Educational Administration: Theory and Practice
2024, 30(1), 4828 - 4834
ISSN: 2148-2403
https://kuey.net/

Research Article

Investigating the Effect of Thinking Map And 7Es Learning Cycle-instructional Approaches on Secondary School Student's Attitude Towards Biology

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Citation: Ugwu, T.U et al (2024), Investigating the Effect of Thinking Map And 7Es Learning Cycle-instructional Approaches on Secondary School Student's Attitude Towards Biology, *Educational Administration: Theory and Practice*, 30(1), 4828 - 4834
Doi: 10.53555/kuey.v30i1.8448

ARTICLE INFO

ABSTRACT

This study investigated the effect thinking map and 7Es learning cycle instructional approaches on students' attitude towards Biology. The study adopted quasi experimental research design, specifically, the pretest post-test non randomized experimental research design. Population for the study consists of 1529 senior secondary two (SS11) Biology students which comprised 770 males and 759 females from 62 public secondary schools in Nsukka Education Zone. A sample of 79 SS 11 Biology students was used for the study. Participants of group one was exposed to thinking map instructional approach, while those in group two were exposed to 7Es learning cycle instructional approach. Data for the study were collected using Biology Attitude Questionnaire (BAQ). Internal consistency reliability coefficient of 0.89 was established for Biology Attitude Questionnaire (BAQ) using Cronbach alpha. Mean and Standard deviation were used to answer the research questions, while ANCOVA was used to test the null hypotheses at 0.05 level of significance. Results obtained from the study showed that students taught biology using 7Es learning cycle had higher mean attitude scores than their counterpart exposed to Biology instruction using thinking map instructional approach. The study revealed that male students had higher attitude scores than their female counterparts in Biology. The interaction effect of instructional approach and gender on students' attitude towards Biology was significant. The implications of the findings were highlighted and based on that, the researcher recommended that major stake holders in education should encourage the adoption of 7Es learning cycle in teaching and learning processes to enhance students' attitude towards Biology.

Key words: Thinking map, 7Es leaning cycle, instructional approaches, Attitude

1. Introduction

Biology is the science of life or living matter in all its form and phenomenon. Biology studies the origin, growth, reproduction, structure and behavior of living matters (Ong'amo et al., 2017) Biology is important in everyday life as it enable individuals to know more about themselves and the environment in which they live. Despite the importance of biology there have been reports of students' negative attitude as a result the dwindling achievement in the subject: West African Examination Council (WAEC) Chief Examiners' reports (2018) and summary report on students' performance from Post Primary School Management Board Nsukka Education Zone (2013 - 2018). Some researchers have suggested the use of so many students centered innovative instructional approaches such as 3E learning cycle, 5E learning cycle, scaffolding among others. Yet the attitude of the students in Biology are not promising. Based on this premise, the researcher seeks to find out if 7E learning cycle and thinking map innovative instructional approaches could help to enhance students' attitude

towards Biology and mainstream the gender difference which has been a case with the students' attitude towards Biology.

Thinking map is a set of eight visual graphic pattern each is based on principles and processes. Thinking map was developed by an educational consultant (Hyerle,2007) as a visual tool used to organize information, generate and classify ideas, words and element related to a theme. Thinking maps are visual representations of thinking that help students see their own learning pathway or the thought processes utilized to solve a problem (Badr, 2020). The specific maps include the Circle map, which defines the context, a Burble map, describes an event or action, a Double bubble map, compares and contrasts two ideas. Tree map classifies and categorizes ideas. Brace map, shows part to whole relationships. Bridge map, used for illustrating analogies, and comparison of ideas. Flow map, shows the steps in a process, Multi - flow map, shows a cause-and-effect relationship (Hyerle, 2007). Therefore, thinking map is an instructional approach that create imaginary ideas of information using different type of images or giving a mental clue of idea from vast array of information in a concise way. Badr (2020); Kumari and Kumari (2013). Therefore, this study set to find out if thinking map could enhance effective teaching of Biology to improve students' attitude to biology.

Another student-centered innovative instructional approach that the researchers determined its effectiveness is 7Es learning cycle. The learning cycle invites the teacher to be able to produce a series of meaningful activities so that students' critical thinking skills are also trained. According to Balta and Sarac (2016). 7Es learning cycle model is a model that could guide students to actively acquire new knowledge in teaching and learning of science and might help them understand the problem and phenomena they may encounter in the environment. It involves elicit, engage, explore, explain, elaborate, evaluate and extend phases. In the elicit phase students' prior understanding are prompted and teachers access any misconceptions the students have. In engage phase teachers use a simple experiment or different event just to capture students' attention, raise questions in their minds and engage them. During the explore phase, questioning method is utilized in order to help students explore and revise the subject. There is no right or wrong answers at this stage; all outcomes are a chance to learn something new. At the explanation phase, teacher interpret the activities of the previous phase, Teacher at this stage introduce, explain define new vocabularies or guide the learner in understanding the new concept. During the elaboration, students are encouraged to use their understandings in new areas. In the evaluation phase, formative evaluation is conducted before the summative in the learning process. Other ways such as multiple choice, quiz, puzzle; structured grid and true false questions among others can be applied to evaluate students learning. In the extend phase students transfer their learning to a new context. Students are therefore expected to extend and expand their understandings to everyday life experiences. Evidence has shown a significant positive effect of 7E learning cycle on students' achievement and skill (Damar, 2013; Gok, 2014; Yenice, 2014 Sadoglu & Akdeniz, 2015; Toraman, 2016; Shaibu & Ishak, 2020). They are of the view that 7Es learning cycle can enhance students' positive attitude more effectively since the model can gives students the chance to explore.

Attitude is a psychological construct that can be deduced from an expressed behavior. Attitudes are formed by people as a result of some kind of learning experience; if the experience is favorable a positive attitude is found and vice versa (Acarli & Acarli 2020). Some attitudes are based on the use of teaching intervention such as visualization exercise to improve students' attitude towards learning difficult concepts in biology. Attitude therefore changes gradually in the couple of time (Byokusenge, Nsangwanwimana & Tamo 2024) Similarly, Aivelo andUitto (2021) stated that attitude is a non-observable psychological construct that can be deduced from an expressed behavior, embracing range of emotional behaviors such as prefer, acceptance and appreciation. Attitude is the major factor in a subject choice, because without development of the right attitudes biology students may not be well prepared to acquire the new knowledge and skills necessary for better achievement in biology concepts (Pearson foundation, 2014). Students who have negative attitudes toward education activities are found to exhibit challenging behaviors anti innovative and off task behavior (Burks, 2022). Some factors are responsible for students' negative attitude towards science subjects, such as a result of fear or failure of science subject, nature of classroom environment and teacher's method of teaching. Students' negative attitude towards Biology has been a very big concern in the field of science Education. However, the study compared thinking map and 7Es learning cycles instructional approaches to determine the approach that could have higher effect on student attitude towards biology. also help to see if the approaches could help to streamline the gender differences in Biology.

Gender is a non-manipulable variable that has been noted by research to influence students' attitude towards Biology. Gender carries with it some cultural or social implications and priorities abound in all spheres of Nigerian society as reported by Ewumi (2012). Gender stereotypes in Nigeria affects certain vocations and professions such that traditionally professions like medicine, Engineering architecture are regarded as men's while nursing, typing, Catering as women's. The stereotyping that science is a male enterprise is of great concern in the field of science education and has resulted to a controversial issue and conflicting reports from different researchers. (Okoro, 2011 and Enebechi, 2016) reported a gender gap in science in favour of females (Agomuoh, 2014 and Ezeh, 2013) indicated gender inequality in Biology in favour of males (Nbina & Awiri, 2014; Nwosu & Ibe, 2014 and Okoyefi, 2015) reported that gender has no effect on student achievement and attitude towards Biology. Considering these inconsistencies. This study therefore aimed at determining the relative efficacy of two innovative teaching approaches on students' attitude towards biology and how gender influence the variable when the innovative approaches are used. The purpose of this study was to investigate

the effect of thinking map and7Es learning cycle instructional approaches on students' attitude towards biology. The following research questions were addressed;

1. What is the mean attitude score of students taught biology using thinking map and those taught using 7Es learning cycle instructional approach?
2. What is the influence of gender on mean attitude scores of students in biology?
3. What is the interaction effect of gender and instructional approaches on students' mean attitude score towards biology?

Hypotheses

Ho_1: There is no significant difference in the mean attitude scores of students taught biology using thinking map and those taught using 7E learning cycle.

Ho_2: There is no significant influence of gender on the attitude scores in Biology.

Ho_3: There are no significant interaction effects of instructional approaches and gender on biology students' attitude scores in Biology.

2. Methods

The study adopted quasi- experimental research design. specifically pretest, posttest non randomized experimental research design. Population of the study consists of 1529 and made up of 770 males and 759 females (SSII) biology students in Nsukka Education Zone for the 2021/ 2022 academic session.

The sample size of the study was 79 SS 11 Biology students, which comprised of 29 males and 50 females The sample size was drawn using multi- stage sampling procedure. First, simple random sampling technique, specifically, balloting with no replacement was used to sample one local Government areas from the three Local Government Areas in Nsukka. Education Zone. Secondly, purposive sampling technique was used to select two coeducational schools in the sampled LG.A.. The choice of co-educational school was because, gender was one of the variables studied. Simple random sampling technique was used to assign the schools into the two treatment groups. The experimental group 1 and experimental group 2 were taught using thinking map and 7Es learning cycle respectively. Experimental group 1 and experimental group 2 controlled each other. Students were pre tested by research assistants before treatment and results were collated and recorded. Each of the group were taught using lesson note prepared by the researcher on 'pollution. After this a post test was administered and the result were collated and recorded. The treatment lasted for four weeks. The Biology Attitude Questionnaire (BAQ) was 26 item statement questionnaires with options A- D was designed the measure students attitude level. The instrument was validated by three experts from Science Education Department. University of Nigeria, Nsukka. Reliability coefficient of 0.89 for Biology Attitude Questionnaire (BAQ) was determined using Cronbach alpha. Research questions were answered `using mean and standard deviation. While Analysis of Covariance were used to test. The null hypothesis at 0.05 % level of significance.

3. Results

Table 1 revealed that the adjusted mean for 7Es learning cycle was 73.14, while that for the thinking map instructional approach was 68.09. The difference was in favour of the 7Es learning cycle. It therefore means 7Es learning cycle was superior to thinking map. The adjusted mean attitude scores of students taught using 7Es was higher than those taught using thinking map instructional approach.

Table 1. Mean ($\bar{X}$)and Standard Deviation (SD) attitude scores of students taught Biology using 7Es learning cycle and thinking map instructional approaches

APPROACH	N	PRETEST		POSTTEST		ADJUSTED MEAN
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}$
7Es	39	66.62	8.43	76.08	7.26	73.14
Thinking map	40	53.38	10.28	65.23	10.32	68.09

Data in Table 2 showed a statistically significant main effect for 7Es instructional approach $F(1,74) = 7.895$, p=.006, η^2 = .078. The null hypothesis, therefore, was rejected, indicating that there was a significant difference in the mean attitude scores of students taught using the 7Es learning cycle and those taught using thinking map instructional approach. The adjusted mean for the 7Es learning cycle was 73.14, while that for the thinking map instructional approach was 68.09. The difference was in favour of the 7Es learning cycle. 7Es learning cycle, therefore, was superior to thinking map instructional approach in Biology. The actual difference in mean scores between the groups was not substantial. The effect size, calculated using eta squared, was .078.

Table 2. Analysis of Covariance of Students' Biology Attitude Scores by Approach and Gender

SOURCES OF VARIATION	SUM OF SQUARES	DF	SQUARE MEAN	F	SIG	Squared Partial Eta
Covariates Pretest	2886.016	1	2886.016	51.936	.000	
Main Effects (combined)	1036.656	2	518.328	9.328	.000	.078
Approach	438.891	1	438.691	7.895	.006	
Gender	597.965	1	597.965	10.761	.002	.124
2-way Interactions Approach x Gender	448.459	1	448.459	8.070	.006	.098
Model	4371.131	4	1092.783	10.665	.000	
Residual	4112.084	74	55.569			
Total	8483.215	78	108.759			

Table 3revealed that the adjusted mean for the male students was 74.22, while that for the female students was 68.47. The difference was in favour of the male students. It therefore means that the adjusted mean attitude score of male students was higher than that of their female students in Biology.

Table 3. Mean ($\bar{X}$) and Standard Deviation (SD) attitude scores of students according to gender

GENDER	N	PRETEST		POSTTEST		ADJUSTED MEAN
		$\bar{X}_1$	SD_1	$\bar{X}_2$	SD_2	$\bar{X}$
Male	29	59.9	10.41	74.52	10.97	74.22
Female	50	59.90	12.17	68.30	9.48	68.47

Table 2 revealed significant main effect of gender F (1,74) = 10.761, p=.002, partial η^2 = .124. The null hypothesis was rejected, indicating that there was a significant difference in the mean attitude scores of male and female students in Biology. The eta-squared statistic (.124) indicated substantial effect.

Table 4revealed a higher adjusted mean score of 80.96 for male students who were taught 7Es learning cycle, while their female counterparts had an adjusted mean score of 72.68. Students who were taught with thinking map instructional approach had an adjusted mean score of 65.48 while their male counterparts had an adjusted mean score of `64.69. The results suggest dis-ordinal interaction effect between instructional approach and gender on the mean attitude scores of students in Biology. This was because, at all levels of gender, the adjusted mean scores were higher for the 7Es learning cycle than for thinking map instructional approach.

Table 4. Mean ($\bar{X}$) and standard deviation (SD) attitude scores by instructional approach and gender

APPROACH	7Es			THINKING MAP		
	N	$\bar{X}_1$	SD_1	N	$\bar{X}_2$	SD_2
Pretest Attitude						
Male	16	62.00	8.52	13	57.38	12.21
Female	23	69.83	6.85	27	51.44	5.28
Posttest Attitude						
Male	16	80.25(80.96)	8.77	38	67.46(64.69)	9.31
Female	23	73.17(72.68)	4.12	64	64.15(65.48)	10.78
Total						
Observed mean		76.08	7.26		65.23	10.32
Adjusted mean		73.14			68.09	

Note: Adjusted mean are in parentheses

Data in Table 2 indicated significant interaction effect of approach and gender F(1,74) = 8.070, p=.006, partial η^2 = .098. The null hypothesis was rejected. The interaction effect of instructional approach and gender on the mean attitude of students in Biology was therefore, statistically significant. The eta-squared statistic (.098) indicated a very small effect.

The profile plot in fig 3 shows a statistical interaction effect of instructional approaches and gender on students' attitude towards Biology. This was indicated by the connected lines for the male and female students' attitude in the respective approaches. However, the Eta squared statistics indicated a small effect. Hence the small effect shown by the graph plot may be introduced by sampling error.

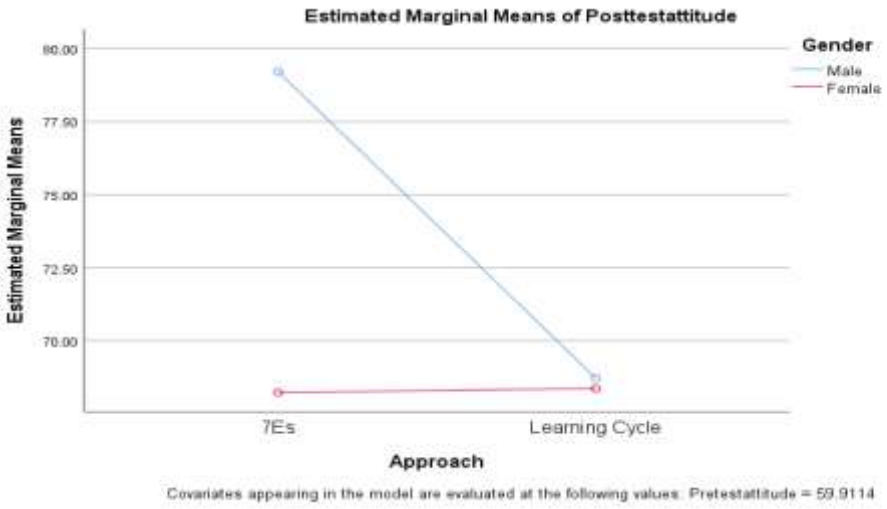

Figure 3. Interaction effect of thinking map and 7Es learning cycle instructional approaches and gender on students' attitude to Biology

4. Discussion

Based on the findings of the study, it was concluded that 7Es learning cycle mode of instruction was found to be superior to the thinking map instructional approach on students' attitude towards Biology. Further analysis revealed higher effect of 7Es learning cycle over thinking map `instructional approach and could be attributed to the fact that 7Es cycles of learning enhanced the Biology students' deeper exploration of the content under study against those taught using thinking map who are more or less guided by the graphic illustration of the content. This is in support of Vygotsky's social constructivist learning which states that that learning is a process of active knowledge construction within and from social forms and processes The active participation of the 7E learning cycle group promoted competence which enhanced positive attitude of students in the group more than those in the thinking map group The study is also consistent with Shaheen and Kayani (2017) who opined that this is because of the inclusive nature of constructivist methods where students can individually construct their own knowledge by relating new phenomena with pre-existing conception. Therefore, 7Es learning cycle is a constructive approach that fosters and sustains a positive attitude that positively regulate behavior (Gok 2014). On the contrary, Wodaj and Belay (2021) are of the view that 7Es learning cycle can be more effective when supported with metacognitive strategy and 7Es learning cycle alone cannot improve students understanding of biology concept. The insignificant effect of thinking map on student attitude could be as a result of the nature of the method which requires graphic competence in other to understand the concept.
However, gender has a significant influence on Biology students' attitude towards Biology, in favour of the male students. Nevertheless, the finding of this study agrees with Akhigbe and Adeyemi (2020) who revealed that gender responsive collaborative model for science instruction statistically significantly improved the academic achievement and attitude of students. The finding of the study on the other hand disagreed with that of Casmir (2011) who reported no significant gender influence on attitude of male and female undergraduate students towards Biology. The variation in the reports of the researchers on the significant influence of gender on student's attitude could be attributed to difference in subjects, sampling error or the method of teaching that was employed in the study.

5. Conclusions

In conclusion, 7Es learning cycle mode of instruction was found to be superior to the thinking map instructional approach on students' achievement and attitude towards Biology. Students exposed to 7E learning cycle irrespective of gender performed better than their counterparts that were exposed to thinking map instructional approach on students" attitude towards Biology. However, there was a statistically significant difference between gender and method on students' attitude towards Biology. Biology students should be actively involved in the teaching process through the use of activity-oriented method of teaching such as 7E learning cycle to promote students attitude towards Biology. The curriculum developers should develop Biology curriculum to incorporate activity-oriented approaches to teaching such as 7E learning cycle to promote Biology students' attitude towards Biology.

5.1 Implications for practitioners

To Biology students, it implies that complimenting Biology teaching with 7E learning cycle will actively involve students in the teaching and learning process and could help to ultimately enhance positive attitude of students towards Biology. Curriculum planners should create awareness of this activity-oriented methods such as7E

learning cycle by inculcating it in biology curriculum to promote students' positive attitude towards Biology. Furthermore, biology teachers should be encouraged to attend conferences, seminars and workshops where innovative and gender inclusive teaching methods such as 7E learning cycle are taught to update their knowledge and skills for effective teaching and learning.

5.2 Limitations

The class was most often rowdy because of noise from the neighboring classes this may constitute a factor in generalization and conclusion of the efficacy of 7Es learning cycle on Biology students' attitude to and achievement in Biology

References

1. Acarli, D.S.& Acarli, H.A. (2020). Examination of students' attitudes towards biology and biology course in terms of gender, grade level and pet keeping. *Problem of Education in the 21st century,78*(3),328-341. https://doi.org/10.33225/pec/20.78.328.
2. Agomuoh, P. C. (2014). Effect of cooperative instructional strategy on secondary school students' achievement in physics. *Journal of Nigerian Academy of Education. 10*(2).142-151.
3. Akhigbe, J. N. & Adeyemi, A. E (2020). Using gender responsive collaborative learning strategy to improve Students' Achievement and Attitude towards learning science in virtual and hands-on laboratory environment, *Journal of pedagogical Research* 4(3) 241-261
4. Aivelo, T. and Uitto, A. (2021). Ractors explaining students attitudes towards learning genetics and belief in genetic determinism. *International Journal of Science Education 43* (2021) 14081425.
5. Badr A. A. (2020) The effect of a programme based on thinking maps on developing learners'reading comprehension skill and their attitude towards reading. *Journal of Education 77* (77) 93 – 156.
6. Bulbul, Y. (2010). Effect of 7E learning cycle model accompanied with computer animation on understanding diffusion and osmosis concept. *Unpublished Doctoral Dissertation, Middle East Technical University, Ankra, Turkey*
7. Balter, N. & Sarac, H (2016) The effect of 7E learning cycle on learning in Science Teaching. A meta-analysis of study. *European journal of Educational Research 5*(2), 61- 64
8. Byokusenge, C. Nsangwanwimana, F. & Tamo, A.P (2024).Investigating the effects of virtual laboratories on students academic performance and attitudes towards learning biology. *Education and information Technologies, 28*(10) 1147-1171
9. Burks, T. N.(2022). Improving student attitude and academic performance in introductory biologyusing a project based learningcommunity,*Journal of Microbiology, Biology Education 23*(1) e00216 -21
10. Casmir, N. E (2011). Influence of Gender on Students Attitude Towards Biology in Enugu. Enugu East Local Government Area of Enugu State. *The Nigerian Journal of Research and Production 18*(1)1.
11. Chaudhry.M and Kazim, E. (2022). Artificial intelligence in Education (AIED): A HIGH LEVEL OF ACADEMIC AND INDUSTRY NOTE. *AI AND Ethics2 (* 13)157 – 165.
12. Damar, S. Y. (2013). The effect on instruction based on the epistemologically and meta cognitively improved 7E learning cycle on tenth grade students' achievement and epistemological understandings in physics *(Doctoral dissertation) Middle East Technical University, Ankra, Turkey.*
13. Ekineh, D. R., & Adolphus. T. (2019). Influence of gender on students' performance in Biology when Taught reproduction using collaborative strategy in secondary schools in River state. R*ivers State University Journal of Education, 22* (1&2), 62 - 72
14. Ewumi, A. M. (2012) Gender and socio economic status as correlate to students' academic achievement in secondary schools. *European Scientific Journal, 8* (4), 431- 440.
15. Gok, G. (2014). The effect 7E learning cycle instruction on 6th grade students' conceptual understanding of human body systems, self-regulation scientific epistemology beliefs and science process skills *(*Doctoral dissertation) Middle East Technical University. Ankra Turkey.
16. Hyerle, D. (2007). *Visual tools for transforming information into knowledge.* Thousand oaks; Corwin Press.
17. Kumari, S. & Kumari, S. (2013). Effect of six thinking Strategies on Development of parallel Thinking in high school students. *Indian Journal of Research. 2(11), 56 – 59.*
18. Long, D. & Carlson, D. (2011). Mind the Map; How Thinking Maps Affect Student Achievement *Networks,* (Online), 13; 1 – 7.
19. Okoyefi, Q. O. (2015). Effect of four mode application technique on achievement retention and multiple intelligence of students with different learning styles in Biology. *Unpublished PhD Thesis Department of Science Education University of Nigeria, Nsukka*
20. Ong'amo, B.L., Ondigi, S.R., and Omariba A. (2017). Effect of Utilizing Biology Teaching and Learning Resources om Students; Academic Performance in Secondary Schools SIAYA DISTRICT – KENYA. *International Journal of Education and Research 5*(1) 1- 20
21. Orunaboka, T. T. (2011). Attitude of Nigerian Secondary School students towards physical education as a predictor of achievement in the subject *Journal of Education and Practice 2*(6) 71-79

22. Pearson Foundation (2014). 8 conditions that make a difference *My Voice*. http//my voice. Pearsonfondation.org/content/8-conditions-make-difference
23. Quinn, P. (2006). Cooperative learning and students' motivation. Unpublished Thesis Department of Education and Human Development of the State University of New York at Brockpot. http://www.brockport.edu/ehd/
24. Sadoglu, G. P., & Akdeniz, A.R. (2015). Effect of designed materials accordingto7E learning model on success of high school students in modern physics, *Journal of Computer and Education Research,* 3(5),96-129. Savitha, R & kannadas, P. (2014) Attitude and behavioural problems among students *Global Journal of Finance and Management 6* (9) 847-852.
25. Shaheen, M.N.K. & Kayani, M. M. (2017). Improving students' attitude towards Biology as a school subject: Do instructional models really work? *Journal of Applied Environmental and Biological Science*. *7(1),110-124*
26. Shaibu, A. & Ishak, N.A. (2020). Effects of the 7Es instructional strategy on the overall attitude of students in Biology in public secondary schools in Adamawa State Nigeria. *Journal of Turkish Science Education 35*(2) 171 – 186.
27. Toraman, C, & Demir, E (2016). The effect of constructivism on attitudes towards lessons. A meta – analysis study. A meta-analysis study. *Eurasian Journal of Educational Research, 62*115-142. http://dx.dol.org/10.14689/ejer.2016.628
28. Wodaj, H & Belay, S. (2021) Effects of 7Einstructional model with metacognitive scaffolding on Students' conceptual understanding in Biology. *Journal of Education in Science Environment and Health 7*(1) 26 – 43.