THE INFLUENCE OF PEER AND SELF-ASSESSMENT ON LEARNING AND METACOGNITIVE KNOWLEDGE: CONSEQUENTIAL VALIDITY[1]

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ABSTRACT

The validity of peer and self-assessment is discussed under the title consequential validity. One of the important reasons is the conception of what influence the peer and self-assessment practices in group works would have on learning and metacognitive knowledge levels of students. This study aims to identify the influence of peer and self-assessment methods used during group work studies on students' learning and metacognitive knowledge levels. For treatment-control group, pre-post test design was used in this research. The results of the study revealed that learning and metacognitive knowledge levels in the treatment group were higher than those in the control group.

Keywords: Cooperative learning, self-assessment, peer assessment, consequential validity

INTRODUCTION

The conceptual framework with the constructivist theory has had an impact on learning processes and assessment approaches, which made the students active in learning, and brought innovations, which lead the way to alternative practices besides those conventional ones.

Although constructivists have studied different components of the theory, authors like Wilson and Cole (1991), Jonassen (1994), Ernest (1995), and Honebein (1996) have brought up some various proposals on establishing a model appropriate to students' conceptual accumulations. Within these proposals, the aspects related to assessment are as follows:

1- Learning should be carried out by learners and it should be controlled internally. Therefore, the students' self-regulation and metacognition should be taken seriously.
2- Learning and assessment activities and tools used in learning environments should focus on improving those metacognitive skills like self-analysis, self-reflection and self-awareness.
3- Different assessment activities should be used and students should experience self-assessment for multiple perspectives (Yurdabakan, 2011b).

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[1] This study was adapted from the unpublished Master's Thesis Report, Dokuz Eylul University, Faculty of Education, 2011.

When these proposals are examined, it can be seen that fundamentally alternative assessment practices focus on student behaviours which are necessary for learning and teaching. For that reason, many researchers (Messick, 1995; Boud, 1995; Hargreaves, 2007; Sambell, McDowell and Brown, 1997) have mentioned about the impact of assessment on learning. This understanding started to gain importance within the framework of educational applications which have emerged with the constructivist theory. One of the main reasons is the strong relationship between the alternative assessment practices and the active participation during the learning process. Because, the active learning methods necessitating active participation requires individuals who are aware of their competencies, who know the subjects to improve, who are conscious enough about their progress, who question, lead and manage their own learning (Yurdabakan, 2011b). This requirement also has lead to the discussion of the relationships between alternative assessment and learning together with metacognitive knowledge. Some authors (Birenbaum, 1996; Boud, 1995; Dochy and Moerkerke, 1997) claim that the usual examinations are mostly based on grading and testing the knowledge obtained as a result of mechanical exercises, which by the way may not be able to serve such purposes like lifelong learning, being critical, and self-assessment; additionally state that such practices may cause to the establishment and development of testing culture which may also receive primary concern. According to them, evaluation should be a process engendering better development and directing to better learning practices. In addition to this, Boud (1995) and Arter (1996) state that goals could be achieved if materials in which learning and assessment are used together and added that assessment practices should change form to enable students to see their own progress and deficiencies they need to complete, and treated as a learning tool that requires better participation. Açıkgöz (2005) pointed out to the link between active learning and active participation, and highlighted that active participation is linked to decision making concerning learning, reflection and self-regulatory skills. This has led to questioning of the relationship between active participation to the learning process, metacognitive knowledge, and alternative assessment practices.

According to Brown (1987), Flavell (1979), and Schraw (2009), metacognitive knowledge includes three components, namely the students' knowledge of general strategies about learning and thinking, the students' knowledge of cognitive tasks showing when and why to use different strategies, and the students' self-knowledge which takes into account the cognition and motivation of students' performance. This view also found reflections in the revised version of Bloom's taxonomy, which was pioneered by Anderson and Krathwohl (2002). As a result of this, the cognitive domain was changed into a two-dimension structure as cognitive process and knowledge. Although the new classification bears some tracks of the original one, the cognitive process dimension includes creating and the knowledge dimension includes metacognitive knowledge. Metacognitive knowledge is handled as thinking about what one knows and questioning one's own learning, and as a skill of managing one's own thinking and is associated with the concept of self-knowledge. Therefore, by drawing attention to the relationship between metacognition, self-knowledge, and self-assessment, writers like Shrauger and Osberg (1981), and Anderson and Krathwohl (2002) stated that metacognitive knowledge encompasses self-knowledge and an individual does self-assessment if he/she judges his/her self-knowledge. Besides, one of the other alternative assessment methods is peer assessment. Peer assessment is defined as the process of individuals' evaluating their peers in a group (Boud, 1995; Falchikov, 1995; Freeman, 1995). Peer assessment is not only a scoring or an assessment process, but also a learning process in which skills are developed (Boud and Falchikov, 2006; Somervell, 1993). As a result, peer-assessment focuses on two skills. Firstly, the results of peer-assessment can be seen as a part of self-assessment and can affect the students' self-assessment skills directly, and their metacognitive knowledge levels indirectly (Flavell, 1987; Somervell, 1993; Topping, 2005). Secondly, it allows the development of skills such as taking responsibility and participation to group work (Van den Berg, Admiraal and Pilot, 2006). Many authors (Boud, 1995; Falchikov, 1995; Freeman, 1995; Topping, 2005) emphasized the relationship between peer-assessment and cooperation skills, and stated that peer-assessment could be very effective in fulfilling some cooperation conditions such as individual appraisability, social interaction and positive dependence. Some other authors like Topping (2005), Yurdabakan (2011a) and Web (1997) stated that peer-assessment is an effective method

in evaluating both cooperative skills and learning resulting from cooperation, providing equal effort and participation in group work, and controlling those students failing to perform team responsibilities.

The aim of the study

The alternative assessment methods which have started to gain importance in the last 20 years have attracted attention of researchers in many respects. One of the issues is the reliability and validity of methods. For example, the writers like Dochy, Segers and Sluijsmans (1999), and Cho and Schunn (2003) have pointed to the need of knowing and developing the reliability and validity of alternative assessment applications or rehandling them again. As a result of this, some researchers (Boud, 1995; Hargreaves, 2007; Messick, 1995; Ross, 2006; Sambell et al, 1997) have started to discuss the consequential validity concept related to the validity of the two alternative assessment methods, self- and peer assessment. According to them, consequential validity can be explained according to the effects of self- and peer assessment on learning and on student behaviour (which are) necessary for learning. Specifically those authors like Boud (1995), Hargreaves (2007), Messick (1995), Ross (2006), and Sambell et al (1997) have drawn attention not only to the effects of assessment on learning, but also to the relationships between learning and lifelong learning, and the relationship between assessment and metacognitive knowledge by stating the social results of assessment knowledge. This led to treatment of learning as consequential validity of self- and peer assessments, since they develop students' skills of assessing themselves. The current study aims to determine the consequential validity of the self- and peer assessment. For that purpose, the research question is posted as: What are the effects of the self- and peer assessment methods, (which are) applied during group work in primary 4th grade science and technology lesson, on students' learning and metacognitive knowledge levels?

METHOD AND PARTICIPANTS

The study has a semi-experimental, pre-test and post-test research design with a control group, which is presented in Table 1.

Table 1: Research Design

Groups	Pre-test	Experimental Process	Post-test
Treatment Group	Achievement Test Metacognition Scale	Self and peer assessment activities based on jigsaw, group investigation, student teams and achievement divisions	Achievement Test Metacognition Scale
Control Group	Achievement Test Metacognition Scale	Traditional indoor teaching activities	Achievement Test Metacognition Scale

After obtaining necessary permissions, the study was conducted with primary 4th grade students in a public school in İzmir. At the beginning of the autumn term of 2010-2011, treatment and control groups were selected among the 4 classes with random sampling method. The research was performed with a total of 67 participants, 31 of whom were in the treatment group, and 36 in the control group.

DATA COLLECTION INSTRUMENTS

Achievement Test

In this study, an achievement test including 33 items was used to examine the students' learning levels in Science and Technology lesson. This test covers the total 22 attainments that can be found in the unit "Let's solve the puzzle of our body". First, a total of 66 items (3 items for each attainment) were prepared and a pre-trial test was obtained. This test was tried on 257 students and item statistics were calculated. By taking into account the attainments and item statistics, the most suitable 33 items were included in the final version of the

test. The item difficulty indexes (p_i) of this test ranged from 0.32 to 0.79, and discrimination indexes (r_{jx}) ranged from 0.89 to 0.40. In addition, KR-20 reliability coefficient of this test was calculated as 0.88.

Metacognition Knowledge Questionnaire

A 30-item metacognitive knowledge questionnaire (MKQ), which was developed by Yıldız, Akpınar, Tatar and Ergin (2009), was used to find out metacognitive awareness levels of students. The students rated each item using a 4-point scale with 1 (never), 2 (sometimes), 3 (often), and 4 (always). According to the factor analysis, the scale consists of two basic components as the knowledge of cognition and regulation of cognition, together with its subcomponents. Cronbach's alpha internal consistency coefficient for the whole scale was calculated as 0.90.

Self and Peer Assessment Forms

In this study, self and peer assessment practices were carried out by considering the two approaches proposed by Web (1997), Ploegh, Tillema and Segers (2009), and Yurdabakan and Cihanoğlu (2009). The first of these approaches enables the members to do self- and peer assessment in terms of "group work skills" (GWS) such as taking responsibility, fulfilling duties, contributing to the learning of others, participating to the discussions, fulfilling the requirements of his/her role; while the second one enables members to do self- and peer assessment in terms of "cognitive learning levels" (CLL), which emerges from group cooperation and is aligned with attainments of the learning process. Self- and peer assessment forms were prepared and applied according to these two approaches. During the preparation of GWS self- and peer assessment forms, the functionality of cooperative group work (Açıkgöz, 2005, Johnson, Johnson and Smith, 1998); and for the CLL the attainments of primary 4th grade Science and Technology course were taken into account. Sample items for these forms and other measurement instruments are given in Appendix 2.

EXPERIMENTAL PROCESSES

The "Let's solve the puzzle of our body" unit in the 4th Grade Science and Technology course aims at students' comprehending the places and functions of some organs related to the human skeleton, muscles, breathing, heart and blood circulation; and all these structures working together, and the effects of exercise on breathing and heart rate. To comply with the purpose of the study, before the experimental treatment, a total of seven pre-course sessions, 2 hours each, were held with the treatment group between 22nd of October and 12th of November, 2010. During these sessions, the cooperative learning and self- and peer assessment applications were introduced, and some sample studies were done. In the preliminary sessions, the following treatments were included for self and peer assessment:

1) Short description of self- and peer assessment approaches,
2) Explaining the aims of self- and peer assessment,
3) Discussing and identifying the assessment criteria for CLL and GWS,
4) In the continuation of a suitable group activity, enabling students to participate in sample assessment practices,
5) Monitoring the assessment process and its results together with the teacher,
6) Providing feedback to the members about assessment processes and their results,
7) Repeating the last 4 tasks (4-7) through the sessions (Yurdabakan and Cihanoğlu, 2009).

After the preliminary sessions between 22nd of November and 24th of December 2010, the experimental treatments were put into practice for 10 weeks. While the lessons in the treatment group were conducted with the techniques like jigsaw, student teams and achievement divisions, group investigations and included structured self- and peer assessment activities; the lessons in the control group were administered by utilizing additional expository teaching, silent reading, and question and answer. The details of the aims of the preliminary and main sessions for the treatment group can be found in Appendix 1.

FINDINGS

In this study, for consequential validity, the effects of self- and peer assessment methods applied during a group work on students' learning and metacognitive knowledge levels were tried to be defined. For this purpose, the achievement and metacognition scores of students in both treatment and control groups were calculated before and after the treatments and descriptive statistics of groups are presented in Table 2.

Table 2: The average scores and standard deviations of groups' achievement and metacognition scores

	Groups	N	$\overline{X}$	S_x		$\overline{X}$	S_x
pre-achievement	treatment	31	38.26	11.69	pre-metacognition	66.13	9.32
	control	36	44.75	13.37		76.89	17.21
post-achievement	treatment	31	87.03	12.11	post-metacognition	84.71	11.61
	control	36	70.83	17.43		71.44	11.97

When pre-test averages of the achievement and metacognitive knowledge levels of treatment and control groups are compared, meaningful differences were found between both achievement (t=-2.10, p<.05) and metacognitive knowledge levels (t=-3.11, p<.01).

Covariance analysis was used to test the effect of the application, because students' pre-experimental achievement and metacognitive knowledge levels were different, the relationship between pre and post tests were high ($r_{achievement}$=0.52, p<.001; $r_{metacognition}$=0.47, p<.001), and group variances were equal in terms of achievement (F_{1-65}=0.041; p=0.84) and metacognitive knowledge levels (F_{1-65}=0.51; p=0.48). According to this finding, when the pre-test averages are taken as common variable and post test averages are taken as dependent variable, Table 3 illustrates the group regression coefficients and corrected post-test averages and standard errors.

Table 3: Corrected post-test means and standard errors of groups

	Groups	N	R^2	Corrected $\overline{X}$	S_e		R^2	Corrected $\overline{X}$	S_e
Post-Achievement	treatment	31	0.67	90.22	1.82	Post-Metacognition	0.52	87.61	1.77
	control	36		68.09	1.69			68.94	1.64

When Table 3 is examined, it can be seen that the corrected achievement post-test averages in the treatment group changes from 87.03 to 90.22, and in the control group from 70.83 to 68.09; whereas the corrected metacognitive knowledge post-test averages vary from 84.71 to 87.61 in the treatment group and from 71.44 to 68.94 in the control group. The covariance analysis results utilized to compare the corrected averages for both groups are presented in Table 4.

Table 4: Covariance analysis for the comparison of groups' learning and metacognition knowledge

	Source of Variance	Sum of Squares	sd	Mean Squares	F	p	η^2
Achievement	Group	7645.00	1	7645.00	76.87	0.000	0.55
	Pre-test	8664.85	1	8664.85	87.12	0.000	0.58
	Error	6365.12	64	99.46			
	Total	430468.00	67				
Metacognition	Group	5055.31	1	5055.31	55.95	0.000	0.47
	Pre-test	3274.76	1	3274.76	36.24	0.000	0.36
	Error	5782.52	64	90.35			
	Total	415260.00	67				

According to the covariance analysis results given in Table 4, there is significant difference between the corrected post-test averages of achievement test and metacognition knowledge scale. The pairwise comparisons revealed that the averages of achievement (p<.001) and metacognitive knowledge levels (p<.001) are much higher in the treatment group. This difference means that the independent variable has a strong effect on the dependent variables. According to these results, it is possible to say that self- and peer assessment applications have an effect on students' both learning and metacognitive knowledge levels.

Furthermore, as given in Appendix 1, the students in the treatment group did self- and peer assessments at the end of each session. Throughout the experiment, a total of eight self- and peer assessment applications were done. To monitor the timely changes in the relationships between self- and peer assessment and at the same time to observe the relationships between self- and peer assessments, correlations were calculated and the results are given in Table 5.

Tablo 5: The correlations between the members' self-assessment, peer assessment, achievement test and metacognition knowledge scores

	Peer 1	Peer 2	Peer 3	Peer 4	Peer 5	Peer 6	Peer 7	Peer 8	Post achiev	Post metacog
Self 1	.01								.25	.34
Self 2		.31							.11	-.21
Self 3			.45*						.27	-.02
Self 4				.52**					.25	.10
Self 5					.58**				.35	.24
Self 6						.65**			.27	.34
Self 7							.60**		.36*	.35
Self 8								.74**	.54**	.59**
Post achiev.	.63**	.40*	.43*	.46**	.41*	.47**	.59**	.68**		.82**
Post metacog	.67**	.54**	.58**	.59**	.52**	.55**	.64**	.75**		

** *p< .01*
* *p< .05*

According to the correlation matrix given in Table 5, it can be seen that the relationships between self- and peer assessment scores vary from 0.01 to 0.74. While the relationships between the self- and peer assessments

were found insignificant in the first 2 sessions, high and significant relationships were observed in the final sessions. Especially, the correlation between self- and peer assessment scores reached its peak in the final session (0.74, $p<.001$). Similarly, the correlations between self-assessment and achievement (.54, $p<.001$) and metacognition (0.59, $p<.001$) were found high and significant in the 8th session. Moreover, all the correlations between peer assessments, post-test scores of achievement and metacognition were found significant. Another significant correlation observed was the one between the post-test scores of scores of achievement and metacognition (0.82, $p<.001$). These correlations show that the self- and peer assessment activities in the treatment group might have an effect on students' assessment skills. Specifically, the high and significant correlations found between the self- and peer assessments and post-test scores of achievement and metacognition in the final sessions reveal that self- and peer assessments may have created an effect on achievement and metacognitive knowledge levels.

RESULTS, DISCUSSION AND SUGGESTIONS

The findings of this research analyzing the effects of self- and peer assessment methods on students' learning and metacognitive knowledge levels during group work reveal that the applications have a positive effect on learning and metacognitive knowledge levels. As it is stated at the introduction, many researchers claim that among alternative assessment methods, self- and peer assessments can improve student characteristics like learning and metacognitive knowledge levels, they examine this under the title of the consequential validity of such assessments. Although the concept of consequential validity is new (See Messick, 1995), many researchers have started to discuss it within the framework of effect of constructivist theory on learning processes and innovations in the area of assessment.

The results obtained in this study are in concordance with the findings of researchers like Boud (1995), Yurdabakan and Cihanoğlu (2009), Hargreaves (2007), Ross (2006) and Sambell et al. It is hoped that results would help the other researchers working on this topic. On the other hand, it can be said that there is a need to inform the users and increase the numbers of studies to improve applications, so that alternative assessment methods, the applications of which started with the 2005 curriculum, could be used in line with their intended purposes

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REFERENCES

Açıkgöz, K.Ü. (2005). *Aktif Öğrenme*. Eğitim Dünyası Yayımları. İzmir.

Anderson, L. W. & Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: *Theory into Practice*, 41(4).

Arter, J. (1997). Using assessment as a tool for learning, in: R. BLUM & J. ARTER (Eds) Student Performance Assessment in an Era of Restructuring, 1-6 (Alexandria, VA; Association for Supervision and Curriculum Development).

Birenbaum, M. (1996). Assessment 2000: towards a pluralistic approach to assessment. In M. Birenbaum, & F. Dochy (Eds.), Alternatives in assessment of achievements, learning processes and prior knowledge (3-29). Boston, MA: Kluwer.

Boud, D. (1995) *Enhancing Learning Through Self Assessment*. Kogan Page, London.

Boud, D. and Falchikov, N. (2006). Aligning Assessment with long-term learning, *Assessment and Evaluation in Higher Education.* 31(4), 399-413.

Cho, K., & Schunn, C. (2003). Validity and reliability of peer assessments with a missing data estimation technique. *World Conference on Educational Multimedia, Hypermedia and Telecommunications,* 3(1), 1511-1514.

Dimitrov D. M., and Rumrill, Jr.P. D. (2003). Pretest-posttest designs and measurement of change. *Work: A Journal of Prevention, Assessment and Rehabilitation,* 20(2):159-165

Dirkes, M. A. (1985). Metacognition: Students in charge of their thinking. *Roeper Review*, 8(2),96-100.

Dochy, F. & Moerkerke, G. (1997). The present, the past and the future of achievement testing and performance assessment. I*nternational Journal of Educational Research*, 27(5), 415-432.

Dochy, F., Segers M., & Sluijsmans, D. (1999). The Use of Self, Peer and Co-assessment in Higher Education: a review. *Studies in Higher Education*. 24(3).

Ernest, P. (1995). The one and the many. In L. Steffe & J. Gale (Eds.). *Constructivism in education.* New Jersey: Lawrence Erlbaum Associates,Inc.

Falchikov, N. (1995). Peer feedback marking: Developing peer assessment. *Innovations in Education and Training International,* 32, 175–187.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist,* 34, 906-911.

Flavell, J. H. (1987). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, 34, 906-911.

Freeman, M. (1995). Peer assessment by groups of group work. *Assessment and Evaluation in Higher Education, 20,* 289–300.

Hargreaves, 2007, The validity of collaborative assessment for learning. *Assessment in Education: Principles, Policy & Practice,* 14(2): 185-199

Honebein, J. (1996). *Seven Goals for the Design of Constructivist Learning.*
http://cter.ed.uiuc.edu/JimL_Courses/edpsy490i/su01/readings/honebein.htm,(Erişim: 15.6.2008).

Johnson, D.W., Johnson, R., & Smith, K. (1998). *Active Learning: Cooperation in the College Classroom.* Edina, MN: Interaction Book Company.

Jonassen, D. H. 1994. Towards a Constructivist Design Model. *Educational Technology,* 34(4), 34-37.

Messick, S. (1995). Validity of psychological assessment. *American Psychologist*. 50 (9), 741-749.

Ploegh K., Tillema H. H., and Segers M.S.R., (2009). In search of quality criteria in peer assessment practices. *Studies in Educational Evaluation,* 35(2-3): 102-109

Ross J. A., (2006). The Reliability, Validity, and Utility of Self-Assessment. *Practical Assessment Research & Evaluation,* 11(10): 1-13

Sambell, K., McDowell, L. & Brown, S. (1997). 'But is it fair?': an exploratory study of student perceptions of the consequential validity of assessment. *Studies in Educational Evaluation,* 23(4), 349-371.

Schraw, G. (2009). A conceptual analysis of five measures of metacognitive monitoring. *Metacognition and Learning,* 4, 33–45.

Shrauger, S. J. & Osberg, T. M. (1981). The relative accuracy of selfprediction and judgements by others in psychological assessment. *Psychological Bulletin,* 90, 322-351.

Somervell, H. (1993). Issues in assessment, enterprise and higher education: the case for self-, peer and collaborative assessment, *Assessment and Evaluation in Higher Education,* 18, 221-233.

Topping K. J. (2005). Trends in Peer Learning. *Educational Psychology,* 25(6),631–645

Van den Berg I., Admiraal W. & Pilot A. (2006) Design principles and outcomes of peer assessment in higher education. *Studies in Higher Education,* 31(3), 341–356

Webb, N. M. (1997). Assessing students in small collaborative groups. *Theory into Practice,* 36 (4), 205-213.

Wilson, B. G., & Cole, P. (1991). A review of cognitive teaching models. *Educational Technology Research & Development Journal*. http://carbon.ucdenver.edu/~bwilson/hndbkch.html (Erişim: 20 Mayıs 2009).

Yıldız, Akpınar, Tatar and Ergin (2009). Exploratory and Confirmatory Factor Analysis of the Metacognition Scale for Primary School Students, *Educational Sciences: Th eory & Practice,* 9(3), 1591-1604

Yurdabakan, İ. (2011a). The investigation of peer assessment in primary school cooperative learning groups with respect to gender. *Education 3-13.* 39(2), 153-169

Yurdabakan, İ. (2011b). The View of Constructivist Theory on Assessment: Alternative Assessment Methods in Education, *Ankara Universty, Journal of Faculty of Education Sciences,* 44(1), 51-77.

Yurdabakan ve Cihanoğlu (2009). Öz ve akran değerlendirmenin uygulandığı işbirlikli okuma ve kompozisyon tekniğinin başarı, tutum ve strateji kullanım düzeylerine etkisi, *DEÜ, SBE Dergisi,* 11(4),105-123

**Appendix-1: Preliminary and main session in the treatment group**

Preliminary Sessions	Date	Aim
1	22.10.2010	Introduction of the procedures to be used in the cooperative learning and cooperative applications and their sample applications.
2	25.10.2010	Presentation of the self- and peer assessment in every detail and teaching its relationship with the group work and a sample application.
3	28.10.2010	Explanation of the importance of belongingness to a group that takes place in cooperative applications, discussion of feedback and cooperation by using some sample applications.
4	1.11. 2010	A sample application on each student's taking responsibility and using his/her time efficiently in cooperative applications.
5	5.11.2010	Introduction of the jigsaw method and a sample application.
6	8.11.2010	Introduction of the student teams achievement divisions (STAD) method and a sample application.
7	12.11.2010	Introduction of the group investigation technique and a sample application.
Pre-Test	20.11.2010	Pre-test application of Science and Technology course achievement test and metacognitive knowledge scale.
Main Sessions	**DATE**	**AIM**
8	22.11. 2010	Processing the topic called "Our skeleton and its parts" with jigsaw technique. Application of the self- and peer assessments and giving/receiving feedback.
9	26.11. 2010	Processing the topic called "Bone types and joints" with STAD technique. Application of the self- and peer assessments and discussion.
10	29.11. 2010	Processing the topics called "The structure of our muscles and their tasks", "The skeleton and muscle relation in action" and "Our skeleton and muscle

|		
		health" with the group investigation technique.
11	3.12.2010	Continuing the topics called "The structure of our muscles and their tasks", "The skeleton and muscle relation in action" and "Our skeleton and muscle health" with the group investigation technique.
12	6.12.2010	Continuing the topics called "The structure of our muscles and their tasks", "The skeleton and muscle relation in action" and "Our skeleton and muscle health" with the group investigation technique. Application of the self- and peer assessments and providing/receiving feedback.
13	10.12.2010	Processing the topic called "Breathing" with jigsaw technique. Application of the self- and peer assessments and giving/receiving feedback.
14	13.12.2010	Processing the topic called "The circulation of the blood in the body" with the group investigation technique. Application of the self- and peer assessments and discussion of the results.
15	17.12.2010	Processing the topic called "We are counting our pulse". The application of the self- and peer assessments and discussion.
16	20.12.2010	Processing the topics called "Exercise and pulse relation" and "Exercise and breathing relation." Application of the self- and peer assessments and providing/receiving feedback.
17	24.12.2010	General revision with the student teams achievement divisions method, application of the self- and peer assessments and discussion of feedback.
The Final Test	27.12.2010	Post-test applications of the Science and Technology course academic achievement test and metacognitive knowledge scale.

Appendix-2: The Samples of the Achievement Test, Self and Peer Assessment Forms

1. Some Sample Test Items from the Achievement Test:

Question 1:
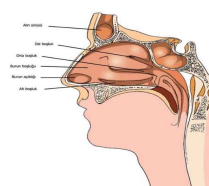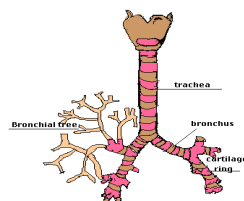
Nose   Trachea   Pharinx

Which task remains unrelated if we match the following tasks with the organs above?

A) Taking the air we breathe to the lungs
B) Clarifying the air we breathe from dust
C) Increasing the oxygen in the air we breath
D) Directing the air we breathe and the nutrients to suitable places

Question 2:

In the following table, people's average pulse numbers in one minute according to their developmental period are given.

Developmental Period	Average Pulse Number
Infancy	100-120
Childhood	80-100
Adulthood	70-80
Old Age	60-70

According to this, in which developmental period is a healthy person with a pulse number of 120 in 2 minutes?
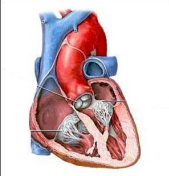
A) Infancy
B) Childhood
C) Adulthood
D) Old Age

Question 3:

- It carries the oxygen and nutrients to the body.
- It collects the carbondioxide in the body.

According to the information given above, which of the following images can be placed in "?"?

A)   B)   D)

2. Some sample items from the self-assessment form:

SELF-ASSESSMENT FORM

Activitiy: _____   **Date : ….../….../……**
Student: _____
Class and Number: _____

1. What did I learn in this activity?
_____
2. What did I do better? Why? Out of 10, how many points do you give to yourself? _____
_____

3. What were the difficult parts? Why? _____

_____

4. Where did I need help? _____

_____

5. In which area should I improve myself? _____

_____

6. If I have a chance to repeat this activity how would I do it? _____

_____

7. What will I do differently in the upcoming studies? _____

_____

3. Some sample items from the self- and peer assessment forms measuring the group work skills:

Please answer by circling one of these choices:

Very good (5), Good (4), Average (3), Bad (2), Very bad (1)

Group Members	Self	Peer 1	Peer 2 …
1. Is volunteered to take responsibility.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
2. Fulfills his/her responsibilities.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
3. Fulfills his/her responsibilities on time.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
4. Participates the group discussion.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
5. Contributes positively to discussions.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
6. Contributes to group work.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
7. Shares the group work.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
8. Communicates with the other members.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
9. Helps the others' learning.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
10. Brings the learning material to class.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
11. Uses materials clean and tidy.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
12. Does his/her homework on time.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
13. His/Her general participation to group work.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
TOTAL SCORE			

4. Sample items from the self- and peer assessment forms measuring the cognitive learning levels:

Name Surname: ………………………………………………………….

Please answer by circling one of these choices:

Very good (5), Good (4), Average (3), Bad (2), Very bad (1)

Group Members	Self	Peer 1	Peer 2…
1. Knows that, while inhaling, the oxygen needed for our body is taken in from outside.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
2. Knows that, while exhaling, carbon dioxide harmful for our body is thrown outside.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
3. Knows the structures and organs in charge of breathing.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
4. Knows which organs the air passes through while breathing.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
5. Shows on a model the route of the air while breathing.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
6. Knows that we should inhale through the nose.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
7. Knows that we should exhale through the nose.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
8. Knows correct breathing.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
9. Knows the importance of correct breathing.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
10. Realizes the change in breathing frequency during exercise.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
11. Knows that the frequency change in breathing during exercise is healthy for our body.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
12. States the factors affecting the breathing frequency except for the exercise time.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
13. His/her general knowledge on this topic.	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)	(5)(4)(3)(2)(1)
TOTAL SCORE			