ICT Integration in Malaysian Smart Schools: Do teachers' gender, computer ownership, Internet access, subject area and ICT training matter?

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Abstract: In this information age, Malaysian teachers are expected to integrate ICT in the learning environments. The issue of how various factors affect teachers' classroom practices are of great concern as the Malaysian Ministry of Education recognizes the importance of ICT in the education sector. This study was conducted to determine the effects of five selected factors on teachers' ICT integration in the classrooms. This study involved 438 secondary school Smart Schools teachers who were randomly selected. The research findings showed that there were no significant effects on ICT integration with respect to teachers' gender and computer ownership. However, there were significant effects in ICT integration due to subject area, Internet access and level of ICT training.

Keywords: ICT integration, gender, computer ownership, Internet access, subject area, ICT training

Introduction

Malaysia has a long term "Vision 2020" which calls for a sustained, productivity-driven growth, which will be achievable only with a critically thinking and technologically literate workforce [1]. To produce ICT literate users among teachers and to ensure some level of ICT sustainability in Malaysian schools, teachers need effective ICT training and continuous support. The development of ICT in many developing countries indicates that this need is largely unmet. The Ministry of Education (MOE) in Malaysia has put in great effort to accommodate the use of ICT in schools and educational settings through the Smart School concept. The Smart Schools are different from the normal national schools as they focus strongly on ICT from both the pedagogical and management aspects. Despite spending almost RM6 billion on ICT in education initiatives such as Smart Schools, a study by the MOE in 2010 reported that approximately 80% of teachers are spending less than one hour using ICT per week [as cited in 2]. This poor uptake of ICT among teachers is indeed alarming as they must embrace ICT and be well equipped to utilize technology tools effectively for instructional purposes [3, 4, 5, 6].

For this reason, there is an urgent need to focus on factors that influence ICT integration in teaching among Malaysian smart school teachers as a large amount of money has been spent on infrastructural development and ICT training. Understanding the interrelated first-order (external/institutional; e.g. resources) and second-order (internal/personal, e.g. beliefs and attitudes) factors that affect the integration of ICT in classroom instruction is indeed crucial [7, 8]. Jones [8] concludes that first-order factors

are easier to tackle and may not require major changes in the teachers' daily routines. This study aims to investigate the effects of the first-order factors (computer ownership, Internet access, subject area, level of ICT training) among Malaysian smart school teachers. This study also further explores the effects of gender as differences between male and female teachers in terms of their ICT usage. The issue of gender gap has been a longstanding issue [9].

1. Related Studies

1.1 Gender

According to Van Braak, Tondeur and Valcke [10], male teachers reported that they integrate computers in their classrooms more often than female teachers. Research by Tinmaz [11], reported that, gender differ significantly on ICT integration scores with male teachers perceiving ICT integration more favourable than females. There was also significant effect of gender on ICT integration scores among the pre-service teachers. Mathews and Guarino [12] found that female teachers reported significantly lower level of computer ability than their male counterparts and accounted for the lower level of ICT implementation in their classroom. Not all studies however, show consistent results. Shapka and Ferrari [13] found no gender difference for computer attitudes and computer outcomes. Differences between sexes might gradually disappear when teachers become more and more acquainted with the educational potential of computers. In fact, a more recent research by Wong, Teo and Russo[14] has indicated that "irrespective of gender, those with higher perceived usefulness, perceived ease of use, and attitude toward computer use towards using computers had higher levels of intention to use computer than those with lower perceived usefulness, perceived ease of use, and attitude toward computer use" (p.1203).

1.2 Computer and Internet Access

Wilkes [15] proposed that, supplying teachers with the opportunity to use computers and other technological equipment at their homes might increase the use and integration of technology into classroom. Possession of a home computer will offer the teachers to learn about technology, software, installing software, troubleshooting, and the Internet on their own time and at their own pace. While the ICT competency and confidence level of teachers will increase, simultaneously, the use of the computer may be integrated into classroom at every grade level and subject areas.

The link between teacher access to technology and increased classroom use is well documented. Becker [16] found that, teachers more often use computers and the Internet when these technologies are available in their classrooms rather than in other locations in the school. The introduction of one-to-one student access to laptops in classroom revealed that teachers used technology more often, possessed a broad knowledge of technology resources, and were making progress in incorporating technology into practice. Novick [17] characterized, access to and use of a home computers and Internet as the main factor contributing to abilities of the teachers to use ICT in classroom instruction. In a more recent study, Md. Khambari, Luan and Mohd. Ayub [18] reported that teachers with Internet access are able to obtain a great deal of up-to-date teaching resources and this in turn will benefit teachers in aiding and enhancing their classroom instructions. Therefore, it is apt that the MOE is encouraging greater use of the Internet in the learning environments to obtain better learning outcome and learning opportunities [19].

1.3 Subject Area

The study by Cuckle, Clarke and Jenkins [20] revealed that ICT was not used as much as it might have been for classroom teaching. The factor most significant in influencing whether teachers used ICT in classroom teaching was their subject speciality. Because ICT has more obvious applications in the sciences, mathematics and social science, it is unlikely to challenge existing teaching and learning skills. In other subjects, ICT use may challenge traditional teaching skills for example in arts and particularly languages, where teachers sometimes believe that teaching and learning depend on a teacher-centered approach.

A study by Whetstone and Carr-Chellman [21] found that science pre-service teachers had the most computer experience and appeared to evaluate computer integration more than pre-service teachers in the other disciplines. Math pre-service teachers had the next-highest computer usage and showed the highest levels of confidence with computers; on the other hand. English pre-service teachers' primary applications for computers were word-processing, e-mail, and the Internet, although only sixty-seven percent of English pre-service teachers felt partially comfortable or comfortable with computers. Social studies pre-service teachers had little formal experiences as their major way to learn about computers.

A survey study by Becker [22], revealed that technology was not efficiently used in core school subject areas such as science, social studies, mathematics and English. Social studies teachers were among the least likely to use technology in the classroom. There is evidence showing that use of technology is not widespread even in subject areas that appear to be congruent with technology. Williams, Coles, Wilson, Richardson and Tucson [23] found that, Mathematics and Science teachers used technology relatively less frequently than teachers of Social and aesthetic subjects. However, no explanation was provided for the discrepancies found. Overall, past studies have found that the functionality of computers in the classroom is quite different for teachers of different subjects.

1.4 ICT Training

Training is vital and its absence was often quoted as a factor hindering ICT integration in the school system. According to Rakes, Field and Cox [24], one of the reasons computers have not yet revolutionized the educational process is that many teachers have not been adequately trained in appropriate applications of computer technology. Colleges and universities continue to produce teachers who do not have the skills needed to enhance curriculum and instruction with computer technology. National Center for Educational Statistics, NCES [25], reports that teachers, who integrate technology into their teaching on a regular basis, are still in the minority. Despite considerable cost and effort the potential of technology remains unfulfilled in the classroom. As more schools are equipped with computers, software and internet access, issues regarding resources such as hardware, software and accessibility to technology have given way to questions regarding the nature and quality of technology training.

There is evidence to suggest that there is need for training teachers in specific ICT skills. Chu [26] points out that, many senior teachers did not have any computer education when in college, and as a result are in need of computer skills training to allow them to make use of computers in their work. Preston, Cox and Cox [27] found that teachers had not had adequate training, particularly in their ability to solve technical problems and in understanding the basic workings of the technology and were frustrated by the expectation

that they learn technology skills and applications on their own. To overcome this problem, they suggested the first stage of training should focus on the basic operations of technology and software applications, and once teachers have acquired the basic skills, only then should they move on to pedagogical training. Training should be differentiated according to teachers' experience and skills in using computers. Amounts of skills training could be delivered according to individual teachers' needs. Wong, Jalil, Ayub and Tang [28] also stressed that IT training is essential because it reduces the differences among student teachers with differing levels of competency with regard to attitudes towards IT. Once they possess positive IT attitudes, they are more likely to adapt and use IT in the learning environments [28]. A newer study by Santos and Pedro [29] concluded that ICT training has a positive effect on teachers' self efficacy and ICT use in their teaching practices.

2. Research Hypotheses

Based on the aforementioned literature, the following null hypotheses were formulated:

H_1: There is no statistically significant difference in ICT integration in teaching due to gender;

H_2: There is no statistically significant difference in ICT integration due to computer ownership;

H_3: There is no statistically significant difference in ICT integration due to Internet access;

H_4: There is no statistically significant difference in ICT integration due to subject area;

H_5: There is no statistically significant difference in ICT integration due to level of ICT training.

3. Methodology

3.1 Instrumentation

The instrument captured information about the teachers' gender, home computer ownership, home Internet access, subjects taught (Mathematics, Science, Language and Social Science), level of ICT training received (Basic, Intermediate and Advanced) and ICT integration. For the assessment to measure the level of ICT integration in classroom teaching, the Alabama's Preparing Tomorrow's Teachers to use Technology (AlaPT) questionnaire developed by Ash, Sun and Sundin [30] was adapted.

3.2 Subjects and Procedures

Data were collected from a sample of 438 secondary Smart School teachers who taught in Form One (Grade 7) to Form Five (Grade 11). Among the 438 respondents, there were 114 (26.0%) male and 324 (74.0%) female respondents. The distribution of respondents according to the main subject area taught in schools showed that 85 (19.4%) teachers taught Mathematics, 120 (27.4%) teachers taught Science, 66 (15.1%) teachers taught Bahasa Malaysia, 102 (23.3%) teachers taught English while 33 (7.5%) teachers taught History and lastly 32 (7.3%) teachers taught Geography. By classifying the respondents into groups according to years of teaching experience, it was found that 219 (50.0%) of them had less than 11 years of teaching experience, 160 (36.5%) had between 11 to 20

years of service and only 59 (13.5%) of the respondents had more than 21 years of teaching service. The overall mean for years of teaching experience was 11.75 years (S.D. = 7.54).

The respondents' ICT profile is shown in Table 1. The data showed that the majority of respondents (n = 416) had less than 11 years of experience using computers in teaching. The overall mean years in using computers for teaching was 5.23 years (S.D. = 3.27). The data also showed that 404 (92.2%) of the respondents possessed computers, whereas 34 (7.8%) of the respondent did not. In comparison, 246 (56.2%) of the respondents had Internet access at home and 192 (43.8%) of the respondents did not have Internet access. Pertaining to the types of ICT training attended by the respondents for the past five years, the majority of them had attended more than one type of ICT training.

Results of descriptive analysis showed that 211 (48.2%) of the respondents had attended basic level of ICT training such as the use of basic window-based software, 159 (36.3%) had attended intermediate level of ICT training such as the use of various kinds of applications in subject areas and the use of Internet for teaching purposes. Only 68 (15.5%) of the respondents had attended advanced level of training such as development of educational software, e-learning, development of interactive website, production and production of multimedia presentations.

Table 1: ICT Profile

Independent Variable	Category	Frequency (f)	Percent (%)
Computer Experience (years)	0 – 5	284	64.9
	6 – 10	132	30.1
	11 – 15	19	4.3
	over 15	3	0.7
Computer Ownership	Yes	404	92.2
	No	34	7.8
Internet Access	Yes	246	56.2
	No	192	43.8
Level of ICT Training	Basic	211	48.2
	Intermediate	159	36.3
	Advanced	68	15.5

n = 438

* denotes questionnaire with multiple responses

4. Results

The independent samples t-test was used to test the first three hypotheses (H_1, H_2 and H_3) while a one way ANOVA was used to test the two last hypotheses (H_4 and H_5).

The first independent samples t-test analysis revealed that no statistically significant difference in ICT integration between the scores for female (M= 85.95, SD= 21.39) and male teachers [M=84.94, SD=24.03; t(345) = –.419, p= .0675] was detected. The effect size was .046.

The second independent samples t-test analysis showed that there was no significant difference in scores between teachers who possessed computers (M=86.12, S.D.=21.65) and those who did not possess computers [M=80.50, S.D. = 26.55; t(436) = 1.202, p= .237] in terms of their ICT integration. The effect size was .25

The last independent samples t-test analysis showed a significant difference in the ICT integration scores between teachers who had access to the Internet (M=88.62, S.D.=21.90) and those who had no access to the Internet [M=81.92, S.D.=81.92, S.D.=21.79; t(436) = 3.183, p< .05] . The effect size was .307.

The first one-way ANOVA analysis revealed a statistically significant difference for four types of subjects area, $F(3, 433) = 6.324$; $p < .05$. Despite reaching statistical significance, the magnitude between groups effect was computed as .042 (small treatment effect). The Scheffe post-hoc test indicated that science (M=90.90, S.D.= 20.12) and language teachers (M=87.32, S.D.= 21.51) scored significantly higher on ICT integration than mathematics teachers (M=79.18, S.D.=22.54). In addition, science teachers also scored significantly higher on ICT integration than the social study teachers (M=80.67, S.D.=23.71). However, there was no statistical significantly difference for the mean score of ICT integration between mathematics versus social study and science versus language teachers.

The second one-way ANOVA analysis revealed a statistically significant differences for level of ICT courses, $F(2, 435) = 7.485$; $p = .001$. The Scheffe post-hoc test indicated that respondents who had attended intermediate (M=88.45, S.D.=20.63) and advanced ICT (M=91.71, S.D.=20.84) courses scored significantly higher ICT integration than the respondents who had only attended the basic ICT courses (M=81.66, S.D.=22.85). However there was no statistical difference for the mean scores of ICT integration between respondents who had attended intermediate and advanced ICT courses. The magnitude between groups effect was .033.

5. Discussion and Conclusion

The finding of this study implied that teachers' ICT integration is independent of gender. In other words, gender has no effect on the Smart Schools teachers' ICT integration in classroom practice. The result concurs with Looker and Thiessen [31] and Wong et al. [14] who reported that males and females have similar rates of computer use and technology acceptance. This may be due to the fact computers and other ICT tools have become essential in Malaysian teachers' professional and daily lives [13].

As shown in this study, computer ownership has no significant effect on ICT integration. This suggests that teachers' ICT integration is independent of owning a computer. This result contradicts that of Silvernail and Lane [32] who reported higher integration levels among teachers who owned laptops. Similarly, the finding obtained by Henrico Country Public Schools [33] reported the distribution of laptops to teachers had resulted in significant higher ICT integration levels. In addition, the findings indicated that teachers who had Internet access at home were more likely to integrate ICT in their teaching than those teachers who had no Internet access. The result of the finding is consistent with the study done by Harris [34] who reported that teachers from high schools with computer and had access to the Internet at home were implementing technology in their classrooms more frequently.

The results of this study also showed that Science teachers were the most frequent to integrate ICT in their teaching followed by Language teachers and Social Science teachers. The least frequent to integrate ICT in their teaching were the mathematics teachers. This is consistent with the findings from the National Centre for Educational Statistics [25] who reported only 25% of secondary English teachers, 17% of Science teachers, 13% of Social Studies teachers and just 11 % of Mathematics teachers in American public schools use computers weekly in their classrooms. However, Williams et al. [23] found that, Sciences and Mathematics teachers used technology relatively less frequently than teachers of Social and aesthetic subjects. In contrast, Whetstone and Carr-Chellman [21] found that science pre-service teachers appeared to have the highest computer usage, followed by Mathematics teachers and English teachers. Social Studies pre-service teachers appeared to have the lowest computer usage.

The results also showed that as a whole, teachers who had attended higher level of ICT training were more likely to integrate ICT in their teaching than those teachers who had attended only the basic ICT training such as using windows-based software. The results of the current finding concur with Milken Exchange on Educational Technology [35], National Center for Education Statistics [25] and Santos and Pedro [29] that reported teachers who obtained higher levels of technology training were better prepared to integrate technology in their curriculum.

6. Implications of the Study

Based on the aforementioned findings and discussions, the implications of the study are:

- Internet access in schools should be expanded so that teachers could easily access online materials even if they do not have home Internet access;
- Teachers need to go through ICT training that is relevant to their subject areas of specialization. There should be more opportunities for ICT training irrespective of teachers' subject areas;
- ICT training should be on-going, tied to the curriculum-specific applications and linked directly to student learning. Continuous professional training in ICT should be prescribed to teachers to promote their ICT integration in teaching-learning.

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