# Social Awareness in the iHelp Courses Learning Content Management System

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**Abstract.** Learning content management systems (LCMS) are web-based e-learning applications that allow an instructor to deliver standards-based learning content to communities of learners. Despite the high popularity of these systems, they tend to have minimal collaborative navigation and awareness features, and students often find themselves learning in a vacuum without a sense of what the rest of the learning community is doing. This paper outlines a number of the awareness features built into our LCMS, iHelp Courses [1], and identifies two specific goals we have on our research agenda with respect to awareness in LCMSs.

## 1. Introduction and Motivation

The iHelp Courses environment [1] is a web-based learning content management system, and was designed primarily to provide a standards-based e-learning platform for instructors while being easy to extend for researchers. It has been deployed at the University of Saskatchewan in the Department of Computer Science in various forms over the past three years, and is used to deliver courses to hundreds of students annually. As an instructional tool, special care has been taken to support popular e-learning standards, notably the IMS Content Packaging specification [2] and pieces of the IMS Simple Sequencing specification [3]. As a research tool, the emphasis has been on building detailed user traces by observing what learners are doing in the learning environment. These traces are both passively collected by the content management system (server side), as well as actively pushed to the content management system by learning content when it is consumed (client side - this process is described more fully in [4]).

The lack of tools to support social awareness in learning content management systems puts online learners at a disadvantage compared to traditional face-to-face classroom environments. Most LCMSs have the primary goal of delivering content (be it static, hypermedia, or multimedia), and tend to graft on interaction tools as separate features, typically ignoring awareness issues altogether. Learners using these environments as their primary method of learning (as opposed to face-to-face or blended learning) may feel like they working alone, with only a few brief moments of structured interaction through moderated discussion forums. One of the consequences

of being a hypermedia environment, as most LCMSs are, is that learners can jump to very different sections of the environment at any time, and lose the connections they have with the peers around them.

The notion of awareness in collaborative environments has been studied in much detail in the last ten years. Dourish and Bellotti perhaps first popularised the term and provide a general definition of awareness as "an understanding of the activities of others, which provides a context for your own activity" [6]. Gutwin et al. refined this definition for educational groupware, and break awareness up into four different subtypes: social awareness, task awareness, concept awareness, and workspace awareness [5]. Of these types, workspace awareness is perhaps most relevant for learning content management systems. Defined as "up-to-the-minute knowledge about other students' interactions with the shared workspace" [5], workspace awareness can be exploited to increase the social interconnections between students, motivate the exploration of material, and provide feedback to the instructor/facilitator of the course.

We can find no scholarly evidence of awareness being exploited in e-learning systems for anything but collaborative activities, but we believe that awareness can be used to motivate learners in a competitive manner as well. This belief is prompted in part by the anecdotal observations of awareness features in competitive video games which are often used to increase motivation, as well as a brief survey of educational psychology research which suggests that students can be motivated by competition (though many caveats apply). We thus further break down the category of workspace awareness into two distinct parts based on the actions the categories are intended to motivate:

1. Collaboration awareness: Features meant to promote collaboration between learners, usually around other artefacts in the system (in our specific instance the artefact of choice is the learning object).
2. Consequential awareness: Features meant to bring an indirect sense of what other learners in the community are doing, though not necessarily to encourage collaboration directly. These features can be targeted against a single learner, an aggregation of learners, or against a simulated learner (e.g. the derived "typical" learner).

We speculate that the support for workspace awareness within e-learning environments will change the browsing patterns of students as they seek to increase interaction with their peers. While we make no claims about the quality of individual interactions, we believe there will be an increase in the quantity of interactions and that this will lead to a larger amount of overall knowledge being shared between learners. This belief is brought about in part by our informal observations of the deployed prototype, and demonstrated that both learners as well as instructors would collaborate more if they were aware of one another. More formally, we hypothesize that:

H1: The addition of collaborative awareness features, as well as communication tools to take advantage of these features, will increase the quantity of interactions in a learning content management system.

We also believe that workspace awareness is also suitable for non-collaborative activities. In particular, we believe that awareness in an LCMS will lead to both higher motivation for students as well as an increase in the quantity of interaction between students. More formally, we claim that:

H2: There is a positive impact on learning when the awareness of peer progress and activity within the content management system is made available to learners.

This paper continues as follows; in section 2 we outline the details of how collaboration and consequential awareness features are being realised within the iHelp Courses system. In section 3 we touch on extensions we are considering to allow for content adaptation using collaborative filtering. Section 4 outlines the studies planned for testing the hypotheses presented, and section 5 concludes the work with a discussion of our anecdotal evidence so far and next steps we intend to take.

## 2. Awareness Features

It should be noted that while much of the work in e-learning and awareness focuses explicitly on enabling cooperative learning, we believe that there is a benefit for awareness of others' activities within the environment even if there is no cooperation taking place. Indeed, we anticipate that some of the comparison cues available in the environment (e.g. section 2.2) will motivate students without leading to cooperation *per se*, and that this may be as valuable to their learning as direct collaboration with their peers.

Awareness features within iHelp Courses can be broken into two categories, collaboration awareness and consequential awareness. While collaboration awareness features have been available within iHelp Courses for some time, consequential awareness features are only now emerging from the prototype stage and are scheduled to be formally evaluated in the coming months.

### 2.1 Collaboration Awareness

Collaboration awareness features provide cues pertaining to the availability of other learners within the learning environment. Collaboration within iHelp Courses can take the form of either synchronous (chat rooms) or asynchronous (discussion forums) messaging. Unlike traditional content management systems, chat rooms and discussion forums can be coupled directly with the content they are meant to be used to discuss. We have implemented a "follow my browsing" model, where appropriate chat rooms or discussion forums are automatically entered when the learner moves to a new piece of content. This feature helps to encourage on-topic discussions and, in the case of synchronous chat rooms, provides an immediate awareness of other learners in the learning environment who are looking at the same content at the same time.

In addition to coupling these tools with content, the navigation window for the course provides two mechanisms to identify where collaborations are happening. The first is a set of two numbers that indicate the number of forum messages posted (and the number the current student has read) about a piece of content. The second is a small icon that represents how many other learners are currently looking at a piece of content. To simplify the interface we chose to use a coarse-grained representation of the number of learners looking at content – one small person icon indicates two or three people are looking at some content, while two icons indicates four or more are looking at a given piece of content. Fig. 1 shows a screenshot of this interface.

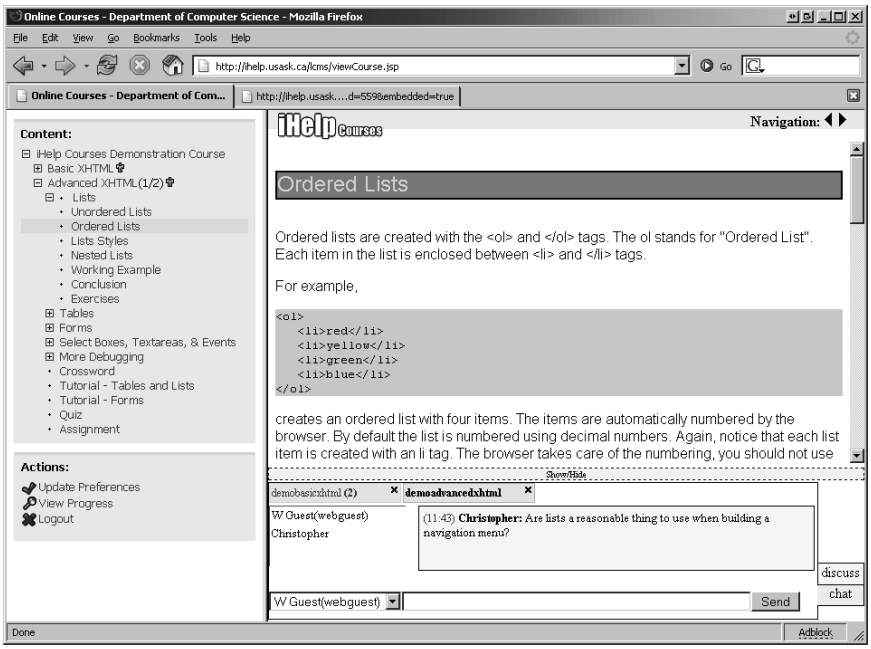


Fig. 1. Collaboration Awareness in iHelp Courses. The navigation menu on the left indicates that there are at least two learners looking at the Basic XHTML or Advanced XHTML modules (or their child content). The numbers in parenthesis behind the Advanced XHTML indicate that there are two discussion forum (asynchronous) messages associated with that piece of content, and one of those messages has been read by the current user. The top right hand frame shows the learning object content, while the bottom right frame shows the collaboration space. The learner can toggle this space between asynchronous or synchronous discussion using the tabs on the right hand side. At current the user is chatting (synchronous) with one another user and is two chat rooms (denoted by the top tabs), the first of which is in the background and has two unread messages in it.

Instructor response to these features have been mixed – instructors for early deployments indicates that content switching of chat rooms can be problematic if it is done too often. They described scenarios where they would have to mimic a given students

browsing pattern just to keep up a conversation. This feature has since been enhanced in two ways:

1. Chat rooms and discussion forums are no longer associated with individual pages. Instead, instructors can choose subtrees of learning activities to associate with rooms. This helps to support the pedagogical goals of the instructor by allowing discussions to happen at an arbitrarily large level of breadth (e.g. one discussion for a course, one per module, or one per lesson). It also allows for special rooms and forums to be associated with individual content pages, such as assignments. Anecdotal reports indicate that this leads to more context-relevant discussions with students.
2. If the learner is focused on the synchronous chat rooms, browsing to new content opens up corresponding chat rooms in the background. This allows the learner to continue conversations he or she may have underway. Background chat rooms provide some subtle clues as to the activity they contain by changing the title of room to indicate the number of unread messages it has.

### 2.2 Consequential awareness

While not yet deployed to a large group of students, we are investigating how various navigational cues can be used to encourage learner exploration of course content. The first of these modifies the background of the activity tree list to provide a comparison of the current learner's activity and the average activity observed by the content management system. This visualization is done by putting a horizontal stacked bar chart behind each node in the activity tree. The student has several options at the top of the navigation window to control the semantics of the bar charts.

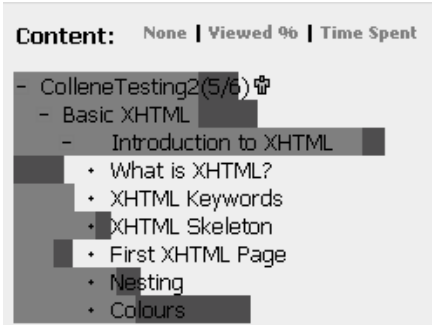


Fig. 2. Consequential Awareness in iHelp Courses. The coloured bar chart underneath the navigation tree indicates how much time the learner is taking (light grey bar) compared to the average learner (dark grey bar). In this figure the current learner is spending less time than the average student on reading content.

Fig. 2 shows the default view, where the learner's time spent on each learning object is compared to the class average for a given course. The learner can change this view to see how they compare mark-wise against the average learner (using the links in the

upper right corner of the navigation window), though this representation makes some assumption about how content and quizzes are linked (e.g. a quiz is assumed to be testing the material for the content in the subtree of its parent).

## 3. Adaptation and Collaborative Filtering

One of our current interests with the iHelp Courses environment is to encourage exploration of external links given in the learning content. We hold the belief that overlinking in educational hypermedia systems provides a negative impact on learning (either in speed, recall, or satisfaction). Further, different users may have different purposes when consuming the same content, but links are content related not task related. A given link may then be less useful for a given task (e.g. trying to get an overview of a subject area) but may be more relevant for another task (e.g. trying to gain depth in a given area). Lastly, links force a strong context switch on learners which discourages exploration. While we have plans to do empirical testing to better understand the effects of linking in educational hypermedia, we are already considering how to best use collaborative filtering to minimize the amount of linking while maximizing its value.

The iHelp Courses environment has the ability to record a path of all links a user investigates, and how long they view the pages behind those links. We believe that applying collaborative filtering on user traces to modify which links are visible, and how they are displayed to a learner may be useful in increasing learner motivation to explore the content. For instance, if two users are in a clique and one has demonstrated a strong competency on a topic and did so only after viewing a given external link, it might be useful to increase the prominence (e.g. and increase of size, or change of colour) of this link when the webpage containing it is displayed to the second user.

We are currently running studies on providing attribute-based adaptation of content within iHelp Courses. As we provide more content adaptation the complexity of determining who is within collaboration distance increases, making it harder to provide accurate collaborative awareness indicators. For example, if the activity navigation menu on the left points to dynamically generated content, one would need to have that content all linked to the same forum and chat room to show an activity indicator, which requires that an instructor provides coarse gained collaboration spaces.

## 4. Study Outline

To test out our hypotheses we are planning a number of studies. The first will examine whether the awareness features as described will influence the quantity of communication (defined as the number of chat messages sent and the number of discussion forum messages posted and read), as well as the quality of communication (where transcripts will be evaluated by subject matter experts to determine whether they are “on-topic”, using a likert scale). We anticipate this being tested in two ways; a large scale (100+ subjects) blended-learning class where learners have in class lec-

tures followed up with several hours of online content, as well as in a smaller scale study (20+ subjects) pure online course where learners have no physical access to helpers or instruction. The first of these will be tested with an entry level academic course on Computer Science for non-majors, and will be compared with another section of that course happening at the same time. The second will be implemented in a service course on computer security that typically includes faculty, administrators, and students on campus.

The testing of the second hypothesis will take place in a smaller class of online students taking our introductory computer science class for non-majors. This class typically has 20 to 30 students. As data has already been collected for the control group (no consequential awareness features enabled), we will compare this with an offering of the course next fall where motivational features are implemented. Key data to observe will be the speed of the user in going through content, the amount of time the user spends on the course, and the regularity in their content

## 5. Conclusions

This paper has briefly summarized some of the awareness features available in the iHelp Courses learning content management system. While some of these features have been tested in wide-scale deployment, a number of them are only now being tested with actual students. Feedback about this system and the sense of community it affords has been mainly positive.

While most of the features are geared towards encouraging learner collaboration, we believe the consequential navigation awareness features also help to facilitate a competitive learning environment. We are inspired often by the positive impacts of competition in multiplayer gaming environments, but note that the benefits and issues surrounding competition in learning systems have been debated extensively. Thus far in our system learners only compete against aggregate data, and that no one "loses". We are planning real-world empirical evaluations of these features to determine the impact these consequential awareness features have on learning and satisfaction.

Although we have not yet empirically studied the relationship between the collaboration and consequential awareness features and competitive learning, we anticipate that both will have an impact on student desire to excel. We believe that the consequential awareness features will encourage underperforming students to "roll up their sleeves" and become more active in the learning environment, while providing positive reinforcement for the high achievers in the course. We further anticipate that the collaboration features will help push students forward to explore new material with the confidence (though awareness indicators) that a peer support network is available.

Adaptation in iHelp Courses is currently limited to a simple attribute-based recommender system provided in the content package of our introductory computer science module. Adding socially derived recommendations using collaborative filtering is possible, but providing automatic adaptation presents a number of challenges in decidability when trying to display awareness cues. We thus believe there may be a deeper link between awareness mechanisms and user models that has been overlooked

by human computer interaction researchers, especially when relating awareness to adaptive systems. Work is underway on distilling a model that relates abstract user characteristics (and historical interactions) with awareness features for specific goals.

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