Academic Achievement from Using the Learning Medium Via a Tablet Device Based on Multiple Intelligences in Grade 1 Elementary Student

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Objective: *To measure academic achievement of the multiple intelligence-based learning medium via a tablet device.*
Material and Method: *This is a quasi-experimental research study (non-randomized control group pretest-posttest design) in 62 grade 1 elementary students (33 males and 29 females). Thirty-one students were included in an experimental group using purposive sampling by choosing a student who had highest multiple intelligence test scores in logical-mathematic. Then, this group learned by the new learning medium via a tablet which the application matched to logical-mathematic multiple intelligence. Another 31 students were included in a control group using simple random sampling and then learning by recitation. Both groups did pre-test and post-test vocabulary.*
Results: *Thirty students in the experimental group and 24 students in the control group increased post-test scores (odds ratio = 8.75). Both groups made significant increasing in post-test scores. The experimental group increased 9.07 marks (95% CI 8.20-9.93) significantly higher than the control group which increased 4.39 marks (95% CI 3.06-5.72) (t = -6.032, df = 51.481, p<0.001).*
Conclusion: *Although learning from either multiple intelligence-based learning medium via a tablet or recitation can contribute academic achievement, learning from the new medium contributed more achievement than recitation. The new learning medium group had higher post-test scores 8.75 times than the recitation group. Therefore, the new learning medium is more effective than the traditional recitation in terms of academic achievement. This study has limitations because samples came from the same school. However, the previous study in Thailand did not find a logical-mathematical multiple intelligence difference among schools. In the future, long-term research to find how the new learning medium affects knowledge retention will support the advantage for life-long learning.*

Keywords: *Multiple intelligences, Tablet, Medium, Achievement*

J Med Assoc Thai 2015; 98 (Suppl. 3): S24-S28
Full text. e-Journal: *http://www.jmatonline.com*

Howard E. Gardner, the developmental psychologist from Harvard University first proposed the multiple intelligence theory in his book 'Frames of Mind' in 1983 in order to change perception about 'intelligence'. The theory explained that human intelligence may not only refer to intellectual quotient (IQ), but also could include other dimensions of intelligence[1]. Gardner's multiple intelligence includes linguistic, logical-mathematical, spatial-visual, musical-rhythmic, bodily kinesthetic, naturalistic, interpersonal, and intrapersonal. Arranging classroom corresponds to a student's multiple intelligence can improve academic achievement more than the traditional classroom[2]. However, there was no effective to long-term memory[2].

In Thailand, logical-mathematical, linguistic, and bodily kinesthetic are the three most common multiple intelligences components in grade 1 student's curriculum. There is no difference in logical-mathematical and linguistic dimension in curriculum among schools whereas there is different of bodily-kinesthetic dimensions in students among schools[3]. One study showed that students who studied in a multiple intelligences-based classroom had higher knowledge, attitude, and perception than a control group without gender difference[4].

Roles of mobile technology in a classroom

Besides a multiple intelligences-based classroom, mobile technology can be used to motivate

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a student to be active in learning both inside and outside classroom. The tablet was usefully used in many kinds of learning. For example, it is interesting and makes student memorizes content better than the non-tablet classroom even when teaching by the same teacher[5], as well as evaluating and giving feedback immediately after learning[6,7]. However, there were some concerns about applying a tablet in a classroom such as disturbing student's concentration[8]. Moreover, there is no difference between speed and understanding[9] so, learning process via a tablet should be well-designed to maximize benefits for a student[10].

In Thailand, the previous study showed that most of grade 1 students prefer to learn via a tablet because they enjoy this method and are happy learning through the medium. While teachers prefer using tablets because it is modern, attractive, and interesting[3].

Material and Method

The present study is a quasi-experimental research (non-randomized control group pretest-post-test design). A group of sixty-two students from a grade 1 elementary school was divided into 2 subgroups. The control group consisted of 31 students (16 males and 15 females) from simple random sampling. The students in this group would learn vocabularies through recitation. The experimental group consisted of 31 students (17 males and 14 females) whom were selected from purposive sampling. The inclusion criterion was a student who had the highest score on logical-mathematic type using a teacher-assisted questionnaire, which had reliability 0.80. Then, this group would learn vocabularies from application named 'QUIZ4FUN' via tablet. This application was developed by using the concept of logical-mathematic. The exclusion criteria were a student who cannot communicate in Thai language, or with a suspected developmental problem. A discontinuation criterion was a student who cannot follow or understand instructions. Both groups had to do the same vocabulary pre-test. Then, the control group learned vocabularies by recitation whereas the experimental group learned from QUIZ4FUN via a tablet. Both groups then did the post-test that included the same content as the pre-test.

Analysis used descriptive statistics including frequency, percentage, mean, standard deviation, 95% confident interval. Inferential statistics included independent t-test, paired t-test, and odd ratio.

The present study was approved by the Human Research Ethics Committee Group 1 of Thammaasat University, Thailand.

Results

The sample included 62 grade 1 students. The control group consisted of 31 students (16 males and 15 females) who were assigned to study by recitation. The experimental group consisted of 31 students (17 males and 14 females) assigned to learn via tablet (Table 1). There was no difference between pre-test score among genders in either the control or experimental group ($t = 1.664$, $df = 29$, and $p = 0.107$ for control group and $t = -0.479$, $df = 29$, $p = 0.636$ for experimental group). There was also no difference of pre-test scores between control and experimental groups ($t = -0.395$, $df = 60$, $p = 0.694$).

Fig. 1 illustrates seven students (22.58%) in control group (studying by recitation) and one student (3.23%) in experimental group (learning via tablet) have decreasing or unchanged post-test scores, while the 24 students (77.42%) in the control group and 30 students (96.77%) in the experimental group have increased post-test scores. Probability of having higher post-test scores after learning via tablet was 30, whereas studying by recitation is 3.43 (odd ratio = 8.75).

In the control group, Table 2 shows the post-test scores' average increase 4.39 points. A paired sample t-test found the mean pre-test and post-test scores of the control group are significantly different. There was no difference between post-test scores

Table 1. The table shows numbers of students classifying by genders and learning methods

Genders	Male		Female		Total	
	n	(%)	n	(%)	n	(%)
Recitation (control)	16	(25.81)	15	(24.19)	31	(50.00)
Tablet (experiment)	17	(27.42)	14	(22.58)	31	(50.00)
Total	33	(53.23)	29	(46.77)	62	(100.00)

between genders (t = 0.140, df = 29, and $p = 0.890$).

In the experimental group, Table 2 shows the post-test scores' average increase 9.06 points. A paired sample t-test showed the mean pre-test and post-test scores are significantly different. There was no difference between post-test score between genders (t = -0.757, df = 29, $p = 0.455$).

In comparing between control and experimental group, the study found the experimental group's post-test mean scores significantly higher than the control group's (t = -6.513, df = 49.853, $p<0.001$). Moreover, mean difference pre-post-test scores of the experimental group is also significantly higher than control group (t = -6.032, df = 51.481, $p<0.001$).

Discussion

From pre-test scores, there was no different between academic performance of control and experimental groups. After each group learned vocabularies by either recitation or QUIZ4FUN, both groups had significant higher post-test scores. Therefore, either recitation or learning via tablet can increase academic achievement.

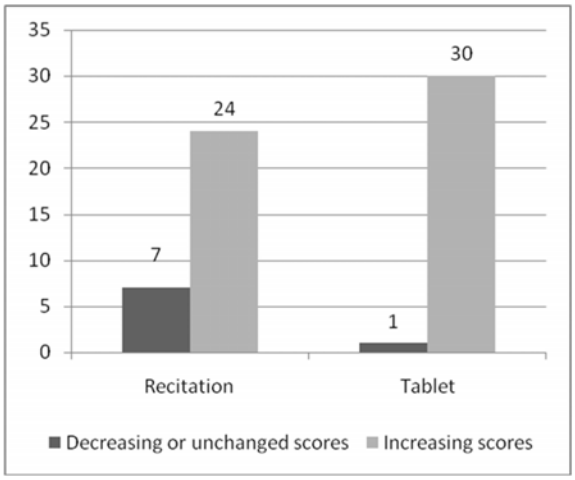

Fig. 1 The figure shows numbers of students with the changed scores compared between control and experimental group.

The number of students using QUIZ4FUN and then increasing post-test scores was more than using recitation. There were 30 students from QUIZ4FUN group (48.39%), whereas only 24 students from recitation group (38.71%) had higher post-test score. Therefore, the evidence supports the effectiveness of the multiple intelligence-based software in a tablet over the recitation. It correlates with the previous study that reported multiple intelligence-based learning can promote knowledge[4]. However, these numbers refer to short-term memory quality. Therefore, it did not prove long-term knowledge retention. Even though the previous study supported the fact that tablet classroom improves a student to memorize more content than non-tablet classroom, a multiple intelligence-based classroom had no effect on long-term memory[2,5]. Thus, future research about long-term knowledge retention, which represents the true learning experience should be considered.

Interestingly, not all students improved their scores immediately after studying. The result may explain why in many curriculum, grade 1 students have to study more than one time or use auxiliary learning media outside the classroom for better achievement. For this reason, learning via a tablet has advantages over classroom studying in terms of process and content of learning. The process includes easier accessibility, evaluation and feedback immediately. The content includes feeling enjoyment and pleasure using a tablet[3].

In the present study, QUIZ4FUN helped students to reach more academic achievement than usual way by recitation. QUIZ4FUN contributed higher mean post-test scores and higher mean difference pre-post-test scores than recitation. There was significantly difference between post-test scores of both groups and significant differences between the mean difference pre-post-test scores of both groups. Moreover, students in the QUIZ4FUN group have higher post-test scores 8.75 times than recitation group. Therefore,

Table 2. The table shows mean score and SD of pre-test and post-test scores as well as the t-test between pre-test and post-test scores

Learning methods	Pre-test scores		Post-test scores		Paired t-test		95% CI	*p*-value
	Mean	SD	Mean	SD	Mean change	t		
Recitation (control)	3.84	1.46	8.23	3.50	4.39	-6.746	3.06-5.72	<0.001
Tablet (experiment)	3.97	1.08	13.03	2.15	9.06	-21.464	8.20-9.93	<0.001

the learning medium via a tablet device that matched multiple intelligences can immediately boost knowledge in grade 1 students both the quantity and quality. The results support the previous study in which a tablet classroom, corresponding to a student's multiple intelligence concept, can improve academic achievement more than the traditional classroom[2,4].

There are some limitations in using only grade 1 students from one school under the Ministry of Education in Thailand. Therefore, it can probably not apply to other grade students or a private school. However, the previous study in Thailand did not find a logical-mathematical multiple intelligence difference among schools. Next, the experimental group was assigned to learn via the software that corresponds to one's own multiple intelligence (logical-mathematical). The student who has other multiple intelligence may not have similar responses.

Conclusion

Even though traditional studying by recitation is the standard method for learning words and effective for gaining academic achievement, the research found well-designed learning material using technology is more effective based on the multiple intelligence theory. This study had advantages because of the purposive sampling with pre- and post-test that can increase reliability of the software's effectiveness in a specific group, which matches multiple intelligence with the software. Moreover, using an innovative academic technology should respond to the need for studying outside a classroom and life-long learning effectively. The software is more affordable and easy to adjust than earlier hardware learning material. Therefore, it is more practical and effective.

Future research about long-term knowledge retention by a new learning medium comparison with traditional studying will benefit educational society in terms of supporting the life-long and outside classroom learning. Therefore, everyone at any age or status, who would like to learn, would have an opportunity to do so.

What is already known on this topic?

This is the first research that proves the effectiveness of learning by multiple intelligence-based via a tablet.

What this study adds?

Scholars have approved the effectiveness of a multiple intelligence-based classroom using a tablet device for academic purposes. This research consecutively applied the theory of embedding software for mobile technology and finding how much more effective it could be.

Acknowledgement

The authors wish to express gratitude to teachers in Rittiya-Wannalai School for supporting the research team.

Potential conflicts of interest

This study was a recipient of a grant from the National Science and Technology Development Agency (NSTDA).

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ผลสัมฤทธิ์ทางการศึกษาจากการเรียนรู้ด้วยสื่อการเรียนรู้ในอุปกรณ์แท็บเล็ตซึ่งมีพื้นฐานจากพหุปัญญาของนักเรียนชั้นประถมศึกษาปีที่ 1

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วัตถุประสงค์: *เพื่อวัดผลสัมฤทธิ์ทางการศึกษาจากสื่อการเรียนรู้ซึ่งมีพื้นฐานจากพหุปัญญาในอุปกรณ์แท็บเล็ต*

วัสดุและวิธีการ: *การศึกษานี้เป็นการวิจัยกึ่งทดลองแบบไม่สุ่มกลุ่มควบคุมและมีทดสอบก่อนและหลังเรียนในนักเรียน ชั้นประถมศึกษาปีที่ 1 จำนวน 62 คน (ชาย 33 คนและหญิง 29 คน) นักเรียน 31 คนได้รับคัดเลือกในกลุ่มทดลอง โดยใช้การสุ่มแบบเจาะจงด้วยการเลือกนักเรียนที่มีคะแนนพหุปัญญาด้านตรรกะและคณิตศาสตร์สูงที่สุดแล้ว จึงให้เรียนรู้ด้วยสื่อการเรียนรู้รูปแบบใหม่โดยใช้แท็บเล็ต ซึ่งโปรแกรมประยุกต์เข้ากันกับพหุปัญญาด้านตรรกะและคณิตศาสตร์ ส่วนนักเรียนอีก 31 คนได้รับคัดเลือกในกลุ่มควบคุมโดยใช้การสุ่มอย่างง่าย แล้วจึงให้เรียนรู้ด้วยการท่องจำทั้งสองกลุ่ม ทำแบบทดสอบคำศัพท์ก่อนและหลังเรียน*

ผลการศึกษา: *กลุ่มทดลอง 30 คนและกลุ่มควบคุม 24 คนมีคะแนนทดสอบหลังเรียนเพิ่มขึ้น (odds ratio = 8.75) ทั้งสองกลุ่มมีคะแนนทดสอบหลังเรียนเพิ่มขึ้นอย่างมีนัยสำคัญ กลุ่มทดลองเพิ่ม 9.07 คะแนน (95% CI 8.20-9.93) มากกว่ากลุ่มควบคุมซึ่งเพิ่ม 4.39 คะแนน (95% CI 3.06-5.72) อย่างมีนัยสำคัญ (t = -6.032, df = 51.481, และ p<0.001)*

สรุป: *ถึงแม้ว่าการเรียนรู้ทั้งจากแท็บเล็ตซึ่งมีพื้นฐานจากพหุปัญญาและการท่องจำช่วยให้เกิดผลสัมฤทธิ์ทางการศึกษา การเรียนรู้ด้วยสื่อการเรียนรู้รูปแบบใหม่ช่วยให้เกิดผลสัมฤทธิ์มากกว่าการท่องจำ โดยกลุ่มที่ใช้สื่อการเรียนรู้รูปแบบใหม่ได้คะแนนทดสอบหลังเรียนเพิ่มขึ้นมากกว่ากลุ่มท่องจำถึง 8.75 เท่า ดังนั้นสื่อการเรียนรู้รูปแบบใหม่ จึงมีประสิทธิภาพมากกว่าการเรียนแบบท่องจำดั้งเดิมในแง่ของผลสัมฤทธิ์ทางการศึกษา การศึกษานี้มีข้อจำกัดเนื่องจากกลุ่มตัวอย่างมาจากโรงเรียนเพียงแห่งเดียว อย่างไรก็ตามจากการศึกษาในไทยก่อนหน้านี้ ไม่พบว่ามีความแตกต่างของพหุปัญญาระหว่างโรงเรียนในสังกัดกระทรวงศึกษาธิการในอนาคต การวิจัยในระยะยาวเพื่อค้นหาว่าการใช้สื่อการเรียนรู้รูปแบบใหม่มีผลต่อการคงอยู่ของความรู้จะยิ่งสนับสนุนประโยชน์สำหรับการเรียนรู้ตลอดชีพด้วย*