European Journal of Social Sciences Studies
ISSN: 2501-8590
ISSN-L: 2501-8590
Available on-line at: www.oapub.org/soc

doi: 10.5281/zenodo.400745 Volume 2 | Issue 2 | 2017

EFFECTS OF SMALL-GROUP LEARNING INSTRUCTION ON ATTITUDES AND PERFORMANCE OF BASIC SCIENCE STUDENTS IN EKITI STATE, NIGERIA

Ayodele, Mathew Olagoke[i], Fatoba, J. Oba
Dr., Department of Science Education, Faculty of Education,
Ekiti State University, Ado Ekiti, Nigeria

Abstract:
The study assessed the effect of small-group learning instruction on attitudes and performance of Basic Science students in Ekiti State, Nigeria. The study adopted a quasi-experimental of pre-test, post-test research design and was carried out on 180 JSS 2 students selected from six secondary schools using purposive sampling techniques. The two instruments used for the study included: Basic Science Performance Test (BSPT) and Students' Attitudinal Scale (SAS). Five hypotheses were generated for the study and tested at 0.05 level of significance. The findings of the study revealed that small-group learning instruction had significant and positive effects on students' attitudes and performance in Basic Science. The findings also indicated that gender had no significant effect on attitude of students taught using small-group learning instruction. Based on the academic success recorded by the small group learning classrooms, it was suggested that small-group learning instruction which is more student-centered and having potential of enhancing students' attitudes toward Basic Science should be adopted as a teaching strategy in schools.

Keywords: small-group learning instruction, students' performance, attitude, junior secondary school students and basic science

1. Introduction

Reforms in Nigerian educational systems had called for the various practices that will support science education programmes and encourage students' participation in the

[i] Correspondence, email goksmann@yahoo.com

classroom. The reforms has encouraged teachers at all level of education to be conversant with the nature of scientific investigations that will allow students to actively participate in the process of teaching and learning based on their experience and knowledge. In recent years, constructivist learning approach rooted in Piaget idea has emphasized the use of students-centered approach to the teaching of science, built upon prior experiences (Bruner, 1961). The Constructivism holds that each learner actively constructs and reconstructs his or her understanding rather than receiving it from a more authoritative sources. Lev Vygotsky (1962) also proposed that the interactions that students have with their peers influences the learning processes. The theory recognizes that learning occurs and cannot be separated from a social context that promote the distribution of expert knowledge where students collaborate to conduct research, share their results and produce a final project. In essence, teachers can only create a learning environment that maximizes the learners' ability to interact with each other through small-group discussion, teamwork, small-group collaboration and feedback.

Small group learning is a form of cooperative or collaborative approach to teaching in which students are arranged in a group of 6-8 learners in the classroom, typically assisted by a teacher. The term small group according to Killen (2007) can be applied to a group of two, but the learning value is maximized if the group is comprised of around eight. The approach has become more common in inspiring students to participate actively in the classroom and cater for knowledge construction processes. A growing body of research has shown that there are various forms of small-group learning methods that are commonly used in the classrooms. These include cooperative learning (Johnson and Johnson, 2009); collaborative learning (Kramarski and Mevarech, 2003)); and inquiry-based learning (National Research Council, 2001) among others. Thayer-Bacon, one of the proponents of collaborative or cooperative learning emphasized the importance of students' relationships with others in developing critical thinking skills (Thayer-Bacon, 2000). Similarly, Kramarski and Mevarech (2003) attribute the superior performance of students working in collaborative group settings to the higher quality of discourse observed among students working together. From an innovative point of view, small-group teaching techniques change the pace of the classroom, allow students to accomplish the group's goals, improve students' cognitive outcomes and increase students' involvement (Johnson and Johnson, 2008; Tran and Lewis, 2012).

In small groups, students can share meaningful ideas and develop social and intellectual skills. When small groups are properly guided by a clear and well defined purposes, based on various activities, significant improvement in learning may occur.

As McCrorie (2006) notes, well-designed small group teaching has clear benefits for student learning in terms of retention of information, critical thinking and consolidation of learning from different parts of a programme. McCrorie further noticed that small-group learning enable learners to take part in discussion, consolidate learning, clarify understanding, and explore ideas and concepts. However, research suggests that cooperative and collaborative learning bring positive results such as deeper understanding of content, increased overall achievement in grades, improved self-esteem, and higher motivation to remain on task (Thayer-Bacon, 2000). According to Bradford, Brown and Cocking, (2000), cooperative learning helps students become actively and constructively involved in content, to take ownership of their own learning, and to resolve group conflicts and improve teamwork skills. Barron and Darling-Hammond (2008) also assert that discipline-based approaches to inquiry learning, if designed well, support students in deep learning. In general, there are significant learning benefits for students who work together on a small group learning activities.

Some studies have reported the effects of different forms of small-group learning. For example, Beck and Chizhik (2008) compared the effects of cooperative learning and other teaching methods on 71 tertiary students' performance in a computer science course in America over a period of one year, and found that the cooperative learning group achieved significantly higher than the conventional lecture teaching group. In another study conducted by Tran (2014) on the effects of cooperative learning on the academic achievement and knowledge retention of First-Year primary education students towards Psychology subject over a period of eight weeks of instruction, it was found that students who were instructed using cooperative learning achieved significantly higher than did students who were instructed using lecture-based teaching. Davis (2009) noted that students who engaged in small group activities, inside or outside of the classroom, achieve a deeper understanding of the material and demonstrate better retention than students who do not participate in such activities.

Students' working together has been associated with positive learning outcomes. For example, the study conducted by Shibley and Simmaro (2002) on the effect of collaborative learning on students' attitudes and performance in an introductory chemistry laboratory showed that students seemed to develop a more positive attitude about the laboratory and about chemistry in the collaborative learning group as judged from their classroom evaluations of the teacher. The study further recommends that the use of collaborative learning provides a means of improving students' attitude toward chemistry. In effects, students working in a collaborative learning environment achieve better in their subject areas. Also in a comparative study conducted by Kipnis and

Hofstein (2005), two groups of high-school chemistry students were compared. The first group conducted inquiry-type experiments whereas the second group performed more conventional, confirmation-type activities. The students in the inquiry group developed more positive attitude towards learning chemistry than did those students who had experienced a more conventional chemistry program. In another study, Anderson (2005) made a comparison between cooperative learning and traditional lecture-based biochemistry curriculum on 420 junior and senior college students. The study revealed that students in the cooperative learning environment scored higher than their peers in standardized testing of the curriculum and were more positive about their learning experience.

Senemoglu (2004) defined attitude as an internal situation that is acquired and has an effect on the selection of behavior. These behavior could be triggered in students by many factors such as the perception of the science teacher; anxiety toward science; the value of science; self-esteem at science; motivation towards science; enjoyment of science; attitudes towards science; attitudes of parents towards science; the nature of the classroom environment; achievement in science among others (Osborne, Simon and Collins, 2003). Developing positive attitude towards science is one of the key goals for teaching and learning science and science-related subjects in schools. Research on students' attitudes towards learning science has shown that there are decline in students' attitudes toward science in general and science learning in particular, and the decline in enrollment in science-based careers (Osborne, Simon, and Collins, 2003). Lindal (2003) showed that the most effective factor contributing to students' decisions to study science is their interest in the subject. If students are not interested in science, they tend not to learn and understand the concepts that are being taught to them. Fairbrother (2000) claimed that pupils learn only if they want to learn. This claim might occurred especially when the right approach are used to teach the subject. Gilbert (2006) identified failure to present a holistic approach to the teaching of chemistry as a major reason for the decline in interest in chemistry and in addition to inadequate emphasis regarding selection and depth of topics taught especially for those who are not going to embark on a career in chemistry or chemistry-related sciences.

Students' attitude towards science influences their efforts in understanding scientific concepts and skills. Research on attitudes indicated that students who have negative attitude towards education activities are found to exhibit challenging behavior including anti-social and off-task behavior (Awang, Jindal-Snape and Barber, 2013). It is assumed that students who are interested in science and understand the scientific concepts, will have more positive attitude towards science and science studies compared to those who have learning difficulties in the science disciplines. The studies

of Rana (2002) and Ayodele (2016) revealed a positive relationship between achievement in science and attitude towards science, whereas the study of Osborne and Dillon (2008) revealed no clear (or negative) relationship between attitudes towards learning science and achievement.

In recent years, gender issues have received an increased attention nationwide. Empirical evidence indicated that generally female educational attainment has surpassed male attainment in many industrialized countries (Pekkarinen, 2012); boys continue to outperform girls in mathematics in most countries (Bedard and Cho, 2010). However, Hazari, Tai and Saddler (2007) attributed differences in science achievement at the K-12 to fewer females attaining degrees in science, technology, engineering and mathematics fields. Further examination of gender differences among students revealed that males outperform significantly than females in science, scoring higher in three of the four sciences content domain: biology, physics and earth science, but there was no measurable difference detected in the average science scores of U. S. eighth-grade males and females in the chemistry domain (American College Testing Program, 2007).

Several studies have also linked students' attitude toward science and gender. For example, Breakwell and Robertson (2001) conducted a longitudinal study to examine the change in attitude towards science over a period of ten years in students between ages 11 to 14 years. The results indicated that boys had more positive attitude and better performance in science compared to girls. Also a comprehensive research conducted in Australia by Barnes, et al (2005) showed that the attitudes of boys towards chemistry was more positive than their girls' counterparts. Contrary to these reports, Cokadar and Kulce (2008) did not offer any support for the effect of gender on attitude towards science.

Inability to apply the best practices in the classroom setting among the teachers has led to mass failure among the students in the science courses. Nevertheless, for improvement in the science courses among the students, small-group teaching has been recommended in many part of the world for science teachers to use. This type of learning is used to teach a specific concept, fact or skill in and outside the classroom. In order to add to the existing literature on the efficacy of this learning method in science classroom, the present study examined the effect of small-group learning instruction among Basic Science Students in Ekiti State, Nigeria.

2. Research Hypotheses

1. There is no significant difference between the performance of students taught using small-group learning instruction and those taught using conventional learning instruction.
2. There is no significant effect of gender on attitude of students taught using small-group learning instruction.
3. There is no significant difference between the attitude of students taught using small-group learning instruction and those taught using conventional learning instruction.
4. There is no significant interaction effect of treatment and gender on attitude of students in basic science.
5. There is no significant interaction effect of treatment and gender on performance of students in basic science.

3. Materials and Methods

The study adopted a quasi-experimental of pre-test, post-test research design.

3.1 Population

The population for the study consisted of all the 21,516 junior secondary school 2 students in Ekiti State, Nigeria.

3.2 Sample and Sampling Techniques

The sample for study comprised 180 junior secondary school 2 students in Ekiti State capital, Ado-Ekiti, Nigeria, in the 2015-2016 academic session using a purposive sampling technique. The study is purposive in the sense that it only involved those schools that showed readiness and interest in the study. Intact classes were used in all the 6 schools selected for the study to avoid unnecessary interruption of the normal class settings. In all, a total of 180 students were used for the study.

3.3 Research Instruments

The instruments used for this study include: Self-developed Basic Science Performance Test (BSAT) and Students' Attitudinal Scale (SAS) that was adapted from the work of Moore and Foy (1996). The Basic Science Performance Test consisted of 25 multiple questions with four options drawn by the researcher from the recommended Basic Science Text materials used for the students. The Students' Attitudinal Scale (SAS) also

consisted of 20 items aimed at measuring students' attitude toward science. The SAS was a four-point Likert scale of strongly agree = 4, agree = 3, disagree = 2, and strongly disagree = 1.

3.4 Validity of the Instruments

The content and face validity of the instruments were ascertained by experts in the fields of Science Education and Test Evaluation for proper scrutiny. The comments of these experts were strictly followed to produce the final instruments used for the study.

3.5 Reliability of the Instruments

In order to ensure the reliability coefficients of the two instruments, the researcher carried out a pilot test on 30 non-participating students from the schools outside the State Capital. The tests were employed once and the scores from the single administration of the tests were subjected to split-half reliability estimate and the results obtain yielded 0.77 and 0.81 for Basic Science Performance Test and Students' Attitudinal Scale respectively. These values were considered reliable and high enough for the study.

3.6 Experimental Procedures

The sample for the study was divided into experimental and control groups respectively. The Small-group-based instructional technique was applied to the experimental group while the control group was exposed to conventional instructional technique. The duration of instruction was five weeks. Students in both groups were pre-tested using the BSPT before the treatment was applied. The essence of the pre-test was to ensure that the two groups are homogeneous in all respect. Topic related to 'You and Your Environment' was selected from *Basic Science Book 2: An integrated science course for junior secondary schools, written by Ndu, F.O.C and Somoye, E. O*. (2008). Instructional package was designed for the teachers and students in the experimental group which contained series of activities to be demonstrated in the classroom. Students in this group studied in small groups of 5-9 students and were allowed to form their own groups with directive from the teachers. The researcher and the basic science teachers act as facilitators by setting up activities to be accomplished in the classroom for the students. The activities include the following: questions from the students, listening and responding to students' comments and questions, sometimes explaining and summarizing etc. The teachers define a time limit for all the activities of the group and at the end of the time limit, students were brought back together to share their experience while teachers provide a feedback to each group as they share their

findings. The students in this group were encouraged to participate actively in all the class work. Students in the control group were not engaged in this series of activities but were only taught the same topic as it used to be in the normal classroom setting. The duration of the lesson/experiment was 40 minutes on each day of the experiment. At the end of the fifth week, a post test was conducted for the two groups using the same BSPT used as the pre-test. Students' scripts were collected, marked and their scores were recorded. The data collected were subjected to analysis of covariance and the hypotheses formulated were tested at 0.05 Alpha level.

4. Results

4.1 Hypothesis 1

There is no significant difference between the performance of students taught using small-group learning instruction and those taught using conventional learning instruction.

Table 1: ANCOVA showing the performance of students taught using small-group and conventional learning instructions

Source	SS	Df	MS	F	P
Corrected Model	3470.062	2	1735.031	247.564	.000
Pretest Achievement	46.590	1	46.590	6.648	.011
Group	3468.084	1	3468.084	494.846	.000
Error	1240.488	177	7.008		
Corrected Total	4710.550	179			
Total	43695.000	180			

*p<0.05

Table 1 above reveals that there is significant difference between the performance of students taught using small-group learning instruction and those taught using conventional learning instruction. ($F_{1,\ 177}$ = 494.846; p<0.05). The null hypothesis is rejected. This implies that there is significant difference between the performance of students taught using small-group learning instruction and those taught using conventional learning instruction.

Table 2: Multiple Classification Analysis (MCA) showing the effect of small group learning instruction on students' performance in Basic Science

Grand Mean =14.72					
Variable + Category	**N**	**Unadjusted Devn'**	**Eta**	**Adjusted for Independent + Covariate**	**Beta**
Small-group	90	4.36	.74	4.36	.02
Conventional	90	-4.36		-4.37	
Multiple R					.020
Multiple R^2					.000

The result in Table 2 reveals that students exposed to small-group learning instruction had higher adjusted mean score of 19.08 (14.72 + 4.36) in Basic Science than those taught using conventional method; 10.37 (14.74 + (-4.37). It implies that the use of small-group learning instruction is effective at enhancing students' performance in Basic. The treatment accounted for about 74% (Eta^2 = 0.74) of the total variance in students' performance in Basic Science.

4.2 Hypothesis 2

There is no significant effect of gender on attitude of students taught using small-group learning instruction.

Table 3: ANCOVA showing the attitude of students in small-group learning instruction by gender

Source	**SS**	**df**	**MS**	**F**	**p**
Corrected Model	2.239	2	1.119	.193	.825
Pretest Achievement	.361	1	.361	.062	.803
Sex	2.156	1	2.156	.372	.544
Error	504.217	87	5.796		
Corrected Total	506.456	89			
Total	33263.000	90			

p>0.05

Table 3 above shows that there is no significant effect of gender on attitude of students taught using small-group learning instruction. ($F_{1, 87}$ = 0.372; p>0.05). The null hypothesis is not rejected. This implies that there is no significant effect of gender on attitude of students taught using small-group learning instruction.

4.3 Hypothesis 3

There is no significant difference between the attitude of students taught using small-group learning instruction and those taught using conventional learning instruction.

Table 4: ANCOVA showing the attitude of students taught using small-group learning instruction and those taught using conventional learning instruction

Source	SS	Df	MS	F	p
Corrected Model	13443.689	2	6721.844	127.004	.000
Covariate (Pretest)	165.267	1	165.267	3.123	.079
Group	13443.182	1	13443.182	253.998	.000
Error	9367.956	177	52.926		
Corrected Total	22811.644	179			
Total	610828.000	180			

*p<0.05

Table 4 above shows that there is significant difference between the attitude of students taught using small-group learning instruction and those taught using conventional learning instruction. ($F_{1, 177}$ = 253.998; p<0.05). The null hypothesis is rejected. This implies that there is significant difference between the attitude of students taught using small-group learning instruction and those taught using conventional learning instruction.

Table 5: Multiple Classification Analysis (MCA) showing the effect of small group learning instruction on students' attitude towards Basic Science

Grand Mean =57.16

Variable + Category	N	Unadjusted Devn'	Eta	Adjusted for Independent + Covariate	Beta
Small-group	90	8.58	.59	8.85	.01
Conventional	90	-8.59		-8.62	
Multiple R					.005
Multiple R^2					.000

Cursory look at Table 5 shows that students exposed to small-group learning instruction had higher adjusted mean score of 66.01 (57.16+8.85) on attitude towards Basic Science compared with their counterparts in the conventional learning group; 48.54 (57.16 + (-8.62). It implies that the use of small-group learning instruction is effective at influencing students' attitude towards Basic Science. About 59% (Eta^2=0.59)

of the total variance in students' attitude towards Basic Science is explained by the treatment.

4.4 Hypothesis 4

There is no significant interaction effect of treatment and gender on attitude of students in Basic Science.

Table 6: 2 X 2 ANCOVA summary of students' attitude towards Basic Science by gender and treatment

Source	SS	Df	MS	F	p
Corrected Model	13455.043	4	3363.761	62.914	.000
Covariate (Pretest)	171.532	1	171.532	3.208	.075
Group	13449.473	1	13449.473	251.550	.000
Sex	8.445	1	8.445	.158	.692
Group * Sex	2.825	1	2.825	.053	.818
Error	9356.602	175	53.466		
Corrected Total	22811.644	179			
Total	610828.000	180			

p>0.05

Table 6 above shows that there is significant interaction effect of treatment and gender on attitude of students in Basic Science. ($F_{1, 175} = 0.053$; $p>0.05$). The null hypothesis is not rejected. This implies that there is significant interaction effect of treatment and gender on attitude of students in Basic Science.

4.5 Hypothesis 5

There is no significant interaction effect of treatment and gender on performance of students in Basic Science.

Table 7: 2X2 ANCOVA showing performance of students in Basic Science by gender and treatment

Source	SS	Df	MS	F	p
Corrected Model	3488.686	4	872.171	124.916	.000
Pretest Achievement	39.825	1	39.825	5.704	.018
Group	3462.624	1	3462.624	495.930	.000
Sex	11.157	1	11.157	1.598	.208
Group * Sex	7.350	1	7.350	1.053	.306
Error	1221.864	175	6.982		
Corrected Total	4710.550	179			
Total	43695.000	180			

p>0.05

Table 7 reveals that there is significant interaction effect of treatment and gender on performance of students in Basic Science. ($F_{1, 175} = 0.053$; $p>0.05$). The null hypothesis is not rejected. This implies that there is significant interaction effect of treatment and gender on performance of students in Basic Science.

5. Discussion

The results of this study reveal that small-group learning instruction had significant effects on performance of students in Basic Science. The higher adjusted mean score of small-group learning instruction over the conventional group implies that the use of small-group learning instruction is effective at enhancing students' performance in Basic Science. This finding is in support of Anderson (2005) who found that students in the cooperative learning instruction scored higher than their peers in standardized testing of the curriculum and were more positive about their learning experience. Analysis of the results further shows that there is no significant effect of gender on attitude of students taught using small-group learning instruction. By implication, the attitude of both boys and girls did not differ significantly. This finding is in agreements with the findings of Cokadar and Kulce (2008) whose study did not offer any support for the effect of gender on attitude towards science. The finding showed a divergent view with the findings of Breakwell and Robertson (2001) whose study revealed that boys had more positive attitude and better performance in science compared to girls.

Results of the study also indicates that there is significant difference between the attitude of students taught using small-group learning instruction and those taught using conventional learning instruction. This result is not surprising, because of the

higher adjusted mean score of the small-group learning on attitude towards Basic Science compared with their counterparts in the conventional learning group is an indicator that those in the small-group learning had positive attitude towards Basic Science. The finding is in accord with the findings of Kipnis and Hofstein, (2005) whose study on two groups of high-school chemistry students show that inquiry group had more positive attitudes towards learning chemistry than did those students in the conventional chemistry program. The result also lend credence to the findings of Shibley and Simmaro (2002) whose study found that students seemed to develop a more positive attitude about the laboratory and about chemistry in the collaborative learning group as judged from their classroom evaluations of the teacher. Interestingly, the results reveal that there is significant interaction effect of treatment and gender on attitude and performance of students in Basic Science. These results suggest that application of small-group learning had significant and positive effects on students' attitudes and performance in Basic Science.

5. Conclusion and Recommendation

In this paper, an attempt was made to assess the effect of small group learning instruction on attitudes and performance of Basic Science students in Ekiti State, Nigeria. The study indicated that the morale of the students was increased in the course of learning collaboratively. This was revealed in their positive attitudes and improvement in their test scores. Based on the findings of this study, it was suggested that small-group learning instruction which is more student-centered and having potential of enhancing students' attitudes toward Basic Science should be adopted as a teaching strategy in schools.

References

1. American College Testing Program. (2007). *ACT high School Profile Report: HS Graduating Class 2007*. HS Graduating Class National Report, Iowa City: American College Testing Program
2. Anderson, W. L. (2005). Comparison of student performance in cooperative learning and traditional lecture-based biochemistry classes. *Biochemistry and Molecular Biology Education, 33, 6,* 387-393.
3. Ayodele, M. O. (2016). Attitude, self-concept and achievement of junior secondary school students in Basic Science in Ekiti State, Nigeria. 6, 1, 167-171.

4. Awang, M. M., Jindal-Snape, D., and Barber, T. (2013). A Documentary Analysis of the Government's Circulars on Positive Behaviour Enhancement Strategies. *Asian Social Science*, *9*5, 203-208.
5. Barnes, G., McInereney, D. M., and Marsh, H. W. (2005). Exploring sex differences in science enrolment intentions: an application of the general model of academic choice, Australian Educational Researcher, 32, 1-23.
6. Barron, B. and Darling-Hammond, L. (2008). Teaching for meaningful learning: A review of research on inquiry-based and cooperative learning. *Powerful Learning: What We Know About Teaching for Understanding* 11-70, San Francisco, CA: Jossey-Bass.
7. Beck, L. L. and Chizhik, A. W. (2008). An experimental study of cooperative learning in CSI. *In proceedings of the 39th SIGCSE technical symposium on computer science education,* 205-209. New York: ACM.
8. Bedard, K and Cho, I. (2010). Early gender test scores gaps across OECD countries. *Economics of Education Review, 29,* 348-363.
9. Blackwell, G. M. and Robertson, T. (2001). The gender gap in science attitudes, parental and peer influences: Changes between 1987-88 and 1997-98. Public Understanding of Science, 10, 1, 71-82.
10. Bransford, J. D, Brown, A. L, Cocking, R. R. (2004). *How people learn: brain, mind, experience, and school*. National Academy Press. Washington D.C.
11. Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*, Harvard University Press
12. Cokadar, H., and Kulce, C. (2008). Pupils' attitudes towards science: A case study of Turkey. *World Applied Sciences Journal, 3, 1,* 102-109.
13. Davis, B. G. (2009). '*Learning in Group' Tools for Teaching.* Second Edition, San Francisco: Wiley.
14. Fairbrother, R.W. (2000). *Strategies for learning*. In: M. Monk & J. Osborne (Eds.), Good practice in science teaching, 7-24. Philadelphia: Open University.
15. Gilbert, J. K. (2006). On the nature of context in chemical education. *International Journal of Science Education, 28, 9,* 957-976.
16. Hazari, A., Tai, R. H., and Sadler, P. M. (2007). Gender differences in introductory university physics performance: The influence of high school physics preparation and affective factors. *Science Education, 91, 6*, 847-877.
17. Johnson, D. W. and Johnson, T. R. (2008). Social interdependence theory and cooperative learning: The teacher's role. In Gillies, R. M., Ashman, A. and Terwel, J. (Eds.). *Teacher's role in implementing cooperative learning in the classroom*, 9-37. New York, USA: Springer.

18. Johnson, D. W. and Johnson, T. R. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher, 38, 5*, 365-379.
19. Killen, R. (2007). *Effective teaching strategies*: Lessons from research and practice. Melbourne: Thomson
20. Kipnis, M., and Hofstein, A. (2005). Studying the inquiry laboratory in high school chemistry. *Paper presented at the European Science Education Research Association Conference*, Barcelona, Spain.
21. Kramarski, B. and Mevarech, Z. R. (2003). Enhancing mathematical reasoning in the classroom: The effects of cooperative learning and metacognitive training. *American Educational Research Journal, 40, 1*, 281-310.
22. Lindahl, B. (2003). Pupils' responses to school science and technology. A longitudinal study of pathways to upper secondary school. Retrieved from http://gupea.ub.gu.se/bitstream/2077/9599/1/gup.ea_2077_9599_1.pdf
23. McCrorie, P. (2006). *Teaching and leading small groups*. Edinburgh: Association for the study of Medical Education.
24. Moore, R. W and Foy, R. L. H. (1997). The scientific attitude inventory: A revision (SAI II) *Journal of Research in Science Teaching, 34, 4,* 327-336.
25. Osborne, J. F and Collins, S. (2000). Pupil's and parents' views of the school science curriculum (London: King's College London).
26. Osborne, J., Simon, S., and Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. International Journal of Science Education, 25, 9, 1049–1079.
27. Osborne, J., and Dillon, J. (2008). Science education in Europe: Critical reflections. London: The Nuffield Foundation.
28. Pekkarinen, T. (2012). Gender differences in Education. *IZA Discussion Paper 6390*.
29. Rana, R. A. (2002*). Effects of parents, socioeconomic status, students, self-concept and gender on science-related attitudes and achievement* (Doctoral Thesis). Institute of Education and Research, University of the Punjab, Lahore.
30. Senemoglu, N. (2004). Gelişim Öğrenme ve Öğretim, Kuramdan Uygulamaya (10th Ed.). Ankara: Gazi Kitabevi.
31. Shibley, I. A. and Zimmaro, D. M. (2002). The influence of collaborative learning on student attitudes and performance in an introductory chemistry laboratory. *Journal of Chemistry Education. 79, 5.* 745. **DOI:** 10.1021/ed079p745.
32. Thayer-Bacon, B. J. (2000). Transforming critical thinking: Thinking constructively. New York: Teachers College Press.

33. Tran, V. D (2014). The effects of cooperative learning on the academic achievement and knowledge retention. *International Journal of Higher Education, 3, (2),* 131-140.
34. Trans, V. D. and Lewis, R. (2012). Effects of cooperative learning on students' attitudes in a Vietnamese higher education classroom. *International Journal of Higher Education, 1, 2,* 1-13.
35. Udu, F.O.C and Somoye, E.O. (2008). *Basic Science Book 2: An integrated science course for junior secondary schools. Longman Nigeria Plc, 45-46.*
36. Vygotsky, L. S (1962). *Thought and language*. Cambridge, MA: MIT Press