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A Design Practice For Interactive- Direct Teaching Based On Constructivist Learning (IDTBCL): Dissolution And Solutions

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Abstract

In the interactive direct teaching based on constructivist learning (IDTBCL) is evaluated as a mental transition or an oriented change from understanding (two dimensions) to conception (three dimensions). This approach focuses on a conceptual structure. Dissolution and the solution are subjects of common misconceptions. Therefore, these concepts have been selected as reference ones for the design practice. In this study, participants are fifty students whose are attending at a high school in Turkey. The halves of participants are selected as experimental group and control group, respectively. Pretest-posttest with control group, which is the one of the quasi-experimental research design, was used for applications. In traditional group (control group), the same instructor used behaviorist approach, and the interactive direct instruction based on constructivist learning (IDTBCL) was done in experimental group during two weeks. Before applications, a conceptual test was administrated to the groups as a pretest. According to pretest results, there was no difference between the groups in terms of conceptual achievement. Although teaching in each group is performed by the same instructor, there is a significantly difference between groups related to the instructor’s the mentality about learning. The significant positive difference in the experimental group can be attributed to the students’ positive attitude toward to the conceptualization and the creation of three- dimensional mental space of the knowledge e.g. about the concepts dissolution and the solution concepts. Accordingly, it may be said that the model of interactive direct teaching-based constructivist learning (IDTBCL) of education in terms of the practice of teacher-centered active learning or meaningful learning can to be an extremely promising approach.

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Keywords: Constructivist learning; direct teaching; interactive direct instruction; constructivist learning-based interactive direct instruction model (IDTBCL).

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1. Introduction

All activities in the classroom are aimed to a permanent change as behavioral, cognitive and affective in the learners’ mind. Therefore, many instructional models have been administrated to teach concepts such as behaviorist and constructivist etc. A world-wide formal teaching practice related with courses is almost entirely a teacher-led one. Therefore, main problem to be addressed is what will be learners’ position in teacher-led applications in terms of mental arrangement and the realization of meaningful learning (Gürses and Doğar, 2013). In order to permanent learning, the meaningful learning should be provided. Ausubel (1963; 1968) proposed a classical cognitive view of meaningful learning. The basis of this perspective is the non-arbitrary and no verbatim cognitive interaction between the new knowledge, potentially meaningful, and some specifically relevant knowledge. In the classical view the single most important factor influencing learning is what the learner already knows. Joseph Novak who is Ausubel’s partner and coauthor of the second edition of the basic reference book on meaningful learning gives to meaningful learning a humanistic connotation, proposing that it is subjacent to the constructive, positive, integration of thinking, feeling, and acting, leading to human empowerment. The social interactionist view of meaningful learning comprises the triadic approach (learner ↔ teacher ↔ educative materials of the curriculum) of Gowin (1981). It is a basically social-interactionist perspective, in which the teaching-learning process is understood as a negotiation of meanings that aims at the sharing of meanings in relation to the educative materials of the curriculum. According to Ausubel’s classic idea, meaningful raises for learning the interaction promoted between new and prior knowledge is, for sure, quite adequate. Nonetheless, little has been said about how the interaction happens. Johnson-Laird’s mental models theory (1983) offers an explanation on how this cognitive interaction might happen: when facing a new knowledge, a new situation, the first mental representation the subject constructs, in his/her working memory, is a mental model (a structural analogue of the situation). Depending on the circumstances, this representation can get stabilized and can evolve to a Piagetian assimilation that is, the construction of a mental model may be understood as the first step for meaningful learning. Such construction reflects an intentionality of the learner because if he/she constructs a mental model it is because he/she wants to solve the situation and to assign meanings to the new knowledge. The research on human cognitive architecture, on how information is acquired, stored and retrieved (Kirschner, Sweller and Clark, 2006). Although the major work on human cognitive architecture occurred, after the teacher effects research had ended, this research on information processing fits the findings on classroom instruction quite well and adds to our understand of the findings from the teacher-effects research (Rosenshine & Stevens, 1986). Cognitivist paradigm (learning theory) is the theory relates to early stages of learning where the learner solves well defined problems through a series of stages with assistance from an instructor (Bruner, 1960 and 1971; Piaget, 1926; Vygotsky, 1962 and Wood, 1986). The developmental theory of Jean Piaget who believed development was a universal process, has been criticized on the grounds that it is conceptually limited, empirically false, or philosophically and epistemologically untenable (Lourenço & Machado, 1996). In the literature, it is reported some constructivist approaches Good, Wandersee & St. Julien, 1993; Matthews, 1994; Phillips, 1995). They are information processing, interactive-constructivist, social constructivist and radical constructivist. They are based on lessening teacher-led and increasing student-led. The interactive-constructivists dispute that learning has both public and private components (Hennessey, 1994; Shymansky, 1994; Reich, 2007). The students and teachers are responsible for instructional process in an interactive-constructive model. The interactive-constructivist approach accepts the essential constructivist assumptions (Yore, 2001). We thought that a real constructivist change in terms of learning requires a more comprehensive change beyond the grasp of understanding. For this, it is tried to propose a novel model that depends on rearrangement of interactive direct teaching approach or effective instruction on the basis of the constructivist learning. In this model named as Interactive Direct Teaching Based on Constructivist Learning (IDTBCCL) learning is evaluated as a mental transition or an oriented change from understanding (two dimensions) to conceptualization or conception (three dimensions). Gürses and Doğar (2013) proposed the basic assumptions of model:

- It should be searched learner’ cognitive and awareness level about subject to be taught
- Interaction between instructor and learners should be consistently stimulated
- Conceptualization requires using of inductive and deductive processes by both instructor and learner.
- Conceptualization success depends on the depth of instructional content instead of its superficiality.
- Learners should be periodically incorporated to instruction with some activities outside the classroom.
In this study, we aimed to investigate the effectiveness of the interactive direct based constructivist instruction on students’ achievement and attitude.

2. Methods

In practice, pre-test-post-test with control group, which is a technique of quasi-experimental research design, was used (Büyüköztürk, 2001). In the control group, lessons were taught by traditional approach and the interactive direct based constructivist instruction approach was treated in the experimental group.

2.1. Sampling

Grade-10 students of 50 attending in a high school in Turkey were selected as sampling. The half of students is experimental group and the other part was chosen as control group.

2.2. Procedure

The dissolution and solutions have been selected as research subjects which are the main topics. The subject was treated by the same instructor with traditional methods of dissolution and the solution during two weeks in the control group. In the experimental group, the issue of dissolution and solution was treated by the same instructor using in the same time.

2.3. Data Collection Tools

The data collection instruments used in this study: Conceptual achievement test (CCT) and the attitude towards to the interactive direct based constructivist instruction method scale. Conceptual achievement test consists of 22 multiple-choice questions and the reliability coefficient (Cronbach alpha) was found to be 0.77. A measurement instrument to be included in one of the most important features is reliability. Some of the questions in the test were prepared by researchers and from literature (Larson, 2013). Additionally, in order to determine the attitude towards to IDTBCL of the students, a developed scale by Demant and Yates (2003) was modified and administrated to experimental group. The scale consists of 23 questions and two sections. In Section A, Likert-type 9 questions with seven options, in Section B, indicate the 13 questions of the students’ attendance, and one open-ended question to express their ideas. The part A of the test questions includes their attitude towards students on the methodology applied and the students’ awareness on IDTBCL is scored in section B.

2.4. Data analysis

After the application, qualitative and quantitative research methods are used together. Pre-test and post-test scores were performed using SPSS 18.0 software package. After treatments, pre-test scores between the experimental and control groups were performed with the t-test. Then, the ANCOVA was administrated to post-test scores (Demant and Yates, 2003).

3. Results

On behalf of the application of the effectiveness of the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) on students’ achievement, there is no difference the pre-test scores between the experimental group and the control group significantly (See table 1). In this case, it is said to be homogeneous. After the treatment, posttest was administrated to the groups. The analysis of covariance in order to determine the effect of the treatment was performed.
Table 1. T-test analysis

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. dev.</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>10.24</td>
<td>2.743</td>
<td>-.282</td>
<td>.779</td>
</tr>
<tr>
<td>Experimental</td>
<td>25</td>
<td>10.44</td>
<td>2.256</td>
<td></td>
<td></td>
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<tr>
<td>Posttest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>25</td>
<td>13.48</td>
<td>4.445</td>
<td>-4.353</td>
<td>.000*</td>
</tr>
<tr>
<td>Experimental</td>
<td>25</td>
<td>17.72</td>
<td>1.990</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p<.05

Table 1 shows that the standard deviation of the experimental group is lower than the control group. This success of the students in the experimental group was closer to each other. This indicates that there is close group homogeneity. In the control group, in terms of students’ achievement was not a complete homogeneity. According to the results of the post test, the experimental group is more successful than the control group. Additionally, there is a significant difference between groups in terms of posttest scores in the favor of experimental group (see Table 2). In this case, it can be said that the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) effects positively on the students’ success compared to the traditional group.

Table 2. ANCOVA results

<table>
<thead>
<tr>
<th>Source</th>
<th>Type III Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>244.715*</td>
<td>2</td>
<td>122.357</td>
<td>10.470</td>
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<tr>
<td>Intercept</td>
<td>893.216</td>
<td>1</td>
<td>893.216</td>
<td>76.429</td>
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</tr>
<tr>
<td>Pretest</td>
<td>19.995</td>
<td>1</td>
<td>19.995</td>
<td>1.711</td>
<td>.197</td>
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<tr>
<td>Groups</td>
<td>229.822</td>
<td>1</td>
<td>229.822</td>
<td>19.665</td>
<td>.000*</td>
</tr>
<tr>
<td>Error</td>
<td>549.285</td>
<td>47</td>
<td>11.687</td>
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<td></td>
</tr>
<tr>
<td>Total</td>
<td>12962.000</td>
<td>50</td>
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<td></td>
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<tr>
<td>Corrected Total</td>
<td>794.000</td>
<td>49</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

a. R Squared = .308 (Adjusted R Squared = .279)

*p<.05

The Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) model provided participation of the students in each course and was more impact on students’ learning (Doğar, Gürses and Dalga, 2013). This reflects positively on the attitudes of students. Table 3 and Table 4 depict that the students’ attitude towards to the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) model.

Table 3. The Attitudes Toward to IDTBCL Scale descriptive results: Section A data

<table>
<thead>
<tr>
<th>Section A: Item no</th>
<th>Certainly disagree</th>
<th>Partly disagree</th>
<th>Disagree</th>
<th>No comment</th>
<th>Agree</th>
<th>Partly agree</th>
<th>Absolutely agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
<td>f</td>
<td>%</td>
<td>f</td>
</tr>
<tr>
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<td>2</td>
<td>8</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>32</td>
<td>7</td>
<td>28</td>
<td>1</td>
<td>4</td>
<td>6</td>
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<td>1</td>
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<td>-</td>
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<td>4</td>
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<td>4</td>
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<tr>
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<td>40</td>
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<td>16</td>
<td>1</td>
<td>4</td>
<td>5</td>
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<td>3</td>
<td>12</td>
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<td>32</td>
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<tr>
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<td>8</td>
<td>32</td>
<td>5</td>
<td>20</td>
<td>2</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

When the above data was examined, it can be concluded that the students’ with a score of 36 and above from attitude towards to the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) model develop a positive attitude and its ratio is 72.0% (Demant and Yates, 2003).

Table 4. The Attitudes Toward to IDTBCL Scale descriptive results: Section B data

<table>
<thead>
<tr>
<th>Section B</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
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<th>10</th>
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<tbody>
<tr>
<td>f</td>
<td>17</td>
<td>24</td>
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<td>21</td>
<td>13</td>
<td>22</td>
<td>19</td>
<td>23</td>
</tr>
<tr>
<td>Percentage</td>
<td>68</td>
<td>96</td>
<td>84</td>
<td>84</td>
<td>80</td>
<td>88</td>
<td>48</td>
<td>92</td>
<td>84</td>
<td>52</td>
<td>88</td>
<td>76</td>
<td>92</td>
</tr>
</tbody>
</table>
When examining the above data 1-12 in participating to the statements, the thirteen-item of the students who participate in the implementation of the method was determined to develop a positive attitude towards of 79.4%. It was determined that the students in the experimental group have a positive attitude of 75.6 % for the whole of the scale. The similar result consists of literature (Uşun and Gökçen, 2010).

Also, the questions which are asked students’ views on the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) model were answered by 24%.

The students’ the answers are as follows:

A good method.

A very effective method, classes are more fun, students will learn new things without getting bored.

This method is becoming more active in the student’s course and the subject does not know the events of daily life by associating it with a good education is a method of providing comments.

I can only say this; extremely useful teaching, the way it should be anyway.

In this method, the students are the center, because students are more active.

These answers have showed that the students have developed a positive attitude towards to the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) model.

4. Results and discussions

Today, lessons are taught by traditional methods at most of our school. This situation is quite common, especially in high schools. Although the reform movement had begun training, there is a lack of practice. Since the number of students and the inadequacy of our schools, teachers tend to provide direct instruction. Therefore, students memorize or completely out of order in the course. However, if the students are presented different ways of learning, it is possible to enriching ways. The mental activity and conceptual structure are very important role in the Interactive Direct Teaching Based on Constructivist Learning (IDTBCL). The subjects are presented in a particular conceptual framework and should be certain limits. Additionally, the teacher should ask a great number of questions and students should be able to get into the debate in order to draw into this mental activity. In this way, students can recognize their potentials; develop self-confidence and motive to learn. Concept maps, concepts and conceptual change texts can be used for removing misconceptions (Güneş, Dilek, Demir, Hoplan and Çelikoğlu, 2010). The Interactive Direct Teaching Based on Constructivist Learning (IDTBCL) model has provided to removing misconceptions. This model takes account into the conceptual structure and dispelling misconceptions. In the control group, exactly teachers have taken place in the centre of teaching. This is not strange situation by the students and the student’s sense of both mental and psychomotor was accustomed to observe. However, teachers who guide the teachers in terms of teaching, which highlights the applications of speech, auditory sense is not satisfactory. In experimental group, due to the nature of existing applications, the teacher in which physically located at the centre of teaching provided that students have led to much more active by thinking, evaluation and mental activities. Thus, an active learning environment was created by an intensive interaction between student and teacher and the true-trends. In other words, the teacher who is located in the centre according to the current the organization oriented to the student-led. Also, he/she thinks together, expresses together, draws conclusions together and does the mentally application process with student-teacher combination, i.e., learning as teaching and teaching as learning have realized component alignment. Of course, this adaptation was required to spend much more energy in the traditional teaching process governing both the preparation and implementation of a teacher.

References


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