Comparison of individual answer and group answer with and without structured peer assessment

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Comparison of individual answer and group answer with and without structured peer assessment

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**Background:** Cooperative learning activities provide active participation of students leading to better learning. The literature suggests that cooperative learning activities need to be structured for a more effective and productive interaction.

**Purpose:** This study aimed to test the differences among three instructional conditions in terms of science achievement.

**Sample:** A total of 79 fifth-grade students, 42 males (53%) and 37 females (47%), participated in the study.

**Design and Methods:** In the first condition, students answered the teacher’s questions individually by raising hands. In the second condition, students discussed the answer in groups and came up with a single group answer. In this condition, the teacher provided only verbal directions to the groups without using any strategy or material. In the third condition, students used a ‘peer assessment form’ before giving the group answer. A pre-/post-test experimental design was used. Multiple-choice and open-ended tests were used for data collection. One-way analysis of variance (ANOVA) was conducted to test the differences in the test scores between the three groups (individual answer, unstructured group answer and structured group answer).

**Results:** Results showed that there were no significant differences among the three learning conditions in terms of their multiple-choice test scores. In terms of the open-ended test scores, students in the structured group answer condition scored significantly higher than the students in the individual answer condition.

**Conclusions:** Structuring the group work through peer assessment helped to monitor the group discussion, provided a better learning compared to the individual answer condition, and helped students to participate in the activity equally.

**Keywords:** individual answer; group answer; peer assessment; cooperative learning; science achievement

**Introduction**

Research shows that students’ active participation in the learning activities and encouraging them to respond to teacher’s questions lead to a better learning (Cavanaugh, Heward, and Donelson 1996; Christle and Schuster 2003; Gardner, Heward, and Grossi 1994; Kellum, Carr, and Dozier 2001; Marmolejo, Wilder, and Bradley 2004). Active participation is an important predictor of academic achievement. However, while asking instructional questions, teachers usually use hand raising technique that allows only one student to answer (Christle and Schuster 2003).
Student response is described when a student responds orally or in writing to an instructional question, with or without hand raising (George 2010).

Even though a teacher allows several students to respond through hand raising, a large portion of the students does not get the opportunity to participate (Christle and Schuster 2003; George 2010; Randolph 2007). Thus, it is a limited technique in terms of active participation of all students in the classroom. Another point is that, in general, only few students voluntarily tend to participate in the activities (Christle and Schuster 2003; Graham et al. 2007; Lambert et al. 2006). Strategies that encourage the participation of the whole class are needed when instructional questioning technique is used (Christle and Schuster 2003; Narayan et al. 1990). Some of the strategies that were used to increase participation were choral responding, where all students respond simultaneously, and timed activities where students were expected to finish an activity within a given period of time through response cards or boards (Heward 2000 as quoted in Christle and Schuster 2003).

One approach that increases student participation is sharing individual ideas with the group and providing a group answer to the teacher’s question (Hancock 2004; Kulatunga and Lewis 2013; Luangrath and Pettersson 2012; Moore 1998; Wiesendanger and Bader 1992). When a group is asked to answer, first, group members are given some time to think and write their answers. Then, they discuss their answers among themselves. Finally, the teacher ends the discussion session (Bartlett 2006; Crouch and Mazur 2001; Ebert-May, Brewer, and Allred 1997). After this session, two strategies can be used: one is to ask students to revise their individual answers, and second is to ask the group to give a consolidated answer reached by a consensus. Groups share their answers among themselves in the class.

Providing a group answer after the discussion in the group can be an example of cooperative learning. Cooperative learning has been defined by Topping and Ehly as ‘small groups in which students have to jointly organize their time and resources to work toward some specific goal’ (as quoted in Topping et al. 2011, 91). It is stated that when students discuss the answer in the groups, the instruction shifts from a teacher-centred passive form to a student-centred active learning (Crouch and Mazur 2001; Ebert-May, Brewer, and Allred 1997). Providing group answer might seem like a simple process; however, it must have the characteristics of cooperative learning in order to benefit the students. Studies have shown that when group learning is not structured, students might answer questions based on their own knowledge and experience without taking into account the group discussion (Hansen, Owan, and Pan 2006). They might come up with an answer without adequately discussing in the group (Hancock 2004); or group members might have difficulty in providing a group answer (Liu and Kao 2005). In order to avoid these problems, teachers need to structure the group activity in a way that all members of the group equally participate in the learning activity and easily come up with a group answer after reaching a consensus (Ebert-May, Brewer, and Allred 1997; Liu and Kao 2005). In order to increase peer interaction and individual participation, the peer assessment approach is recommended.

‘Peer assessment is an arrangement for learners to consider and specify the level, value, or quality of a product or performance of other equal status learners’ (Topping 2009, 20). Peer assessment of student contribution increases the participation of group members in activities and restrains their tendency to act as a free rider (Brooks and Ammons 2003; Divaharan and Atputhasamy 2002; Freeman 1995; Kench et al. 2009). For a more effective participation, the peer assessment approach
can go beyond solely assessing the individual contribution of students. For example, it can include assessment of written reports, and answers or products of individual students by their peers. Hence, peer assessment can be used to enhance classroom discourse (Gan 2011). Students’ products can include writings, oral presentations, portfolios, test performance, or other behaviours. Peer assessment is conducted in the form of reciprocal exchange, either face to face or in written form among the assessors and assessees (Topping 2009). The current study involves the most common type of feedback, outcome feedback, also known as knowledge of results. It is the information describing whether or not the results are correct, or the steps are implemented appropriately (Butler and Winne 1995).

Related literature suggests that cooperative learning activities need to be structured for a more effective and productive interaction (Gillies and Ashman 1998; Gillies 2008; Kaldi, Filippatou, and Anthopoulou 2013). In the current study peer assessment was used as a structuring strategy in group discussions with the purpose of increasing student achievement. Previous studies on this matter are descriptive and the use of peer assessment during instructional questioning has not been tested yet through an experimental design.

**Purpose**

This study aimed to test the differences among three conditions of answering instructional questions in terms of science achievement. In the first condition, students answered the teacher’s questions individually by raising hands. In this condition, the teacher allowed at least four students to answer the same question one by one. In the second and third conditions, students worked in groups of four. In the second condition, students discussed the answer in their groups and came up with a single group answer. The teacher checked the answers quickly and evaluated. The teacher gave only verbal directions to groups without using any strategy or material. In the third condition, students used the ‘peer assessment form’ (see Figure 2) before giving a group answer. The purpose of this form was to evaluate each individual answer in the group and give feedback before deciding the group answer. This checklist form revealed the levels of agreement and disagreement among group members and prepared them for the group discussion (Sluijsmans, Dochy, and Moerkerke 1998).

There are two main goals of this study. First, is to compare the individual answer condition through hand raising with the group answer conditions in terms of student learning; and the second is to test if structuring the group work provides an extra benefit compared to individual answer condition. Structured group answer strategy was expected to reduce the previously mentioned problems during group work and enhance students’ learning.

**Method**

The current study used a pre-/post-test experimental design. The independent variables were the three conditions of answering instructional questions: ‘individual answer’, ‘unstructured group answer’ and ‘structured group answer’. The dependent variable was the fifth-grade science achievement. At the time of the study, the groups were learning the topic ‘Light’ in science.
**Participants**

A total of 79 fifth-grade students, 42 males (53%) and 37 females (47%), participated in the study. Students were randomly assigned to three different instructional conditions. There were 26 students in the ‘individual answer’ condition, 27 students in the ‘unstructured group answer’ condition and 26 students in the ‘structured group answer’ condition. A primary school with standardised test scores above the national average and low rates of absenteeism and dropout was selected for the study. The average age of participating students was 11.4 years.

**Design and treatment**

As shown in Figure 1, before the treatment, groups received a science achievement test. There were no statistically significant differences among the groups based on their pre-test scores ($F_{(2,76)} = 0.222$, $p > .05$). The pre-test included only multiple-choice items but not open-ended ones. One of the reasons for this was to reduce the familiarity effect (Büyüköztürk et al. 2008). Furthermore, the main purpose of the pre-test was to examine whether there were any differences among groups in terms of achievement. Pre-test scores for the nationwide tests were also compared. Again, there were no statistically significant differences among the groups ($F_{(2,76)} = 1.435$, $p > .05$). In the experiment, the lessons were taught by the same science teacher to all the groups. The teacher was a female with 20 years of experience. The teacher voluntarily participated in the study and she was highly rated by the school administration.

There were four lessons lasting a total of 160 mins. Students received the post-test after the treatment and the groups were compared in terms of their science achievement. As mentioned above, the post-test included both multiple-choice and open-ended items.

In all three conditions, the content and evaluation of the lessons were the same. The only difference was the different way of instructional questioning. In order to ensure the congruency among conditions, detailed lesson plans were developed by the teacher with the assistance of the researchers beforehand. All three groups received the same instructional questions in the same order. A total of 16 instructional questions (four per lesson) were asked to the groups. All of the
questions were open ended, comparison, cause and effect or interpretation type questions; short-answer, verification, disjunctive or concept-completion type questions were excluded. Following are some of the examples of instructional questions posed by the teacher:

- ‘When we change the number of batteries in a circuit, what would be the dependent, independent and constant variables?’
- ‘Where do we use natural light sources in daily life? Give two examples.’
- ‘Why do street lights look smaller when you move away from them?’

**Individual answer condition**

In the individual answer condition students answered the teacher’s questions individually by simply raising hands. In this condition, the teacher allowed at least four students to answer the same question one by one. The students answered orally and each student was responsible for his/her own answer, since there were no group discussions.

**Unstructured group answer condition**

In the second experimental condition, students discussed the answer in their groups and came up with a single consolidated group answer. In this group, students were required to write down their individual answers after the teacher posed the question. Later, each student shared his/her answer with the group. Groups were encouraged to discuss individual answers and come up with a single consolidated group answer. The group answer was written on a card and all the cards were raised at the same time. The teacher checked the answers quickly and did her evaluation. In this condition, no extra strategy or material was used other than giving verbal instructions to the groups. There might have been interactions among students that involved peer assessment or peer feedback in this group. However, these interactions were not structured. Therefore, this condition was named as ‘unstructured group answer’ condition.

**Structured group answer condition**

In the third experimental condition, similar to the second condition, students wrote down their individual answers after the teacher posed the question. Different from the second condition, groups in this condition used the ‘peer assessment form’ shown in Figure 2. The purpose of this form was to evaluate each individual answer in the group and give feedback before deciding on the group answer. This was named as ‘structured group answer’ condition, because the process of peer assessment and group answering within the group was implemented in a guided and structured way.

**Peer assessment form and implementation**

As shown in Figure 2, the peer assessment form had two sections. The first section contained questions with separate spaces for individual student’s answers. The second section contained boxes with the names of other group members. The students assessed other group members for their answers as ‘correct’, ‘partly correct’ or ‘incorrect’.
The use of the peer assessment form had two phases: individual answer and peer assessment. In the first phase, students wrote down their individual answers after the teacher posed the question. Then, group members passed the form clockwise in the group. Group members examined the answers on the form they received and checked the answers as ‘correct’, ‘partly correct’ or ‘incorrect’. The cycle was ended when all the forms in the group were filled by all the members. Thus, group members assessed their peers’ answers and received feedback on their own answers. This phase provided data for the group discussion. After the second phase, all the forms were collected in the middle of the table and the discussion was started. The discussion was mainly focused on resolving the disagreements. After the discussion, groups decided on a group answer and wrote the answer on a card. The cards from all groups were collected at the same time and the teacher evaluated the answers.

Data collection instruments

Two data collection instruments were used in this study – multiple-choice and open-ended tests. Both the tests were designed based on the curriculum objectives and specialists’ opinions. Detailed information about these instruments is given below.

Multiple-choice test

There were 19 questions in the multiple-choice test based on the objectives of the fifth-grade science curriculum described by the Turkish Ministry of Education. The test was developed by the teacher and revised by two specialists. In terms of cognitive processes in the test, students were expected to use understanding and applying
skills according to Bloom’s revised taxonomy. The highest possible score on the multiple-choice test was 19. The reliability value for the multiple-choice test was computed as KR-20 = 0.75. The average difficulty was 0.68, and the average discrimination of test items was 0.44.

Open-ended test
As in the multiple-choice test, open-ended questions were also based on the objectives of the fifth-grade science curriculum. A total of 13 open-ended questions were included in the test after the specialists’ revisions. Open-ended questions were scored by the teacher and the researcher, independently. The inter-rater reliability value between the two assessors was 0.92. The highest possible score on the open-ended test was 100.

Data analysis
In order to test the differences in the multiple-choice and open-ended test scores of three conditions (individual answer, unstructured group answer and structured group answer), one-way analysis of variance (ANOVA) was conducted in SPSS 18.

Results
The data were tested for normality before determining the significant differences among the groups. For multiple-choice test, Kolmogorov-smirnov test results showed that the data had normal distribution for all three groups ($Z_{group A} = 0.888, p > .05$; $Z_{group B} = 0.709, p > .05$; $Z_{group C} = 0.637, p > .05$). Similarly, data from open-ended tests showed normal distribution for all three groups ($Z_{group A} = 0.540, p > .05$; $Z_{group B} = 0.898, p > .05$; $Z_{group C} = 0.675, p > .05$).

Table 1 displays the descriptive statistics of science multiple-choice test and open-ended test scores in three different learning conditions. As seen in Table 1, in the multiple-choice test, the average score of the students in the individual answer condition was $M = 13.42$ ($SD = 3.84$), the students in the unstructured group answer condition scored $M = 12.59$ ($SD = 2.89$), the students in the structured group answer condition scored $M = 12.92$ ($SD = 3.67$).

Table 2 shows the results of one-way analysis of variance (ANOVA). Accordingly, there were no significant differences among the three learning conditions in

<table>
<thead>
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<th>Learning conditions</th>
<th>N</th>
<th>Mean</th>
<th>SD</th>
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<td></td>
<td></td>
</tr>
<tr>
<td>Individual Answer</td>
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<td>3.84</td>
</tr>
<tr>
<td>Unstructured Group Answer</td>
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<tr>
<td>Total</td>
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<td>12.97</td>
<td>3.47</td>
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<tr>
<td>Open Ended Test</td>
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<td></td>
<td></td>
</tr>
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<td>Structured Group Answer</td>
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<td>12.35</td>
</tr>
<tr>
<td>Total</td>
<td>79</td>
<td>54.74</td>
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</tr>
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</table>
terms of their multiple-choice test scores \((F_{(2, 76)} = 0.377, p > .05)\). In other words, answering the teacher’s questions individually by raising hands, or in a group in an unstructured or structured way did not make any difference in students’ multiple-choice test scores.

On the other hand, as seen in Table 2, there were significant differences among the three learning conditions in terms of their open-ended test scores \((F_{(2, 76)} = 3.536, p < .05)\). The post hoc test results showed that the students in the structured group answer condition \((M = 59.32, SD = 12.35)\) scored significantly higher than the students in the individual answer condition \((M = 49.70, SD = 12.78)\). There was no other significant difference among instructional conditions in terms of their open-ended test scores.

**Discussion**

There were two main findings in this study. One of them was that there was no difference in the science achievement of individual answer and unstructured group answer conditions. The other finding was that the students in the structured group answer condition scored higher than the students in the individual answer condition, but only in the open-ended test.

Previous research reported positive effects of group work based on cooperative learning on student achievement (Johnson, Johnson, and Stanne 2000; Slavin 1991). Group learning can be more effective than teacher-centred individual learning since students may have a better understanding of each other’s way of thinking and it provides opportunities for reciprocal teaching (Ebert-May, Brewer, and Allred 1997; Gillies 2008; Jacobs et al. 1998). Moreover, working together to achieve a learning goal helps students to actively participate, compared to individual learning conditions (Crouch and Mazur 2001; Ebert-May, Brewer, and Allred 1997). Individual answering through hand raising, on the other hand, is limited in terms of interaction and active participation (Christle and Schuster 2003; George 2010; Graham et al. 2007; Lambert et al. 2006; Randolph 2007).

Despite the advantages of group learning, the current study could not find any difference between the individual answer condition and unstructured group answer condition in terms of science achievement. This finding indicates that group work needs to have certain characteristics in order to make a difference in students’ learning. Previous researchers have reported some issues in the group work if it is not well designed. For example, group activities may be dominated by certain students (Brooks and Ammons 2003; Divaharan and Atputhasamy 2002; Kench et al. 2009;
Salomon and Globerson 1989; Strong and Anderson 1990) or groups may have difficulty in reaching consensus due to lack of democracy in the group (Bechman 1990). If teachers do not monitor the group work, there might be some problems in listening, asking questions or answering within the group (Harwood 1995). When not monitored effectively, several students might stay passive during group work and only a few students can participate actively. This contradicts with the main objective of cooperative learning, which is the high motivation and participation of all members in the group (Ebert-May, Brewer, and Allred 1997; Liu and Kao 2005). Johnson and Johnson (2002) emphasised that managing group work requires a series of cognitive processes. When these cognitive processes are not monitored or guided by the teacher, group work might seem complex and difficult for students.

In the unstructured group condition in this study, students were required to write down their individual answers and discuss their answers with other group members. Then, groups came up with a single group answer. No strategy was used in this group in order to monitor the group discussion. This lack of monitoring might have caused some students to dominate the group and might have resulted in an ineffective group discussion. Gillies (2008) stated that even though cooperative learning promotes student learning, simply placing students in groups and expecting them to work together without any structure or guidance may not be beneficial.

The current study found significant differences in the achievement of students in the individual answer condition and students in the structured group answer condition. In the structured group answer condition students used a peer assessment form before the group discussion. Structuring the group work in this way helped monitor the group discussion and provided a better learning outcome compared to the individual answer condition. This finding supports the literature about the significance of structuring cooperative learning (Gillies and Ashman 1998; Gillies 2008; Kaldi, Filippatou, and Anthopoulou 2013).

Structuring the group work through peer assessment provided some benefits that were not observed in the unstructured group answer condition. First, all of the students were participating and interacting with each other. It is highly likely that the idea of assessing other students’ answers and being assessed by other students gave the group members a sense of responsibility; thus, they might have been more precise and careful in writing their answers. Through this process, no matter how dominant some students were, each student equally participated in the activity. On the other hand, in unstructured group work, students might have had difficulties in peer assessment or peer feedback, since only verbal guidance was provided. Descriptive studies showed that students at the elementary level prefer working individually rather than as a group. This might be due to ineffective or poorly structured group work experiences (Antil et al. 1998; Baines, Blatchford, and Kutnick 2003; Gillies 2003). It was observed in the current study that when group activity is effectively designed and implemented, not only the aforementioned problems are reduced but also student learning is improved.

There were learning differences between the individual answer and structured group answer conditions in the open-ended test but not in the multiple-choice test. Regardless of the question format, both tests focused on higher-level thinking skills such as interpretation, explanation, prediction and drawing conclusion. In the multiple-choice tests, students were given a list of possible answers and asked to select the best answer. However, in the open-ended tests, the participants were required to write their answers without any clue or example (Ackerman and Smith 1988; Hall...
The above characteristic, as well as the chance factor in the multiple-choice test, may be a cause for the students not showing desired performance.

**Conclusion**

The findings of this study indicated that peer assessment is a valuable tool in evaluating student learning and can be used in addition to teacher’s assessment in classroom (Falchikov and Goldfinch 2000; Van Gennip, Segers, and Tillema 2010). Future studies might focus on other aspects of group work and peer assessment, for example, the quality of students’ answers, how much of the individual answers is reflected in the group answer, the discourse within the groups, the effect of social and academic levels of students on group work, and the effect of homogeneous and heterogeneous grouping.

**References**


