



AENSI Journals

Advances in Environmental Biology

ISSN-1995-0756 EISSN-1998-1066

Journal home page: <http://www.aensiweb.com/AEB/>

Investigating the effectiveness of instructing elementary school mathematics course using supplementary instructional software emphasizing the constructivism approach on the level of academic achievement of mathematics

¹Sara Nagshine and ²Bager Sardari

¹M.A. Student, Department of Educational Sciences, Marand Branch, Islamic Azad University, Marand, Iran

²PHD, Department of Educational Sciences, Marand Branch, Islamic Azad University, Marand, Iran.

ARTICLE INFO

Article history:

Received 26 September 2014

Received in revised form 20 November 2014

Accepted 25 December 2014

Available online 2 January 2015

Keywords:

mathematical education, onconstructivism, education software, academic achievement.

ABSTRACT

The purpose of the study is "effectiveness mathematical education software based onconstructivism on academic achievement". Research method is quasi-expermental. The population of the research consists of all primary students in kхой city. The statistical sample included two grade-4 primary school classes of female students in kхой. The number of the students for experimental and control groups were 20 students. Students were matched in these two groups with Riwen. For collective data, use academic achievement test. Reliability test by use Alpha Kronbakh were 0/78. The instruments for the study were a pre and posttests for the students' academic achievement and a checklist for observing the process of teaching in classes. The results of the research show that constructivism software effect on grouping, high levels of ognitive domain, motivation, problem solving.

© 2014 AENSI Publisher All rights reserved.

To Cite This Article: Sara Nagshine and Bager Sardari., Investigating the effectiveness of instructing elementary school mathematics course using supplementary instructional software emphasizing the constructivism approach on the level of academic achievement of mathematics. *Adv. Environ. Biol.*, 8(25), 755-765, 2014

INTRODUCTION

Developing knowledge-based community has been facilitated nowadays. The latest studies have indicated that learning is the key to knowledge-based society. People are able to produce and use the knowledge through learning. One is able to facilitate the learning process assisted by the communication technologies. Electroniclearning provides novel perspectives nowadays. In this field, transforming knowledge has been substituted by constructing knowledge accompanied by emphasizing on memory, repetition and reward. Such a changing has turnedout to beregarded as constructivism point of view in recent years which has been emphasized to boost the instruction process.

Constructivism is taken into account as the philosophy of learning which has to do with making knowledge by the learners. The general principlesofconstructivism are defined as the ones in which the learner can only understand new situations on account of the existed understanding. Learning comprises of active processes in which the learner infers the meaning through relating the new ides with those of existed. The theory of constructivism indicates on the position of student against the teacher. It retains the main topics and concepts. Hence, the learner conceptualizes and solves the problem. Creativity and innovation of learner is admitted and is supported. Constructivism learning point of view leads to mental structures, the learners would attain the things they have planned for beforehand through mediating new information. People are highly learners when they play a role in its development, in constructivism theory, content-based learning and beliefs and attitudes are effectively correlated and the learners are supported by means of the innovations and providing the solutions.

Theconstructivism approach is highly concerned in the field of mathematics instruction. a constructivist teacher encourages the students to infer the meanings through posing meaningful questions, teachers adapted to such theoriesbelieve that students are able to develop mathematic-based knowledge instead of learning it through the direct instruction. So, students interpret what they observe or what they do inrelation to what they already know.

Corresponding Author: Sara Nagshine, M.A. Student, Department of Educational Sciences, Marand Branch, Islamic Azad University, Marand, Iran

Inconstructivism-based classroom setting, the teacher provides the students with meaningful problems and encourages them to determine the hypothesis and to provide a variety of solution. the mathematics teacher is not the distributor of knowledge, rather he plays the role of facilitator, it should be taken into account by the mathematics teacher that the learners should experience with a variety of methods and goals so that they act better in generating and transforming the knowledge [6].

The constructivist approach relies to a large extent on the trend of computer-based learning and concepts of group learning, active learning and generating knowledge are among the critical variables. In this regard. This approach encourages the learners to face the open-based targets and leads them to understand better. Based on the assumption that the essence of technology is to modify and facilitate anything, one would expand and develop the instructional software and their position in learning process. In line with this is the changing of mathematics and its instruction which has enjoyed a lot from technology. Since computers provide us with new facilities such as color, voice and movement through which one is able to perceive new aspects leading to facilitated instruction [8]. Computer assist the student in solving the problems. In addition, the act of scoring and registering them is done by computers and the educational history of each student is kept in them to be used later when necessary [12]. Indicating on computer-assisted learning, Domens points out that computer-assisted learning would show more efficiency in theoretical framework [10]. Hence, employing correct use of the instructional software in analyzing the problem-solving which can reduce the amount of problems on the part of the teachers and facilitate the learning for the students. The issue to be mentioned here is whether one is able to get informed of the effectiveness of such software through utilizing the mathematics instructional software based on constructivist approach in primary school level.

Methodology:

Based on the essence and goals, the research falls into the category of quasi-experimental design. The statistical population comprises 1470 students educating in fourth grade of primary school in Khoy for the year 92-93. Two primary schools were chosen from Khoy schools. Subsequently, the level of intelligence was evaluated by Rion test. Experimental and control group involved 20 and 20 students, respectively.

Instruments:

Instructional software:

The study made use of compact disc of Education Technology Organization for mathematics-based discussion to be provided by Educational technology Organization.

Academic achievement test:

The academic achievement test was developed for the current study to be prepared as open-ended. The administered pre-test and post-test of both groups included 10 items scored as 20.

Rion intelligence test:

To homogenize the experimental and control groups, kids' intelligence test of Rion was run. The study made use of observation checklist to determine the amount of progression.

Findings:

Hypothesis 1: teaching method using mathematics instructional software regarding the constructivist approach has an effect on group working of students.

Table 3.4: Summary of Kolmogorov-Smirnov test analysis

| | | |
|---------------------------|----------|--------|
| Maximum of differences | Absolute | 0.692 |
| | Positive | 0.000 |
| | negative | -0.692 |
| Kolmogorv-Smirnov | | 1.765 |
| Significance (two-tailed) | | 0.004 |

Kolmogorov-Smirnov test is used to assess the normality of experimental and control groups., the level of significance in this test is 0.004. The significance state indicates that variables are not distributed normally and should be substituted by U-test.

Table 4.4: the output of U-test for independent samples in hypothesis 1

| | |
|---------------------------|--------|
| Hypothesis 1 | |
| U Mann Withney | 21 |
| Z value | -3.265 |
| Significance (two-tailed) | 0.001 |

The value of Z in test is -3.265 and higher than value of 2.58 at 0.01 level of significance, this shows that the amount of group work is more compared to that of control group and this indicates that instructing through constructivist software is in opposition to instructions with no software. Null hypothesis is rejected and research hypothesis is accepted.

Hypothesis 2: teaching method using mathematics instructional software regarding the constructivist approach has an effect on learning motivation of students.

Table 4.7: the output of independent t-test for independent samples in hypothesis 2

| | | | | | T-test regarding the quality of means | Levin test for equation variances | | | |
|--|-------|----------------------------------|-----------------|--------------|---------------------------------------|-----------------------------------|--------------|---------|-----------------------------|
| 99% confidence interval for the two means difference | | Difference of standard deviation | Mean difference | significance | Degree of freedom | Independent t | significance | F value | |
| high | low | | | | | | | | |
| 1.347 | 0.115 | 0.22 | 0.73 | 0.003 | 18 | 3.318 | 0.037 | 4.874 | Variances are assumed equal |
| 1.362 | 0.1 | 0.22 | 0.73 | 0.004 | 18.700 | 3.318 | | | Variances are assumed equal |

Leven test is significant for the variance homogeneity of hypothesis and the level of significance of Leven test is 0.370. In case the test is significant, the assumption of variances equity is questioned and one should use the t-test of non-equal variances. Based on the above table, the observed t-test value (3.318) and critical value of the table (2.861) is higher at 0.01 alpha level. This result corresponds to 99% confidence interval for the difference of two means which does not involve the null hypothesis. So, null hypothesis is rejected and the research hypothesis is confirmed, saying that the means of pre-test and posttest in both groups are different. The level of significance of this test is accepted at 0.004 alpha level. It is determined from t-test results that teaching through constructivist software increases the motivation of learners in relation to the teaching method.

Hypothesis 3. Teaching method using mathematics instructional software regarding the constructivist approach improves the problem-solving skill of students.

Table 4.10: the output of independent t-test for independent samples in hypothesis 3

| | | | | | T-test regarding the quality of means | Levin test for equation of variances | | | |
|--|-------|----------------------------------|-----------------|--------------|---------------------------------------|--------------------------------------|--------------|---------|-----------------------------|
| 99% confidence interval for the two means difference | | Difference of standard deviation | Mean difference | significance | Degree of freedom | Independent t | significance | F value | |
| high | low | | | | | | | | |
| 1.001 | 0.014 | 0.239 | 0.51 | 0.044 | 18 | 2.124 | 0.311 | 1.071 | Variances are assumed equal |
| 1.002 | 0.013 | 0.239 | 0.51 | 0.045 | 22.961 | 2.124 | | | Variances are assumed equal |

Leven test is not significant for the variance equity of and the level of significance of Leven test is 0.311. In case the test is not significant, the assumption of variances equity is accepted and one should use the normal t-test with equal variances. Based on the above table, the observed t-test value (2.124) and critical value of the table (2.064) is higher at 0.05 alpha level. so, null hypothesis is rejected and research hypothesis is accepted. it is reported based on t-test results that instructing through using software is affective in problem-solving development compared to traditional ways of instruction.

Hypothesis 4. . Teaching method using mathematics instructional software regarding the constructivist approach has an effect on students' cognitive learning level.

Table 13.4: output of U-test for independent samples in hypothesis 4

| | | |
|---------------------------|--|--------|
| Hypothesis 1 | | 36.500 |
| U Mann Withney | | |
| Z value | | -2.518 |
| Significance (two-tailed) | | 0.012 |

The Z value in test is -2.518 and higher than 1.96 at 0.05 level of significance. This implies that the level of students' response to meta cognitive level is higher in experimental group compared to that of control group and this means that teaching using constructivist software is significant compared to no-software instructing. So, null hypothesis is rejected and research hypothesis is accepted.

Hypothesis 5. Teaching method using mathematics instructional software regarding the constructivist approach has an effect on students' mathematics academic achievement.

Table 4.14: the output of dependent t-test for pre-test and post-test in experimental and control groups in hypothesis 5

| | | | | | T-test regarding the quality of means | Levin test for equity of variances | | | |
|--|-----|----------------------------------|-----------------|--------------|---------------------------------------|------------------------------------|--------------|--------------------|--------------------|
| 99% confidence interval for the two means difference | | Difference of standard deviation | Mean difference | significance | Degree of freedom | Independent t | significance | F value | |
| high | low | | | | | | | | |
| 0.000 | 19 | -22.36 | -10.15 | -13 | -13 | 0.52 | -11.56 | Pre-test post-test | Experimental group |
| 0.000 | 19 | 15.117 | -7.21 | -10.38 | 0.582 | 3.49 | | Pre-test post-test | Control group |

The results of t-test, comparing the academic achievement of students in experimental and control group, shows that the observed t-test (-22.36) is higher than critical value (2.750) at 0.01 alpha level. So, null hypothesis is rejected and the research hypothesis is accepted, saying that the means of pre-test and post-test in both groups are different. Also, the observed t-test (-15.117) in control group is higher than the critical value (2.0750) at 0.01 alpha level. So, null hypothesis is rejected and the research hypothesis is accepted, indicating that the means of the results for pre-test and post-test in both group differ. The independent t-test in independent groups studies the level of significance in post-test of both groups. The following table shows the results of t-test for evaluating the level of significance in academic achievement test.

Table 4.15: the output of independent t-test for post-test in experimental and control group in hypothesis 5

| | | | | | T-test regarding the quality of means | Levin test for equity of variances | | | |
|--|------|----------------------------------|-----------------|--------------|---------------------------------------|------------------------------------|--------------|---------|-----------------------|
| 99% confidence interval for the two means difference | | Difference of standard deviation | Mean difference | significance | Degree of freedom | Independent t | significance | F value | |
| high | low | | | | | | | | |
| 4.34 | 0.37 | 0.75 | 2.3538 | 0.003 | 38 | 3.136 | 0.655 | 0.201 | Variances are assumed |

| | | | | | | | | | |
|------|------|------|------|-------|-------|-------|--|--|-----------------------------|
| | | | | | | | | | equal |
| 4.34 | 0.37 | 0.75 | 2.35 | 0.003 | 67.92 | 3.138 | | | Variances are assumed equal |

Leven test is not significant for the variance equity of and the level of significance of Leven test is 0.655. In case the test is not significant, the assumption of variances equity is accepted and one should use the normal t-test with equal variances. Based on the above table, the observed t-test value (3.136) and critical value of the table (2.66) is higher at 0.01 alpha level. So, null hypothesis rejected and research hypothesis is accepted. It is reported based on t-test results that instructing through using software increases the academic achievement in experimental group.

Discussion and results:

The study results indicated that the teaching method regarding the constructivist approach had an effect on students' group working activities. As believed by Tabin and Imold (1993), a constructivist teacher assumes that there would be a variety of opportunities in which students are able to talk about their learning leading to students' achievement through maximizing the social interaction among learners and proving emotional intelligences. One would claim that encouraging students to discuss in classroom would be one of the critical aspects of constructivist teaching. It is highlighted that besides participating in small groups, the class-based discussions is regarded as another method to encourage students to share their thoughts. This would pave the opportunity for students to show out what they have known and what they already know. The results of this study correspond to that of Riorz indicating that supporting the value of cooperative learning in all educational fields is increasing. Also, the obtained result is in line with the ones to be obtained by Sheikh Feini (1385) in relation to holding groups lower than 5 students.

Employing the five senses of his in the field of education through media, color, motion and animation, activation of learners in learning processes, taking appropriate feedback with each student choose, the ability of plan repetition in each time as desired, the possibility of progression rate, individual-based instruction.

Based on the viewpoints of Fekrit and John, using the simulated questions would bring about significant difference in level of motivation in experimental group compared to the control group., so, this is line with research finding, saying that using constructivist software increases the motivation of learners for learning. The simulated software provide real-based settings for students in which animation, voice, picture and etc. would be provided, leading to increased motivation.

Teaching method increases the problem-solving skill of students relying on constructivist viewpoint. The obtained results derived from the current study are in line with those found by Sheikh Feini [30], Ferguson [13] and Heiromi [15]. Sheikh Feini believes that the imposition of learning in constructivism is based on problem-solving which does not correspond to the results obtained by Gatri and conditioning of Skinner. This is due to the fact that learning is defined as the correlation between stimulus and respondent and such an interaction would make changes in individual's behavior. From Skinner's point of view, learning is said to be the overt changing of behavior in individual's response to have occurred in environment while in constructivist approach, learning leads to knowledge where the learning should be assumed distinguished from accustomed behaviors.

Teaching method has an effect on students' cognitive learning level relying on constructivist approach

Dal and Terish [19] confirmed that constructivist software drew students' interest and would enable them to find the opportunity of discovery and innovation of new concepts and findings of this study are in line with these reports. Based on Rodgers's point of view, learning should lead to meaningful case. Findings of this study take into account the meaningful and cognitive learning where solutions to achieve it are provided such as preparation, providing organizers, determining learning goals.

Also, the reports indicated that teaching methods based on constructivist approach would have an effect on students' mathematics academic achievement and there is a difference between students' academic achievement regarding the two ways of teaching. Using computer in classroom setting and its effect on education effectiveness have been proved by several researchers. The findings of Hoveida [17], Poorjamshidi [22], Saadatmand [28], Shabiri [29] and international researchers such as Mike Harland, Bialo [3], Stapham VangLineski, Damens [10] which are in line with those obtained by the current study.

Others researchers have reported similar results to be in line with the current study findings. A number of these scholars have explored the inconsistency of several other studies, as an example in case, Zang [36] and Zao and Izko reported similar results for one group and differentiated result of the other group.

It was found that the findings of this study were in line with those reported by Kinji and Betholm [18], Bich and Avaida [1], Zigler and Cherager and Wallace and Mclaphin [33].

Suggestions:

- It is suggested that Officials' of Ministry of Education pave the way for establishing novel educational technologies.
- Regarding the development of novel technologies such as different educational software, it is recommended that the required instructs will be provided on how to use such technologies in the field of education especially for teachers of different educational levels.
- It would be recommended that the educational software are provided with optimum efficiency for courses of different educational levels by experts.
- Special educational software are given to teachers to use in classes.

REFERENCES

- [1] Beech, R. and M. Awaida, 1992. A survey of Factors Associated with Student Computer Use in Resource Specialist Programs. *Dissertation Abstracts International*, 52(7-A): 2513.
- [2] Brandsford-J.D.et al., 2008. *how people learn :Brain .Mind-experience & school* . Washington – D.C.:National Academy press.
- [3] Biolo .Ellen R and Sivin- Kachala. Jay, 1996. *The Effectiveness of technology in schools: A Summary of Recent Research*. SLMQ, 25: 1.
- [4] <http://www.ala.org/ala/aasl/aaslpubsandjournals/slmrb/editorschoiceb/infopower/selectbiohtml.htm>
- [5] Carpenter, Sh, 2010. Constructivism a prospective,A *Journal of the Australian association of mathematics teacher Inc(APMC)*,1: 29-32.
- [6] Cey, T., 2010. *Moving toward constructivist classrooms*,[Online]
- [7] Available:<http://www.usask.ca/education/coursework/802papers/ceyt.html>.
- [8] Chamanara, Sepide, 1384. the effect of behaviorism on teaching mathematics and critics' point of view, *Mathematics teaching Development*, 71: 11-21.
- [9] Dale, S, niederhauser, trish Stoddard, 2001. *teachers instructional perspectives and use of educational software,USA: teaching and teacher*,17: 15-31.
- [10] Damoense, 2003. *Online learning – effective learning for higher education in South Africa*. AJET 19 . *Australian Journal of Educational Technology*.
- [11] <http://www.ascilite.org.au/ajet/ajet19/damoense.html>
- [12] Etemad, Iraj, 1373. *Educational technology*, Tehran.
- [13] Ferguson, D., 2001. *Technology in a constructivism classroom*,*Information technology in childhood education annual*, pp: 45-50.
- [14] Grab, Mark and grab, Cindy9, 1999. *Intergrating tech nology for meaningful learning*. Boston: Houghton Mifflin company.
- [15] Hirumi, A., 2002. *Student-centered technology-rich learning environments: operationalizing constructivist approaches to teaching and learning*,*Journal of technology and teacher education*, 10: 497-541.
- [16] Huffman, Douglas, Goldberg, Fred and Michlin, Michael, 2003. *Using computers to create constructivist learning environments: impact on pedagogy and achievement*, *Journal of computers in mathematics and science teaching*, 22: 151-169.
- [17] Hoveida, Tanaz, 1375. *The effect of television teaching method on learning mathematics*, Tehran: *Television and Cinema Higher-Education School*.
- [18] Kenji, R., and U. Betlehem, 2002. *Task Engagment & Mathematics Performance in Children with Attention- Deficit Hyperactivity Disorder: Effects of Supplemental Computer Instruction*. *School Psychology & Quarterly*, 17: 242-257.
- [19] Lipponen, lasse, Rahikainm, marijuana, lallimo, jiri and hakkarainen, kai, 2001. *Patterns of participation and discours in elementary students computer supported collaborative learning*. *Learning and instruction*, 3: 190-99.
- [20] MicHarland, C.S., 1995. *Using computer technolgy to monitor student progress and remediate reading problem*. *School Psychology Review*
- [21] Pane, johnf, Corbett, albert,t and john, bonnie, E., 2004. *Assessing dynamics in computer-based instruction*,retrieved august 26,2004,from <http://web.cs.cmu.edu/acse/chi96.htm>.
- [22] Poorjamshidi, Maryam, 1381. *Investigating the role of instruction assisted by informative networks on academic achievement of Persian Language course of Junior High school female students of Tehran in the year 1380-81*. M.A. thesis. *Teacher Training University of Tehran*.
- [23] Reeves, C. Thomas, 1998. *The impact of media and technology in schools*. February 12 , 1998. http://www.athensacademy.org/instruct/media_tech/reeves0.html
- [24] Rogers, C.R and H.J. Frelberg, 2004. *Freedom to learn*(3rd ed) Columbus,OH:Merrill/Macmillan.
- [25] Santrock, J.W., 2008. *Educational psychology*(2nd&3rd ed),New York:McGraw-Hill.
- [26] Statham and Torell. 1996. *Computer- Based Technology and Learning*

- [27] Mathematics, North central regional educational laboratory. Phase 3: deta driver <http://www.ncrel.org/tplan/cbtl/phase3.htm>
- [28] Saadatmand, Mohsen, 1381. Studying the effect of computer-assisted teaching on English learning of first grade Senior high school and comparing it with traditional ways of instruction. M.A. thesis. Teacher Training University of Tehran.
- [29] Shabiri, Seyede Fateme, 1382. Providing supplementary software of physics in third grade of senior high school course and exploring its effect on cognitive and emotional aspects of students. M/A/ thesis. Teacher Training University of Tehran.
- [30] SheikhiFeini, Ali Akbar, 1385. Introduction to constructivist cognition and learning implication: Tehran, TarbiatModares University, Faculty of Humanities.
- [31] Traynor, L. Patrick, 2003. Effects of computer – assisted- instruction on different learner . Journal of instructional psychology.
- [32] http://www.findarticales.com/p/articals/mi_mOFCG/is_2_30/ai_105478983 /print
- [33] Wallace, Gerlad; McLafphlain. Jimza, 1373. Incapacities of learning the concepts and attributes. Translated by M. TagiMonshiTosi. Mashhad: Razavi Publications.
- [34] Wenglinsky, Harold, 1998. Dose it computer ? The relationship between educational technology and student achievement in mathematics. Priceton, NJ: educational testing service. Retrieved March 6 //ftp.ets.org/pub/res/technology.pdf
- [35] Zhang, C., 2002. An investigation of traditional and constructivism models of internet training and effects on cognitive gain. Society for information technology and teacher education international conference., (1): 2343 – 2344. <http:// dl.ace.org/11444>.
- [36] Zhao, Y and G.A. Cziko, 2001. Teacher adoption of technology: A perceptual control theory perspective. Journal of technology and teacher education.