Facilitating Knowledge Sharing Among Unpaced Online Learners
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Abstract.
Many universities now offer Internet-based education. Most research studies have determined that the Web is an effective teaching medium, with student learning outcomes at least equivalent to those of classroom-based counterparts.

Web-based courses generally reflect many features of the traditional academy: they generally have specified start and end dates and limited entry points, and they consist of cohorts of students who proceed through each course at about the same pace. This cohort model lends itself to a group-based, online learning experience. Present online learning management systems usually assume an underlying cohort-based learning model. They attempt to replicate many desirable features and activities derived from classroom-based learning contexts. This strategy, in turn, enables increased interaction and knowledge construction among learners.

However, there is also a long tradition of open education that addresses the needs of learners who for one reason or another do not fit the classic mould of higher education. Therefore, open education to those students has to be provided on an individualized and unpaced basis. The often-unpaced nature of this “individualized” model requires flexible alternatives to cohort-based online interactions that have hitherto been lacking.

This paper presents an asynchronous knowledge sharing system (ASKS) that creates virtual cohorts among unpaced online university students in the School of Business at Athabasca University. The system provides a structured process for students to share information. It also provides a streamlined method for instructors to evaluate student participation more easily and objectively compared to other online learning management systems in both unpaced and paced online learning environments.

1. Introduction
Post-secondary academic institutions and companies have been quick to seize the opportunity presented by the World Wide Web (Web) to offer online courses. Research shows online teaching being as effective as classroom learning (Gerhing 1994; Golberg 1997; McCollum 1997). To some, the virtue of the Web as a teaching medium is not even debatable, the effectiveness of Web-based teaching is seen as dependant on the design and delivery of online instruction rather than the medium itself (Clark. 1994). Most research work on distance education deals with the design and delivery of courses for cohort students (Arbaugh 2001; Burke 2001; Chidambaram et al. 1990; McEwen 2001; Montoya-Weiss et al. 2001). Some reasons for this concentration on cohort students is because most distance education programs are birthed in traditional, campus-based institutions. Courses are designed to start and end at specific times just like regular classroom teaching. Another reason is that online learning management systems borrow features from group support systems. Also, academic programs strive to train students to work in teams to prepare them for the real working world where group work has become a necessity. An area that has received little attention in the distance education community is the design and delivery of online courses for the individual online learner. Individual online learners are students enrolled in distance education programs with continuous enrolments. Course start and end dates are defined by the student’s registration date and not a prefixed school semester or term. Individual online learning also pertains to employees in companies that implement continuous online training programs. Discussions and collaboration appear to be irrelevant for individual online learners because by definition these students do not belong to a class and courses are designed to be self-paced. This paper presents the design of a system that fosters knowledge building and sharing in an individual study distance education online environment.

In the following sections requirements for online learning are discussed, followed by a presentation of the main features of a learning system designed to facilitate information sharing and enable a fair and objective way of evaluating class participation. Suggestions for follow-up evaluation of the system and directions for further research conclude the paper.

2. Supporting Online Learning

Error! Bookmark not defined.
Most individual study programs give total control of the learning process to students. A number of studies have shown that trainees do not make good instruction material if they are given complete control over course material (Steinberg 1989; Williams 1989). Attempts at assisting an individual learner can be advanced on two fronts; devising methods and technique that enable a student to take better control of the learning process (Bell et al. 2002), and facilitating collaborative learning.

Adaptive guidance (Bell et al. 2002) is one technique that has been proposed to assist an individual learner. It makes extensive use of computer programs to monitor and assess a learner’s progress and provides feedback augmented with futuristic information aimed at enhancing self-regulation in learning. For instance, instead of a student jumping all over the course material the system would provide the proper sequencing of the course material to ensure maximum effective absorption of course content. The system proposed in this paper implements the principles of adaptive guidance, but instead of delegating adaptive guidance to a computer program, the course professor or tutor is provided easy access to a course knowledge database to enable them to play the adaptive guidance role. Allowing the course instructor to provide adaptive guidance helps to increase high student-instructor interactivity. Instructor immediacy behaviour is one of the factors that has been found to increase student satisfaction with online courses (Arbaugh 2001).

Effective learning requires three main attributes; active learning and construction of knowledge, cooperation and teamwork in learning, and learning through problem solving (Alavi 1994). While the first and last attributes can build into course material, the second cannot be easily implemented for individual distance learning, since there is no real class. A longitudinal study on the efficacy of desktop video-conferencing found higher critical-thinking among distance synchronous communicating groups than in other comparative groups (Alavi et al. 1995). Encouraging and facilitating teamwork is, therefore, one way of enhancing learning effectiveness for an individual online learner.

Since there are no real classes for individual home study students, virtual classes are created based on course start dates. Depending on rate at which students register for a course, a virtual class can be based on say a calendar month, or every quarter of a calendar year. The system uses private and public discussion boards found in most group decision support systems (Nunamaker Jr. et al. 1991). The way information flows between these discussion boards is however modified to suit virtual classes. Students and instructors access the system through different URLs. Main Web pages for both students and instructors are described next.

### 3. System Features for Students

Figure 1 shows the main screen for students. Three main features on this screen are the knowledge sharing topics on the left pane, the main menu (top part of the right pane) and the topic entries column headings just below the main menu.

#### 3.1 Knowledge sharing topics

Knowledge sharing topics have three parts; a closed or open file folder icon just to the left of the topic, the topic followed by the number of entries in that topic so far in parenthesis, and a trash can icon for the topic showing entries that are in the recycle bin. The topic is a short heading for a knowledge sharing question similar to the heading line in an email system. Entries for the topic with an open folder icon are displayed in the right pane.

#### 3.1.2 Delete and Post buttons.

Topic entries that have not been reviewed or reviewed and rejected by the instructor/tutor can be selected for posting or deleting. A check box appears to the immediate left of such entries. Clicking the “Post” button on the main menu makes the entry accessible to the instructor for reviewing and inaccessible to the student for editing. The “Delete” button moves selected messages from the topic’s inbox to the corresponding topic’s trash can. Entries in the recycle bin, can be recovered back into the inbox or deleted permanently. Clicking the “Compose” button brings up a topic entry editing screen. This screen has the look and feel of familiar email systems.
3.1.3 “Hints” button

The “Hints” button only appears if the instructor has provided overall comments on all entries made by the student. Comments on a single entry are accessible from the date link in the instructor comments column. Figure 2 shows an example of a “hints” screen. Main features of this screen are the instructor’s overall comments in red and the list of entries by a student’s virtual classmates that the student has not mentioned as yet. It is the instructor’s discretion to reveal to the student all or just some of the missed entries.

3.1.4 Instructor’s comments

If the instructor has evaluated an entry, a “new mail” icon and date of evaluation appear in the instructor’s comments column. When a student reads the
comments, the icon changes to an “opened email” icon. Entries that have been rejected by the instructor appear with a red “X” icon and a date the rejection was entered. Other instructor’s comments entries are “Not sent to instructor yet” and “Awaiting evaluation” for entries that have not yet been submitted for evaluation and submitted entries awaiting evaluation respectively. The submission date and the date under the instructor’s column save to give the student a quick determination of how quickly the instructor evaluated submitted entries. Clicking the date in the instructor’s comments column opens the instructor’s comments page.

3.2 System Features for Instructors

Figure 3 shows the fact evaluation screen. A fact is evaluated by comparing it to current class entries. The instructor then selects one of the three possible comparison outcomes; the entry is similar to a current class entry, or the entry is new for this class, or entry cannot be accepted as a class fact in its current form. Selecting any one of the three options fills the entry comment box with a randomly selected preset comment. Instructors can add, delete or modify these preset comments. Using preset comments frees instructors from having to type in comments for every entry they evaluate. However, if the instructor feels a student need further guidance than is provided by any one of the preset comments, he/she can overwrite the preset comment with a focused personalized comment.

![Image of Fact Evaluation Screen]

3.2.1 Class Participation Evaluation

There are four evaluation criteria for each student’s class participation: attendance, participation, articulation and relevance. Attendance is to measure how many topics a student has participated in virtual class discussion. Participation is to measure the number of facts raised by each student as compared to the total facts entered by the whole class. Relevance is a measure of the importance of a point to the discussion topic and is applied at a class level. Students who bring up the same point are awarded the same relevance score. Articulation is a measure of how well a student phrased a point and is applied at an individual level. A student’s overall score on class
participation will be a weighted average on these four criteria. Formulas on how to calculate class participation score are shown in the appendix.

After all the student’s entries on a topic are evaluated, the overall comment screen automatically comes up. This screen enables the instructor to enter an overall assessment of the student’s entries and also gives the student permission to view class entries that the student has missed. The default setting is to enable access to all the missed entries. The instructor can choose to keep some entries hidden from student as an encouragement for the student to come up with the missing entries. The overall comment to the student can be phrased to help the student come up with the missed entries. The instructor also has access to entries from prior classes (course entries) that the present class has not yet mentioned. This information can also be used to phrase the overall comment to enable students to come up with the missing facts.


The system described above addresses some of the most common problems associated with evaluation of group participation in both classrooms and paced online courses. First the instructor must recall both the frequency and quality of contribution made by all students who participated in a classroom. Second, the evaluation of both classroom and asynchronous computer conference contributions by instructors is also very subjective. Third, participation by both students in both fora is a mutually exclusive exercise. Once one student mentioned a point, others are prevented from making the same one. There is no way for the professor to know which students had similar observations in a classroom. Students who make early submissions to online threaded discussions have an advantage over students who submit contributions later. Though it conceivably could be incorporated into an individualized online learning environment, the threaded discussion board is inappropriate for the same reason. Students who register early have an advantage over students who register later.

The system described above enables fair and accurate assessment of class participation in an individualized online learning environment. The recording of class participation in private workspaces first creates a permanent record of each student’s ideas on a topic. This is akin to a teacher knowing what is in mind of every student who raises a hand in class. Students can come up with new ideas after viewing the class’s common pool of facts and still get credit for it.

Our future research will involve evaluating the effectiveness of this system. The system is designed to turn an individualist learner into a collaborative learner. We will measure how effective the system is in fostering the different possible types of learning interactions; student-to-student, student-to-professor, student-to-class, professor-to-class, and professor-to-student. We will also examine if the system creates a high perception about the fairness of the class participation process and the allocation of participation marks. Perceived usefulness and easy of use have been shown to be major determinants of the acceptance of new technology (Davis 1989). Follow-up research will replicate the TAM model for this system for the two main user communities; students and professors.

5. References

Davis, F. "Perceived usefulness, perceived ease-of-use, and user acceptance of information
Appendix: Class Participation Evaluation

The overall class participation grade is the sum of the scores on the four criteria: attendance, participation, articulation, and relevance. Formulas calculating the scores on the four criteria are shown below.

\[
\text{Attendance} = \frac{TA}{T} \times W_a
\]

Where

\( T \) = Total discussion topics for the course
\( W_a \) = Weight for attendance criterion
\( \text{Participations} = \frac{n}{N} \times W_c \)

Where

\( n \) = Total count of class or class equivalent facts entered by student for all topics
\( N \) = Total count of class facts for all topics
\( W_c \) = Weight for participations criterion
\( \text{Articulation} = \frac{\sum \sum a_{ij}}{n \times HA} \times W_c \)

Where

\( TA \) = Total topics attempted by student
\( n_i \) = Total count of class or class equivalent facts entered by student for topic \( i \)
\( a_{ij} \) = Articulation score awarded to student for topic \( i \) fact \( j \)
\( n \) = Total count of class or class equivalent facts entered by student for all topics
\( HA \) = Highest score on the articulation scale
\( W_e \) = Weight for articulation criterion
Relevance \[ = \frac{\sum_{i=1}^{TA} \sum_{j=1}^{n_i} r_{ij}}{\sum_{i=1}^{TA} C_i \sum_{j=1}^{mr_{ij}}} \times W_r \]

Where

\( TA \) = Total topics attempted by student

\( n_i \) = Total count of class or class equivalent
facts entered by student for topic \( i \)

\( r_{ij} \) = Relevance score awarded to student
for topic \( i \) fact \( j \)

\( C_i \) = Total count of class facts entered for topic \( i \)

\( mr_{ij} \) = Maximum Relevance score awarded
to student for topic \( i \) fact \( j \)

\( W_r \) = Weight for relevance criterion

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