Students' Chemistry Learning Process Through VisualProgramming Language: A Preliminary Study

Parimalah Loganathan, Adibah Mohd Alwi, Najibulla Romainor, Corrienna Abdul Talib, Chuzairy Hanri, Adi Maimun Abdul Malik, Kang Hooi Siang

ABSTRACT---Decline in students' interest towards science related subjects like chemistry and decreasing number of expertise in science related careers is a major issue that needs serious attention. Introducing computer programming into teaching and learning process is believed to be able to cultivate interest and make learning process more meaningful. In recent years, there are numerous researches conducted regarding teaching and learning of visual programming. However, there are very few studies that highlight the integration of programming into pedagogical content. This study is conducted to survey the perception of learning process by students of different gender when they use visual programming language to create a content based presentation. This research employed a quantitative research design using descriptive analysis. The respondents were 24 form four students from seven secondary schools in Johor who took part in "Scratchtopia Challenge", a competition held to introduce visual programming to students. A set of questionnaires consisting 13 items comprising three constructs of learning process; active learning, perceived usefulness and enjoyment were answered by the respondents during their briefing session of the competition. The instrument has acceptable reliability value of 0.97. Their feedback was analyzed quantitatively using Social Packages for Social Sciences (SPSS). The findings of the study indicated that visual programming did influence the students' perception on chemistry learning process even before participating in the competition. The researchers recommended other interested researchers or organization to use these findings as evidence or support for further investigation on the subject.

Index Terms: —Chemistry Content, Chemistry Learning Process, Gender, Visual Programming

I. INTRODUCTION

Since 1967, the government of Malaysia targeted 60:40 ratio of student participation in Science and Art subjects respectively. To date, the government's motive to achieve 60% enrolment in science stream has never been fulfilled [1]. Instead, student participation in science stream over the years and their performance in international examinations like TIMSS and PISA has deteriorated. Poor performance in science subjects would directly affect the number of students who take up science and technology related careers in future [2]. This scenario is very alarming as the fast-growing global economy and advancement of science and technology demands students in the 21st century to be equipped with set of skills that will help them stay relevant and competent in the technologically savvy society.

Decline in students' interest towards science and decreasing number of expertise in science related careers is a major issue that needs serious attention. Therefore, local scholars and academicians have conducted numerous studies to investigate the ways to improve student's interest and their achievement in science. As in [3], argues that learning can be made into a fun experience when a teacher is able to plan classroom activities that enable the students to experience learning which will guide them towards achievement. Teachers should create the opportunities to develop interest among students who are motivated to learn by stimulating their curiosity and eagerness to make new discoveries. Introducing computer programming to children at an early age is able to cultivate interest and to make learning activities more effective [4].

Realizing this, The Ministry of Education has taken initiative to inject visual programming languages in the revised Standard Based Curriculum for Secondary Schools (*KSSM*) and Standard Based Curriculum for Primary Schools (*KSSR*) which has been implemented since 2017. Since its implementation, there is a growing interest among researchers to investigate the benefits of programming languages towards students' computational thinking, reasoning skills and creativity. However, there is still space for researchers to find out if introducing programming in classrooms can enhance academic performance.

A. Visual Programming Language in National Curriculum

In the 21st century, people are expected to not only be consumers, but also producing individuals. This scenario explains the necessity to expose children at a younger age to computer sciences, as they are born in the millennial era, digitally and technologically savvy [5]. Many countries are starting to introduce programming as a basic skill alongside reading, writing and arithmetic. Students as young as five years old are being schooled in coding for the future. For example, Britain has implemented coding towards children as early as five years old. Meanwhile, The United

Revised Manuscript Received on May15, 2019.

Parimalah Loganathan, Science, Mathematics and Creative Multimedia Department, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

Adibah Mohd Alwi, Science, Mathematics and Creative Multimedia Department, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

Najibulla Romainor, Science, Mathematics and Creative Multimedia Department, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

Corrienna Abdul Talib, Science, Mathematics and Creative Multimedia Department, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

Chuzairy Hanri, Science, Mathematics and Creative Multimedia Department, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

Adi Maimun Abdul Malik, School of Marine Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

Kang Hooi Siang, School of Marine Engineering, Universiti Teknologi Malaysia, Johor Bahru, Malaysia.

Kingdom's education system emphasizes on the importance of adapting the curriculum to teaching kids logical thinking to create and debug programs. On the other hand, Finnish national curriculum stresses on producing children who are able to build technologies, to understand and create apps and technological devices on their own [6].

In Malaysian schools, coding is offered to Year 6 students through the Module on Programming within the subject of Information, Communication and Technology (ICT). In this module, students learn to use their logical and computational thinking to solve problems given to them using programming applications such as Scratch. Students learn to create algorithms and develop simple programs (Curriculum development Centre). Coding is also taught in secondary schools through the Basics in Computer Science subject offered in lower secondary and Computer Science subject in upper secondary. Programming with computer does not require high proficiency. Therefore, it can be easily integrated into learning activities to improve logical-mathematical, project based learning, problem solving and critical thinking skills [6].

Programming is more than just coding, for, it exposes students to computational thinking which involves problem-solving using computer science concepts like abstraction and decomposition. Even for non-computing majors, computational thinking is applicable and useful in their daily lives [7]. In recent years, the availability of free and user-friendly programming languages has fueled the interest of researchers and educators to explore how they can be integrated in curriculum, not only to foster computational thinking, but also to enhance interest and subsequently improve academic achievement.

B. Chemistry Learning Process

Chemistry is among the science subjects which is regarded as a tough subject. Researchers who have conducted previous studies to identify the difficulties in learning chemistry, deduced that the abstract nature of chemistry is the main reason why most students find it to be difficult [8], [9]. Due to its highly conceptual nature, it demands acquisition of deep conceptual understanding in a meaningful way, instead of traditional rote learning [8].

As mentioned at the earlier part of this article, learning process or experience encountered by students draws huge impact on their interest towards a content. Indirectly, it boosts their motivation and achievement level. Referring to some recent studies [4] advocates the importance of motivational and personality factors such as achievement motivation and fear of failure on academic achievement. Learning is regarded as an active and constructive process directed towards a certain goal. A meta-analysis study conducted by [10] concluded that active learning promotes higher examination scores among students in STEM related subjects. Hence, chemistry teachers should use appropriate teaching aids that will improve the overall teaching and learning process [3].

C. Learning Process and Gender Difference

The infusion of technology in students' learning is not something new in the educational world. But it has always been a topic of interest among researchers to find out if computer or technology assisted learning setting has any significant difference between different gender in their learning and academic performance.

For instance, through a study conducted by [11] to investigate the effect of computer assisted instruction on students learning and performance, it was reported that there is no significant difference in the learning and performance of boys and girls who were exposed to CAI either individually or in groups. Similar results were discovered in a later research conducted by [12] where gender had no influence on students' performance and learning after exposed to computer supported cooperative learning and independent Computer Assisted Instruction settings. In other hand, [13] reported that, significant difference exist among male and female learners in terms of perceived playfulness, attitude and intention to use the technology when they were involved in blended learning settings. Based on their findings, the researches recommended to consider the components of usefulness and playfulness in planning successful blended learning environments, depending on user's gender.

While numerous previous researches had been conducted to explore the effect of computers aided lessons on students' attitudes and academic achievement, there are insufficient studies that has been carried out to investigate if any gender difference can affect the learning process while using programming languages.

D. Visual Programming And Learning Process

In a framework proposed to integrate computational thinking into science education, [14] gave serious consideration on designing science pedagogy with programming by keeping in mind both teachers and students as the modelling platform (e.g., Logo, NetLogo and Scratch) users. In their framework [14], emphasise on programming pedagogy to be low-threshold(*i.e.*, easy to program, similar to NetLogo and Logo), wide walls(*i.e.*, students should be able to design a wide range of artifacts, such as animations, games, and science experiments, much like Scratch), and high ceiling(*e.g.*, NetLogo that supports advanced programming and modelling of complex phenomena using a library of intuitive programming primitives).

There are numerous studies conducted by researchers on how programming would affect children cognitively and affectively. In a research to investigate the effect of different programming learning tools on students' motivational and attainment levels, [4] learnt that different programming tools provide different levels of motivation and attainment among students. The researchers discovered that more attractive tools like Scratch and PyGame result in higher motivational and attainment scores among students compared to Visual Basic Express. On the other hand, a study by [15] has concluded that besides promoting algorithmic thinking and programming skills, visual programming tools are also able to enhance logical mathematical thinking skills as well as academic achievement of students, compared to conventional teaching methods.

In [16], students' deep thinking skills were cultivated when they were allowed to create games on their own using the programming tool. While having fun designing science or mathematics content-based games, students' learning experience is further enhanced, and they become more motivated to learn the subjects. These findings [16] conclude that programming can be useful as a technological medium for the active learning of science and mathematics. Through a separate study [17], researchers advocate that visual programming also has proven to enhance self-directed learning by increasing students' understanding and confidence level.

According to a five year study conducted by [6] to analyze the benefits and possibilities of coding with a Visual Programming Language through classroom projects and activities, it was proven that cross-curricular implementation of visual programming language in teaching content demonstrates effective educational environment. Through their research [6], the effect of programming language being analyzed in two main dimensions; first dimension focusing on computational concepts and practices while the second dimension was about the learning process. The researchers observed and analyzed students' active learning, fun, motivation, enjoyment and perceived usefulness as subscales under dimension. The study revealed that visual programming language has demonstrated significant improvement on both dimensions.

In recent years, the research about teaching and learning visual programming has been a topic of interest among scholars around the world. However, there are very few studies that highlight the integration of programming into pedagogical content. Based on the literature review that have been performed, this preliminary study is conducted to survey the perception of learning process by students of different gender when they use visual programming language to create a content-based presentation.

II. RESEARCH OBJECTIVE

Based on the literature review, this study is conducted to:

i. survey the perception of students in their chemistry learning process in three aspects; active learning, perceived usefulness and enjoyment while using visual programming language.
ii. to find out if there is any gender difference in students' perception of their active learning, perceived usefulness and enjoyment while using visual programming language

III. METHODOLOGY

This research employed a quantitative research design using descriptive analysis. According to [18], quantitative data is systematic, standard, easy to analyse and can be presented in a shorter time. Therefore, generalization can be done swiftly and accurately. Research samples were among participants from selected schools that joined "Scratchtopia Challenge". A number of 52 schools were invited to join the program and 7 schools were excited to participate in the challenge. From the 7 schools, a total of 24 students were selected as the research samples to survey their chemistry learning process.

The research instrument was adapted from [6] to measure the students' learning process. The instrument then experience modification to study more on the learning process of chemistry among the selected participants. Initially the instrument had five constructs such as active learning, contents in art history, computational concepts, perceived usefulness and enjoyment. However, the components were reduced into three main constructs due to their relevancy with chemistry and learning process. For example, construct of contents in art history is not related with chemistry, hence, the researchers eliminate the construct from the instrument. Therefore, three constructs are selected such as active learning, perceived usefulness and enjoyment due to their relevancy to chemistry process learning.

The instrument was created and designed with Google form and Google spreadsheet due to its features of accessibility and easy to distribute among the participants. The instrument consists of two parts; Part A and Part B. In Part A, it consists of participants' demographic details such as name, school and gender. Meanwhile the second part consists of 13 items of Chemistry Learning Process items which were classified based on their constructs. These 13 items recorded participants' response by using Likert Scale ranging from 1 to 5. Table 1 shows the value of Likert Scale and its definition.

Since, the original instrument experienced modification and alteration, a pilot study need to be conducted. According to [19], pilot study is important to detect possible encounters in methodology before conducting the actual study. A pilot study is conducted on samples that do not take part in the actual research. The pilot study was used to identify the weaknesses of the research instrument and enhance the reliability of the research. The reliability if an instrument refers to the consistency of measures produced by the instrument in repeated implementation of the instrument [20]. The internal reliability of the instrument was tested by running on Statistical Package for the Social Science (SPSS) version 20.0 to obtain Cronbach's alpha value. The pilot study was conducted on 23 students from

SMK Taman Universiti who did not participate as the actual research sample. After analysis, the instrument has acceptable Cronbach reliability value of 0.97. According to Bonett and Wright (2015), an instrument with Cronbach reliability value of more than 0.7 is acceptable because the items show consistency of normal data distribution.

Table 1: Points of Likert scale in Chemistry Learning Process and their category.

Point	Sub-Category	Category
1	Strongly Agree	Agree
2	Agree	
3	Neutral	Neutral
4	Disagree	Disagree

In Chemistry Learning Process instrument, there were three constructs; active learning, perceived usefulness and

enjoyment. A total of 13 items were adapted from [6] and classified into their own perspective scales that relate with Chemistry learning process. Table 2 shows the construct and their items in the instrument.

Table 2: Chemistry learning process scales and their items.

Construct	No	Items
Active learning	1	I can learn many facts of the Chemistry topic while completing my project.
	2	I will become more interested in chemistry subject while completing my project.
	3	This project can aid my learning of the chemistry topic.
	4	I will participate actively in the project
	5	This project will improve my ability to communicate clearly.
Perceived Usefulness	6	Scratch project can increase the efficiency of my learning process.
	7	The scratch project can help improve my learning performance.
	8	Scratch application is useful to enhance my learning.
Enjoyment	9	I am happy to use scratch application.
	10	I enjoy creating my chemistry project using scratch application.
	11	I am enthusiastic to use the Scratch application.
	12	I feel motivated to use the Scratch application to complete my project.
	13	I am relaxed and comfortable to complete my project.

The instrument was distributed during briefing session of the "Scratchtopia Challenge" program. The 7 participating schools sent their representatives and these representatives were selected as the research sample. The participants were asked to answer the instrument through online Google form and the participants responses were kept and handled through Google spreadsheet as handling software. Collected data were analyzed by using computer software of Statistical Package for Social Sciences (SPSS) version 20.0. Descriptive statistics was used to study the students' chemistry learning process.

IV. RESULT AND DISCUSSION

A. Students' Chemistry Learning Process

To achieve the objectives of this preliminary study, a set of questionnaires have been analyzed using Social Packages for Social Sciences (SPSS). From Table 3 shown that the percentage of the students' scores for the chemistry learning process by using three constructs such as active learning, perceived usefulness and enjoyment. The marks chosen by the students according to the Likert scales as mentioned in the methodology part.

Table 3: Constructs, items, and statistical values of students' chemistry learning process

Construct	Items	Percentage		
		Agree	Neutral	Disagree
Active learning	1	42	46	12
	2	54	21	25
	3	50	17	33
	4	42	21	37
	5	38	42	20
Perceived usefulness	6	54	21	25
	7	54	21	25
	8	50	21	29
Enjoyment	9	58	13	29
	10	50	21	29
	11	50	8	42
	12	46	21	33
	13	46	33	21

* A - Agree
N - Neutral
D – Disagree

In the construct of active learning, 42% of the participants agreed they able to learn many facts of the chemistry while experiencing the visual programming by themselves. In addition, 54% and 50% of students agreed that they tend to become more interested in chemistry and the visual programming can aid learning in chemistry respectively. Furthermore, 42% of the students agreed they will actively participate in doing the visual programming, however 42% of them are neither agree nor disagree whether the visual programming will improve their ability to communicate clearly. During experiencing the visual programming, students can observe their learning environment as more constructivist which indirectly promote themselves to be an active learner.

In the construct of perceived usefulness, 50-54% of students involved agree that the visual programming can enhance their learning performance and learning process. It means that the efficiency, utility, and improvement in the learning process can be positively reflected, however it is around 25-29% of the students disagree and 21% of them neither agree nor disagree. These percentages might contribute from the students' perception that visual programming is complex, where they have to complete the task of their own visual programming which consist high level of abstract concept [21].

According to [21], motivational affect is important for learning, because if it lacks of motivation or positive affect, the learning process will be hardly progressed. In enjoyment construct, most of the students are enthusiastic, motivated, relaxed, and happy to work with visual programming as the percentage for items in enjoyment construct is around 50-58%. However, around 21-29% of them were disagree and 8-29% of them neither agree nor disagree with the items in enjoyment construct. Students who disagree might find it difficult to use visual programming because they think it is uninteresting, perplexing and too difficult to master [21].

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

B. Gender and Chemistry Learning Process

For the second objectives of this preliminary study, a set of questionnaires also have been analyzed using Social Packages for Social Sciences (SPSS). Table 4 shows the mean of the students' scores for the chemistry learning process by using three constructs which are active learning, perceived usefulness and enjoyment according to their gender.

Construct	Items	Gender	Statistics	
			Mean	SD*
Active learning	1	Male	3.000	0.95346
		Female	2.167	0.93744
	2	Male	3.083	0.99620
		Female	2.167	1.02986
	3	Male	3.500	1.31426
		Female	2.167	1.11464
	4	Male	3.500	1.31426
		Female	2.417	0.99620
	5	Male	3.333	0.98473
		Female	2.417	0.79296
Perceived usefulness	6	Male	3.250	1.13818
		Female	2.167	0.83485
	7	Male	3.250	1.28806
		Female	2.167	0.93744
	8	Male	3.333	1.49747
		Female	2.167	1.02986
Enjoyment	9	Male	2.917	1.67649
		Female	2.083	1.50504
	10	Male	3.333	1.30268
		Female	2.333	1.37069
	11	Male	3.250	1.60255
		Female	2.500	1.24316
	12	Male	3.167	1.26730
		Female	2.500	1.31426
	13	Male	3.250	1.21543
		Female	2.417	1.08362

* SD – Standard Deviation

For all construct tested in chemistry learning process, most of the female students showed positive feedback than the male students whereby the male students neither disagree nor agree with many items tested in the questionnaire. According to the previous studies regarding to the gender differences and the perception towards learning process, the female students perceived the learning process to be more positive than the male students [22]-[25]. By referring to Table 4, in the construct of active learning, the following statement that give the positive feedbacks by the female students are as follow:

- Ican learn many facts of the chemistry topic while completing my project.
- I will become more interested in chemistry subject while completing my project.

In the second and third construct, female students again show the positive feedbacks on the perceived usefulness and enjoyment they will encounter while completing the task using the visual programming. Since the female perceived the technology-based learning environment as more positive than their counterparts as stated by [25], it can be seen that the female students agreed that the visual programming they are handling can improve and enhance their learning performance.

In addition, female students show more enjoyment using the visual programing to complete their task related to chemistry as they agreed with the statement in the questionnaires that indicate their happiness, enjoyment, enthusiasm, motivation and relaxation, while the male students still neutral, neither agree nor disagree.

V. CONCLUSION

The findings showed that the students have initial perception of learning process in chemistry through visual language programming in order to produce a content-based presentation. Learning process can be one of the factors that can influence the students' achievement in chemistry while doing the programming. In addition, through this visual programming, students' perception through learning environment and process can affect their achievement in chemistry. On top of that, the positive perceptions from their learning environment can enhance their learning in the subject matter [26], [27].

In this survey, perception have been studied which emphasize on students' feedbacks while handling their chemistry visual programming. There is a slight difference between male and female students feedbacks which might contribute to their achievement in chemistry as stated by [28] that gender differences can influence the students' achievement. Moreover, there is no significant mean difference between male and female students in chemistry self-efficacy scores which is similar to past research [28], [29]. According to the findings of this study, it can be implied that Malaysia secondary school science program should take gender differences into account. Consequently, chemistry teachers should organize visual programming as classroom activities on the basis of gender differences; so that each student in the classroom can have the opportunity to develop positive attitudes towards learning chemistry. Moreover, further research can be done related to the interaction effect between gender and grade level on other branches of science to internalize the situation in science while conducting any other visual programming.

VI. ACKNOWLEDGMENT

The research project was supported by European Union program ERASMUS +, Capacity building in higher education, No 73751-EPP1-2016-1-DE-EPPKA2-CBHE-JP, Innovative teaching and learning strategies in open modeling and simulation environment for student-centered engineering education (InMotion) and Universiti Teknologi Malaysia (Vot 4C118) andUTM KTP-NMG 2019 No. S.J130000.0853.4Y174.

REFERENCES

1. F. A. Phang, M. S. Abu, M. B. Ali & S. Salleh (2014). Faktor penyumbang kepada kemerosotan penyertaan pelajar dalam aliran sains: satu analisis sorotan tesis. *Sains Humanika*, 2(4)
2. A. Meluso, M. Zheng,H. A. Spires, & J. Lester, (2012). Enhancing 5th graders' science content knowledge and self-efficacy through game-based learning. *Computers & Education*, 59(2), 497-504.
3. N. Kar, N. Zarini, & S. Saleh (2012). Kesan Pendekatan Inkuiri Penemuan Terhadap Pencapaian Pelajar Dalam Mata Pelajaran Kimia. *Jurnal Pendidik dan Pendidikan*, 27.
4. M. A. Osman, S. P. Loke, M. N. Zakaria, & A. G. Downe (2012). Secondary students' perfectionism and their response to different programming learning tools. Paper presented at the 2012 IEEE Colloquium on Humanities, Science and Engineering (CHUSER).
5. F. Kalelioğlu (2015). A new way of teaching programming skills to K-12 students: Code. org. *Computers in Human Behavior*, 52, 200-210.
6. J.-M. Sáez-López, M. Román-González & E. Vázquez-Cano (2016). Visual programming languages integrated across the curriculum in elementary school: A two-year case study using "Scratch" in five schools. *Computers & Education*, 97, 129-141.
7. S. Y. Lye & J. H. L. Koh (2014). Review on teaching and learning of computational thinking through programming: What is next for K-12? *Computers in Human Behavior*, 41, 51- 61.
8. Y. Satilmiz (2014). Misconceptions about Periodicity in Secondary Chemistry Education: The Case of Kazakhstan. *International Online Journal of Primary Education*, 3(2).
9. M. M. Woldeamanuel, H. Atagana & T. Engida (2014). What makes chemistry difficult? *African Journal of Chemical Education*, 4(2), 31-43.
10. S. Freeman, S. L. Eddy, M. McDonough, M. K. Smith, N. Okoroafor, H. Jordt & M. P. Wenderoth (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, 111(23), 8410-8415.
11. M. O. Yusuf & A. O. Afolabi (2010). Effects of Computer Assisted Instruction (CAI) on Secondary School Students' Performance in Biology. *Turkish Online Journal of Educational Technology*, 9(1), 62-69.
12. O. Abimbade, A. Akinyemi, L. Bello & M. Olusegun (2018). Comparative effects of an individualized computer based instruction and a modified conventional strategy on students' academic achievement in organic chemistry. *The Journal of Positive Psychology and Counselling.* To be published.
13. A. Padilla-Meléndez, A. R. Del Aguila-Obra, & A. Garrido-Moreno (2013). Perceived playfulness, gender differences and technology acceptance model in a blended learning scenario. *Computers & Education, 63*, 306-317.
14. P. Sengupta, J. S. Kinnebrew, G. Biswas, & D. Clark (2013). Integrating computational thinking with k-12 science education. *Education and Information Technologies*, 18(2):351-380
15. Ö. Korkmaz (2018). The effect of scratch-and lego mindstorms Ev3-Based programming activities on academic achievement, problem-solving skills and logical-mathematical thinking skills of students. *Malaysian Online Journal of Educational Sciences*, 4(3), 73-88.
16. A. Shariff & M. Yatim (2007). Introducing Squeak Etoys to Enhance Science and Mathematics Learning. Paper presented at the proceedings of the 1st International Malaysian Educational Technology Conference, Johor Bahru, Malaysia.
17. T. Ferrer-Mico, M. À. Prats-Fernàndez & A. Redo-Sanchez (2012). Impact of Scratch Programming on Students' Understanding of Their Own Learning Process. *Procedia-Social and Behavioral Sciences*, 46, 1219-1223.
18. A. G. Mohd Najib (2003). *Reka bentuk tinjauan soal selidik pendidikan.* Skudai: Universiti Teknologi Malaysia.
19. J. W. Creswell (2002). *Educational Research: Planning, Conducting and Evaluating Quantitative and Qualitative Research*. New Jersey: Pearson Education, Inc.
20. J. W. Creswell (2012). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research* (4th ed.). Boston, MA: Pearson.
21. A. Wilson & D. C. Moffat (2010). Evaluating Scratch to Introduce Younger Schoolchildren to Programming. Paper presented at the PPIG.
22. B. Abdi (2010). Gender differences in social skills, problem behaviors and academic competence of Iranian Kindergarten children based on their parent and teacher rating. *Procedia-Social and Behavioral Sciences*, 5, 1175-1179
23. I. Heemskerk, G. Dam, M. Volman & W. Admiraal (2009). Gender Inclusiveness in Educational Technology and Learning Experiences of Girls and Boys. *Journal of Research on Technology in Education*, 41(3)
24. Bain, C. D. & M. Rice (2006). The Influence of Gender on Attitudes, Perceptions, and Uses of Technology. *Journal of Research on Technology in Education*, 39(2)
25. R. Koul, D. L. Fisher & T. Shaw (2011). An application of the TROFLEI in secondary-school science classes in New Zealand. *Research in Science and Technological Education*, 29(2):147-167
26. M. Newby & T. H. Nguyen (2010). Using the same problem with different techniques in programming assignments: An empirical study of its effectiveness, *Journal of Information Systems Education*, 21, 4, 375–382.
27. J. Peer & B. J. Fraser (2013). Sex, grade-level and stream differences in learning environment and attitudes to science in Singapore primary schools. *Learning Environments Research*, 18(1)
28. Y. A. Tenaw (2013). Relationship between self-efficacy, academic achievement and gender in analytical chemistry at Debre Markos College of Teacher Education.*African Journal of Chemical Education*, 3(1)
29. Y. C. Aydin, E. Uzuntiryaki & B. Demirdogen (2011). Interplay of motivational and cognitive strategies in predicting self-efficacy and anxiety. *Educational Psychology*, 31(1):55-66