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The comparison between guided inquiry and traditional teaching method. A case study for the teaching of the structure of matter to 8th grade Greek students

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Abstract

This paper aims to compare the guided inquiry with the traditional method. In order to proceed to this comparison, eight lesson plans for the teaching of the structure of matter were constructed for both methods. These lesson plans were applied to 8th grade Greek students of secondary school. The statistical analysis showed a significant supremacy of the guided inquiry against the traditional teaching method for the teaching of the structure of matter. Also, the findings indicated higher score performance in the tests for the boys compared to that for the girls.

Keywords: guided inquiry; traditional method; chemistry; structure of matter;

1. Introduction

Many literature reviews have reported a large number of misconceptions related to the students’ comprehension of the structure of matter (Birk et al., 1999; Furio et al., 1996; Nicoll, 2003; Peterson, 1993; Taber, 1998; Vlassi et al., 2008). These misconceptions may be caused due to several reasons. One of them is probably an inappropriate teaching method. This paper aims to compare the guided inquiry method with the traditional one for the teaching of concepts that refer to the structure of matter.

Inquiry can be defined as "the intentional process of diagnosing problems, critiquing experiments, and distinguishing alternatives, planning investigations, researching conjectures, searching for information, constructing models, debating with peers, and forming coherent arguments" (Linn et al., 2004).

The publication of the "Science Education Now: A renewed Pedagogy for the Future of Europe" report (Rocard, 2007) once again brought science as inquiry and by inquiry to the top of educational goals. Inquiry based learning has been officially promoted as a pedagogy for improving science learning in many countries (Bybee, 2000; & NRC, 2000). Students are prompted to resolve the problem, or else to discover the answer. For the discovery of the solution of the problem, students proceed to investigate of alternative choices using subtlerfuges, strategies και methods that they had already practiced (constructivism).

They also use apperceptive thought and analytical thought, as mental means. The students explore and the teacher becomes the guide in this research. Also, recent developments in cognitive learning theory and classroom research

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results suggest that students generally experience improved learning when they are actively engaged in the classroom and when they construct their own knowledge following a learning cycle paradigm (Farrell et al, 1999).

This strategy of directed investigation includes the following steps (Bybee, 2006):

First step: Elicitation (Psychological and cognitive preparation, verification of the previous knowledge, elicitation of the students’ misconceptions).

Second step: Engagement (specification of the problem).

Third step: Exploration (enouncement of the hypotheses, planning of the investigation, experimentation, collection and organization of the data).

Fourth step: Explanation (analysis and regularization of the data, explanations).

Fifth step: Elaboration (Overshooting of the data, explanation of the phenomena, finding of analogies, evaluation of the ascertainments).

Sixth step: Evaluation (Evaluation of the learning objects by the teacher).

Seventh step: Extending (Application of new learning objects to similar cases, generalization and transport of new learning objects to different situations).

2. The effectiveness of the guided inquiry method

The concept of inquiry-based learning has appeared numerous times throughout history as a part of the educational philosophy of many great educators. Various findings across 138 analyzed studies indicate a clear, positive trend favoring inquiry-based instructional practices, particularly instruction that emphasizes student active thinking and drawing conclusions from data.

Teaching strategies that actively engage students in the learning process through scientific investigations are more likely to increase conceptual understanding than are strategies that rely on more passive techniques, which are often necessary in the current standardized-assessment laden educational environment (Minner et al., 2010).

Based on the researches by Oliver (2007) and Prince et al. (2007), the inquiry-based teaching style presents students with a problem to be solved and it increases students’ motivation. More importantly, the inquiry-based learning actively involves the students in the learning process and allows the students to learn the contents on their own, which provides more opportunities for the students to gain a deeper understanding of the concepts and become better critical thinkers (Wang et al., 2011).

3. The comparison between guided inquiry and traditional method

The guided inquiry method is far removed from the traditional ways of teaching, where the teacher’s opinion dominates and the students are only compelled to memorize and reproduce knowledge. According to Bruner, who established this method, the teacher relies on a suitable analytical program and plans the course in the beginning of the year. During this course he presents an instructive experience or another subject that offers an opportunity for research and discussion.

In order to measure the effectiveness of the method, we proceed to the comparison of the guided inquiry with the traditional teaching method. Eight lesson plans for the teaching of the structure of matter were constructed for both methods. These lesson plans were applied to 8th grade students of secondary school. 174 students from the experimental group were taught with guided inquiry method. The same lessons were also applied to another 183 students from the control group using the traditional teaching method. A pretest as well as a posttest with cognitive content questions (8 opened type and 32 closed type) was used as the instrument of this research.

Before the main research, a pilot study was conducted using a group of 30 students from each sample. The evidence of construct validity was calculated with “item-total score” correlation using the Pearson’s correlation coefficient (r). Four questions were described as inappropriate and it was removed from the questionnaire (Bieger, 1996 & Newby, 1997).

4. Results

After the expressive correction, the transformation and the modification of questions, the control of their reliability and validity was repeated.
It was found that all 36 questions were found appropriate. The price of Cronbach’s Alpha was equal to 0,7521 for the control group and 0,7276 for the experimental group.

The Kolmogorov – Smirnov, Shapiro-Wilk and Levene tests were used in order to control the depended variables regarding their regularity. Also the Levene test was used in order to check the equivalence of scatterings. Based on the above controls it was found that all the presumptions were not valid for the use of ANOVA analysis (Table 1).

<table>
<thead>
<tr>
<th>%test</th>
<th>Method</th>
<th>Statistics</th>
<th>df</th>
<th>Sig.</th>
<th>Statistics</th>
<th>df</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>pretest</td>
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<td>0,201</td>
<td>183</td>
<td>0,000</td>
<td>0,882</td>
<td>183</td>
<td>0,000</td>
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<tr>
<td></td>
<td>inquiry</td>
<td>0,219</td>
<td>174</td>
<td>0,000</td>
<td>0,870</td>
<td>174</td>
<td>0,000</td>
</tr>
<tr>
<td>posttest</td>
<td>traditional</td>
<td>0,100</td>
<td>183</td>
<td>0,000</td>
<td>0,964</td>
<td>183</td>
<td>0,000</td>
</tr>
<tr>
<td></td>
<td>inquiry</td>
<td>0,119</td>
<td>174</td>
<td>0,000</td>
<td>0,947</td>
<td>174</td>
<td>0,000</td>
</tr>
<tr>
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<td>0,000</td>
<td>0,972</td>
<td>183</td>
<td>0,000</td>
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<td></td>
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<td>0,000</td>
<td>0,960</td>
<td>174</td>
<td>0,000</td>
</tr>
</tbody>
</table>

For the comparison of the two samples, a non-parametric test ought to be chosen, the Mann-Whitney U test. The means are M1=43,99% for the control group (traditional method) and M2=70,67% for the experimental group (guided inquiry method) (Figure 1). There is statistically significant difference between the two samples. (p<0,01)

Figure 1. The comparison between the means of the two methods

The difference in the performance between boys and girls, according to the teaching method, is also examined in this research. As table 2 shows, girls that are taught with the traditional method have greater performance than boys. The opposite result is observed for the students of the experimental group.

<table>
<thead>
<tr>
<th>% test mean</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>traditional</td>
<td>41,13</td>
<td>46,42</td>
</tr>
<tr>
<td>inquiry</td>
<td>73,11</td>
<td>68,45</td>
</tr>
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</table>
5. Conclusions

The guided inquiry method is based on the constructivism that uses student-centered activities. According to Slunt et al., 2004 “these activities involve the student in the learning process rather than allow the student to passively gather information from a delivered lecture in the more traditional ‘stage on the stage’ method of instruction”.

Besides, Ausubel based on the golden rule of educational practice, which states that teaching should be done according to what students already know. Also, the constructivist theory of learning suggests that knowledge is constructed through a process of interaction between an outside stimulus and conceptions that already exist in the learner’s head (Sozbilir, 2002).

The comparison between the guided inquiry and the traditional method for the teaching of the structure of matter showed a significant supremacy of the first method. These results are confirmed by other researches (Meany et al.; 2001 & Bindel et al., 1997) in which the guided inquiry method was applied during several courses for different cognitive subjects. Also, the findings indicated higher score performance in the tests for the boys compared to the girls.

References

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