Getting Students to Teach Each Other: Doing More with Less in IS Education

Charles E. Downing [1], Chang Liu [2]

Operations Management and Information Systems Department, College of Business, Northern Illinois University, DeKalb, IL 60115

[1] cdowning@niu.edu; [2] cliu@niu.edu

Abstract

A course enhancement is described as a way to help alleviate educational problems in content understanding, need for multiple explanations, and lack of extra assistance. The method operationalizes students helping each other, and receiving credit for it. The method uses a web-based information system and the process works as follows: Mary helps Joe with a difficult course concept. As compensation, Joe logs in to the information system and registers the fact that Mary has helped him. He also gives Mary a "helpfulness" rating and comments on the help he received. Ratings translate into course points (for Mary and others), and students who accumulate enough points received Bronze, Silver, or Gold "Helper Status". Students who reach Gold status get letters of recommendation from the professor upon request. A survey study conducted in classes using this Helper System versus one not using it suggests that such a system can help with the problems of content understanding, need for multiple explanations, and lack of extra assistance. Student performance on individual course assignments also improved when the Helper System was implemented.

Keywords

Course Enhancement; Effective Instruction; Information System; Educational Assistance; Survey Study, Student Performance

Introduction and Background

Budgets are tightening in every corner of the global economy, and institutions of higher learning are no exception. Faculty and staff have been asked to do more with less, and one result has often been larger class sizes. Those faced with such class size increases have been presented with unique challenges for student engagement (Day & Kumar, 2010; Lee et al., 2005). In the field of information systems, the problems are often compounded by the complex and often technical nature of the material along with the fast pace of change (Kim & Kim, 1999). Downing (2002) reviewed the literature in Information Systems education and found three major issues / problems in achieving effective learning in large lecture settings: Problems in Content Understanding, Need for Multiple Explanations, and Lack of Extra Assistance. These issues remain problems today (Day & Kumar, 2010) and are discussed individually below:

Problems in Content Understanding

As Downing (2002) explains, "Often students have trouble with the rapidly evolving content of an Information Systems course. In particular, given the pace of change in the Information Systems field in the 1990s up to the present, the volume of material that needs to be covered simply to gain 'general IS knowledge' is so formidable as to create problems (Gill & Hu, 1999; Lightfoot, 1999; Maier & Gambill, 1996; Nelson, 1991; Silver et al., 1995; Simmering et al., 2009). Students find it difficult to grasp even the vocabulary and acronyms of the field, and without such foundation it is a stretch to think these same students would be able to effectively apply their new knowledge to business problems (Haworth & Van Wetering 1994; Lightfoot, 1999; Zawacki et al., 1988)." (Downing, 2002, pgs. 165-166).

Need for Multiple Explanations

A second problem enumerated in Downing's (2002) review is Need for Multiple Explanations: "Students frequently need or desire multiple explanations of difficult topics, and the professor and the textbook are often not enough (Mckinney & Yoos, 1998; Thomson, 1994). In particular, in a lecture setting most course information is tied to a single source, the professor, and teaching/learning activity focuses on that source's explanation (including biases) of the content (Thomson, 1994). Thus, teacher-centered courses have severe limitations in promoting learning, and additional sources are important (Mckinney & Yoos, 1998; Thomson, 1994). Increasingly, the web is being looked to for creative possibilities (Lee et al., 2005; Yang et al., 2007)." (Downing, 2002, pg. 166).

Lack of Extra Assistance

And finally, a third problem originally enumerated by Downing (2002) which still persists today is Lack of Extra Assistance: "Despite the fact that multiple sources are necessary, certain students still sometimes desire and need more individual time with the professor [or Teaching Assistant, etc.] of a lecture course. Doing so in a large lecture setting is problematic for the instructor, yet to ensure a quality learning experience some individual attention must be available to students (Gursky, 1998; Thomson, 1994; Wagner & Van Dyne, 1999)." (Downing, 2002, pg. 166).

Theoretical Grounding

The literature concerning the alleviation of these issues/ problems is rich. Each issue/ problem has had extensive theoretical and empirical studies conducted in an effort to guide instructors toward success, and those studies are considered issue by issue in the following sections.

Research Concerning Solving Problems in Content Understanding

Ambrose and Bridges (2010) note that for students to understand the content being presented, the material must be presented at the correct difficulty level, and peers can often provide that level. It is impossible for a professor in a large class to tailor the content to the exact best level for each student, but peer-to-peer content delivery has shown to be helpful. When given the correct initial level by peers, students can incrementally rise to the level of the wider class. Metcalfe and Kornel (2005) found that the timing of the delivery of the content was crucial, and Smith and Vela (2001) showed that changing the environment helped students assimilate content. A professor is generally constrained by the class meeting time, office hours, and location, but peers operate on much more of a "24/7" and location-independent basis. Whereas if a student fails to understand a concept being explained in the 2:00-2:50 class, he/she is left in a difficult spot when dealing with the professor, but can still obtain help from a peer at a different time and place. In addition to Level, Timing and Environment, Mayer and Moreno (2003) showed that the content needed to be presented in manageable segments to regulate cognitive load (so the students do not get overwhelmed). Once again, the professor's schedule of delivering content is more rigid as compared to a student's peers. A peer could discuss a difficult concept for fifteen minutes before dinner and thirty minutes before bedtime, for example. Taken together, research has clearly shown that peer explanation can enhance students' content understanding.

Research Concerning Solving the Need for Multiple Explanations

Roscoe and Chi (2008) and Griffin et al. (2008) found definitively that explanations given in addition to those from the instructor enhanced student learning. Often a student can grasp a concept being taught by simply hearing it explained a different way. As people who, in many cases, have been raised in similar cultural and historical settings, peers can often provide that additional explanation that resonates with fellow students (Roscoe and Chi, 2008). Additionally, both Bereiter and Scardamalia (1985) and Bjork (1988) discovered that varying the material presentation and content explanation facilitated learners' active integration of the information. Clearly, receiving explanation above and beyond those given by the instructor help students learn the concepts being taught.

Research Concerning Solving the Lack of Extra Assistance

Taylor and Rohrer (2010) showed that extra tutelage could come from study sessions and interaction with peers, and the variety of explanations and content provided therein could enhance learning. Possibly more important, if students found the process of organizing and participating in extra sessions or interactions relatively convenient, they were much more likely to participate (Ambrose and Bridges, 2010). Online availability has been shown to make organizing and participating in such activities much more convenient (Yang et al., 2007). And finally, students have shown that they are more likely to engage in positive behavior if an appropriate reward mechanism is in place (Ambrose and Bridges, 2010). Seeking and receiving extra assistance is a positive behavior (Taylor and Rohrer, 2010), and doing so in an online-assisted environment can conveniently give students the extra help they often need.

Research Summary and Theoretical Direction

A method is needed where the interaction between students and their peers can be facilitated and rewarded. If properly designed, such a method could lead to better content understanding, more

explanations being received, and extra assistance being given, all of which has been shown to enhance overall learning.

The Teaching Method

The Teaching Concept

This paper reports on a course enhancement based on the research designed to alleviate the three aforementioned issues / problems. The enhancement is very simple: Operationalize the students teaching each other. Of course, students on the right-hand-side of the normal distribution (the top students) have been doing this forever: If they don't understand something, they get help from one another. Operationalization of this process, in terms of the course enhancement described herein, means making available help accessible to all students (not just the top students) and giving course credit to those who help. The course enhancement is a centralization of available help for students, from other students in the class willing to help. This centralization began as "manual", with available help announced in class, and students receiving help emailing a Teaching Assistant (TA) to indicate they had received help, from whom, and if the help received was of high quality. The TA would then keep a record of students who had helped others, and give participation credit accordingly. The centralization evolved to a web-based information system which was much more efficient and served the same purpose. These centralization concepts will be referred to hereafter as the "Helper Policy" (where students emailed the TA to indicate help received) and the "Helper System" (where students logged into a web-based system to indicate help received).

The Web-Based Helper System

If a student would like extra help from a classmate, he/she logs into the Web-Based Helper System, using a secure username and password chosen for the class, and sees the four main options shown in Figure 1: View Student Directory, View Student Reviews, View Gold Helpers, and Write a Review.

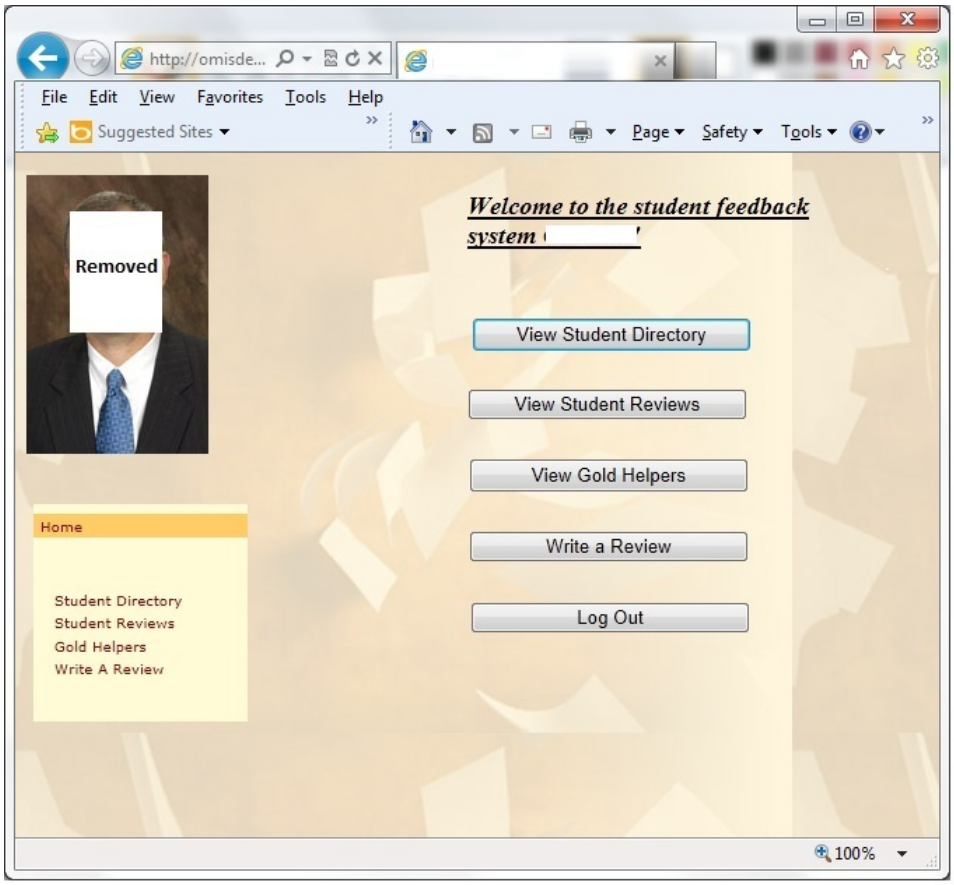

FIG. 1 AVAILABLE OPTIONS IN THE HELPER SYSTEM

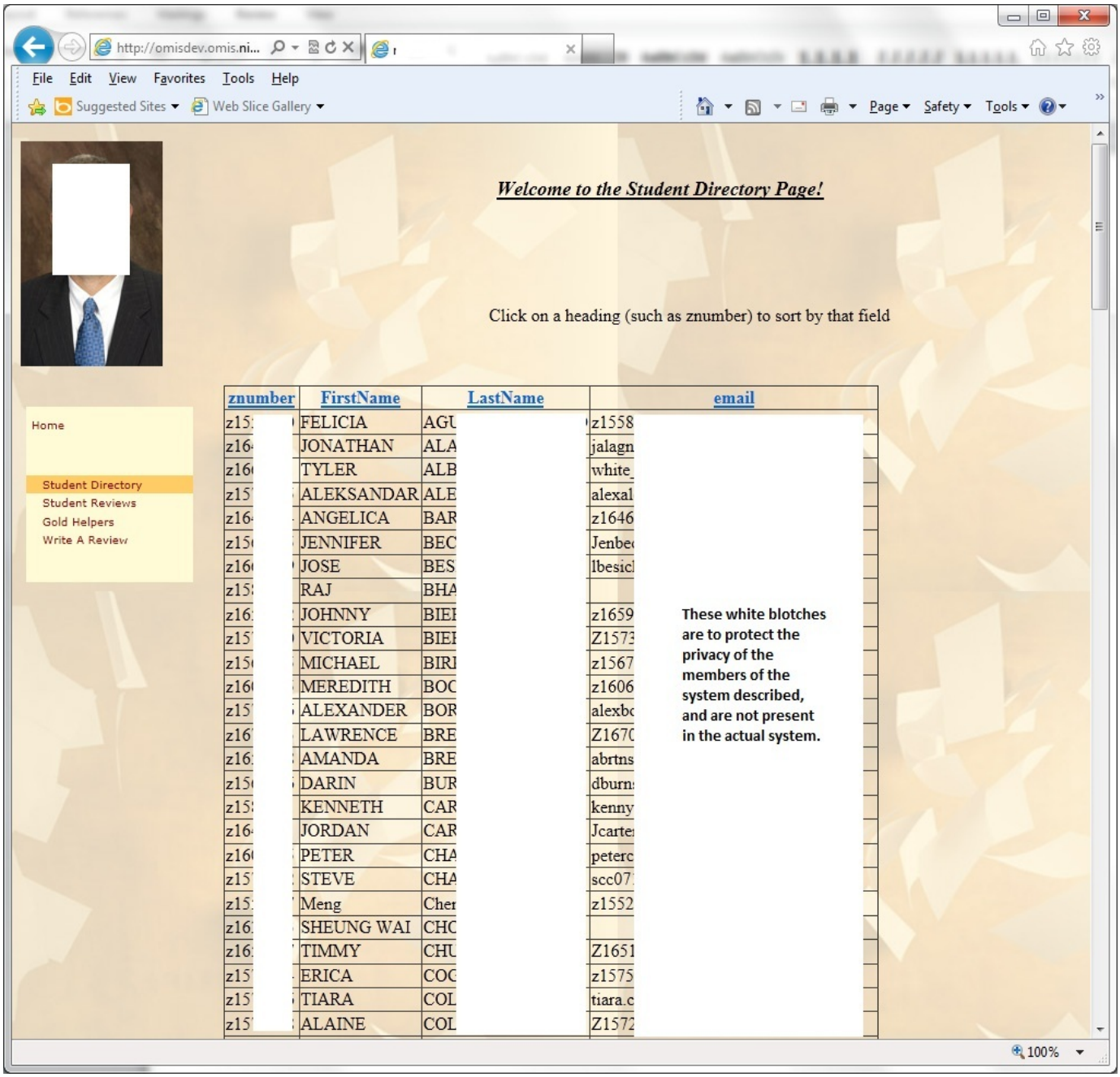

FIG. 2 VIEW STUDENT DIRECTORY

The Student Directory, which includes email addresses, is provided as shown in Figure 2, so students can cross-reference with the course seating map (not shown) to find contact information to solicit help. Most students do not need the Student Directory option.

The logged-in student may proceed in any order, but the recommended first step is the View Student Reviews option, which shows which students have helped others, on which topics, the rating they received, and their email addresses. Note that ratings can be 1, 2, or 3 point, with 3 being the best. Comments are included, as shown in Figure 3. Columns are searchable by simply clicking on the title, so a student could search by a student's first name, last name, topic (comments), etc. The student can then contact the appropriate student for help. Additionally, top students looking for more course points often offer help to students in labs, direct them to the online system, etc. Once a student is helped, he/she provides "compensation" to the helper by logging into the Web-Based Helper System and rating the helper. Ratings translate into course participation points.

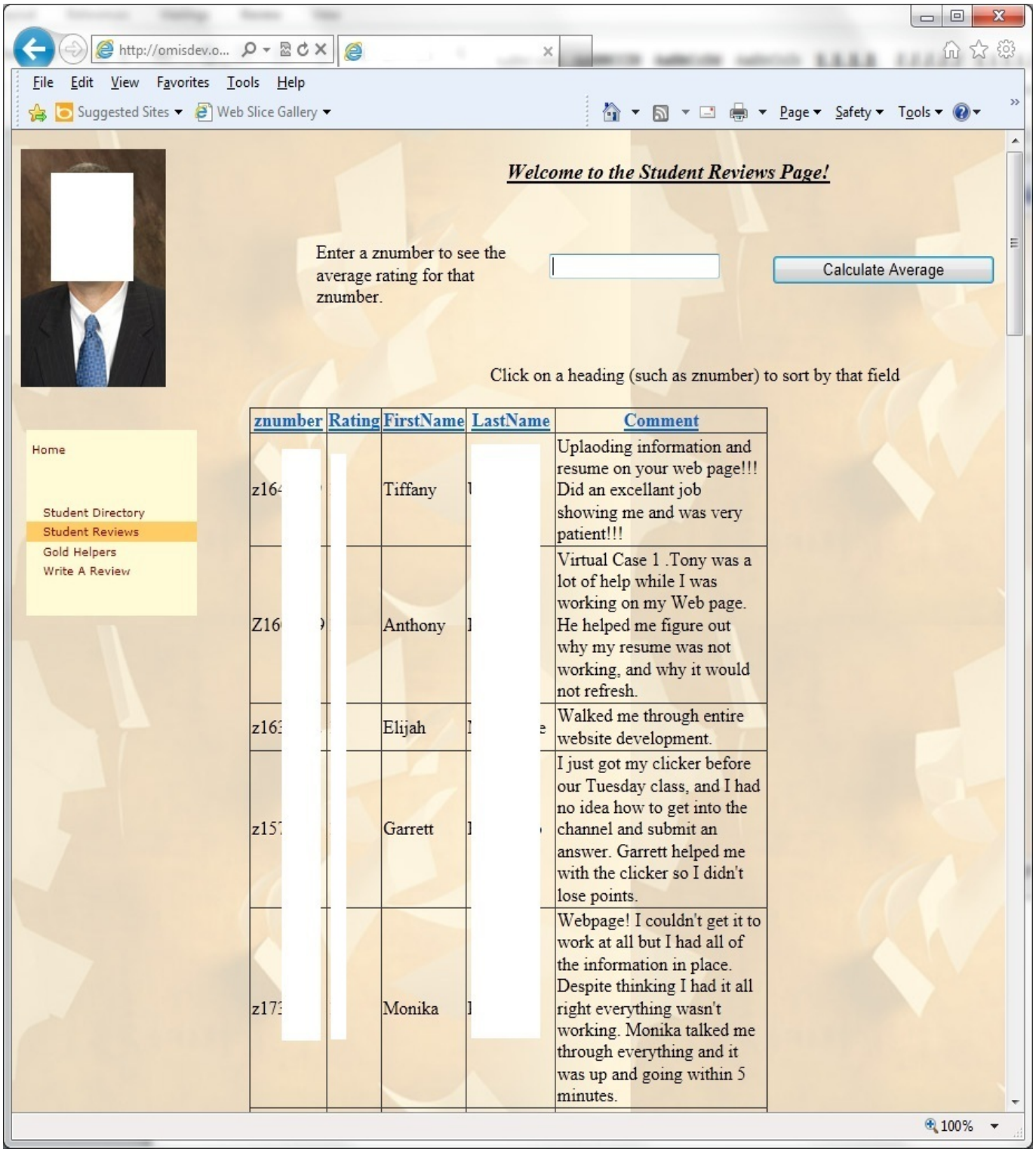

FIG 3. VIEW STUDENT REVIEWS

If the logged-in student wants a more refined search in terms of finding "the best" helpers, he/she can choose the third option, "View Gold Helpers", as shown in Figure 4. If a helping student has amassed 30 or more points assisting others (recall that one instance of help earns at most 3 points), that student will be recognized as a "Gold Helper" (Twenty or more points is a "Silver Helper", and 10 or more points is a "Bronze Helper"). In addition to the participation points for helping classmates, students who reach Gold Helper Status are guaranteed a recommendation letter from the professor upon request.

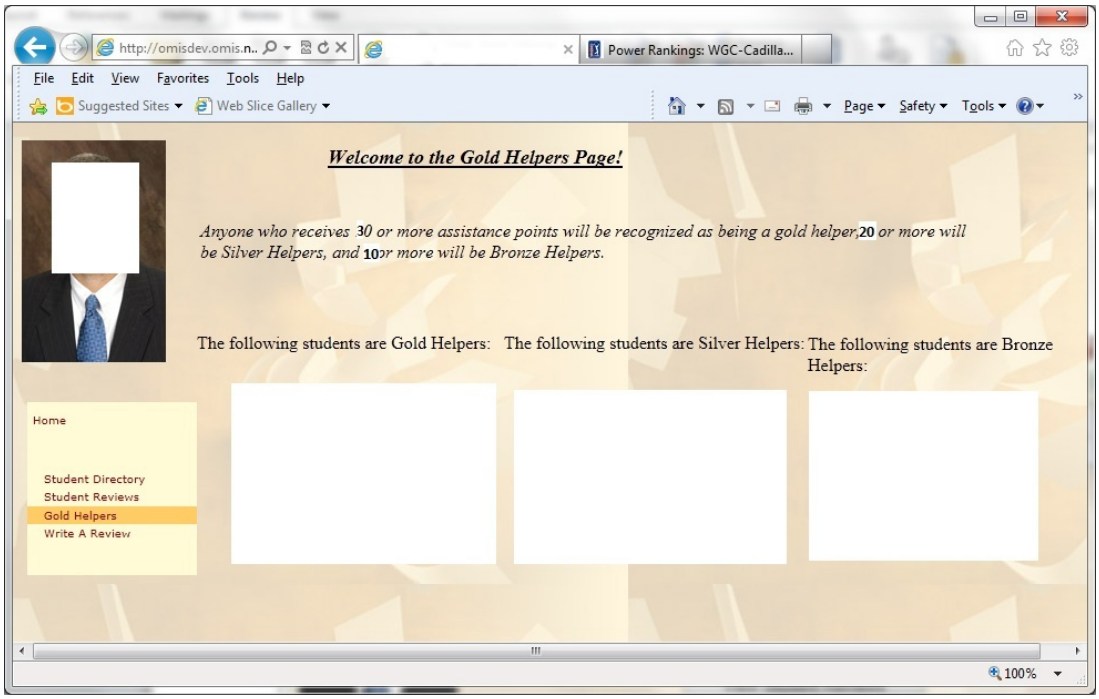

FIG. 4 VIEW GOLD HELPERS

The fourth and final major option in the system is "Write a Review", as shown in Figure 5. This is the option required for students who received help. Completing the review is the "compensation" from the helped student to the helper student. The social stigma of being a person who solicits help and then does not take the time to compensate the helper has been enough to ensure this option is completed.

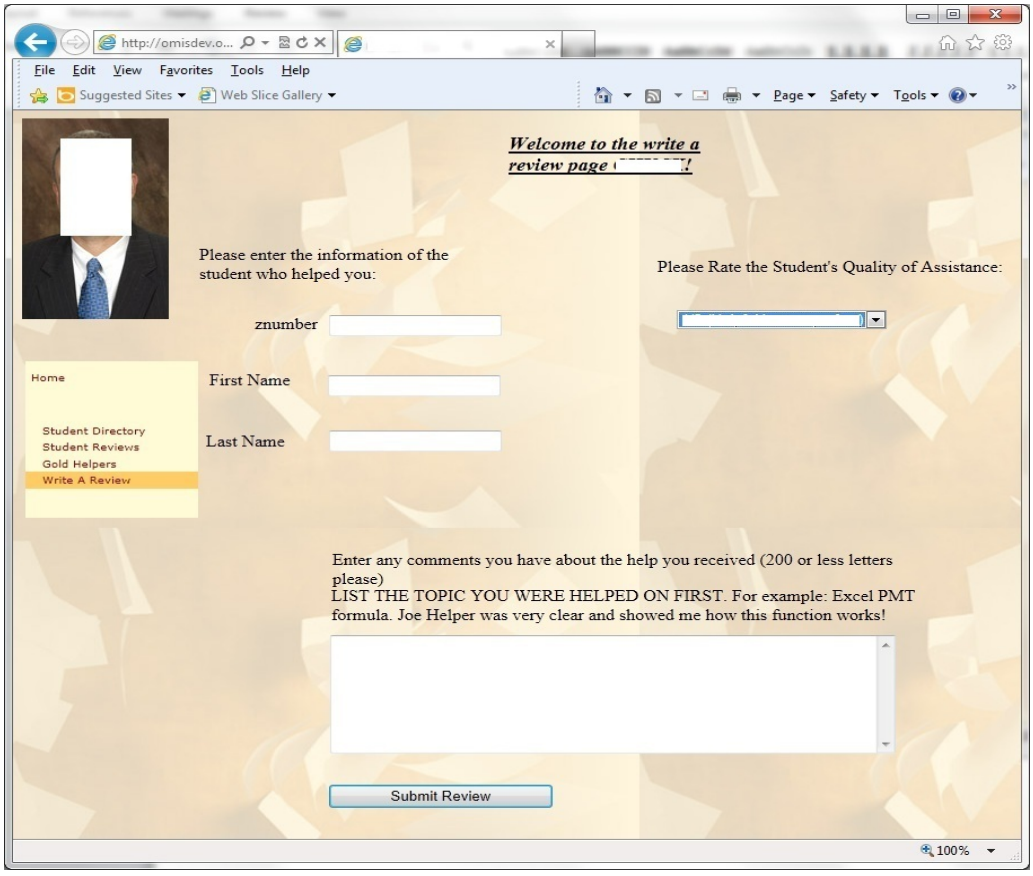

FIG. 5 WRITE A REVIEW

Our experience has been that both the number of students offering help using this system, as well as the number receiving help, have never been lower than 20% of the class population, and have never been higher than 50% of the class population, independent of class size.

A Helper System Example

Joe Student is having trouble understanding the web site development assignment for our class. He has not been able to understand the professor's explanation, and would like another explanation from a peer. He has heard about the Helper System both in the syllabus and from the professor in class, and he figures he will give it a try. He logs in and sees the four options in Figure 1. He chooses "View Student Reviews" so he can see what help others have received on web site development. He views the screen in Figure 3 (without the privacy white out) and sorts as needed by clicking on the columns. He notices that Elijah (last name whited out, but Joe would have the full name) has helped another student with web site development ("Walked me through entire website development"). He goes to the Student Directory and finds Elijah's email address, and emails him to seek help. Elijah may choose to help or not to help. His incentive is participation points, and possibly a letter of recommendation from the professor if he accumulates enough points. Joe and Elijah arrange the helping session on their own. Sometimes this is done before or after class, during a lab, or in the residence halls. If Elijah declines to help, Joe would repeat this process and ask someone else. After Elijah helps Joe, Joe logs back into the Helper System and chooses the "Write a Review" option, and fills in the necessary information shown in Figure 5. Thus the "win-win cycle" has been completed: Joe has received help, and Elijah has received recognition, and participation points, for helping.

The Study

The key question is whether this system of encouraging students to help teach each other is beneficial to the overall learning of the students. While four years of anecdotal evidence certainly suggests that this is the case, more formal validation of the benefits of the enhancement was desired and pursued using a survey in three separate courses. The hypothesis of the study was simply that the Helper System was beneficial to the students in solving issues in the areas of Content Understanding, Need for Multiple Explanations, and Lack of Extra Assistance.

Study Setting

The course studied was "Information Systems in Organizations", the core survey MIS course required of all Business students at a large public Midwestern university (undergraduate enrollment approximately 17,000). Three separate sections were studied: Spring 2008, where no Helper System at all was in place, Fall 2008, when the Helper System was put in place as a policy but with no supporting web-based system (students had to email the TA to report receiving help), and Fall 2010, when the Helper System became a fully-functioning online web-based system. In the case of each course section, the students were divided roughly equally between male and female (never lower than 40% of the total in each case), and were always in the range of 80-90% Juniors, with the remainder being mostly Seniors. On a scale of 1-5, with 5 being the most proficient, at the beginning of the semester students averaged 3.1, 3.2, and 3.0 for the three sections of self-ratings of computer competence, but the differences were not statistically significant.

Study Design

Students were asked to complete a survey concerning each of the three problem areas discussed previously. The survey changed slightly from when no Helper System was in use (Spring 2008) to when it was in use (Fall 2008 and Fall 2010). A copy of the Spring 2008 survey instrument appears in Appendix A, and a copy of the Fall 2008/2010 survey instrument appears in Appendix B. Pilot surveys were run in both cases. While careful preparation was taken with both the pilot survey and the full survey, a formal process of establishing the reliability and validity of the instruments was not followed. Hence the intent of this study is to serve as a "teaching brief" and not rigorous empirical research.

Results

Class time and a small amount of participation credit was given for survey completion. The Spring 2008 class received 183 completed surveys for an 85% response rate, the Fall 2008 class received 238 completed surveys for an 82% response rate, and the Fall 2010 class received 220 completed surveys for an 75% response rate. As shown in Table 1, the survey

results overwhelmingly support the Helper System as a useful tool course enhancement. Statistical testing used was "z-test: Two-Sample for Means", and testing was done first for Spring 2008 vs. Fall 2008 and then Fall 2008 vs. Fall 2010 for each question. In every case (significant at p<.01 or better) the means for questions in the "no Helper System case" (Spring 2008) were greater (worse) than the means for questions in the "Helper Policy case" (Fall 2008). Additionally, in every case (also significant at p<.01 or better) the means for questions in the "Helper Policy case" (Fall 2008) were greater (worse) than the means for questions in the "Helper System case" (Fall 2010). For example, when responding to the statement "The class [or Helper System] provides an opportunity for me to get extra help if I need it." (see Appendices A and B for survey instruments), the average student responses in Spring 2008 (no Helper System), Fall 2008 (Helper Policy only), and Fall 2010 (Helper System), respectively, were 2.85, 1.65, 1.23, on a seven point scale, with "1" being "Strongly Agree". Statistical testing on these means confirmed what the numbers seem to indicate: that "Helper Policy only" was superior to "no Helper System", and "Helper System" was superior to "Help Policy only".

While the survey data is useful, student performance in assignments in which they were able to seek help was also examined. The course has seven "Virtual Cases" (VCs), some being assigned for group work and some being assigned for individual completion. Historically, students were able to get help easily when working in a group, but often had difficulty when asked to complete assignments on their own. Therefore, the score changes over the different Helper System scenarios for the VCs which required individual completion, those being VC1, VC2 and VC6, were studied. Each VC was scored out of a 100 point maximum. As shown in Table 2, the scores for each of these VCs improved with improvements in the Helper System. Again, statistical testing used was "z-test: Two-Sample for Means", and testing was done first for Spring 2008 vs. Fall 2008 and then Fall 2008 vs. Fall 2010 for each question. In every case (significant at p<.05 or better) the means for the VC scores in the "no Helper System case" (Spring 2008) were lower (worse) than the means for the VC scores in the "Helper Policy case" (Fall 2008). Additionally, in every case (also significant at p<.05 or better) the means for the VC scores in the "Helper Policy case" (Fall 2008) were lower (worse) than the means for the VC scores in the "Helper System case" (Fall 2010). As with the survey results, statistical testing on these means confirmed what the numbers seem to indicate: that "Helper Policy only" was superior to "no Helper System", and "Helper System" was superior to "Help Policy only".

TABLE 1 SURVEY RESULTS

	NO HELPER SYSTEM (SPRING 2008) **(1 is "Strongly Agree", 7 is "Strongly Disagree")**	***HELPER POLICY ONLY (FALL 2008)*** **(1 is "Strongly Agree", 7 is "Strongly Disagree")**	***WEB-BASED HELPER SYSTEM (FALL 2010)*** **(1 is "Strongly Agree", 7 is "Strongly Disagree")**
Responses	183	238	220
Students	215	292	293
Response Rate	85%	82%	75%
Content (response mean)	2.54	1.76	1.24
Multiple Explanations (response mean)	3.25	1.62	1.21
Extra Assistance (response mean)	2.85	1.65	1.23

TABLE 2 COURSE ASSIGNMENT RESULTS

	NO HELPER SYSTEM (SPRING 2008)	*HELPER POLICY ONLY (FALL 2008)*	*WEB-BASED HELPER SYSTEM (FALL 2010)*
Students	215	292	293
Virtual Case 1 mean (100 points)	75.4	82.5	92.3
Virtual Case 2 mean (100 points)	72.8	80.1	87.5
Virtual Case 6 mean (100 points)	69.7	77.4	89.2

Discussion and Conclusions

Verdict on the Results and the System

The results indicate that the Helper System (both having a policy only and, even better, having an information system) was a valuable course enhancement. Qualitative comments reinforced the numerical survey findings:

- Problems in Content Understanding and Need for Multiple Explanations: Students commented that they found it beneficial to have peers help them with difficult concepts. While professors often attempt to explain everything clearly, often a second and third explanation from someone at a peer level is extremely useful. The system brought students who needed help from peers to a central and "official" area (the web site), and student comments indicated that the stigma of seeking help was thereby reduced.

- Lack of Extra Assistance: Students commented how helpful it was to be able to get extra help from willing and competent sources (students listed on the system as knowing particular topics). Often students seeking points came after hours to labs, etc., offering help and recommending classmates consult the online system for future assistance. These helpful students became like extra TAs, to everyone's benefit.

Study Limitations

It is important to note that the possibility for bias always exists when students are asked in a classroom setting about something that is happening in that classroom setting. But the results are so positive that even if bias is present they should be considered useful. These students indicated that to help with Content Understanding, Multiple Explanations, and Extra Assistance, the Helper System was a valuable course enhancement.

Concept and System Limitations

The major limitation of the concept and the system is the trust associated with student ratings. Students are getting class participation points for helping one another, and there is no check on whether the help was delivered in a manner acceptable by the faculty or the university. Therefore, it is not hard for students to "game" the system. We have remedied this by having class participation be no more than 15% of a student's total grade, and also by doing random checks of help received ("Hey, Bob, I see you received help on an advanced query from Sarah… can you briefly tell me what she covered and what you learned?"). In the first case, if a student cheats and pads his/her grade by abusing this Helper System, it should show up on the quizzes and exams which still count for far more of the class grade than participation does. The idea is that 15% is enough to be an incentive for students to participate, but not enough for them to be able to obtain a grade that they did not earn. In the second case, we have found that being site moderators, and carrying out one or two well-publicized instances of TAs or faculty "checking in" with people receiving abnormally high amounts of help from one person (or other anomalies) has done wonders to reduce this behavior. Having said that, the issue of students rating each other can be problematic, and improvement should be considered for future Helper Systems, using, for example, the work of Haselmann et al. (2011).

Implementation Guidelines for Interested Faculty

The reader should not be intimidated and believe that special software needs to be purchased to use the

concepts described in this paper. First, recall that the Helper Policy simply requires students sending an email to a TA, and the TA keeping a record of students who helped others and giving them appropriate points. Such a procedure can be implemented with a simple syllabus change, an email system, a TA and a spreadsheet. In small classes this could be implemented immediately. We went to the web-based Helper System due to the volume of emails the TA was receiving in our larger classes. But again, fear not: The Helper System is simply a relational database on a web site. We've used two tables: Students and Reviews. Those table are queried to give the options shown in Figures 1 through 5. For our front end, we used Microsoft's Visual Studio, and for the database itself we used Microsoft's SQL Server. But of course the software packages themselves are not important. Nearly every Information Systems Department or program will have faculty and/or TAs who can construct such a system in a short period of time. And the benefits easily make such construction worthwhile!

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APPENDIX A – SURVEY INSTRUMENT USED PRIOR TO HELPER SYSTEM

Class Learning Survey (Anonymous)

Please assess the following learning dimensions of our class:

Class Dimension	**Strongly Agree**			**Neutral**			**Strongly Disagree**
Content Understanding: The class allows me to understand the topics we are covering.	❑	❑	❑	❑	❑	❑	❑
Multiple Explanations: The class lets me integrate my classmates' understandings and explanations with my own understanding.	❑	❑	❑	❑	❑	❑	❑
Extra Assistance: The class provides an opportunity for me to get extra help if I need it.	❑	❑	❑	❑	❑	❑	❑
Other (please list):	❑	❑	❑	❑	❑	❑	❑

Comments:

APPENDIX B – SURVEY INSTRUMENT USED AFTER IMPLMENTATION OF HELPER SYSTEM (first via course policy only, then via a web-based system)

Helper System Survey

Please assess the following learning dimensions of our class with regard to our "Helper System" (students who understand things help other students and receive credit):

Class Dimension	Strongly Agree			Neutral			Strongly Disagree
Content Understanding: The Helper System allows me to understand the topics we are covering.	❑	❑	❑	❑	❑	❑	❑
Multiple Explanations: The Helper System lets me integrate my classmates' understandings and explanations with my own understanding.	❑	❑	❑	❑	❑	❑	❑
Extra Assistance: The Helper System provides an opportunity for me to get extra help if I need it.	❑	❑	❑	❑	❑	❑	❑
Other (please list):	❑	❑	❑	❑	❑	❑	❑

Comments: