Students' Gender, ICT Attitude, Computer Self-Efficacy and ICT Engagement on Use of ICT for Learning Mathematics among Secondary Mathematics Students in Zanjan-Iran

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***Abstract* – The purpose of this study is to determine ICT use in Mathematics learning based on gender, students' attitudes toward ICT, computer self-efficacy, and ICT engagement among secondary Mathematics students. In this study, 390 Mathematics students comprised of 199 females and 191 males from 31 secondary schools in Zanjan-Iran were randomly selected by the sampling technique. A set of questioner was used to collect data for this study. Findings show that the combination of the three variables significantly predicted ICT use in Mathematics learning. Gender does not make any significant contribution to the prediction of the dependent variable. The study implies that a greater emphasis on the three independent variables narrows the gap in ICT use among students.**

***Keywords* – Gender Different, ICT Use, Learning Mathematics, ICT Attitude**

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I. INTRODUCTION

The trend of technological developments around the world is continually increasing over the past few years, in such a way that schools are forced to integrate ICT into their curricula to ensure that their students are capable of coping up with the challenges of technological turmoil (Wolff & Castro, 2000).To contend with the technical difficulties of the current dispensation, governments, and school authorities have continued to invest huge sums of money in education (Millán et al., 2010).In the background of this study, ICT use is referred to as the extent to which teachers use ICTs for the purpose of facilitating students' learning of Mathematics. Students' ICT engagement relates to the extent to which students perceive that they are involved in the school ICT implementation processes (Gebre, Saroyan, & Bracewell, 2014).

Students' engagement in ICTs suggests the involvement of the students in ICT implementation decisions and processes for schools about how the decisions and processes affect the students in their studies and help them in accomplishing their tasks (Park View Primary School, 2013). So engaging in ICT and using ICT are fundamental for learning process like Mathematics classroom.

II. LITERATURE REVIEW

Student's ICT Attitude

Students' ICT attitude toward their use of ICT is a crucial factor. A study in Iran showed that students' attitude towards ICT has a significant influence on their engagement with the ICT and use of ICT tools (Sankaran, Sankaran, & Bui, 2000). Additionally, Ajzen and Fishbein (1977) have posited that to elucidate and predict students' ICT-related behaviors, it is vital to understand their ICT attitudes. Congruently, in a study conducted by Kamau (2014), attitude towards technology was found to have the significant influence on the use of ICT among Mathematics students. A study undertaken in Malaysia has revealed that there is no significant difference between male and female students' attitude toward the use of ICT in the learning process(Wong & Atan, 2007). This emphasizes that students attitude toward ICT usage no different for gender.

Students' Computer Self-Efficacy

Computer self-efficacy is defined as the degree to which an individual believes that he/she can perform a particular task/job using the computer (Compeau & Higgins, 1995). Bandura (1986) characterized self-efficacy as being both a product of our interactions with the world and influence on the nature and quality of those interactions. Hence, students' self-efficacy has significant direct or indirect effect on their Mathematics learning achievements (Greene, Miller, Crowson, Duke, & Akey, 2004). Studies have shown that students with high level of computer self-efficacy are more likely to challenge themselves and motivate themselves to perform (Bandura, 1994). The study by Ng (2006) has shown that in the UK, the effect of computer usage on earnings was not found in the case of males while a substantial and significant computer impact was found for females. On the whole, considerable importance has been attributed to the role of computer self-efficacy in influencing students' use of ICT.

Students' ICT Engagement

From the general educational perspective, the term students' engagement has often been used in various ways to match the circumstances of its use (Forehand, 2014). Students' participation in school learning is perceived as a sign of effective classroom instruction and also a

consequence of the school activities to improve knowledge (Kubiatko & Haláková, 2009). Studies have shown that students who are fully engaged in schools tend to achieve higher levels of academic success than those who are not engaged (Vazirabadi, 2010). Kubiatko and Haláková (2009) observed that although students' engagement had been used as a construct in several studies to reconnect bored and disengaged students with the desire to learn, most researchers used the term differently. However, students' engagement in classroom and school is an important determinant of their learning outcomes and achievement, which is also associated with their engagement in technology in recent times (Duffy, 2008).
Students' engagement in ICTs suggests their involvement in ICT implementation decisions and processes for schools concerning how the decisions and processes affect the students in their studies and help them in accomplishing their tasks (Park View Primary School, 2013).

This study has operationally defined students' ICT engagement as a multi-dimensional construct that is comprised of three critical dimensions of indicative of affective, cognitive and social or behavioral engagement in ICT in classrooms. To engage students in ICTs, they need to be mindfully engaged in intellectual activities that support collaboration and working with ICT tools, along with other students (Chen, Lambert, & Guidry, 2010; Denner, Werner, Bean, & Campe, 2005; Richardson & Newby, 2006).

ICT Use in Education

A study by Hermans, Tondeur, van Braak, and Valcke (2008) have shown the significant relationship between the use of ICTs in training students and the level of the learning progress of the students. The study also revealed that teachers were more satisfied when using computers and accessing the internet to teach students. Hitherto, integrating ICTs in the teaching process often yields positive developments and changes in curriculum structure and brings reforms to lessons content and structure as well as to the general performance and measurement tools used (Fathi Vajargah & Saadattlab, 2014). Whereas in most parts of the world the most practical steps for integrating technology in secondary school engaging them in ICTs are being taken, but Iran things have remained unchanged (Karami & Attaran, 2013).

In a study conducted among students in the USA, findings have shown that there is a positive relationship between the use of technology for learning and students engagement in technology and their academic performance (Hamari et al., 2016). An exploratory study conducted in India, voluntarily engaged in mobile learning has shown that the use of ICTs for learning brings significant improvement in the level of academic learning and motivation among students (Sampath Kumar & Biradar, 2010). Overall, the changing trends in the use of technology across the globe are indicative of an ever increasing need for technology integration in education. For Iranian Government to achieve her fundamental objective of integrating ICTs in her educational sectors, tackling the ICT needs of her secondary schools will be a step in the right direction. It is slightly unlucky that in developed and developing countries, despite increasing ICT tools innovations and improve procurement, ICT tools like the computer are still under-utilized in many schools system (Hawkridge, Jaworski, & McMahon, 2016).

III. RESEARCH OBJECTIVE AND HYPOTHESIS

The purpose of this study was to identify**:**

Objective:
To determine the relationship between students' attitude, students' computer self- efficacy and ICT engagement with students' use of ICT in learning mathematics based on gender.

Hypothesis:
H_1: There is a major relationship between students' attitude and students' use of ICT in learning mathematics based on gender.
H_2: There is a significant relationship between students' computer self- efficacy and students' use of ICT in learning math based on gender.
H_3: There is a significant relationship between students' ICT engagement and students' use of ICT in learning mathematics based on gender.

IV. RESEARCH METHODOLOGY

This survey study was conducted in Iranian Mathematics students. The population of this study was Mathematics students at the secondary level. A stratified random sampling was the technique used to select 390 students from the districts one and two in Iran-Zanjan. For the purpose of the study, questionnaires were prepared for a survey to obtain information on students' ICT engagement and students' use of ICT for Mathematics learning. The instrument for the study was a questionnaire consisting of two parts. Part A gathered demographic information of the respondent. To measure students' ICT engagement, 16 items were adopted and to measure student' use of ICT in Mathematics learning we developed 11 items. Those instruments were created on a 5-point Likert-scale labelled: 1(strongly disagree), 2(disagree), 3(slightly agree), 4(agree), and 5(strongly agree). Permission to use, modify, and translate the items have been obtained from the authors. A pilot study was conducted on 42 secondary Mathematics students before actual data collection measures the reliability of the instrument in section B. The reliability of the device to measure the students' ICT engagement, students' ICT attitude, students' computer self- efficacy and students ' use of ICT in learning Mathematics were 0.930 and 0.831, were acceptable for the actual students (Pallant, 2010b).

V. FINDINGS

The objectives of this study determined the effect of students' ICT attitude, students' computer self –efficacy and students' ICT engagement on students' use of ICT for learning mathematics. The first table shows a correlation between students' ICT attitude, student's computer self-efficacy and students' ICT engagement with students' use of ICT in learning Mathematics. According to the result of Table 1 the highest and positive correlation exist between students' ICT engagement and students' use ICT in learning Mathematics ($r = .516, \mathrm{p} < 0.000$). There is a strong relationship and a result (Pallant, 2010).

Table 1 Correlation

Independents variables		IULM
SIA_M	Pearson Correlation	435**
	Sig. (2-tailed)	.000
CSE_M	Pearson Correlation	.399**
	Sig. (2-tailed)	.000
SIE_M	Pearson Correlation	.516**
	Sig. (2-tailed)	.000

The next part of the discussion deal with the regression coefficient between students' ICT attitude, students' computer self-efficacy and students' ICT engagement with students' use of ICT in learning Mathematics. Table 2, presented the regression coefficient between endogenous variable and exogenous variables. According to Table 2, there is a significant positive relationship between students' ICT attitude students' computer self-efficacy and students' ICT engagement with students' use of ICT in learning Mathematics. According to the result of Table 2 the highest and positive relationship between students' ICT engagement and students' use ICT in learning Mathematics ($r = .516, \mathrm{p} < 0.000$). It is the strong relationship and a result (Pallant, 2010a).

Table 2 Coefficient Multiple linear regression

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.163	.233		-.699	.485
	SIA_M	.334	.052	.277	6.460	.000
	CSE_M	.186	.047	.176	3.946	.000
	SIE_M	.508	.063	.361	8.006	.000

Typically, the model of prediction for the use of ICT in learning Mathematics using independent variables (SIA, CSE, and SIE) as a predictor was achieved as follows:

$Y = -.163 + .334x_1 + .186\,x_2 + .508\,x_3 + Ɛ$

Where,

Y = Students' use of ICT in learning Mathematics
x1 = students' ICT attitude (SIA)
x2 = students' computer self-efficacy (CSE)
x3 = Students' ICT engagement(SIE)
Ɛ = Error

Additionally, multiple linear regressions were accordingly performed to predict factor (students' use of ICT in learning Mathematics) by the influencing of students' ICT attitude, students' computer self- efficacy and students' ICT engagement. The following model summary table3 shows that the multiple correlation coefficients (R) obtained were 0.614 for students using the predictor simultaneously and the R^2 value obtained 0.377. The R^2 value indicates how far a variable can explain the variation of a dependent variable. The coefficients of determination are 37.7% which is the extent of variation in the dependent variables are an influence on students' use of ICT in learning Mathematics.

Table 3 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.614	.377	.372	.74365

Table 4 shows the ANOVA analysis results for the Multiple Linear Regression models. ANOVA, F (3, 386) obtained was 77.795 (p = 0.000) with the p-value smaller than 0.01 was obtained, indicating that the predictor (students' ICT attitude, students' computer self-efficacy, and students' ICT engagement) significantly predict the dependent variable (Students' use of ICT in learning Mathematics).

Table 4 ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	129.065	3	43.022	77.795	.000b
	Residual	213.465	386	.553		
	Total	342.530	389			

a. Dependent Variable: IUML_M

b. Predictors: (Constant), SIE_M, SIA_M, CSE_M

T-Test

Independent-samples t-test used to compare the mean scores of two different groups of people (male and female). In this study, Table 5 indicated that, for female Mean and Standard. Deviation is 3.3764, S=.8598 and for Male Mean and Standard. Deviations are 3.3275, S= 1.01566 respectively.

Table 5 Group Statistics

	Gender	N	Mean	Std. Deviation	Std. Error Mean
IUML_M	Female	199	3.3764	.85958	.06093
	Male	191	3.3275	1.01566	.07349

IUML_M:ICT Use for Learning Mathematics

Table 6 illustrated that the impact level of Levene's test in this study is .013 < p=.05, this means that the variances for male and female are not the same. In table 8, the output for the Sig. (2-tailed) value is .607. This value is above the required cut-off of .05(pallant.2010). The results show that is not a statistically significant difference in the ICT use for learning Mathematics scores for males and females among secondary school students in Iran-Zanjan.

Table 6 Independent Sample T-Test

		Levene's Test for Equality of Variances		T-test for Equality of Means						
									95% Confidenc Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Uppe
lUML M	Equal variances assumed	6.294	.013	.515	388	.607	.04896	.09514	-.13809	.2360
	Equal variances not assumed			.513	372.2	.608	.04896	.09547	-.13876	.2366

Calculating the Effect Size for Exogenous-Samples

Effect size statistics offer an indication of the scale of the differences between male and female. The most common different effect size used to be eta squared. Eta squared the range from 0 to 1 and represented the proportion of variance in the endogenous (dependent) variable that is illuminated by the exogenous (independent) variable.

The formula for eta squared is as follows:

Eta squared $=\frac{t_2}{t_2+(N_{1+N_2-2})}$ Eta squared $=\frac{.513}{.513+(199+191-2)}=.569$

According to Pallant (2010), for interpreting this value are: .01=small effect, .06=moderate effect, .14=large effect. For this research, the table shows that the effect size of .569 is the largest effect. It means gender explains only 56.9% of the variance in ICT use for learning Mathematics.

The Results for Independent-Samples T-Test

This test was showed to compare the ICT use for learning Mathematics among secondary school students in Iran-Zanjan for gender. There was no significant difference in scores for males (M=3.327, SD=1.015) and females [M=3.376, SD=.8595; t (388) =.515]. The magnitude of the differences in the means was large (eta squared=.569).

VI. DISCUSSION

This research was investigating the relationship between students' ICT engagement, students' ICT attitude and students' computer self- efficacy a students' use of ICT in learning Mathematics based on gender. Students' use of ICT in learning Mathematics need to mindfully engage in intellectual activities when they work with each other's to use ICT tools. Although there are divergent views about the measurement of technology usage, in most cases researchers rely on self-reports for evaluation of individuals' technology usage behavior. Literature has highlighted on the significance of using ICT in a learning process (Fishbein & Ajzen, 2011).As a country with a broad range of learners, Iran is also interested in utilizing technology in schools (Mohammadi, Abrizah, Nazari, & Attaran, 2015). Also, a study by Zaranis (2014) showed that using ICT in Mathematics Education has higher positive impacts on students' learning.

Students' ICT attitude is the important factor that affected on students' use of ICT for learning Mathematics based on gender. Congruently, ICT approach evaluation is associated with statements that test students interaction with ICT tools like computer hardware, and software, and their activities that involve ICT use (Smith, Caputi, & Rawstorne, 2000).Although, the study by Shashaani (1997) has shown that, studies on gender and the use of ICT have frequently recognized differences in use of and attitudes towards ICT between boys and girls.

Findings in this study revealed that there is no significant different between male and female students' computer self-efficacy ICT engagement and students' attitude toward ICT as a predictor factor of students uses of ICT in learning Mathematics. Similarly, another study conducted in Taiwan has shown that there is no gender gap in the opportunities of accessing the Internet and using ICT tools (Tsai & Tsai, 2010) current finding is consistent with Schweingruber, Brandenburg, and Miller (2001) findings from the middle school students in the US. Also, in a study conducted in Malaysia, significant relationships have been found between students' use of ICTs and their ability to solve mathematical problems (Mkomange, Chukwuekezie, Zergani, & Ajagbe, 2013). In sum, using ICTs for learning is quite fundamental for achieving the desired reform in education both in Iran and all round the world. The use of ICTs for learning Mathematics is necessary because ICTs make learning more efficient, easier and faster and they also add fun to it. Thus, to ensure that students use ICTs in the classroom, teachers must support them and parents must be involved as well. In the same vein, schools need to engage students in their ICT implementation policies.

VII. CONCLUSION

Overall, students' engagement in ICT is crucial to ensuring that they use ICTs in learning. Hence, this study specifically examines the effort involved in incorporating ICTs into active participation strategies in the classroom to promote learning awareness. In recent, year ICT application rapidly developed for many different purposes and it is an essential factor for the education system. Engaging in ICT is one of the important keys to using ICT for learning Mathematics. Hence, students' ICT engagement, students' ICT attitude and students' computer self-efficacy based on gender have the significant higher impact on students' use of ICT in learning Mathematics among Iranian Secondary Mathematics students. The limitation of the current study is the real information that the data sources distributed from self-reported questionnaires. Alternative research methods like interviews or observations could be joint with surveys in future studies regarding students' ICT attitude, students' ICT engagement and students' computer self-efficacy based on gender.

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