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STRATEGIES FOR PROFESSIONAL SKILL DEVELOPMENT THROUGH THE STRENGTHENING OF STUDENT GROUPS: A CASE OF STUDY

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Abstract

Innovation in education and research is a constantly concern in every higher education academic institutions. Being aware of how fast technology moves, against the university curricula which rarely reacts at the emergence of new tendencies, the Department of Systems Engineering of Universidad del Norte has designed a strategy to create extracurricular spaces. In those spaces, students can develop research, application and entrepreneurship skills, set in identifying current problems and the design of solutions of those problems, using cutting edge technology in a didactical way.

These spaces are handled through the students group CCEIS - Scientific Committee of Systems Engineering Students (in Spanish), whose working lines are coordinated by professors with experience in areas like data storage, communication between applications, digital interactions and application development in mobile platforms, among others.

The experience has allowed the growth of students groups, strengthening the research profile of the group and an increase in the motivation of the students. The student members found in these groups the opportunity of exploring new technologies and applies their theoretical knowledge obtained during their career. In this work we present the obtained results on the first year and a half implementation of this strategy, and the learned lessons.

Keywords: student groups; engagement

Resumen

La innovación en educación e investigación es una preocupación constante en todas las instituciones de educación superior. Conscientes de la rapidez con la que se mueven las tecnologías, en contraste con los

currículos universitarios que rara vez alcanzan a reaccionar a la aparición de nuevas tendencias, el Departamento de Ingeniería de Sistemas de la Universidad del Norte ha diseñado una estrategia para crear espacios extracurriculares. En estos, los estudiantes puedan desarrollar habilidades de investigación, aplicación y emprendimiento, ambientado en la identificación de problemas actuales y en el diseño de soluciones a tales problemas, usando tecnología de punta de una manera didáctica.

Estos espacios se manejan a través del grupo estudiantil CCEIS – Comité Científico de Estudiantes de Ingeniería de Sistemas, cuyas líneas de trabajo son coordinadas por profesores con experiencia en áreas como almacenamiento de datos, comunicación entre aplicaciones, interactividad digital y desarrollo de aplicaciones sobre plataformas móviles, por mencionar algunos.

La experiencia ha permitido el crecimiento de los grupos estudiantiles, la consolidación del perfil investigativo del grupo y un aumento en la motivación de los estudiantes. Los estudiantes miembros encuentran en estos grupos la oportunidad de explorar tecnologías nuevas y aplicar sus conocimientos teóricos obtenidos a lo largo de la carrera. En este trabajo se presentan los resultados obtenidos en el primer año y medio de implementación de esta estrategia y las lecciones aprendidas.

Palabras clave: *grupos estudiantiles; compromiso*

1. Introduction

Student engagement is a crucial factor in order to get good results from students during their career. Many of current tendencies in software developing are not covered in core and elective courses, which tend to demotivate students. The absence of these topics could be clearly evidenced in the results of students when they submit in the courses, which are aligned to achieve different goals according to the course.

Different topics like application networking, video game development, interactive software and no relational databases are not usually covered in a formal way. That knowledge is acquired by personal research done in free time. In order to find a way to join modern concepts with the necessary courses to get a degree, it is necessary to find a way to adopt these concepts without a modification of program courses and their contents.

Webb *et al.* (2012) stated that the motivation problem can be faced from middle school, where students are more willing to take additional time to learn new concepts to know how their interests work. That experience clearly shows how a similar strategy could be made to enhance motivation in university students.

2. Related work

Different strategies have been proposed in order to reach high levels of motivation among students. Also, an interesting goal aimed in those strategies is to maximize the potential of students which demonstrates higher interest on extracurricular activities.

Minority groups were considered by Labrador *et al.* (2006) in order to propose activities for increment their participations. Minorities were considered because they constitute an important part of population. Their program has a broad range of research projects in several fields of Computer Science and Engineering, such

as robotics, databases, networking and artificial intelligence. In order to work with a minority group, the majority of students recruited came from Hispanic communities. The objectives of the program included student involvement, better preparation of undergraduate students, increasing students in graduate programs and independent learning capability improvement. The program was evaluated using periodical surveys and the results reflected an increase of involvement of student on research activities.

An interesting approach is described by Dahlberg *et al.* (2008) where the authors aimed to increment the retention and graduate recruitment doing immersive research experiences with undergraduate students. The strategy let undergraduate students to work directly with faculty and lab researchers. The selected projects for undergraduate students were related with gaming, robotics and visualization. Their results show that students demonstrate improvements in terms of self-efficacy (confidence in computing research, research methodologies, and presentation of research findings) and the interest of obtaining a PhD in computing.

ITiCSE Working Group (2011) reported several strategies implemented in a number of universities in Australasia, Europe and North America. They identified activities like streaming (different versions of a similar degree program), tangible results within a context, peer mentoring ("students learning from students"), self and peer assessment, competitions, research experiences and extracurricular activities as those which are the most attractive to students during the undergraduate program. Those activities should be under supervision by professors in order to get the maximum results. They evaluated the interest and motivation of students, who had interesting comments like "*Training taught me to identify cases where knowledge learned in my degree could be applied to real problems and inspired me to learn above and beyond my usual undergraduate studies*".

Industry-University activities have shown to be very attractive to students. A proposal described by Goldman *et al.* (2012) presents student working groups who combine their studies with real part-time employment in an educational department. The strategy was implemented with interdisciplinary engineering students at Synopsys Armenian Education Department. Each student working group works with Educational Design Kits, which let them to work with several electronic models in real processes. Working in the assigned tasks (which are actual requirements of a company) equipped them with real life practice in the field.

A serious research activity done by undergraduate student groups was described by Lopez *et al.* (2012). The proposal is targeted to students to make research groups in order to evaluate energetic resources in the region. The activity involves basic studies, practical workshops and field trips. The results of their research were presented in different local, national and international events. The experience called the attention of students of other engineering programs which joined the groups.

At Universidad del Norte, there has been experiences whose goal was to kick start the interest of undergraduate students in novel topics, like interactive multimedia, oriented to the development of artistically and visually rich content; the main activity is called Virtualizarte. This activity, organized by the Library and Departments of Graphic Design and Systems Engineering, consists in a week-long workshop that introduces the students to the technology necessary to implement a project that will be shown on the last day. This experience was a very important example to the new strategy adopted for the student group in the Systems Engineering Department, based on the positive reaction of the students during and after the workshop in terms of motivation, and also by the expertise they developed in the tools they learned.

3. CCEIS

The Scientific Committee of Systems Engineering Students (CCEIS in Spanish, which stands for Comité Científico de Estudiantes de Ingeniería de Sistemas) is a student group established in 2008 with the support of the Department of Systems Engineering, whose main goal was to provide an extracurricular space for students who wanted to extend their knowledge in the latest topics related to the disciplines of computer science, information and communication technologies, software design, etc.

During its first years of existence, the group coordinated many activities, being the main one the Lectures of Special Topics in Systems Engineering: a one-day event with invited speakers from industry and academia who presented novel topics in terms of scientific research, applied science and explorations of new technologies. This event was open and advertised in the city and brought students from all the local institutions. Other emergent activities included a burn-a-thon supported by Microsoft to make software licenses available to the students, and other social activities with the other student groups in the university.

The group worked for four years, due to the leadership of some remarkable students who brought together the people to organize the group's main activity. However, once most of the students of the first generation started to graduate, the number of active members started to decrease considerably, up to the point in which in spring 2012 only 2 students were active members of the group. The main reason of this substantial reduction of personnel was mainly due to low motivation, related to aspects like the following: In the two previous years of the group only the Lectures activity took place, and the rest of the year there was no other major activity that required the collaboration of the team; there were not many professors from the Department that were working closely with the group; the main topics of research in the Department were not appealing to the students; there was not a widely shared recognition of the outstanding achievements of the students, neither inside nor outside of the University.

This situation was observed by the directives of the Department, and it was clear that a new approach was needed in order not to lose this valuable space for extracurricular activities of the students.

3.1 Description of the new strategy

The redesign of the CCEIS came as a consequence of another experience that took place during the spring 2012, led by Andrés Bejarano, an adjunct instructor of the Systems Engineering Department. Bejarano, while being on his last year of his master's program, had the initiative to start working in the topic of computer graphics with a small group of undergraduate students who had already been part of the Virtualizarte workshops. This group of students and Bejarano explored the tool Processing (http://processing.org) and studied fundamental topics of computer graphics, like geometry, linear algebra, and mathematical functions to support complex motion patterns, etc. The group met every week for 2 hours in the Networks Lab of Department. The experience with the students was very successful. At the end of the first semester, all the students in the group had developed basic videogames, based on the content of the work.

The next step involved the planning of the 1st Week of Computer Graphics, which followed closely the format of Virtualizarte, having a workshop session and a project to develop during the week of work. More than 20 students participated in this activity, which at the end were very happy with the results, the learning experience of a technology which was not included in the curriculum, and the possibility to apply it immediately. In addition, on the project presentation session, representative from the University, including

both faculty and administrative personnel, and local companies, were invited to see the projects. They provided very positive feedback to the students on the good quality of their work.

Both the students and Bejarano were very excited about continuing with the work in the area. One question was raised: should they create a new group or should they join CCEIS, which most of the students were not part of. The final decision was to let CCEIS be the organization behind the work of the new computer graphics group, which would become a line of applied research.

Based on this model, other adjunct professors joined the group as mentors for other lines, including Databases, Mobile Programming and Web programming, and all of them started by fall 2012. The population of students participating in the CCEIS group increased dramatically to almost 50 students, and most of them very active in the activities of the group.

Once the new organization took place, and the students were motivated and were working in their own topics, it was clear that defining a common goal to the group was necessary to make it more cohesive. The first idea was to develop the content for the stand for the Systems Engineering program in the career fair. Usually CCEIS always helped in terms of logistics and decoration of the stand, but rarely had the opportunity to show what they were capable of in terms of actual products. The decision was to develop two videogames during the second semester: a classical 2D game adventure and a color tracking-based 3D flight navigator. Under the guidance of the mentor, the student divided into teams with specific responsibilities for each module of the games: 2D and 3D design, logic and physics, user interaction. The responses from the high school students who participated in the career fair was very positive, and were very impressed and interested on the products, inquiring about how were they developed, in which semester could they build applications like those, etc. In addition, the students who developed the games were very pleased to be able to show their work and being recognized outside the university.

The final component was to improve recognition inside the university, from their own peers in other programs, and even from the same program but that were not part of CCEIS. The idea was to being able to show the best class projects that the students were developing already as part of the academic work. Many courses in the program require final projects that usually are built in formats like videogames, interactive websites, information systems, etc. The students did not have any space to show their outstanding work to the whole community and being recognized. This space was created as the Class Project Show: a day-long event in which pre-registered students have a demo session of their projects. The students, professors and high school students are invited to visit the projects and to vote for their favorite project. There is no differentiation among the participants; for example, student from third semester will be competing with students from eighth semester. The results in terms of positive interaction between peers and the recognition of the winners were very positive for the students.

In addition to these local activities, the group had an opportunity to participate in a national research oriented conference on computer graphics, presenting a poster on the Flight Simulator they developed for the career fair. This was another space for recognition in a more formal scenario, which proved the quality of the work being developed by the groups.

In general, the new strategy attacked all the detected problems of the group, and generated a positive dynamic of collaboration among students, and among students and their mentors, which was very well received by the community. In the next section, the perception of the group about its own status during the

first semester of 2013 is evaluated in order to determine the level of success of this strategy in terms of motivation and participation.

4. Results

In order to know the students perception of student groups and complementary activities, several questions were asked to get as much information as possible about their conception of student groups and the new strategy.

The activities were done during academic semesters, which mean they will interfere with regular responsibilities like midterms and lecture classes. It was perceived a decrement of students who attended the scheduled meetings in all the student groups. One of the questions of the survey asked for those reasons that difficulties their presence in the groups. The results show that academic activities were the main reason of this decrement. Personal issues and the advance topics for some students were the second reasons they gave.

The main question was "*Which of the following factors were most influential in your low or non-participation in the activities of the group?*" The results (Image 1) show that academic charges (which are the projects, midterms and different submissions) is the most selected factor.
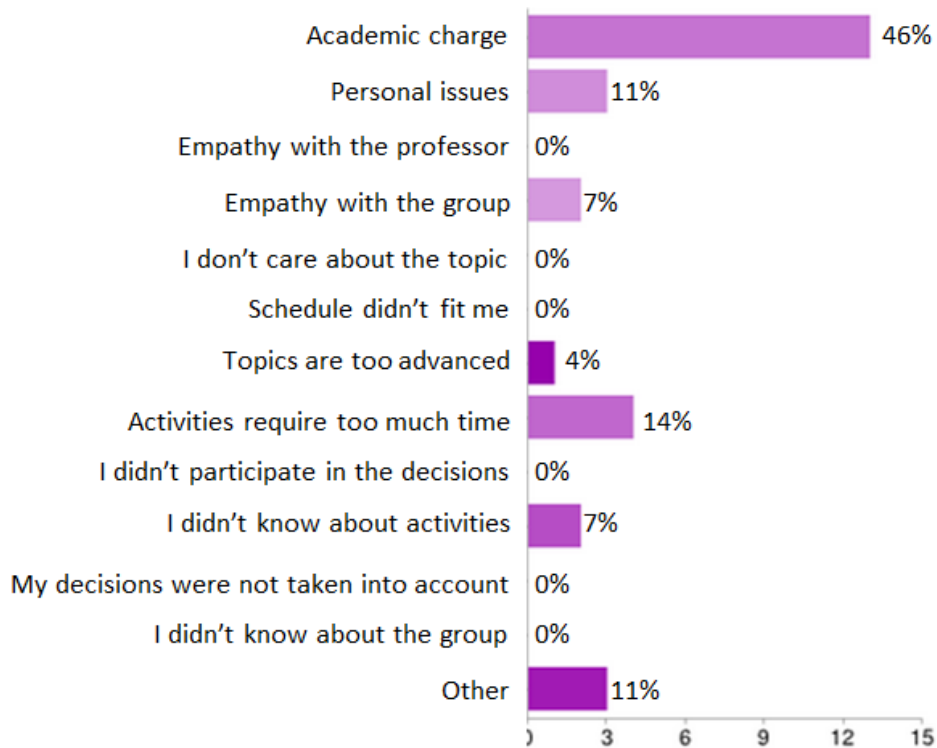

Image 1. Main reasons for personal lack of performance in the group

Regardless of the previous factor, the second question "*How is the motivation factor of belonging a student group?*" was made to detect the general perception of belonging a student group. The results (Image 2) clearly show that it is a very important model to get motivation during the career.
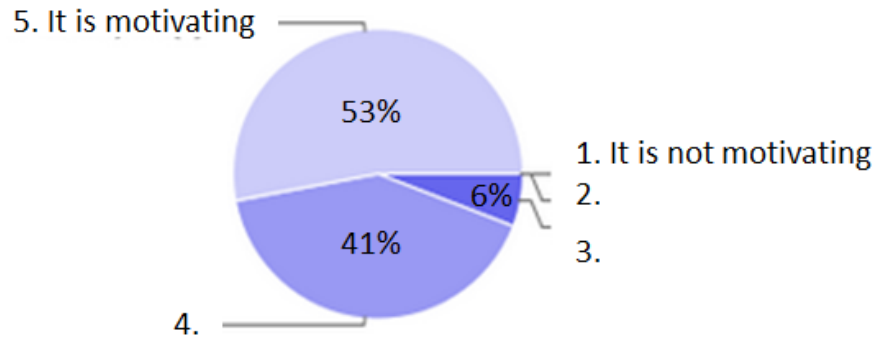
Image 2. Motivation scale of belonging a student group

5. Conclusions and future work

The CCEIS has suffered an incredible transformation from an agonizing organization to a very vibrant and active group that collaborates closely with the mentors and the Department in the multiple activities that are now under the responsibility of the students. Growing from just one activity per year to five activities along the whole year, and creating the spaces for interaction were critical to impulse this growth.

However, this is still a very early stage of the process, and some situations need to be address in order to assure the continuity of the process. The first one is that some of the students that are leading the process will be graduating soon, thus it is very important to guarantee that there will be active successors that will keep pushing the group to keep the rhythm and even extend the limits by finding other motivating activities.

The second problem is that many students opted to be part of more than just one line of applied research, which, together with their high academic load have reduced the amount of work and commitment that they could do in a single line. This is a major problem because the students cannot see a great improvement of contribution to the area, thus they may lose motivation in the whole experience. This issue requires a redesign of the structure of the groups, so that there are restrictions on the number of lines that a student can join. Also there may be some strategies to divide the junior and the senior members, because their needs and expectations are different from one another.

The third problem encountered was that the content given in the groups was overlapping with the content given in some courses in the curriculum. This started to become a problem for the professor because some students knew already part of the material, while others were completely new to the subjects and the experienced ones were bored in the first part of the course. This issue is still in discussion so that professors can come out with a parallel content line, not given in their class but in the group only. This of course requires an extra work for the mentor.

And finally, it is necessary that more professors from the Department become mentors for the group. Many have not yet joined given that they consider their topics to be not so much appealing to the students, as videogames can be. However, finding a way to increment their inclusion is another way to guarantee the sustainability of the group in time.

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