

# Chapter 15

## Learner–Interface Interactions With Mobile–Assisted Learning in Mathematics: Effects on and Relationship With Mathematics Performance

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### ABSTRACT

*This study attempted to determine the effects on mathematics performance of learner-interface interaction with mobile-assisted learning in mathematics. It also determined the relationship between these interactions and students' mathematics performance. It revealed that students solved more complex problems as they went through the intervention period, and that they solved more than 50% of the problems correctly. Participants had little prior knowledge of linear equations. However, after the intervention period, students achieved a normalized class learning gain of 41%, which was higher than the 30% minimum. Testing of difference between means confirmed that the difference between posttest and pretest scores was significant. Most of the skill sets were correlated with time used in solving linear equations. Moreover, identifying equivalent mathematical expressions required all three forms of learner-interaction, for students to become familiar with this skill. Recommendations future studies are presented.*

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## INTRODUCTION

The proliferation of relatively inexpensive mobile devices has provided new forms of learning for students. The capabilities of the educational software in mobile devices create opportunities for learners to learn at their own pace, and at their convenience. They make learning materials more accessible (Valk, Rashid & Elder, 2010), anytime and anywhere (Martin & Ertzberger, 2013), for learners who are on the move (Attard & Northcote, 2011; Park, 2011). Educational mobile applications are now capable of providing learners with assessments and feedback, without a teacher present (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013). These mechanisms support learning activities that avoid learner embarrassment. Their availability as educational materials is so flexible that students may utilize them before, during, or after classroom sessions (Aker, Ksoll, & Lybbert, 2012).

This form of learning (i.e., mobile learning or m-learning) enforces learner-centered educational paradigms that, in turn, empower students to develop their own skills and knowledge, and direct them toward meeting their educational objectives (Sharples, Taylor, & Vavoula, 2007). M-learning facilitates active participation of learners in constructing their own learning experience (Dela Pena-Bandalaria, 2007). Traxler (2007) commented that learners control their learning, so that it is “just-in-time,” “just enough,” or “just-for-me.” This type of learning may provide corrective actions and feedback, whenever the learner needs them. In other words, m-learning allows learners to be responsible for their own learning (Valk et al., 2010). Overall, the purpose of m-learning is to improve engagement with the course (Attard & Northcote, 2011; Male & Pattinson, 2011; Pollara & Broussard, 2011; Boyinbode, Ng’ambi, & Bagula, 2013) and the academic success of the students (Penuel et al., 2002; Crompton & Burke, 2014).

Several studies report the results of engagement through the educational use of mobile devices. For example, Kiger, Herro, & Prunty (2012), Zhang, Trussell, Gallegos, & Asam (2015), and Taleb, Ahmadi, & Musavi (2015) discussed positive outcomes of mobile learning interventions. On the other hand, Bakker, Van den Heuvel-Panhuizen, & Robitzsch (2015) showed that mini-games used by students at home had no significant effects on students’ mathematics performance. Further, Wu et al. (2012) reviewed the studies of Doolittle & Mariano (2008) and Ketamo (2003), and showed that the latter two studies arrived at results unfavorable to mobile learning.

M-learning has a democratizing effect on the learning experience of students (Valk et al., 2010), the capability of providing useful responses, and an impact on the motivation of the students to engage in a course (Taleb et al., 2015). However, it is still unclear how mobile-assisted learning in mathematics, with adaptive feedback mechanisms, can affect mathematics performance of learners, in the context of self-regulated learning. The present study attempted to address this research gap, in light of these situations. Toward this goal, it sought answers to the following questions:

1. What is the learner-interface interaction with the software, in terms of types and number of problems solved, number of days spent in utilizing the software, time used in solving the problems, and number of hints utilized in solving equations?
2. What is the mathematics performance of the students before and after the intervention period?
3. How much would the students learn from the intervention period?
4. Is there a significant difference in the mathematics performance of the students before and after the intervention period?
5. Is there a significant relationship between the learner-interface interaction with the mobile-assisted learning in mathematics and the mathematics performance of the students?

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