Using a Mobile Classroom Interaction System (M-Cis) In a Science Instruction Laboratory Class: Students' Motivation

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Abstract

One of the critical tasks of teaching is motivating the learner. Motivation is usually defined as an internal state that reinforces, rewards, and provides incentives for engaging participation in learning communities. Establishing a classroom environment that supports this internal state is critical if learners are to be motivated. This study aims to measure the effects of a Mobile Classroom Interaction System (m-CIS) on student motivation. m-CIS environment is designed using m-learning perspective and students' view of using mobile phone in science classroom. An m-CIS incorporated communication between students and teacher using students' mobile phones, computers, web area (internet), a server and projector. The established network system provided communication among students, students to teacher, and teacher to students. The M-CIS was used in the laboratory of a university science education department with take consider to students' views about using self phones in classroom. Four science instruction laboratory classes were used in this study. Two groups were randomly assigned as the experiment groups and two other groups as the control groups. The study continued during a spring term. A questionnaire for motivation toward science was used to collect data about how students' motivation changed throughout the term. The scale includes motivation towards five factors: research, performance, communication, cooperation, and attendance. No significant difference is found between experiment and control groups while the results are discussed to implement m-CIS with a broader range of educational settings.

Keywords: Science instruction, motivation, m-CIS.

1. Introduction

Student motivation has an important place in reaching prospective instructional goals. Motivating a class full of students is important for designing appropriate learning environments. Today, teachers use different instructional strategies and methods to motivate students in the classroom, and they generally rely on student-centered learning strategies to reach their goals. This may include various instruments for engaging and motivating students in learning activities. When creating a motivating and student-centered learning environment, student interaction needs to be supported. The Mobile Classroom Interaction System (m-CIS) is designed to promote classroom interaction which is an important part of teaching and learning in class. A science instruction laboratory has an essential place in meaningful science learning i.e. students' ability to interpret and apply science concepts in a hands-on environment (A. Hofstein & Mamlok-Naaman, 2007). Students' motivation is a critical factor to gain students' educational attainment.

1.1. Motivation

Educators and curriculum developers have attempted to design motivating curricula that take into account engagement of instructional activities, that support students' achievement with appreciable awards, or that facilitate an autonomous learning environment for students (Bransford, Brown & Cocking, 2000). In such cases, one might ask "What is motivation?" and "Does it play a role in the educational environment?"

Motivation is identified as an internal state that includes the appearance and direction of sustainable behavior. A motivated person has more drive to achieve his or her goals, to study hard, and to exert him to perform a task. Motivation is associated with impetus, necessity, encouragement, fear, aim, social pressure, self-confidence, interest, concern, belief and expectation. These forces may be categorized as intrinsic extrinsic (Woolfolk, Hughes & Walkup, 2008). Which motivating forces (intrinsic or extrinsic) are more critical to reach instructional goals? Researchers studied the effects of both for academic achievement. Research shows that students who are influenced by extrinsic forces have low performance in school. Also, intrinsic motivation has high a correlation with academic achievement. In other words, intrinsic motivation is predictably positive in academic achievement but extrinsic motivation is not (Areepattamannil, Freeman & A.Klinger, 2011). One of the critical instructional goals is the student achievement. In this case, intrinsic motivation comes into prominence high student academic achievement. Today, a proactive-assertive approach rather than reactive-corrective approach to student behavioral management (Nichols, 2006). Teachers think a well designed and managed classroom is one of the important needs to a successful academic learning environment (Welton, Smith, Owens & Adrian, 2000). Consequently, if high student motivation in learning activities is desired, class design must support high student awareness levels, self-efficiency, and an autonomous learning environment.

1.2. Technology-enhanced Learning Environment: Motivation

Technology-enhanced instruction is becoming increasing important and popular in education. However, putting forward that technology-aided instruction is more motivating for students, there is not enough research (Na, Kang-hao & Chun-hao, 2010). Personal computer playfulness is both pleasant and effects intrinsic motivation. Although this joyfulness can vary from person to person, having an acquaintance with using technology provides motivation with time-consuming learning activities (Venkatesh, 2000). Individual social-cultural life affects a person's psychomotor behavior, cognition, and affective behavior. Children pay attention to adults' communication with each other and observe their behaviors (Maynard, Martini & Gauvain, 2005). Students' social interaction starts at an early age and affects the classroom environment. According to social learning theory, a technology-enhanced learning environment provides opportunities for students' active participation, collaboration, and evaluation of their performance (Na, et al., 2010). Two facts are important to motivate students in class. First, students must believe in the importance of the task and its usefulness. Second, students must have the ability to perform tasks autonomously (Jank, 2008).

1.3. Science Instruction, Motivation, Classroom Interaction System

Advancing technology, especially wireless devices, allow for easier communication, and wireless mobile devices are used with more frequency in educational areas. They are used in classes for decreasing boredom, engaging students in learning, giving an opportunity to follow up students' learning performance by teachers, collaborative learning, and evaluating learning and teaching as a portfolio (Liu et al., 2003). Classroom interaction technology applies in learning environment with different mobile devices. A popular technology is the Student Response System (SRS). Especially in recent times, research on SRS use in classes shows that they increase student motivation towards the subject, and have a positive effect on academic achievement (Beatty & Gerace, 2009; Duggan, Palmer & Devitt, 2007; Fies & Marshall, 2006; Kay & Knaack, 2009; Kenwright, 2009; MacGeorge, Homan, Jr, et al., 2008; MacGeorge, Homan, Jr., et al., 2008; Palmer, Devitt, Young, & Morris, 2005; Penuel, Boscardin, Masyn & Crawford, 2007; Powe, Faulkenberry, Harmond & Cooper, 2009; Uhari, Renko & Soini, 2003).

The laboratory has a great impact on students' learning in regard to scientific concepts and interpretation. Science instructors state that a well-designed class environment needs to support students' interpretation of conceptual information, provide feedback on activities for advancing students' critical thinking skills and inquiry ability, and meet the requirements of students (Yarnall, Shechtman & Penuel, 2006). Laboratory activities give students the chance to enjoy them and serve as a medium for motivating students (A. Hofstein & Mamlok-Naaman, 2007). Well-designed classroom with consider among teacher-student social interaction need for establishing good learning environment in laboratories (Avi Hofstein, 2004). Usually, students study in small groups for laboratory applications, or there is just one experiment activity that is led by the teacher or a group. Others then observe this in the science instruction laboratory. In such cases, it is difficult to provide multi-directional communication (student to student, student to teacher, teacher to student). Technological support can be an effective way to solve that challenge. The m-CIS was designed to solve these communication problems through the use of mobile devices.

Students' views influenced the design of m-CIS, for example, their views towards the use of mobile phones as a learning tool in the science laboratory.

2. Method

This study aims to measure the effects of a Mobile Classroom Interaction System (m-CIS) on student motivation. M-learning perspective and students' view of mobile phones in science classroom is used when designing the m-CIS. The system promotes communication between students and teacher using students' mobile phones, computers, web area (internet), a server and projector. The established network system provided communication between students, students to teacher, and teacher to students. Research was conducted in a science laboratory course since students needs to use their most advanced and various abilities. For example, they use their own senses to classify, investigate and observe in a typical classroom setting; students need more collaborative and social interaction in a laboratory setting. A Questionnaire for Motivation Toward Science Learning Scale was used to evaluate students' changes in motivation (Dede & Yaman, 2008). The scale includes motivation towards five factors: research, performance, communication, cooperation, and attendance.

The m-CIS was designed by a researcher to investigate its usability as a system for instruction. M-CIS consists of two technological components: hardware and software. Hardware includes: a computer, connected to the internet and controlled by teacher, a projector connected to computer, students' mobile phones, and a server computer for processing incoming commands from mobile phones and the computer. Software includes: a web page, and a user password entrance system for providing interpersonal communication. Questions and answers, and classroom discussions were administered with the m-CIS.

In this study, students who enrolled in a science teacher education program at a small town university in northeastern part of Turkey were surveyed to determine their changes in motivation after using m-CIS. The survey was administered to 148 pre-service science teachers, but the statistical analysis was limited to 143 participants. Four classes were randomly selected, with two class assigned as an experiment group and two classes as a control group. A biology laboratory class was used for the study. M-CIS was used in evaluating the course and student learning near the end of the course. A Questionnaire for Motivation Toward Science Learning scale was calculated with an internal consistency reliability of Cronbach's Alpha 0.80 by the researcher. Scale was used at the beginning of the term and end of the term to put forward students' motivational changes. An ANCOVA statistical analysis was used to perform motivational variation.

3. Results

The scale used to investigate students' motivational changes has different reliability in this research. Item-total analysis shows that 6 items indicate no correlation with total score, and some items have somewhat low correlation. Because of that, 6 items were removed from the scale. In that case, new reliability factor was analyzed for 17 items and Cronbach's Alpha is calculated at 0.77. The tables below show a statistical analysis of students' changes in motivation toward science. The probability value is assumed 0.05 in all analysis.

Table 1: Tests of Between-Subjects Effects

Dependent Variable: MotivationPost

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	234,6[a]	2	117	,792	,455	,011
Intercept	2133	1	2133	143	,000	,507
MotivationPre	152,8	1	152	1,031	,312	,007
Exp-GroupA Cont-GroupB	64,86	1	64	,438	,509	,003
Error	2074	140	148			
Total	9727	143				
Corrected Total	2098	142				

a. R Squared = ,011 (Adjusted R Squared = -,003)

A pretest score is used as a co-factor for change in student motivation toward science learning. As Table 1 shows, there is no statistical difference ($p \leq 0.05$) between the experimental group (Group A) and the control group (Group B).

Table 2: Descriptive Statistics

Dependent Variable: Motivation Post			
Exp-GoupACont-GroupB	Mean	Std. Deviation	N
GroupA Experiment	80,79	12,29	69
GroupB Control	82,31	12,06	74
Total	81,58	12,15	143

As shown in Table 2, there are no significant differences between the mean motivation for the experiment group and the control group. The experiment group's motivational change is not statistically meaningful when the pre-test effect is controlled.

4. Discussion

In this study, student motivation toward science learning is measured and the effect of using mobile in-class communication system in a science lab is analyzed on student motivation. An ANCOVA statistical technique is used to determine differences between the experiment and control groups. There were no significant differences ($p \leq 0.05$). It is known that motivation has an important role in learning and science instruction. And also Personal beliefs affect from various fact (Bonney, Kempler, Zusho, Coppola & Pintrich, 2005). Research shows that designed systems used in science laboratories don't influence students' motivation toward science learning. New research design should be considered to thoroughly investigate the time of m-CIS in classroom, and teachers' strategies using the system, and students' preferences. Additionally, a well-designed instrument should be implemented to precisely measure even the minuscule effects.

Handheld devices provide an opportunity for employing formative assessment implementations for teachers and instant feedback to students. Furthermore, research reports stat that these devices support students' levels of engagement and motivation. However, defining motivation is difficult to explain in regard to learning performance and effects on behavior (Roschelle, Penuel, Yarnall, Shechtman & Tatar, 2005). A consideration for utilizing the dynamic structure of motivation is needed in new research. Using correct measurements is important to explain that dynamic structure. m-CIS is a newly designed system so research is needed in regard to its usability in the classroom. Long-term studies and additional dimensions should be investigated for generating pedagogical bases in educational activities.

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