

The participants were 66 students from a European upper high school. The sample consisted of 34 males (51%) and 32 females (49%). The average age of students was 16.2 (SD = 0.99). They were all enrolled in a Physics course (part of their official curriculum) having the same educational background. All students had the same exposure to information technologies. Based on a self-reported questionnaire about computer efficacy as well as mobile-devices efficacy they were asked to fill in (Kenny, Neste-

**Table 1**  
Impact of paper-, computer- and mobile-based delivery on students' attitudes, motivation and performance.

Study	Results
<i>Computer-based assessments</i>	
Chua and Don (2013)	- Computer-based testing increased participants' intrinsic motivation, self-efficacy and anxiety
Timmers et al. (2013)	- Positive effects of invested effort and self-efficacy on achievement in computer-based assessments
Deutsch et al. (2012)	- A web-based mock examination changes attitudes in favor of computer-based assessment
Chua (2012)	- CBT develops stronger self-efficacy, intrinsic and social testing motivation
Cakir and Simsek (2010)	- No significant difference exists between students who studied in a computer-based environment and a paper-based environment
OECD. (2010)	- Students enjoyed computer-based tests more than the paper-and-pencil tests
Macedo-Rouet et al. (2009)	- Students preferred paper-based delivery mode for learning and assessment
Macario (2009)	- Most student participants prefer computer-based assessments over paper-and-pencil based ones
<i>Mobile-based assessments</i>	
Looi et al. (2015)	- The experience of the mobilized science curriculum improves students' test results, engagement and self-reflection
Sun (2014)	- Mobilized science curriculum increases students' motivation for answering questions and improves student learning in terms of test achievement
Song (2014)	- The use of mobile devices (compared to the paper-based material) leads to better students' understanding of the subject matter with positive attitudes toward seamless science inquiry
Looi et al. (2011)	- A mobilized science curriculum (compared to a traditional program) increases student engagement and performance
Hwang and Chang (2011)	- A formative assessment mobile-based approach promotes students' learning interest and attitude and also improves learning achievement
de-Marcos et al. (2010)	- m-learning auto assessment improves student achievement
Romero et al. (2009)	- Students were highly motivated and enjoyed using mobile application for testing while no significant differences in the results obtained
Chen and Chung (2008)	- Personalized mobile-based English vocabulary learning promotes learning performances and interests of learners

Download English Version:

<https://daneshyari.com/en/article/10312754>

Download Persian Version:

<https://daneshyari.com/article/10312754>

[Daneshyari.com](https://daneshyari.com)