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A Web Tool for the classification of web spaces: Contributions to learning on single-answer and variable-answer group tasks

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Abstract

Although many instructors use collaborative group work as a useful educational tool, much research remains to be done on how learning actually occurs within collaborative learning environments. In the present research, we are using a Web based tool, which has been developed by the author, for the classification of the web spaces and its use by first year prospective primary school teachers in the field of Natural Sciences. In this context, we investigate its contribution to learning in a collaborative environment for single-answer group tasks and variable-answer group tasks. The results reveal modest, but important support for the hypothesis that the use of the Web tools benefits the student group that works on variable-answer group tasks.

Keywords: Natural sciences, collaborative environments, teamwork, primary schools.

Introduction

The need for teamwork in all education fields is being recognized (Gasen & Preece, 1996). Collaboration is considered to be a dynamic, social process going beyond coordination of separate efforts (Adams & Hamm, 1990), since it leads to shared awareness and understanding through interactions with others in order to construct new ideas or products. For this reason, group dynamics, especially social solidarity and joint responsibility for reaching group goals, are regarded to be essential ingredients in the success of any collaborative learning project (Shrage, 1990). Active participation and student-to-student support are thus vital for the necessary shift in student values and attitudes towards learning (Hamm & Adams, 1992).

Relevant research on group working and learning has focused on different task types, such as variable-answer tasks including group goals, which have been found to produce a positive collaborative learning environment (Cohen, 1994; Cohen, Lotan, Scarloss, & Arellano, 1999). Other studies on collaborative group work, however, have revealed that learning is facilitated through the engagement of groups in single-answer tasks where elaborate explanations are produced and prompt answers are given to the questions arising within the group work (Webb, 1991; Webb & Palincsar 1996).

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The aim of the study presented in this article is to shed considerable light on the influence that task structure has on group dynamics that affect cognitive performance when the Web tool is used as a means for collaborative learning.

The research on collaborative group work, however, reveals a discrepancy as far as the specific participation variables that lead to learning gains are concerned. While the overall rate of task related participation has not been found by Webb's (1991) review of research, to relate significantly to learning, Cohen (1994) reports a significant relationship between task-related participation and learning and suggests that this discrepancy may be resulting due to a difference between the task structures used by the above researchers.

Cohen's research, in particular, uses group tasks with no clear answers, since these types of tasks, according to the researcher, promote more task-related student interaction than do tasks with clearly correct answers, such as the ones used by Webb, who asked the students, for example, to explain why one electrical circuit had a brighter light bulb than another (Webb et al., 1998). Cohen's explanation for the discrepancy in results mentioned earlier seems to be valid since, according to Webb's (1991) reports, learning gains result from giving elaborate explanations and receiving prompt answers to questions within collaborative groups while other forms of interactions (such as giving and receiving unelaborated answers, receiving explanations, asking questions and receiving no response), which occur at a higher rate, seem to be unrelated or detrimental to learning. Due to the discrepancies in the participation variables that may facilitate learning, shown by previous research, the analysis of the relationships between different types of participation variables and achievement is regarded to be of particular importance.

Searching for Information on the Internet

The first problem the student or teacher faces while searching for information on the Internet and especially on its most popular component, the Worldwide Web (www), is the existence of a plethora of information that is not rationally structured and which lacks "organization". Although searching for information through browsing on the Internet from one site to another, by means of a browser, may seem to be a relatively easy task, it soon leads to a situation where the student or the teacher does not know whether a particular piece of information exists, or if they are aware of its existence they may be unable to locate it or find the way to locate it more generally. This results in collecting interesting information which may, nevertheless, be irrelevant (Brandt, 1997; Hess, 1999). This way of working may become quite tiring, unproductive or disorienting for the student since searching takes longer (Brandt, 1997; Hess, 1999). The situation worsens when the search is not based on a preset scenario and results in a significant difficulty or/and in refusing to use the search machines as well as to learn the ways of effective search in the web.

A number of search engines have often been used to overcome the above problem. The search engines may be engines using key words, or search engines based on thematic directories. The general search engines can be characterized as first generation engines, if they themselves perform the requested task, or second generation search engines, if they send it to others and deliver the relevant results afterwards.

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However, which is the way to conduct the search? A feature, common to all search engines is the use of key words that are of relevance to the subject. Most of them may be used in combination by means of logical operators (AND, OR, NOT, AND NOT…) in order to produce reasonable suggestions and facilitate the search. Finally, the search of information can be conducted by means of natural language questions. The results are usually lists of websites from the same engine's data base, or from websites that cover quite a significant part of the Worldwide Web. These form the basis for the two main search engines models, which are the thematic directories (e.g. http://www.yahoo.com) and ones offering the opportunity to conduct the search through key words (e.g. http://www.lycos.com, http://www.altavista.com).

The Science Search Application

Structural features

Science Search is an Internet application that adopts the role of a scientific addresses list, that is, it creates a database with listed web sites where the user can:

a) Search for information in relation to a variety of subjects,
b) Be informed about the most updated results of his/her search,
c) Review the previous contents of his/her listed websites in order to compare the contents of a chosen site at different times,
d) Enrich the websites list according to his/her own interests.

It is worth noting here that this application is independent of the particular subjects and can therefore be used in cognitive fields other than the Physical Sciences alone. Summarizing, Science Search is an Internet program which permits keeping up with the material published on web sites that the user has selected and filing websites of interest as well as their content, at regular time intervals whereas the application itself is controlled through the Internet by means of a simple browser. This programme's advantage is its ability to create a database while it also offers the opportunity of classification according to the users' choices.

The programme's work environment

Upon entering the application, the "authentication process" screen appears (Figure 1) where the user enters his/her personal identifier and password. The "Entrance" function is subsequently selected, and the system presents the user's central personal screen after having checked the data supplied. In order to see the listed websites, the user selects the function "view the websites" which leads to the required list. Here, the user can simply enter a new website, work on a previously existing one by altering its data or delete one that is no longer of interest (Figure 2).

In the interface of the application there is an additional function "Check" which controls the website's content and works as follows:

- If the content has not been altered, the latest update of the website is presented.
- If the content has been altered, the new edition is listed on the database and we are informed of the latest change and the new date of change is listed.

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When the student/teacher wishes to end the programme, the function "exit" on the upper left part of the screen is selected and the programme ends.

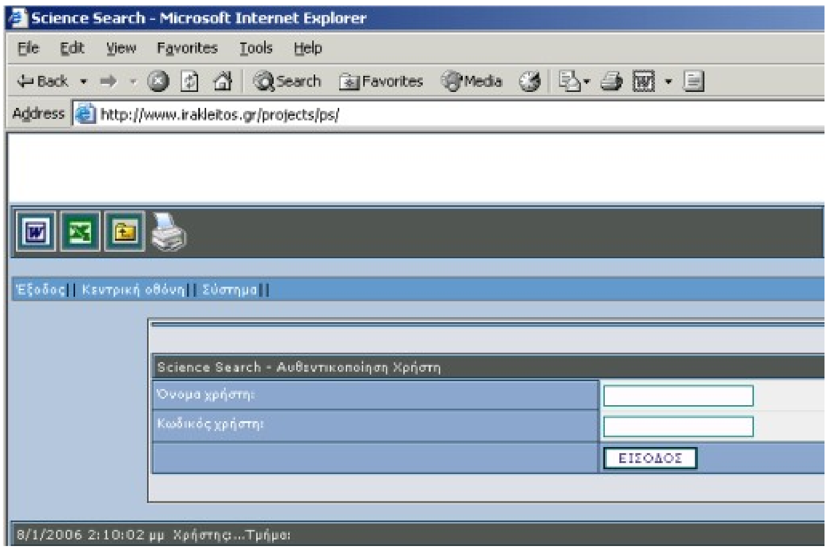

Figure 1. The initial interface of the system (developed in the Greek Language)

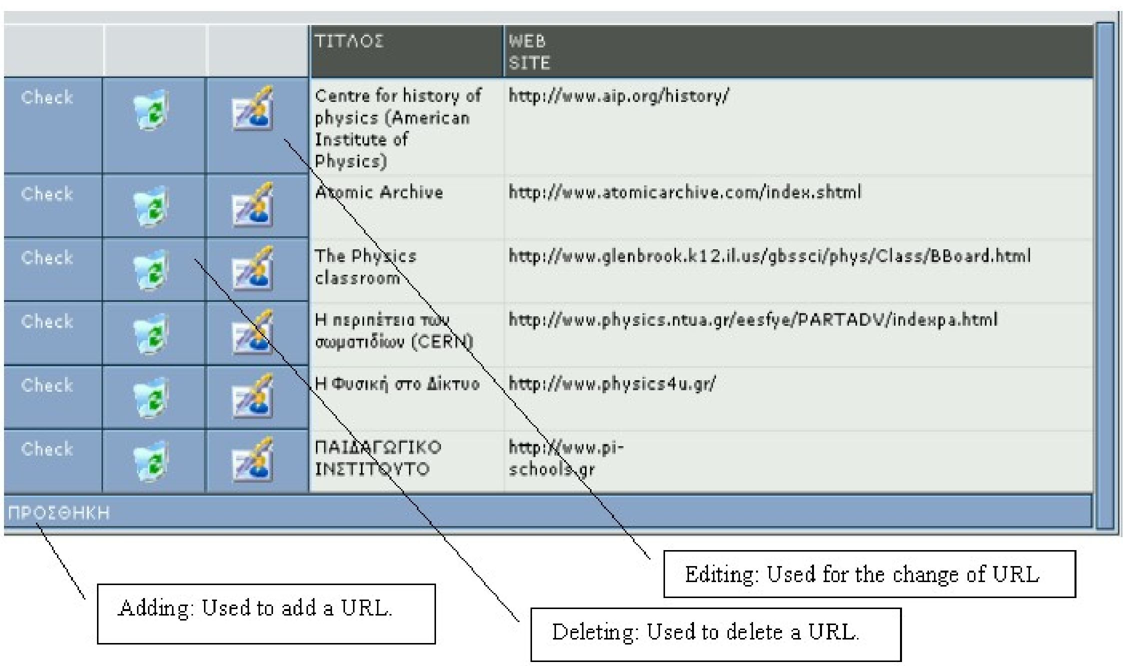

Figure 2. The system interface (developed in the Greek Language)

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Design and Procedure

In order to examine the potentials of the program in terms of its use by teachers as well as students for the teaching and learning of Physical Sciences, we have set forth a research project which is currently under way. However, it worth presenting some of the initial pilot phase results which, in our opinion, support its use on everyday educational activities of the school, if not every other, class. During the pilot phase, the program was presented to 40 students enrolled in the course titled “Introductory Physics”.

This study was conducted in three phases. Phase one consisted of a pre-test, phase two consisted of collaborative group work, and phase three consisted of a post test. Three weeks after the administration of individual pre-tests, each group carried out its group task: (a) five groups completed a single-answer s Physics task and (b) five groups completed a variable-answer Physics task. Group tasks were randomly assigned to the 10 groups and each group consisted of four students. Before the groups engaged in their tasks, they were told that they must undertake their tasks as a group and come up with a single solution for the entire group. In addition, group members were told to make sure that everyone in the group agreed with, accepted, and understood the final answer. Finally, the group members were told that they would be given similar tasks to do on their own in about two weeks time. The purpose of giving these guidelines and information to the participants was to encourage them to work as a group to accomplish the tasks and to learn from each other. No formal instruction on collaboration was provided to participants. Two weeks after the group work, each student completed an independent post-test that was similar to the pre-test mentioned earlier. Both the pre-test and the post test consisted of tasks of an equivalent level to the group tasks.

During the research (Phase 2) which lasted for 3 months, students were permitted to use the web tool in order to find the data needed for the given tasks. The teaching method used was the traditional one and there was no help offered by the teacher for the assigned tasks.

After having assigned the two types of group tasks, a questionnaire was given out to the students, which seeked to find out their preferred approach to learning.

In this questionnaire, there were three possible outcomes:

1. I am interested in explaining phenomena in a simplistic way without referring to the fundamental laws of Physics.
2. I am more interested in solving problems.
3. I am interested in the various concepts in Physics in a coherent way, giving meaning to various observations in a holistic way.

Results

The present study concerns prospective primary school teachers in the Department of Pedagogy in the University of the Aegean enrolled in the course «Introductory Physics» and the following research questions were formulated for the research:

a. Do the students' cognitive achievements depend on their participation to single-answer group tasks and variable-answer group tasks?

b. Does the approach to learning change over the duration of the course due to the use of the Science Search?

An example of different forms of tasks is the following: The variable-answer task required groups of participants to design an experimental apparatus concerning the rotational motion of a solid body and to try to find the unknown weight of a body using the apparatus and the kinematic and dynamic relations concerning the motion. For the single-answer group task, students were given the apparatus and they were asked to solve the problem to calculate certain quantities asked by the problem.

For the two types of group tasks, pre-test and post-test scores, were moderately correlated (single-answer task $r = .46$, $p < .05$; variable-answer task $r = .58$, $p < .01$).

For the two types of group tasks, perception for Physics, was correlated (single-answer task $r = .56$, $p < .05$; variable-answer task $r = .78$, $p < .01$.

Analysis of the results reveals a strong shift of students towards conceptual change and this is primarily true for students involved in variable-answer tasks.

Single Answer Task: Prior to the intervention, 8 belonged to category 1 (their perception on physics) 6 belonged to category 2 and 6 belonged to category 3.

Following the intervention by the Web Tool 3 students remained in category 1, 3 of them shifted to category 2 and the other 2 shifted to category 3.

Variable Answer Task: Prior to the intervention, 9 belonged to category 1 (their perception on physics) 6 belonged to category 2 and 5 belonged to category 3.

Following the intervention by the Web Tool 2 students remained in category 1,3 of them shifted to category 2 and the other 4 shifted to category 3.

During phase 3, students took their post-test and the groups who participated in the variable answer task showed an impressive improvement in their cognitive performance when compared to those who participated in the single answer task.

During the test, the rubric required students to attempt all 15 questions in the space of 2 hours. The performance scale for the diagnostic test ranges from 1 to 4, with 1 being the score which corresponds to wrong answers without reason, 2 to correct answers with correct reason for less than 5 questions, 3 to correct answers with correct reason for less than 15 questions and 4 to correct answers with correct reason for more than 15 questions.

More precisely, the mean (MD) of the single-answer task increased from a value of MD=1.6 to MD=2.1, whereas in the variable answer task, an initial MD=1.6 reached MD=2.8 following the intervention of science search.

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Conclusion-Discussion

Task-related participation contributes to achievement gains, according to previous research (e.g., Cohen, 1994), while other studies suggest that giving explanations, and not task-related participation, may contribute to achievement gains (e.g., Webb, 1991). The present study results suggest that task-related participation contributes to learning more when groups engage in variable-answer tasks (such as the ones used by Cohen. It is also suggested that there is a significant shift in terms of perception of Physics for groups involved in variable-answer tasks.

Following phase 3, an informal discussion was held with the students, from which some interesting points were raised: At the single-answer task, group member participation was limited to suggestions, explanations and questions they chose to pose to the rest of the group, when the task did not require such sort of interaction.

Consequently, any form of learning that took place ended up strongly related to giving explanations. However, on the variable-answer task, group members were required to participate for the successful completion of the task assigned. As a result, all students had an opportunity to contribute and participate significantly and their performance was not solely dependent on the amount of explanation given. Therefore, all group members who worked on the variable-answer task demonstrated a fairly similar amount of learning from their group work.

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