The Analysis on the Learning Outcomes of Elementary Students in Smart Education

IL-Soo Park¹ and Jeong-Hoon Hwang²*

¹Department of Elementary Education, Gongju National University of Education, Republic of Korea; Passp101@naver.com
²Faculty of Sciences and Liberal Arts, Young dong University, Republic of Korea; 1jhhwang@u1.ac.kr

Abstract

Objectives: This study aims to verify learning outcomes of elementary students in the smart education. We expect that this study will be useful for educators in the field of the smart education. Methods/Statistical Analysis: We selected an elementary school with the smart education, and another elementary school as a control, which both have demonstrated the similar academic achievement, had a comparable local environment and socio-economic status. In this study, the learning outcomes were studied in terms of 5 variables including problem solving, learning attitude, self-directed learning ability, character, and information literacy. Analysis between two group data was carried out using the independent sample T-test. Findings: Results of this study are as follows: First, we were not able to verify a significant difference in learning outcomes of the smart education on elementary students in a comprehensive manner. Second, with regard to the difference of learning outcomes by grades, while the 4th graders and 5th graders have insignificant difference in learning outcomes, the 6th graders have a significant difference. Third, by investigating sub-factors in learning outcomes between the smart school and the control school, we verified that the 5th graders have a significant difference in their learning attitude and self-directed learning abilities, and the 6th graders have a significant difference in their characters and information literacy. As a result, we conclude that the smart education benefits 5th graders and 6th graders in elementary school with regard to their learning outcomes. Improvements/Applications: The smart education is to be used for 5th graders or older. This study result will be used as a basis to enable the successful establishment of Korean smart education.

Keywords: Elementary Student, Learning Outcomes, Smart Education, Smart Device, Smart School

1. Introduction

Smart education is defined to be an intelligently customized teaching-learning support system that leads to comprehensive changes in the overall education system, such as new educational methods, curriculum, evaluation, and teacher, required by the 21st century knowledge/information society. Based on the best communication environment, it appears to be an educational form that combines the social leaning and the adaptive learning⁴. This study aims to verify learning outcomes of the smart education in elementary school. We expect that this study will be useful for educators in the field of the smart education.

The smart education is now recognized as a new 21st century educational paradigm that fosters and develops all students to become global leaders by existing education system, such as educational contents, methods, evaluations, and environments⁴. In this study, we investigated the efficacy of the smart education, based on five abilities – problem solving, learning attitude, self-directed learning, character, and information literacy, targeting elementary school students. These five learning abilities are the core competencies of the 21st century, and are common educational goals of smart schools and the rapidly changing knowledge/information society.

Based on these contemporary needs, students shall learn educational contents using smart/mobile devices
in anytime, in any place, and students shall obtain, share, and develop knowledge by utilizing smart devices, as learning subjects. Recently, various studies have been performed on smart education. But, previous studies have demonstrated insufficient learning outcome of smart education. This study was to investigate the learning outcomes of the smart education in elementary school.

2. Experimental Procedure

2.1 Study Participants

In order to verify learning outcomes of the smart education, we selected two elementary school groups - an elementary school with the smart education and a control elementary school. Subjects had demonstrated similar academic achievement, local environment and socio-economic status. Subjects studied in this research are shown in Table 1.

2.2 Dependent Variables and Learning Outcome

In this study, we established 5 learning outcome variables, which are problem solving, self-directed learning ability, learning attitude, information literacy, and character. This study was to investigate these variables in order to verify learning outcomes of the smart education in elementary school.

2.3 Data Processing and Analysis

In Table 2 and Table 3 the survey was conducted on 563 elementary school students as a target. A reliability of survey was confirmed with the Cronbach’s alpha test. Analysis between two group data was carried out using the independent sample T-test. This study was to investigate the effects of the smart education according to the grades. Finally, in order to verify the practical significance of the smart education, we calculated effect sizes and percentiles of no overlap.

3. Experimental Results

3.1 The effect of the smart education on elementary student’s learning

3.2 Learning Outcomes of the Smart Education per Grade

4. Conclusion

This study aimed to investigate learning outcomes of the smart education in elementary schools. In order to accomplish the research goal, we investigated learning outcome differences between 4th, 5th, and 6th graders from the smart school and the control school. The learning outcomes consisted of problem solving, learning attitude, self-directed learning ability, character, and information literacy. The results of this study are discussed in the following. First, we were not able to verify significant differences in learning outcomes of the smart education in elementary school (t = 1.269, p > .05). In addition, the sub-factors of learning outcomes by the smart education did not exhibit any significant differences, in terms of problem solving (t = .665, p > .05), learning attitude (t = .881, p > .05), self-directed learning ability (t = .993, p > .05), character (t = 1.591, p > .05), and information literacy (t = 1.267, p > .05). Second, the learning outcomes of the smart education were a significant differences in 6th grade (t = 2.093, p < .05), but notsignificant differences in 4th grade (t = 1.138, p > .05) and 5th graders (t = 1.965, p > .05). Third, we discussed the learning outcomes of the smart education per grade with regard to 5 sub-factors (learning attitude, self-directed learning ability, problem solving, information literacy, and character). The 4th graders in the control school had higher mean values of the 5 sub-factors than those in the smart school, but did not demonstrate significant differences. The 5th graders in the smart school had higher mean values of all 5 sub-factors than

| Classification | 4th Grade | 5th Grade | 6th Grade | Total |
|----------------|-----------|-----------|-----------|-------|
| Smart          | 83(30.0)  | 130(46.9) | 64(23.1)  | 277(100.0) |
| Control        | 113(39.5) | 83(29.0)  | 90(31.5)  | 286(100.0) |
| Total          | 196(34.8) | 213(37.8) | 154(27.4) | 563(100.0) |
Table 2. Results of the difference in learning outcomes between the smart school and the control school

| Variable                     | School     | N     | M      | SD      | t      | p     | ES(U₃) |
|------------------------------|------------|-------|--------|---------|--------|-------|--------|
| Learning Attitude           | Smart      | 277   | 18.1625| 3.59634 | .881   | .379  | .074 (52.95) |
|                             | Control    | 286   | 17.8811| 3.97358 |        |       |        |
| Self-directed Learning Ability | Smart      | 277   | 18.6715| 3.68634 | .993   | .321  | .084 (53.33) |
|                             | Control    | 286   | 18.3497| 3.99431 |        |       |        |
| Problem Solving             | Smart      | 277   | 18.2780| 3.70839 | .655   | .513  | .055 (52.20) |
|                             | Control    | 286   | 18.0699| 3.82448 |        |       |        |
| Information Literacy        | Smart      | 277   | 18.9639| 3.75598 | 1.267  | .206  | .107 (54.25) |
|                             | Control    | 286   | 18.5455| 4.06996 |        |       |        |
| Tenacity                    | Smart      | 277   | 19.5307| 3.25765 | 1.591  | .112  | .134 (55.33) |
|                             | Control    | 286   | 19.0664| 3.64751 |        |       |        |
| Total                       | Smart      | 277   | 93.6065| 15.06918| 1.269  | .205  | .107 (54.25) |
|                             | Control    | 286   | 91.9126| 16.57824|        |       |        |

Table 3. Results of the difference in learning outcomes between the smart school and the control school by grade

| Variable                     | School     | N     | M      | SD      | t      | p     | ES(U₃) |
|------------------------------|------------|-------|--------|---------|--------|-------|--------|
| 4th grade                    | Learning Attitude | Smart | 83    | 18.3373| 3.37956| -1.683| .094  | .242 (40.43) |
|                             | Control    | 113   | 19.2389| 3.92855|        |       |        |
| Self-directed Learning Ability | Smart      | 83    | 18.5301| 3.45824| -1.136| .257  | .164 (34.50) |
|                             | Control    | 113   | 19.1593| 4.08299|        |       |        |
| Problem Solving             | Smart      | 83    | 18.5301| 3.71332| -1.050| .295  | .151 (43.99) |
|                             | Control    | 113   | 19.0885| 3.65122|        |       |        |
| Information Literacy        | Smart      | 83    | 19.1566| 3.46931| -.005 | .996  | .001 (49.97) |
|                             | Control    | 113   | 19.1593| 4.38253|        |       |        |
| Character                   | Smart      | 83    | 19.5783| 2.82463| -.991 | .323  | .137 (44.56) |
|                             | Control    | 113   | 20.0442| 3.75450|        |       |        |
| Total                       | Smart      | 83    | 94.1325| 13.59858| -1.138| .257  | .163 (43.49) |
|                             | Control    | 113   | 96.6903| 16.83962|        |       |        |
| 5th grade                    | Learning Attitude | Smart | 130   | 18.1692| 3.76466| 2.415*| .017  | .338 (63.23) |
|                             | Control    | 83    | 16.9157| 3.58249|        |       |        |
| Self-directed Learning Ability | Smart      | 130   | 18.6462| 3.89168| 2.094*| .038  | .296 (61.64) |
|                             | Control    | 83    | 17.4699| 4.06453|        |       |        |
| Problem Solving             | Smart      | 130   | 18.0231| 3.80091| 1.823  | .070  | .255 (60.07) |
|                             | Control    | 83    | 17.0241| 3.93228|        |       |        |
| Information Literacy        | Smart      | 130   | 18.8000| 4.09083| .486   | .627  | .068 (52.71) |
|                             | Control    | 83    | 18.5181| 4.18290|        |       |        |
| Character                   | Smart      | 130   | 19.4385| 3.54594| 1.765  | .079  | .250 (59.87) |
|                             | Control    | 83    | 18.5301| 3.73623|        |       |        |
| Total                       | Smart      | 130   | 93.0769| 16.53402| 1.965 | .051  | .276 (60.88) |
|                             | Control    | 83    | 88.4578| 16.85903|        |       |        |
The Analysis on the Learning Outcomes of Elementary Students in Smart Education

| 6th grade | Learning Attitude | Smart 64 | 17.9219 | 3.56038 | 1.384 | .169 | .225 (58.91) |
|-----------|-------------------|----------|----------|----------|-------|------|-------------|
|           | Control 90        | 17.0667  | 3.92858  |          |       |      |             |
| Self-directed Learning Ability | Smart 64 | 18.9063  | 3.57557  | 1.288   | .200  | .210 (58.30) |
|           | Control 90        | 18.1444  | 3.64603  |          |       |      |             |
| Problem Solving | Smart 64 | 18.4688  | 3.34744  | 1.235   | .219  | .201 (57.96) |
|           | Control 90        | 17.7556  | 3.65756  |          |       |      |             |
| Information Literacy | Smart 64 | 19.0469  | 3.42924  | 2.226*  | .027  | .362 (64.14) |
|           | Control 90        | 17.8000  | 3.42233  |          |       |      |             |
| Character | Smart 64          | 19.6563  | 3.21316  | 2.543*  | .012  | .414 (66.05) |
|           | Control 90        | 18.3333  | 3.15872  |          |       |      |             |
| Total     | Smart 64          | 94.0000  | 13.90215 | 2.093*  | .038  | .341 (63.33) |
|           | Control 90        | 89.1000  | 14.60341 |          |       |      |             |

Among the sub-factors, the smart education positively affected the learning attitude ($t = 2.415$, $p < .05$) and the self-directed learning ability ($t = 2.094$, $p < .05$). Meanwhile, the 6th graders in the smart school had higher mean values of all 5 sub-factors than those in the control school. Among the sub-factors, the information literacy ($t = 2.226$, $p < .05$) and the character ($t = 2.093$, $p < .05$) has benefited from the smart education. This result is concordant with a claim by Kim et al. that the smart education be effective in elementary school students’ information literacy and their characters. Implications in this study are as follows: According to this study, the smart education did not generate effective learning outcomes in elementary school. However, learning outcomes of the smart education per grade revealed that 6th graders benefitted from the smart education and we were able to verify practical significances in all 5 sub-factors. The 4th graders and 5th graders did not show significant differences on learning outcomes by the smart education, but the 5th graders in the smart school was significantly higher in the learning attitude and the self-directed learning ability. In contrast, the 4th graders in the control school rather showed higher means than those in the smart school, but did not significant differences in learning outcomes. In other words, the smart education is found to be not effective in all elementary school students. In addition, we were able to verify differences in effect by each sub-factor of the smart education per grade. In this regard, we are listing a few suggestions in the following. First, we suggest that an initial attempt for the smart education is suitable in 5th graders. Based on the results in this study, learning outcomes by the smart education are demonstrated in the 6th graders. Although not statistically significant, the 4th graders in the control school and the 5th graders in the smart school showed higher learning outcomes. Therefore, we propose the initial application of the smart education in the 5th graders. Second, we were able to verify the differences in learning outcomes by sub-factors of the smart education per grade. The learning outcomes of smart education depend on the context variables. Therefore, if educators the smart education, they shall consider the following context variables such as aim of education, curriculum, instructional method, grade and other context.

5. References

1. Ministry of Education. Science and Technology. Available from: http://www.education.go.ke/
2. Heo H, Lim KY, Kim H, Lee HW. Validation of the assessment instrument for teacher competency for SMART education. The Journal of Educational Information and Media. 2013; 19(2):151-73.
3. Leem J, Ahn S. A qualitative study on educational usefulness and problems of smart pad-based instruction in elementary school. Journal of The Korean Association for Information Education. 2014; 18(1):75-87.
4. Lee E, Lee J. Analysis of structural relationships of learner characteristics, interactions flow, perceived usefulness and learning satisfaction in SMART education environments: Focused on elementary school. The Journal of Educational Information and Media. 2013; 19(3):573-603.
5. Kim M, Kwon D. The study on the educational prerequisites for stable implementation of SMART education in school. Research for Learner-centered Curriculum and Instruction. 2013; 13(5):661-76.
6. Kim Y. Current Status and Future Direction of Smart Education. Seoul: Korean Educational Development Institute; 2011.
7. Kim H, Lim C. Smart Learning curriculum for enhancing pre-service teachers’ practicum experience: A case study of SMART teacher lab. The Journal of Korean Teacher Education. 2013; 30(3):197-220.
8. Kim S W, Lee Y. The analysis on research trends in programming based STEAM education in Korea. Indian Journal of Science and Technology. 2016 Jun; 9(24):1-11.
9. Hwayeol C, Woonhan K, Hyejin C. Effects of smartphone-based learning properties on user satisfaction and recommendation intention. Indian Journal of Science and Technology. 2015 Oct; 8(26):1-7.
10. Eom SJ, Youn JJ, Kim HJ. A study on image selection for the development of educational contents enhancing undergraduates’ creativity and personality. Indian Journal of Science and Technology. 2016 Jul; 9(26):1-6.
11. Kim HS, Kye B, JiKil H, Jeon J. The impact of smart-education on school educational case of a model school in Sejong City. Journal of Korean Education. 2013; 40(3):27-48.
12. Ahn YO, Park SB, Hwang SY. A study on the application of smart learning for the domain of expressive activities in elementary school. The Korean Journal of the Elementary Physical Education. 2013; 18(4):1-16.
13. Lee I. A study on learning effect improvement method in smart learning. Bulletin of Korean Society of Basic Design and Art. 2013; 14(1):345-57.
14. Leem J, Ahn S. A qualitative study on educational usefulness and problems of smart pad-based instruction in elementary school. Journal of the Korean Association of Information Education. 2014; 18(1):75-87.
15. Kim H. Issues on model development for the quality control of smart education contents and teaching/learning [Research Material RM 2011-20]. Seoul: Korea Education and Research Information Service; 2011.