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Designing a Peer Support System for Computer Programming Courses using Online Social Networking Software

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Abstract

In this paper we explore the design and preliminary evaluation of an online peer-to-peer support system for higher education. Our software utilizes existing online social networking (OSN) software to provide students with a multi-dimensional peer-to-peer support structure. More specifically, this research introduces an innovative expansion to online course learning software that enhances communication based on a student's course activity including course grades and technical abilities. We measure the impact of our system across introductory computer programming courses, taken by traditional college students. Initial survey data was positive and while overall levels of agreement fell between pretest and posttest surveys, the majority of students responded favorably to the new system.

1. Introduction

The United States Department of Labor, Bureau of Labor Statistics projects that jobs within the technology sector, including computer programming and information analysts, are expected to grow 17% over the next decade [1]. An additional trend in the United States identifies fewer than 40% of undergraduate students entering into science, technology, engineering and mathematics (STEM) disciplines will graduate with a STEM degree [2].

While a wide range of factors contributes to these attrition rates, including previous success in K-12 mathematics and science courses and STEM teaching quality at the college-level, another contributing factor, known as the 'fear factor' also persists. As identified in Rogerson and Scott [3], the fear factor is a large problem within the computer information systems field. In their research, they discovered that fear formed a very real barrier for students that causes intense emotion and loss of confidence and increased self-doubt. This fear is particularly prevalent during a students' freshmen year of college where students are learning to adapt to higher expectations from course instructors and non-uniform learning schedules. Particularly with STEM fields, freshman students often begin taking introductory courses in their discipline. And it is the successful completion of these introductory courses that can affect a student's progress, not only in their major, but in their overall institutional retention between their first and second year [4].

Two decades ago, Gerdes and Mallinkrodt [5] presented the term "social adjustment" as a factor in student retention. They defined social adjustment as the process by which students become integrated into the campus community, build support networks, and negotiate the new freedoms afforded by college life. And while a student's general aptitude for STEM subject matter and the quality of teaching instruction may be out of a students' control, students can look to expand upon their social network and affect other factors. In doing so, they can build a strong support network of classmates, which can help to alleviate the fears and uncertainty brought on by complex STEM subject matter and new learning environments.

In this research we introduce a peer support system and integrate it into the course learning platform within our university. Our approach is novel across a number of dimensions. For starters, our software disembarks from traditional course management system (CMS) software and introduces online social networking (OSN) software as the primary environment for course interaction. Next, our software design offers students a dynamic approach to recommending peer connections. Similar to how students use technologies such as Facebook, Twitter and other OSNs, students can discover shared interests among their peers including personal hobbies, interests, and likes and dislikes. Furthermore, students can connect with peers having similar technology interests or track major[1]. Lastly, and most importantly, our system provides students with a peer support network, where low-performing students are dynamically linked with higher-

[1] Major tracks allow students to focus their major in one of the following areas: 1) Database technology, 2) Networking, 3) Programming, 4) Information Systems, 5) Web technologies.

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performing students (i.e. those students excelling in STEM are matched with those students struggling).

We introduce our design to traditional college-aged freshmen taking their first STEM course, an introductory computer programming course, which is required for all computer information systems (CPIS) majors. Preliminary survey results reflect strongly on the success of the design indicating that students had a positive experience interacting with the OSN and also perceived high levels of peer support.

2. Peer Support in Education

Research asserts that successful learning is collaborative and social instead of isolated and competitive [6]. Furthermore, peer support in higher education can be supported through OSN software, which helps students develop shared understandings and mutual support and discussion spaces that can address problems students have with course material [7, 8]. Additionally, by making users feel connected to a community and increasing their knowledge of other members in the community, OSN software can facilitate norms of reciprocity and trust and, therefore, create opportunities for collective action [9]. Consequently, creating this shared space can facilitate levels of peer camaraderie and support.

As described in the field of captology, Fogg and Nass [10] state that computing technologies can apply social dynamics to convey social presence and to persuade. In our peer support system, social dynamics must come in the form of reciprocity. Reciprocity or, more specifically, norms of reciprocity considers the idea that if the community provides a user with valuable resources, it is a user's responsibility to give back to the community. The literature classifies this specific type of peer support networking as a subset of peer-tutoring called same-level peer tutoring [11]. Unlike peer assisted learning, students are working alongside students at the same grade level, rather than students specifically trained to tutor. In an experiment performed in Hammond et al. [12] it was discovered that students valued 'obtaining different perspectives', 'learning with others' and the 'opportunity to air concerns away from teaching staff' and in the main the sessions contributed to their enjoyment of learning. Additionally, research has found that students feel comfortable communicating with peers because of similar language styles [13].

In this research we focus our attention on peer-recommendations based on grades, interests and technical aptitude. Discussed in detail in Section 5, a carefully designed recommender system can help facilitate connection-making and interaction across an OSN. This type of system can be especially beneficial for freshmen students and facilitate social adjustment. Our design can also be beneficial across introductory courses in STEM disciplines, in our case computer programming, to help mitigate fears and apprehension in learning STEM material.

3. Theoretical Model

As researchers in social learning technologies, theory has played an important driver in the creation of our OSN and the addition of new software components. For this particular research, our goal is not just to design a space for individuals to interact, but design an environment that responds to students' needs and promote and facilitates peer support. What has emerged is the model illustrated in Figure 1, which accounts for how individuals learn, the importance of continual engagement, and the collaborative space they interact within.

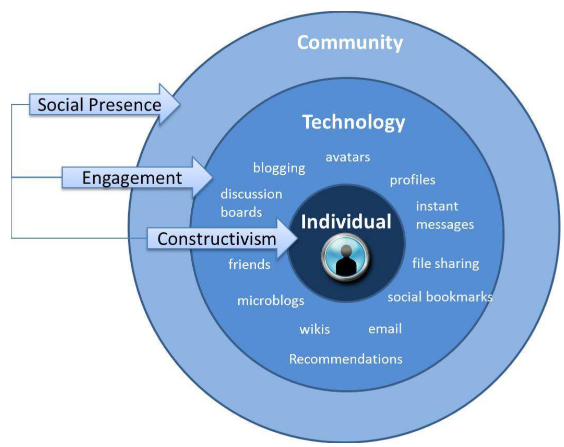

Figure 1 - Theoretical Model for OSNs in Education

Prior research has traced the roots of online communities to constructivism [14, 15, 16]. Thus, at the center of our model resides the individual. ***Constructivism*** states that learning can be based on the interaction and experiences of the learner [17, 18]. These interactions and experiences can be directly influenced by a user's engagement with course technologies. While some students are not the most vocal students, particularly when they are having trouble mastering material, a sophisticated OSN design can provide those students with a mechanism to connect with students in the virtual and physical space. Ideally, students can find and make those connections they feel most comfortable making.

Studies have shown that students who leave college prematurely were less engaged than their peers [19]. Additional research has found that student engagement can be directly linked to grades and motivation [20]. The computing discipline is largely hands-on, where students are expected to show competency through the construction of software. However, like in many STEM fields, a student can become demotivated quickly, should they be unable to grasp certain core principles. Thus, getting students re-engaged in course material is tantamount to their success. ***Engagement theory*** asserts that students must be meaningfully engaged in learning activities through interaction with others, facilitated and enabled by technology [21]. For this research, we construct dynamic modules that can facilitate interaction among students and engage those students struggling to grasp critical course concepts by directly linking peer-connections to learning objectives.

Rounding out our model is ***social presence theory***, which largely represents the OSN as a whole. Social presence theory looks at the degree to which an individual's perception of the online community, affects his or her participation [22, 23]. When an individual believes that others are interacting and exchanging information, that individual may be more inclined to engage themselves. What makes our OSN design so powerful is the link from the virtual space to the physical space. Providing students with valid connections to their classmates allows students to begin communications in a virtual space and reconnect in the lab setting, or vice-versa. Additionally, our system is fueled by dynamic data, captured from up-to-date course progress reporting, that allows students to connect with peers that are excelling or struggling with course material.

Together, these three theories provide a well-rounded model that considers the community, the individual and how each can be influenced and enhanced with technology.

4. Towards a Peer Support Recommendation System

In the process of determining the best approach for our system, we investigated those systems used across today's most popular OSN software. This process was important in understanding the various methods OSN software use to recommend users.

A common problem across recommender systems is known as the cold start problem, where intelligent agents have a difficult time recommending data since there is no data available for performing calculations [24, 25, 26]. To overcome this, most platforms require a minimal amount of information at the start a slowly aggregate more data as a user participates in the OSN. As more data is accumulated, these systems can perform more complex backend calculations and present users with a defined subset of peer-recommendations based on existing user data such as friend of a friend, location, education/work history, general interests and popular site content. In our approach, we present numerous subsets, based on different criteria as defined in our design section.

4.1 Google+

Illustrated below is the presentation layer for the Google+ recommendation engine. While Google+ maintains a strong online presence due to its integration with services like Picasa and YouTube, it has experienced challenges in the OSN space compared with its competitor and leader in OSN software, Facebook. Because of this, and the fact that Google is the dominant player in internet search, it is interesting to investigate how Google+ recommends new connections. With access to Gmail, Google+ can quickly search emails for connects, their most accurate source for possible connections. Google+ also applies the friend-of-a-friend model, which extrapolates from existing Google+ connections. Additionally, Google+ provides more advanced search based on general interests, workplaces, schools or location. Lastly, they provide a "what's hot and recommended" section (not shown) that recommends the most popular content from across the site.

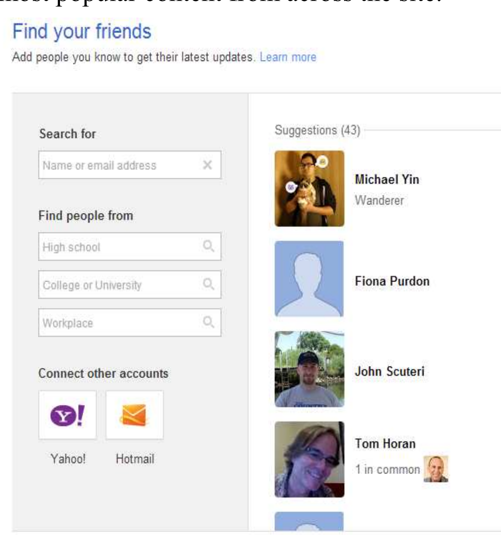

Figure 2 – Google+

4.2 Facebook

Next up is the dominant player in OSN software. Facebook has maintained dominance for a number of reasons not discussed in this research. Initially, Facebook began as a way for college students to connect with their peers within their specific institution. Today, anyone can join and connect with friends, family and organizations. When it comes to expanding its already dominant userbase, Facebook relies on several approaches. Clicking the "Find Friends" button allow users to find connections from their hometown, current city, or education. Similar to Google+, Facebook also allows users to import email addresses, which they can use to match and recommend new connections. Similar to Google+, Facebook mines data content users and their connections "Like" to recommend simliar content from across the site.

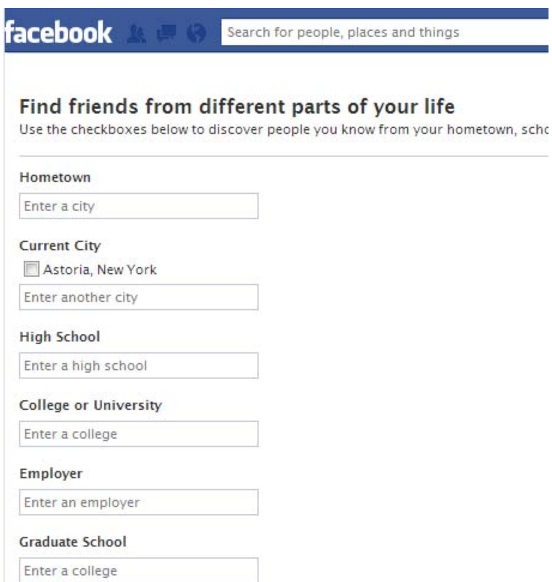

Figure 3 – Facebook

4.3 Twitter

Finally, we reviewed Twitter's approach, shown in Figure 4. While Twitter allows users to import contacts, unlike Google+ and Facebook, Twitter focuses less on matching peer-to-peer connections and more on matching a user's general interests, which they do by suggesting who to follow based on content an individual currently follows. Additionally, Twitter uses trends to recommend users, and companies can pay to have tweets promoted.

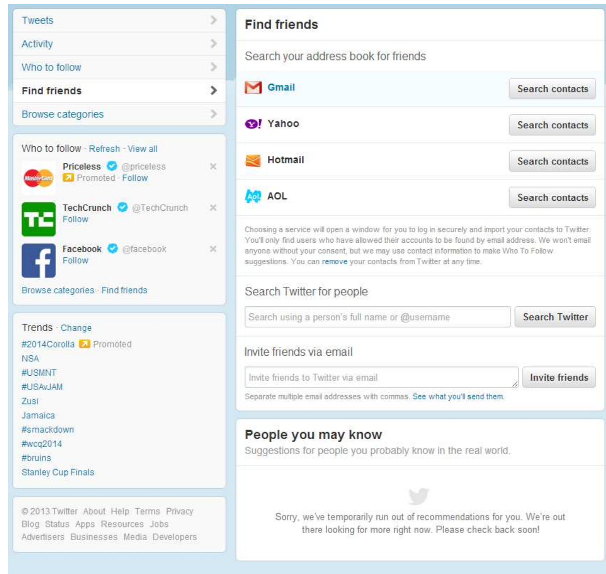

Figure 4 - Twitter

5. System Design

A few years prior to the Web 2.0 revolution, Preece [27] stated that OSN developers can control the design of OSN software but it remains difficult to control social interaction across the OSN. While this statement was made to indicate that not all social technologies will yield the desired level of interaction sought by their design, we believe it is more important to acknowledge that OSN designers have the capabilities to positively impact social interaction

This concept lies at the core of Design Science Research, where researchers are concerned with the way things ought to be in order to attain goals and devise artifacts to achieve these goals [28]. Today's educational environments are virtual playgrounds for experimenting with new designs that can facilitate learning and foster connection building. Utilizing advances in web technologies, designers are able to construct new IT artifacts, or enhance existing ones, to create a more dynamic student-centric learning experience. In this research, our IT artifact is the design and integration of a peer-to-peer support system for students that integrates the designs of popular social software described in the previous section with new components that consider students' academic performance.

5.1 Online Social Networking Platform

Having a software platform that is adaptable to the needs of instructors and students was critical. In recent years, we have evaluated a variety of proprietary and open source social software, eventually choosing Elgg. Elgg labels itself as an online social learning engine and specifically targets educational settings. Elgg provides a range of social features and has an easy-to-use interface. Available through SourceForge.com, Elgg comes bundled with online discussion boards, blogging, file sharing, the ability to create multiple sub-communities[2] and peer-to-peer (P2P) networking capabilities such as friending and messaging. Additionally, Elgg provides for the ability to restrict access to data across a number of levels, including individual-level, community-level, logged in user-level and also custom levels of restriction making it a great system for creating multiple course environments.

Our goal as social software researchers was not to produce another piece of institutional software, but to offer a user-centric and self-sustaining social learning environment for students to interact and share knowledge. To facilitate this idea further, we modified the Elgg homepage design to present users with a randomized summary people and content from across the site.

5.2 Peer Support Recommendation Engine

Innovative software design can foster social interactions across a site, and new connections can invoke a feeling of freshness for the system, providing users with something new (e.g., blogs, discussions and files) or someone new (e.g., peers and instructors) to interact with. One way to enhance this is to utilize student-driven data, which can automatically and dynamically generate recommendations through some type of recommender engine. Recommender systems address a fundamental problem of information overload and help users search a wide variety of content of which they have no firsthand knowledge [29]. Specifically, if students are already experiencing information overload from learning a new programming language, it may be difficult to seek out connections or help amongst their peers. Our approach is similar to Zhang and Hiltz [30], who implemented a mechanism to recommend users of an online research community other users based on certain preferences. However, even with a powerful, accurate recommendation system, acceptance of recommendations among users of social collaborative systems can be dependent on the type of system making those recommendations and a users' involvement in the formation of that group [31].

Consequently, designing our peer support system began with the simple rule of thumb, "provide students with a non-obtrusive mechanism to make new connections across their discipline." To elaborate on our design, we break our system down into three layers, 1) data, 2) business and 3) presentation, combining the presentation layer with data and business layers to conserve space.

5.2.1 Data and Presentation Layers. The data layer is represented with a screenshot of the Edit Profile screen in Figure 5. Our data model looks to capture the following critical information used to drive our recommendation engine.

1) Personal Information – In addition to capturing basic interests and hobby information, we capture degree specific information such as degree track, programming skills and programming aptitude.
2) Course Information – We also capture and store student course information including tests, quizzes, assignments and lab work.

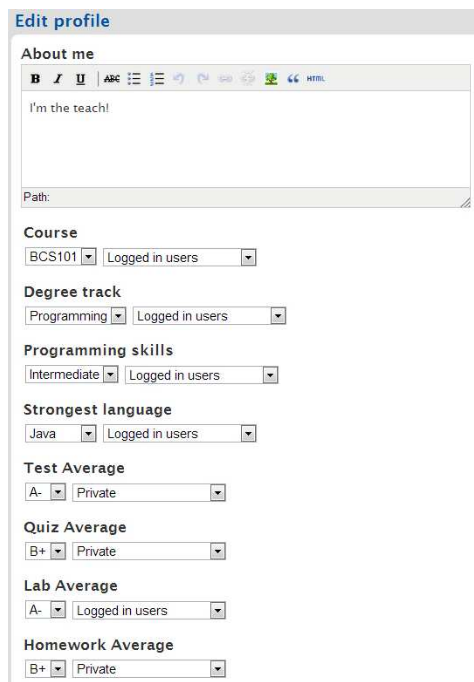

Figure 5 - OSN Profile

5.2.2 Business and Presentation Layers. The business layer is what drives our peer-to-peer support engine and is represented by the OSN Dashboard in Figure 6. The business logic was simplistic for our first iteration, since our goal was not to create a perfect matching system, but one that provided a

[2] Sub communities allow instructors to set up multiple courses within the environment, while still allow students to interact with peers outside their respective courses.

good fit. The first four dimensions focus on presenting users with other users within the same degree track, and with the same common language interests and with users with the same programming skills and aptitude. To provide these recommendations, a simple keyword matching algorithm was used. In order to keep the data fresh, results were randomized on each page refresh.

The module uses a simple algorithm for matching students as follows:

1) Calculate the averages for all students in the course using course project results to date and store those results in an array.
2) If a student's average is a B or above, they are identified as a possible peer-mentor and are presented a subset of students with grades less than a C. More weight was given depending on how high a student's grade was.
3) If a student's average is below a C, which is the minimum grade required for continued progress in the CPIS degree, they were matched with B or higher students. More weight was given depending on how low a student's grade was.

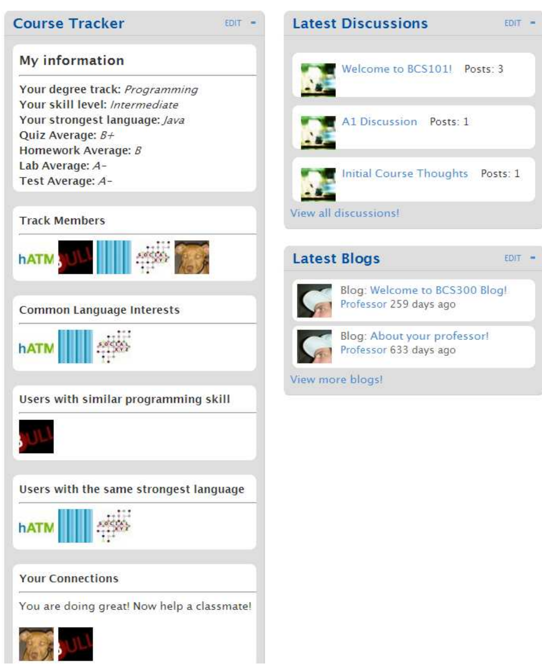

Figure 6 – OSN Dashboard

6. Research Design

Our research design is categorized as one-group pretest-posttest quasi-experimental design. Similar to the characteristics of a field experiment [32, 33], we measure the effects of our system design on a specific population within an existing organization. While the organization, an undergraduate school, is not a "naturally" occurring setting, it is pre-existing and baselines exist for which to compare results. As exploratory research, we ask the following high-level research questions:

1) What will be the impact of our OSN software for students across introductory CPIS courses on aspects of learning, social interaction and course community?

2) What will be the impact of a peer support system have for students across introductory CPIS courses on aspects of learning, social interaction and course community?

7. Results

7.1 Site Usage

From mid-August to mid-December of 2012, the OSN received 1,693 visits with an average of 12 pages per visit and average of 9.75 minutes per session. The content created across the site was as follows:

1) Blogs - A total of **219 blog posts** were made across the site. As one example of a blog assignment, students were required to reflect on specific computer programming concepts such as the difference between for-loops, while-loops and do-while loops.

2) Discussion – Discussions were used to enhance interaction on various programming topics, resulting in **266 discussion posts**.

3) Files – Following (1) and (2), students were sometimes required to share programming examples and/or screenshots of program execution. This resulted in **456 files** being uploaded across the system.

7.2 Survey Data

A pretest and posttest was distributed to 23 students taking an introductory programming course; one that is required for all computer programming and information systems majors. The return rate was 100%. Survey instruments tracked student perceptions before and after using the online learning environment. For all survey questions, a five-point numeric scale was used.

The introductory programming course was specifically designed for traditional incoming freshman. As a result, the majority of students (91%) were traditional college-aged freshman, aged 18-21, with two students outside this age-range. The class composition was 86% male and 14% female. Pretest questions also asked students' interest and aptitude for computer programming. Of our population, 70% indicated having no experience programming and 87% indicated that they were interested in learning a new programming language. Only 30% indicated that they were nervous about learning computer programming.

7.2.1 OSN Design. Our first set of questions focused on students' general perception of the OSN. Instruments were measured for internal reliability across this construct, resulting in a Cronbach's alpha score of .76. Detailed in Table 1 are responses to those survey items. Initially, students were largely positive about utilizing the OSN, which we attribute to students overall familiarity with OSN software. 86% of students indicated that the OSN would increase interaction, 91% believed it would foster new connections and 82% believed it would contribute to learning. Post-intervention, perceptions of the OSN remained positive, although they did not match initial pretest expectations. Across the same set of survey items, 72% perceived higher levels of interaction, 61% perceived stronger social ties and 72% perceived higher levels of learning.

Table 1 - OSN Design (Pretest / Posttest)

SA=Strongly Agree, A= Agree, N=Neither Agree nor Disagree, D=Disagree, SD= Strongly Disagree

Survey Item	SA	A	N	D	SD	AVG	STDV
(Pre) The OSN will increase interaction.	32%	55%	9%	5%	-	**2.0**	**1.2**
(Post) The OSN increased interaction.	11%	61%	28%	-	-	**2.2**	**0.7**
(Pre) The OSN will help make new connections.	27%	64%	9%	-	-	**2.0**	**1.0**
(Post) The OSN helped make new connections.	17%	44%	22%	17%	-	**2.4**	**1.0**
(Pre) The OSN will facilitate CPIS learning.	27%	59%	14%	-	-	**2.0**	**1.1**
(Post) The OSN facilitated CPIS learning.	17%	56%	22%	6%	-	**2.2**	**0.8**

7.2.2 Collaboration. Our second set of questions focused on students' perceptions of collaboration and social interaction. Instruments were measured for internal reliability across this construct, resulting in a Cronbach's alpha score of .87. Detailed in Table 2 are pretest and posttest responses to these survey items. Pretest results showed that 87% of students thought it would be important to have high levels of social interaction, 74% were interested in collaborating with peers and 87% felt information exchange was important. After our intervention, student perceptions shifted downward and 72% indicated that high levels of social interaction were important, 61% felt collaboration with peers was important and 67% perceived information exchange as important.

Table 2 -Social Presence Items (Pretest / Posttest)

SA=Strongly Agree, A= Agree, N=Neither Agree nor Disagree, D=Disagree, SD= Strongly Disagree

Survey Item	SA	A	N	D	SD	AVG	STDV
(Pre) High levels of social interaction will be important.	30%	57%	9%	4%	4%	**1.9**	**0.8**
(Post) High levels of social interaction were important.	13%	57%	13%	13%	4%	**2.2**	**1.0**
(Pre) Collaborating with classmates will be important.	35%	39%	26%	-	-	**1.9**	**0.8**
(Post) Collaborating with classmates was important.	17%	44%	33%	6%	-	**2.3**	**0.8**
(Pre) Exchanging feedback with peers will be important.	35%	52%	13%	-	-	**1.8**	**0.7**
(Post) Exchanging feedback with peers was important.	9%	57%	35%	-	-	**2.2**	**0.6**

7.2.3 Peer Support. Additionally, we explored student perceptions of peer support. Instruments were measured for internal reliability across this construct, resulting in a Cronbach's alpha score of .74. Detailed in Table 3 are pretest and posttest responses to these survey items. Pretest results showed 83% stating that they would contact a classmate if they needed help, 83% also felt that their classmates would provide help if they needed it, 96% stated they would provide help their classmates and 48% were interested in sharing their work. After our intervention, 78% responded that they contacted classmates when they needed help, 83% felt that their classmates provided help when they needed it, 43% stated that they provided help when their classmates needed it and 48% were interested in sharing their work.

Table 3 -Peer Support Items (Pretest / Posttest

SA=Strongly Agree, A= Agree, N=Neither Agree nor Disagree, D=Disagree, SD= Strongly Disagree

Survey Item	SA	A	N	D	SD	AVG	STDV
(Pre) I am willing to contact a classmate if I need help.	26%	57%	17%	-	-	**1.9**	**0.6**
(Post) I contacted classmates when I needed help.	13%	61%	9%	17%	-	**2.2**	**0.9**
(Pre) My classmates will provide help when I need it.	30%	52%	17%	-	-	**1.9**	**0.7**
(Post) My classmates provided help when I needed it.	22%	61%	9%	4%	4%	**2.1**	**0.9**
(Pre) I will provide help should classmates need help.	35%	61%	4%	-	-	**1.7**	**0.6**
(Post) I provided help when classmates needed help.	13%	30%	48%	9%	-	**2.4**	**0.8**
(Pre) I am interested in sharing my work.	26%	22%	39%	9%	4%	**2.4**	**1.1**
(Post) I was interested in sharing my work.	13%	35%	39%	13%	-	**2.4**	**0.9**

7.3 Qualitative Survey Data

Open-ended questions allowed students to reflect on other aspects of the OSN, including user interface and overall functionality. Students were also asked to provide any recommendations for the system going forwards. Regarding the OSN concept, one student stated, “It was a creative idea for class because it was on a private server, unlike a class on Facebook, which could be easily hacked.” Regarding the dashboard, which was the primary interface into the site, one individual stated, “The interface was very slick and gave much control to the end user.” Another mentioned, “The interface was fluid and easy to use.”

In terms of improvements, one student stated, “It would be helpful if classmates could upload videos to the blogs if they were confused on a certain subject,” which we viewed as an excellent idea. Another stated, “A live chat, similar to other social networking sites, would be beneficial.” One last student stated, “Make content tagging mandatory,” which we agree is an underappreciated, yet incredibly beneficial phenomenon that can foster content search and meta-analysis.

8. Discussion and Implications

If we accept the trends from the Bureau of Labor Statistics, there will be an increasing demand for computer programming majors. However, a disconcerting fact concerns the large drop-off of computer majors for various reasons, one of which is the fear factor involved across the STEM discipline and the lack of a strong social support network for students. In this research we design a system that provides students with the support they need to continue forward in the computing field. Specifically, our software provides students with the ability to make new connections or seek assistance from their peers.

8.1 Social Adjustment and Learning

Prior research has shown numerous benefits to using OSN software over CMS software in classroom environments [34, 35]. This should come as no surprise since universities are inherently social settings. Consequently, coursework should reinforce and embrace this concept for newly admitted college students, who face many challenges, including learning core concepts in their discipline, and adjusting to new social dimensions of higher education. It was encouraging to discover high levels of student agreement that the OSN facilitated course interaction (72%), and that this level of interaction was important (72%). While there was a sharp decline in agreement that information exchange was important (87% to 67%), which we attribute to the overwhelming challenges students face when learning a computer language face, results were still largely positive. Finally, we were most encouraged by the fact that 72% believed that the OSN design contributed to learning computer programming.

Although we only measure perceived learning in this study, we believe that any low-cost mechanism that can support learning provides students with value. We state that OSN software is low-cost primarily because there is essentially a zero-learning curve for digital natives, or those individuals having grown up with Internet. It is these students who have been first adopters of today's OSN software, thus making the transition into learning-based OSN software smoother. Additionally, we assert that any system than can assuage a student's fears of progressing through STEM academic path, as critical for the growth of STEM graduates. When students perceive a strong social setting, they will be more comfortable to engage in those social norms, which in this case is a learning environment specifically geared at CPIS material. While we do not discuss in detail, we found a high correlation (.80) on the survey item "The OSN increased interaction" and "The OSN helped in learning CPIS," which reaffirms our belief that social learning is valuable in higher education that can be aided by OSN software discovered in prior research.

8.2 Peer Support

The primary goal of this research was to provide students with mechanisms to form support structures that can follow them as they progress through their respective STEM discipline. Prior research has found that recommender systems possess a potential for facilitating peer-connections within educational settings [36]. In this research, posttest results revealed that 78% of students felt comfortable contacting their peers indicated that they would be comfortable contacting another member of the community should they experience difficulty with course material and 83% felt that their peers would provide them with the help if they needed it. These high levels of perceived support can be critical to alleviating the fears discussed in the opening sections of this paper. What makes our OSN software particularly intriguing is that it is not branded as an institutional resource. Instead, OSN software places the locus of control with the student. Not only does our design present users with a subset of high-performers that they can connect with, but it allows them to first explore a set of shared interests before reaching out.

We found it alarming to discover that only 50% of students stated that they would provide help if their classmates needed it. This number could be a simple reflection of the fact that there was about a 50/50 split between students performing very well, versus those students struggling to keep their head above water. Nevertheless, norms of reciprocity play a critical role in the success of OSN software. And even for students who are struggling, they may be missing out from the added benefits from trying to help their peers. Therefore we deem it critical that all participants be willing to provide support to their classmates.

8.3 System Design and Expansion

If a peer support system is to be truly effective, more courses must be willing to adopt this type of software. Currently, the software is utilized by one course instructor, while the majority of other instructors rely solely on CMS software. Should our software be adopted across more CPIS courses, students will gain access to a larger and more substantial peer support network. Additionally, as students begin to interact more with the software, across more courses in their degree, they would be able to achieve greater milestones and store more learning artifacts, that can help construct their personal online portfolio, which they can take with them when they complete their degree. Furthermore, such artifacts could then be mined to better match at-risk students with peer-mentors and peer-tutors. This model could help our design move away from same-level tutoring and towards peer-assisted learning, where tutors are more mature and possess successful mentoring traits including self-confidence, empathy, sociability, integrity, reliability and innovative [37].

9. Conclusion

Attenuation in STEM disciplines is larger than that in other disciplines and can be fueled by a student's fear in learning advanced STEM topics and difficulty in adapting to learning in higher education. In this research, we design, implement and evaluate a peer support system for OSN software used across STEM disciplines. We introduced our design across introductory CPIS majors and matched students excelling in course material with those struggling. Posttest survey results were favorable with the majority of students agreeing that the software facilitated course interaction, community and learning. Additionally, student's perceived high-levels of peer support indicating that they felt comfortable contacting their peers should they need help and that their peers would provide them with the help they need.

As we continue to build and extend our OSN design, we remain hopeful that with design modifications and better alignment with course instructors we can foster higher levels of retention across the computer programming major and, in turn, foster greater levels of learning and interaction across our institution.

10. References

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