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Abstract

In this paper we analyse data from a self-rated questionnaire together with statistics of the learners' real activity in a collaborative learning environment called EDUCOSM. Besides being of theoretical interest, the manifestation of self-perceptions in actual behavior is important for the development of better support facilities. For example, correct interpretation of both questionnaire and log data is likely to be necessary for partially automated group formation. This paper focuses on motivation and social abilities. The results suggest that group formation carried out without any supporting information from the system does not always lead to good results.

1. Introduction

Individual goals and social abilities become a crucial issue when we talk about supporting the learning process in a collaborative learning environment. It is of utter importance to understand the learner's goal orientation and her social group role; the learner might for instance have a deep-oriented or a surface-oriented approach towards studying. Similarly, learning attitude may be cooperative, competitive or individualistic.

This paper analyses data collected during a course held at the University of Helsinki in autumn 2003. A pre-test questionnaire helped to understand the participants' goals and expectations, while log data of their activity in the learning environment showed their actual behavior in the educational setting.

One key objective of our study was to find out whether the EDUCOSM system enabled the course participants to achieve their individual goals through the available set of tools for asynchronous collaborative knowledge construction.

The paper is organized as follows: section two describes the theoretical framework of the study and section three presents the data and methods used to get the results, which are shown in section four. Conclusions of the whole study are presented in section five.

2. Theoretical framework

2.1. Goal orientations

Motivational and affective factors play a significant role in learning, whether it is individual or collaborative in nature, or takes place in face-to-face or virtual settings. Paul Pintrich's Motivational Expectancy Model [1] classifies motivation into three categories: value, expectancy and affective components. In this paper we focus on two value components of motivation.
Intrinsic goal orientation: the learner has deep-oriented approach towards studying. She enjoys challenging tasks where she can study the subject as thoroughly as possible.
Extrinsic goal orientation: the learner has surface-oriented approach towards studying. She tries to be successful in her studies, and strives for high grades for extrinsic reasons.

2.2. Social group roles

The basic premise of social interdependence theory is that the type of interdependence structure in a situation determines how individuals interact with each other. Social interdependence exists when individuals share common goals and each individual's outcomes are affected by actions of the others. In this study we analyse students' group roles with the following classification of Deutsch [2] and Johnson and Johnson [3]: *Cooperative learner:* Working together cooperatively to accomplish shared learning goals.
Competitive learner: Working against each other to achieve a goal that only one or a few can attain.
Individualistic learner: Working by oneself to accomplish goals unrelated to the goals of others.

2.3. Signaling

Signaling means adding cues to the present material that help the learners to process the material [4]. Thus it is a viable way to promote the learners' ability to select, organise and integrate new information.

In this study signaling is operationalised as teachers', tutors' and peer learners' unlimited permission to add highlights and comments to any document that exists in the system.

2.4. Description of the EDUCOSM system

EDUCOSM [5] consists of an integrated set of tools for asynchronous collaborative knowledge construction. The core of the system is a shared document pool, which contains both external resources found on the web and documents written by the students themselves. Collaborative writing is enabled by a browser-based editor, which is a customised version of MoinMoin Wiki. The students are encouraged to publish several draft versions during the writing process for general discussion and review. The main tools used for this kind of collaboration, as well as work taking place around the external documents, are joint annotations and threaded discussions. The activity is self-organising by nature. While course assignments and other requirements determined by the instructor certainly affect the direction of the activity, it is important to realise that it is the learners themselves who have the main responsibility for the actual learning process.

3. Data and methods

3.1. Course setting

The data set was collected during the Autumn 2003 from a course titled "Context Aware Computing", given at the Department of Computer Science, University of Helsinki. The course was web-based with a few lectures. It was mandatory to publish the results of group work in the EDUCOSM system and recommended to also write them in EDUCOSM. Eighteen students, fifteen male and three female, registered for the course, but only thirteen completed it, out of which four were graduated students and nine undergraduate ones. Median age was 27 years. All were computer science majors, except one who was a student at the department of education, with a strong background in computer science; seven students were not Finnish. Two teachers acting as tutors supported the participants. The students had to produce two reports on topics listed by the instructors. The first assignment was done in groups of two and the second one in groups of three or four. The groups were not allowed to stay the same during the whole course. The course lasted nine weeks; the first assignment was completed during the first four and the second during the following five. At the end of each assignment, each group was required to give a presentation of their work.

3.2. Pre-test

The pre-test questionnaire [6] contained ten items measuring motivation, group work abilities and signaling. The response options varied in a five-point Likert-scale from "1 - Completely Disagree" to "5 - Completely Agree". The motivation category consists of a value section that has two subscales: intrinsic goal orientation and extrinsic goal orientation. The group work abilities category consists of a social interdependence section that has three subscales: cooperative, competitive and individualistic learners. The signaling category measures learners' expectations of usefulness of peer signaling.

Descriptive statistics show that students tend to have practical orientation towards studying, i.e., they aim to optimize final grade (M=4,1) while avoiding too deep oriented approach (M=3,8). Responses indicated that to 'show others' is the least important reason to study (M=2,9). The results indicate that the students have negative preconception of its usefulness (M=2,4 and M=2,8). This attitude shows in their own signaling behavior (M=2,4).

3.3. User profiles and classification

Realization of individual goals was studied with respect to activity in the system (log data), goal orientation and social abilities (pre-test) and learning outcomes (final grade).

The participants' profiles were classified on the basis of the log data. Each of our profiles is a collection of one or more skills. For each skill, we gave a rating ranging from one (low) to four (very high). The results of the classification are shown in [tab.1] and [tab.2].

	1 Low (%)	2 Medium (%)	3 High (%)	4 Very high (%)
Reader (n of documents)	<= 10 (10)	<= 30 (31)	<= 50 (52)	> 50 (>52)
Writer (total n of hours)	<= 1	<= 5	<= 10	> 10
Commenter (total n of comments)	<= 10 (2)	<= 30 (6)	<= 50 (10)	> 50 (>10)
Highlighter (total n of highlightings)	<= 5 (2)	<= 20 (8)	<= 40 (16)	> 40 (>16)
Knowledge builder (n of documents added)	<= 1 (3)	<= 4 (11)	<= 8 (22)	> 8 (>22)

Table 1. User skills classification

4. Results

4.1. Pre-test, log file and learning outcomes

The results of the pre-test show that only two participants (18%) would prefer text books that have underlinings by other students. In addition, three participants (27,3%) think that "Underlinings by other students in course books disturb my own learning." Only three participants (27,3%) agree about the possible benefit of subsequent reader when reading underlined text in a course book. The answers indicate negative attitude towards signaling correlated, as expected, negatively with total number of highlightings (r=-.385, p=.242). The correlations of other signaling items with the total number of highlightings were consistent with the theoretical framework.

The results of the analysis of non-parametric correlations between pre-test values and learning outcomes (i.e., final grades), results showed that external goal orientation correlates slightly more positively with high learning outcomes (r=.431, p=.186) than internal goal orientation (r=.409, p=.211).

Individualistic ratings in the pre-test had a negative correlation to the learning outcome (r=-.300, p=.369). This result might be due to the fact that this particular course was based on cooperative learning. The most competitive learners had highest learning outcomes (r=.416, p=.203).

	1 Low N (%)	2 Medium N (%)	3 High N (%)	4 Very high N (%)
Reader	2 (11,1)	5 (27,8)	9 (50)	2 (11,1)
Writer	4 (22,2)	4 (22,2)	7 (38,9)	3 (16,7)
Commenter	4 (22,2)	4 (22,2)	7 (38,9)	3 (16,7)
Highlighter	10 (55,5)	3 (16,7)	2 (11,1)	3 (16,7)
Knowledge builder	11 (61,1)	4 (22,2)	2 (11,1)	1 (5,6)

Table 2. Distribution of the participants' activity

4.2 Group work – a case study

In this case study we focus on the characteristics of a particular group working on the first assignment. The group consisted of two people (one male, $x1$, and one female participant, $y1$). According to the pre-test, $x1$'s goal orientations were both moderately intrinsic (3,0/5) and extrinsic (3,0/5), while $y1$'s both goal orientations were as high (4,5/5). Both group members rated themselves as moderately individualistic (3,0/5). The male group member had moderate drive for competition (3,0/5), compared to the female (5,0/5). The participants felt beforehand that they had moderate ($x1$ 3,5/5) or excellent ($y1$ 4,5/5) group work abilities. On the basis of the pre-test we would expect this group to show a high degree of collaboration and achieve good results in the first assignment.

During the first two weeks of the assignment, $x1$ was very active in reading and annotating articles and also spent much time writing in Wiki, while $y1$ seemed to be getting acquainted with the system. In the third week, $x1$ was extremely active in writing and published the final version of the assignment, while $y1$ still had not log into the system. During week four, neither $x1$ nor $y1$ logged into the system. In terms of the classification, $x1$'s level of activity was 'high' in reading, 'very high' in writing, 'high' in commenting, 'very high' in highlighting, and 'low' in knowledge building. $y1$'s activity, on the other hand, was 'medium' in reading, 'low' in writing, 'low' in commenting, and 'low' in knowledge building. At the end of the course, both received B's ($x1$ got 45/60 points and $y1$ 40/60 points). The analysis suggests that collaboration among people having different goals may lead to unbalanced distribution of the workload, which might interfere with the achievement of the goal itself.

5. Concluding remarks

In this study we investigated the relationship between learners' individual differences, measured with a pre-test, and the actual use of EDUCOSM, a collaborative learning environment, measured with log data. The learners were profiled with a self-rated questionnaire containing items to measure their motivational level, social abilities and attitude towards annotation at the beginning of the course.

The low correlation of pre-test results with learning outcomes could be explained by high initial expectations being later lowered by factors such as high workload or technical problems with the system.

Another important result is that group formation carried out without any supporting information from the system does not always lead to good results. Most people were active readers, writers and commenters. There seemed to be a shortage of highlighters and knowledge builders.

Our current research is aiming to gain knowledge needed in building automated support for group formation and providing better support facilities for the collaborative learning process.

Acknowledgements

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