

# SNAG: Using Social Networking Games to Increase Student Retention in Computer Science

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## ABSTRACT

One of the primary goals of attending academic conferences is professional networking, yet even though this interaction can increase one's feeling of community within a field, conference attendees are not interacting as much as they could be. Similarly, it's known that students who do not feel as if they are part of a larger academic community are less likely to participate in extracurricular activities and organizations, lowering retention rates. To combat both of these problems, we present SNAG (Social Networking and Games). SNAG is a suite of mobile and Internet games which aim to facilitate social networking between members of a group, and can be used in either a conference setting or within a university. This paper focuses on one specific game, Snag'em, and discusses our evaluation for our SNAG games.

## Categories and Subject Descriptors

K.3.0 [Computers and Education]: General; K.8.0 [Personal Computing]: General—*games*

## General Terms

games, social networking, diversity

## 1. INTRODUCTION

Communities are defined as a result of interaction and liberation by people brought together by similar interests and common goals [19]. These interactions, though, do not always create a community which is representative of all members. Certain factors such as level of extroversion, position within the community, and even native language can cause social inequality between all members of the group, in-

fluencing the growth of the community [11]. In a conference setting, this can impact the way individuals interact with one another and could be detrimental to overall conference success as well as students' feeling of belonging. A few academic institutions have created technological responses to this problem through ubiquitous, proactive peripheral displays [10, 11], RFID tags [8], and wearable computers and devices [16], though little work has been done to systematically evaluate these techniques or explore the long-term effects of facilitated interaction on participants' feeling of community.

A sense of community is also paramount in an academic setting. A student's feeling of belonging within their college, or even specific department, has a strong positive correlation to that person's retention rates within their major. This effect is substantial particularly in math and the sciences, where minority students suffer without a strong student support group [15]. This feeling of community can be nurtured with small group activities which augment the individual's role within a group and helps students to foster connections [14]. Creating an educational community that actively involves students with other members of the institution, particularly their peers, strongly correlates to both student success and student retention rates [4, 14]. This emphasis on collaborative learning is vital, with Wegerif once noting that "*without a feeling of community, people are on their own, likely to be anxious, defensive, and unwilling to take the risks involved in learning*" [18].

Unfortunately, social interaction among students does not just happen; rather, it must be intentionally designed into the course structure to produce the intended results [14]. Regardless of the benefits, however, student social interaction is not yet compounded into most university classes, and many professors do not take advantage of integrating existing social networking sites into their assignments. There are a few possible reasons for this, including professors who do try to encourage social interaction, but are unsure of the proper way to approach the problem [5, 9]. Of course, this push for encouraging student socialization is not universal; some professors believe that networking will not benefit the students in their course, or that there is not enough time to cover material while designing an environment which facilitates group interaction between students. We are targeting

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this problem by creating a collection of social networking games to support community building in a university or department instead of into a particular class. This allows students to develop a sense of community with their classmates without interfering with the specific way the course is being taught. Through the SNAG (Social Networking and Games) project, we will distribute numerous games which will each augment some aspect of communication at multiple universities and conferences and we will measure how these games affect students' feeling of belonging within their community.

## 2. RELATED WORK

### 2.1 Social Networking at Universities

Interesting work by Treisman et al. describes their observations of minority students at Berkeley, and report that many Black and Latino students had the intention of being math and science majors, but could not get through the prerequisite entry-level courses [15]. They also found that minority students rarely studied in groups, choosing to study and go over homework on their own. This work presents an analysis of this observation, describing that these minority students did not feel the sense of community which the majority races in science and math clearly did. When the authors developed a specific learning-intensive program for minority students which facilitated meeting and working with their peers, the students' grades rose significantly. Treisman et al. propose that individual faculty are directly responsible for creating learning environments that foster collaborative learning; furthermore, without environments that foster this kind of involvement, student success suffers. SNAG games are being designed to ease the process of getting to know other people in the student's academic community, and we hope that with these games as ice breakers and conversation facilitators, students will eventually be able to feel like they are part of a cohesive group. While Treisman's suggested learning-intensive program is clearly effective, similar programs may be expensive in terms of time and money, and may be difficult to integrate within a university department. If SNAG games prove to be equally effective in motivating student engagement and retention, any interested universities will be able to utilize these systems to build a feeling of community among their students without having to create a separate program into their specific learning environment.

Regardless of race, gendered attrition is also common in STEM (science, technology, engineering, and mathematics) fields, and research by Cohoon et al. provides evidence that something as seemingly simple as a support system is enough to increase the female student retention in the computer science major [7]. The authors performed a series of interviews, distributed a series of questionnaires, and referred to quantitative shifts in enrollment and retention in computer science departments throughout Virginia State. In each of these departments, the ones with the highest enrollment and retention were the ones which provided a support system for their students and emphasized peer-to-peer relationships. Similar results were found by Thomas et al. who discuss the use of computing identity development for college students through the growth of leadership and peer mentoring in a class called the STARS Leadership Corps [4]. The STARS Leadership Corps, or STARS Alliance, is a group devoted to outreach, research, and technical advancement, and the authors hypothesize that building networks between students

and across schools can increase retention in the field of Computer Science. They show that when students are interacting with one another, they have more means of supporting one another, and therefore have more desire to stay in the department. These results are not surprising, and there exists a strong foundation of research that shows that higher student retention rates and satisfaction, particularly among minority students, result from the existence of a community of peers to support the development of a student's identity [13]. From our observations of students interacting with SNAG games thus far, it seems these tools may be able to provide impetus for the development of peer-to-peer support systems.

### 2.2 Facilitation at Academic Conferences

Over the past few years, there have been numerous attempts to augment academic conferences with software and hardware products which can suggest friends based on your activities [12], locate specific conference members [3], store information about these conference members [2], or detail information about people in a user's general vicinity [11]. SpotMe, a specific industry-developed social networking system, requires participants to carry a portable device to track the location of other members [3]. The SpotMe system also tracks the interests of users, and notifies an individual when someone with similar interests to them is within a close distance. While SpotMe can help a conference member locate a person of interest, CharmBadge can help them log that person's information. CharmBadge, a product created by Charmed Technology, Inc., programs information which would appear on an attendee's business card into their system [1]. When two conference members interact, their individual e-information is added to each other's personal contact database. At any time, conference attendees can log in to their personal CharmBadge webpage and view the contact information of all of the participants they have interacted with. Each SNAG game tries to encourage a different type of interaction, and the goals of the tool determine the system's social networking capabilities. From reviewing the successful applications developed for conferences discussed above, we have integrated similar concepts into our games. For example, using various SNAG games, users may be able to view their social network, see the names and pictures of nearby attendees, store contact information of other players, find players with similar interests, or learn about and advertise relevant events to the community. The quantity of tools developed to facilitate conference interaction is fairly large, though little systematic evaluation has been done to compare these tools against each other. Our evaluation of SNAG games will help clarify what aspects of communication between conference attendees can be augmented by these developed tools, and can help steer future development of these applications to best fit the intended goals.

## 3. SNAG GAMES SUITE

The SNAG games suite is still in development, and will consist of a wide variety of games which will each be able to facilitate some kind of social interaction. While some games will only involve two people, other SNAG games will be able to incorporate each of the members in the community all playing at the same time. All games will be downloadable applications for smart phones or can be played through SMS texting, though some games can be accessed over an Inter-

net browser as well. In addition, participants can sign into their SNAG site at any time to view the contact information about the people they've played with. We chose to emphasize mobile phone applications over other modalities because it allows the participants to be able to engage in game play "in the moment," without having to run off to find a computer or go to an arbitrary location. This design choice will allow us to assess how people use these games to interact with people on an ad hoc basis, even though we do acknowledge that it currently limits who will be able to play these games. Different SNAG games will have different focuses, allowing people to choose a game which matches the type of social interaction they're trying to achieve. The games fall into three main categories, based on the three types of communication that our suite aims to facilitate: one-on-one, few-on-few, and many-on-many. These interactions all differ in the *quantity* of people playing at a time and the *quality*, or depth, of the information a game should help bring out. While one-on-one games would promote an in-depth factual exchange between two people or a high-quality bonding activity, many-on-many games would emphasize a general familiarization with as many people in the community as possible. Few-on-few, or small group, games are designed for 3-10 people and will often have a heavier focus on teamwork, allowing all players in a group to work together. Currently, three SNAG games are completed: World of Workout (one-on-one), TableTilt (few-on-few), and Snag'em (many-on-many). In addition to these games, a camera and GPS-based version of the common game 'hot and cold', similar to 'hide and seek,' is in the design stages, and can be played one-on-one, few-on-few, or many-on-many. Our team is constantly designing and developing new game ideas for the SNAG suite, and development will continue through Spring 2011.

#### 4. SNAG'EM

Snag'em is a large group networking game that is essentially a human scavenger hunt. Snag'em was developed in PHP, providing a web-based front-end which allows players to create their online profile and forge connections with other users. In this social networking game, players create a list of facts about themselves, called tags, which are then randomly presented to other players as missions. Missions are presented in the format, "SNAG someone who works in the Games and Learning lab," and can only be completed by interacting with a person who fits this qualification. Most of the game's interactions are enabled by our MySQL flexible database design, which allows new types of tags to be integrated into the game seamlessly. This game can easily be deployed in either a conference or university, which makes it very representative of the other games in the SNAG suite. We received extremely positive feedback from our preliminary playtesting, and our formal evaluation is yielding very promising results thus far.

##### 4.1 Game Play and Mechanics

Upon registering for Snag'em, players create a profile, add character tags, and design a virtual avatar, or "Snaggle." The game randomly generates five missions and the user can choose the one that best fits the type of person they want to meet. Players "snag" other players who meet the mission criteria, which are sets of tags, by entering their 4-digit SnagID. To dissuade cheating by entering in random



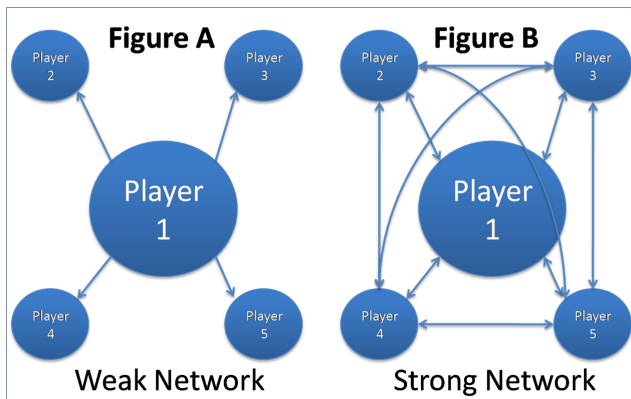
Figure 1: A simulation of how a Snag'em player would interact with the game.

ID numbers, points are deducted for incorrect answers. This also helps to encourage more substantial conversations with an individual, because it motivates the player to make sure the person does, in fact, have the trait they need to locate. Difficulty, in this case, is defined by the probability of people in the community who associate with a given tag. More points are awarded for more difficult missions, and players are able to view the commonness of a trait requested in a mission before choosing whether or not to accept it. To ensure these quests are neither too easy nor too tedious, missions will only be generated when 10% - 90% of players fit the given qualification. When the player has achieved their mission, they can generate a new list of quests and continue snagging! For this game, players are able to interact with the system using a browser or through SMS texting. Mockups of how a player would interact with the game via text message are illustrated in figure 1.

In addition to single snag missions, players can also accept *event* missions. Community events, which players and moderators can add to the Snag'em website, appear as missions, and players can "accept" them by RSVPing that they will attend. Later at the event, a code will be announced and attendees will be able to enter in the code to receive points for their RSVP. If players RSVP and do not attend, points will be deducted from their overall score. As a reward for going to these events, we provide the player with in-game prizes such as new Snaggle customizations or "forfeit mission" coupons which allow players to discard missions without a point penalty. Encouraging students to attend community events is an important aspect of Snag'em's influence on community building and thus retention.

##### 4.2 Network Connectivity

One of the most notable aspects of Snag'em is that it encourages players to build a cohesive, strong network by offering connectivity bonuses that boost how many points are earned per snag. When two people have snagged each other for a mission, the connection between these two people is mutual and they are referred to as friends. When snags are not mutual, a weak connection is created between the two players. Figure 2 illustrates the difference between what



**Figure 2: The difference between weak and strong social networks.**

a weak and strong social network may look like. By rewarding more points for more complete networks, we encourage players to help their friends complete missions in order to form more valuable social groups. We are designing a visualization of players' social networks, ranging from their direct snags to information about friends-of-friends. With this, users can form a cohesive idea about who they have been able to find for missions, and where their strongest connections lie. We will use color and thickness to portray information about the network back to the user. For example, strong connections are formed when there are mutual snags among a group of people, and will be denoted with darker and thicker lines. We will also show users groups where they are forming strong and weak relationships, to promote players to engage with more groups. Higher bonuses are given when a player snags a person who is outside of their usual networks. Additionally, while players are able to snag the same people more than once, less points are rewarded than would be given for introducing a new person into their network. This system encourages players to interact with people from different groups, while also promoting regularity in these interactions to build strong connections. Aside from each person being able to view their personal network, we will be displaying the global network on plasma screens located throughout our computer science building. The dynamic visualization is still in development, though a text-based social network description is currently in place.

## 5. PRELIMINARY EVALUATION

We performed a pilot study on Snag'em at the STARS Celebration 2009. Eighty of 280 attendees (28%) played Snag'em over the course of three days. Of those participants, 40 players (50%) successfully scored points in the game and 28 (35%) completed two or more missions in game. Player activity, we found, was consistent throughout the conference, with players playing at all hours of the day from as early as 8:30am to as late as 10:00pm, even though conference sessions usually ended at 6:30pm. We were also surprised when players would immediately resume game play after the game occasionally went down. The game suffered from several hacking attempts where players attempted to destroy the database and award themselves extra points, as well as two server shutdowns. Regardless of this, the game maintained its popularity throughout the conference. De-

spite the game's vulnerabilities, the game received positive feedback, and several of the moderators observed Snag'em players as being among the most enthusiastic attendees at the conference. At this point, it is unclear whether already social people were the ones who decided to play Snag'em, or if Snag'em helped foster self-confidence and self-assurance in people who were interacting in this way with their peers. Many players indicated that their favorite feature of the game was meeting new people, and in unstructured interviews with participants, some reported that Snag'em was a great way to meet and interact with other students during lunch and coffee breaks. Another participant stated that she had met more people at this conference from Snag'em than she ever had at any other similar celebrations she attended. The game gained enough popularity that Spellman College, another institution which had a presence at the STARS Celebration, asked for a copy of the game for use during a week-long "Geek Week" event the following semester.

## 6. EVALUATION PLAN

We have recently begun formally evaluating Snag'em with the computer science students at our university to determine if SNAG games have the potential to help develop a community among our players, and consequently, if this results in higher retention rates among our students, particularly our females and minorities. Community within our College of Computing and Informatics or at a conference will be gauged using the Sense of Community Index 2, a reliable measurement for evaluating a sense of belonging within a group [6]. We will also measure the student's positive and negative affect using the Positive Affect / Negative Affect Scale, or PANAS [17], which measures the mood of the participant over a specified amount of time. While for university studies this may be long-term affect over the course of a semester, we would use "at this moment" affect to study their sense of belonging. Students will be asked to report their level of engagement and interaction with faculty and other students within the environment the study is taking place. Our system tracks the activity of our players, allowing us to investigate the manner in which students as a whole, and particular subsets of students, such as females and minorities, interact with our given tools. From this, we can measure what types of interactions are most benefited by SNAG, what type of people get the most benefit from what type of SNAG time, and how people interact with SNAG games to augment an interaction without given instruction. We are also very interested in how well SNAG games can encourage people to interact and form relationships after their initial meeting has ended compared to control groups. We will examine how SNAG games are used as icebreakers, and if people use their saved contacts to build stronger and more permanent relationships. This information will help us understand what criteria best facilitate interactions between people in a university or at a conference, and allow researchers to develop tools which are best suited for the population we are trying to reach. Finally, using SNAG games such as Snag'em, we can further investigate the connection between a sense of community and retention rates, and determine if higher retention *directly* results from a feeling of community, and not a third factor which impacts both community and retention separately.

## 7. DISCUSSION AND CONCLUSION

The SNAG games suite has two main goals: encourage a sense of community among students or conference attendees and consequently increase female and minority retention rates, and to assess how different types of game-based social facilitation tools are used by different subsets of people. There has been a foundation of research which states that a strong community can increase the retention rates of students, particularly minorities, in computer science, though there has been no work evaluating how we can use games to foster the growth of a strong network of people. Each SNAG game will be evaluated separately to examine individual effectiveness in regards to its fun, ability to motivate and facilitate conversations, ease of use, and, for some games, how extended use over the semester affected the players' feeling of belonging within the community they were playing with. We will also evaluate the games as a whole, assessing which people found which games to be most beneficial to help us identify design principles for social networking games. Most vitally, we can use SNAG to discover what characteristics are required to increase retention - is an intensive renovation to a CS department necessary, or are engaging, ubiquitous tools and applications sufficient to obtain the desired results?

It is paramount to build community in science and math departments and at academic conferences to broaden the participation of women and minorities in these underrepresented fields. Addressing the different social interaction styles of diverse groups may help increase a sense of belonging for those who feel different in a field, and remove the barriers to their continued participation. Snag'em, as well as our other SNAG games, will be thoroughly evaluated so we can answer the interaction questions presented in this paper. Future work will determine what aspects of ubiquitous tools best benefit women and minorities, how universities and conferences can be impacted by SNAG games, and what quantitative correlation exists between changes in feeling of community and changes in retention rates.

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