Joining the University: Developing an identity, participating in a community of practice and constructing success and failure in mathematics

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ABSTRACT

Withdrawal from universities and failure in mathematics are currently considered complex research issues. Available literature on these topics advocates for holistic theoretical approaches. Following this suggestion, the present article uses Situated Learning Theory for studying the processes through which freshman students craft and develop their identities while participating in practices within a university community, focusing particularly on the socio-cultural construction of success and failure in mathematics. The research, based on a qualitative methodology approach, was carried out on a Computer Science degree program, which is characterized by giving special importance to mathematics in the first-year curriculum and for featuring high dropout and failure rates. Data were collected during six months of ethnographic fieldwork involving six freshman students and three first-year teachers. Data analysis gave rise to four emergent categories regarding success and failure as socio-cultural constructions: labels used to categorize students and their developed identities, the relationships established between teachers and students, the different ways of understanding withdrawal, and the differences between high school and higher education.

Keywords: First-year at University. Identity Development. Communities of Practice. Success and Failure in Mathematics. Qualitative Research.

A entrada na Universidade: desenvolvimento da identidade, participação numa comunidade de prática e construção do sucesso e do fracasso em matemática

RESUMO

Atualmente, tanto a evasão na universidade como o fracasso em matemática são considerados problemas de pesquisa complexos. A literatura sobre esses tópicos defende o uso de enfoques teóricos holísticos. Seguindo essa sugestão, este artigo utiliza a Teoria da Aprendizagem Situada para estudar os processos através dos quais os alunos ingressantes desenvolvem suas identidades ao participar das práticas da comunidade universitária, prestando especial atenção à construção sociocultural do sucesso e do fracasso em matemática. Através de uma metodologia qualitativa, a pesquisa foi desenvolvida num curso de Bacharelado em Ciências da Computação caracterizado por dar uma importância especial à matemática no *curriculum* do primeiro ano e por ter elevadas

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taxas de evasão e fracasso. Os dados foram coletados durante seis meses de trabalho de campo etnográfico envolvendo seis estudantes e três professores do primeiro ano. A análise dos dados levou à emergência de quatro categorias vinculadas ao sucesso e ao fracasso como construções socioculturais: etiquetas usadas para categorizar estudantes, relações estudante-professor, diferentes explicações sobre a evasão e diferenças entre o ensino médio e a universidade.

Palavras-chave: Primeiro Ano na Universidade. Desenvolvimento da Identidade. Comunidades de Prática. Sucesso e Fracasso em Matemática. Pesquisa Qualitativa.

INTRODUCTION

We live in a society strongly oriented towards professional occupation, where credentials are necessary for entering the labour market. High school graduates have to deal with an increasingly complex and changing world. In order to live an economically self-sufficient life, many of them will need some form of postsecondary education (KUH et al., 2006).

In turn, it cannot be ignored that mathematics is frequently associated with failure at different educational levels (GIMÉNEZ; DÍEZ PALOMAR; CIVIL, 2007; KNIJNIK, 1996). According to Giménez, Díez Palomar and Civil (2007) the fact that failing in mathematics may actually truncate someone's professional career constitutes clearly a form of exclusion. In this scenario, lack of success in mathematics during the first year at the university can render access to better opportunities for professional development problematic. As teachers and researchers, we address and study these problems seeking to avoid the production and reproduction of these forms of exclusion.

Furthermore the lack of success experienced by freshmen during their first year at the university is a problem which features different characteristics in different countries. It relates, among other things, to the conditions set for accessing this level established by the educational system of each country. Considering that these conditions are extremely varied throughout the world, local research projects prove necessary, since research results cannot be transferred without serious reflection from one country to another. In addition, knowing what happens in different countries contributes to illuminate the many facets of our research problem and to question our own points of view.

In the country where this study was developed, the public university system is recognized as prestigious, and is free of charge for all students. The only conditions that any applicant must fulfill to enroll in a university degree program are to finish high school and to complete a month long introductory course. In addition, there are no pre-established quotas on the number of students to be accepted per degree.

During the past decades, the University System in Argentina became massive. But, according to Escurra (2011), the apparent democratization of universities, evidenced through high enrollment rates, has been shadowed by the factuality of subsequent failure and withdrawal. Thus, whereas in this country a large number of students join the university, just a few of them graduate. The largest withdrawal rates occur during the first year. The Faculty where this study was conducted, pertaining to the second largest University in the country, is not an exception. Table 1 shows the withdrawal rates in

the first year during the period 2007-2012. This Faculty offers six degree programs. This study focused on the Computer Science degree program, which exhibits the most massive enrolled population among them. This degree is characterized for giving special importance to mathematics in the first-year curriculum. Table 2 shows that withdrawal in the early part of the Computer Science degree program is a recurrent problem.

In education, there is vast literature exploring the factors that support and hinder student success at the university (e.g. TINTO, 1993; OZGA; SUKHNANDAN, 1998; WILCOX; WINN; FYVIE-GAULD, 2005). Sociological, organizational, psychological, cultural, and economical theoretical perspectives have alternatively been used to develop research in this area (KUH et al., 2006). Nowadays, there is consensus among the research community that student success is such a complex research issue that it cannot be explained using a single perspective (ZEPKE; LEACH; BUTLER, 2011). This research topic calls for multi-faceted, holistic theoretical perspectives and analysis. Following this suggestion, this article uses Situated Learning Theory for studying the processes through which freshman students develop their identities while participating in practices of a university community that allows certain affordances and constraints for the newcomers. Particularly, it explores the socio-cultural construction of success and failure in mathematics during the initial freshman year.

Accordingly, the current article assumes that joining the university is about developing an identity as a member of a community. At the same time, it considers that learning more about how students come to perceive themselves and navigate their first-year experience allows revealing "aspects of the organizational structure that support and hinder student success" (KUH et al., 2006, p.104).

TABLE 1 – Withdrawal rates during the first year at the Faculty where this study was conducted – all degree programs.

Period	Students enrolled	Students re-enrolled the following year	Difference	Percentage
2007-2008	403	241	162	40,2
2008-2009	329	187	142	43,2
2009-2010	423	240	183	43,3
2010-2011	439	210	229	52,2
2011-2012	476	240	236	49,6

Source: Statistical Yearbook of the University.

TABLE 2 – Withdrawal rates during the first year – Computer Science degree program only

Period	Students enrolled	Students re-enrolled the following year	Difference	Percentage
2007-2008	175	91	84	48,0
2008-2009	171	98	73	42,7
2009-2010	161	92	69	42,9
2010-2011	161	86	75	46,6
2011-2012	200	106	94	47,0

Source: Statistical Yearbooks of the University.

THEORETICAL PERSPECTIVES TO ANALYSE STUDENTS SUCCESS

An extensive literature explores the problem of student success at the university. Devlin (2011) proposed that two positions underpin much of the research developed in the area. The first one focuses on the student and is based "on the assumption that university success is primarily the responsibility of individual students" (p.5). From this assumption, it can be inferred that a student is likewise responsible for his/her failure. Several researchers have criticized such a position, arguing that such burden should be shared between institutions and students. That leads to the second position, which moves the focus to the institutions. Research conducted using this perspective analyses the role of social institutions in creating and perpetuating barriers for students. Both positions have shown limitations mainly because they are based and centered on a deficit discourse of students or institutions (DEVLIN, 2011).

In order to overcome these difficulties, a dialectical perspective is needed. As Ozga and Sukhnandan (1998) advocated, such perspective must be able to capture both the individual and the institutional processes involved in the first year at the university and to explore the mutually constituent relationships between them. The perspective developed by Lave and her colleagues provides a suitable theoretical perspective in this direction.

SITUATED LEARNING: DEVELOPING AN IDENTITY THROUGH PARTICIPATING IN A COMMUNITY OF PRACTICE

According to Lave (1996), people and the social world implied in the activity cannot be analyzed separately; rather, there exist mutually constituent relationships between people, the activities that people carry out, and the situations in which these activities are carried out. In order to construct a theory that might embrace these mutual relationships, the author suggests encompassing people, activities and situations into the category she calls social practice.

From this perspective, activities, tasks, functions, and understandings do not exist in an isolated way. They are parts of a wider system of relationships within which they have meaning; they exist within communities of practice (LAVE; WENGER, 1991). Thus, the ideas of «being a good student» or «being good at math», for example, do not exist isolated; they exist within a university community of practice that impregnates them with meaning.

This theory is explicitly interested in persons, as "persons-acting-in-the-world, as members of a socio-cultural community" (LAVE; WENGER, 1991, p.52). Through participating in a social practice people learn specific skills but, mainly, they become members of a community, they develop their identities. Therefore, when students join a Computer Science degree program, they surely learn some skills related to mathematics

and programming. However, becoming knowledgeable skilled is subsumed in the processes involved in developing an identity as a university student in and through achieving membership in a community of practice (LAVE, 1991).

Thus, identity is understood in social terms. Wenger (1998) asserted that identity is under continuous development while persons are negotiating their membership into social communities. This author characterizes identity, firstly, as a negotiated experience: "we define who we are by the ways we experience our selves through participation as well as by the ways we and others reify our selves" (p.149). Regarding mathematics, we develop our identities by the ways we participate in mathematical practices as well as by the ways we and others reify ourselves through sentences like "you are good at math!" or "maths were always my nightmare!" Secondly, identity has also a temporal dimension –where and what we have done in the past is part of who we are at present. In this sense, when students arrive at the university, they come with a long history of participation in mathematical practices. This history leaves marks in the way students relate to mathematics and can be expressed in sentences like "At high school I was so dumb at maths!" or "maths always seemed easy to me". Finally, identity is about negotiating and conciliating our various forms of membership in several communities (WENGER, 1998). School communities of practice are not the only ones that determine our identity about mathematics. Family communities or communities developed at workplaces can also contribute to the way we perceive ourselves as mathematics learners. Consequently, membership does not determine our identity in a simple way.

In view of the fact that situated activity has a heterogeneous, collective, and multifocal character – because different individuals that contribute to the activity know different things, have different interests, and are located in different social places – conflict is an unavoidable aspect of human experience (LAVE, 1996). An analysis of the changing participation in these conflictive practices should be focused on exploring:

> […] disagreements over what is relevant; whether, and how much, something is worth knowing and doing; what to make of ambiguous circumstances; what is convenient for whom, what to do next when one does not know what to expect, and who cares more about what. (LAVE, 1996, p.15)

These issues prove of great importance when analyzing the entrance into a degree program characterized by having high withdrawal rates and for giving special importance to mathematics. Throughout this article, the different answers that freshman students and first-year teachers gave to those issues will be presented.

Furthermore, learning is considered as an aspect of participating in practice. Consequently, learning is a social, historical, and culturally situated process. This turns the category *learning failure* into a blurry concept. According to Lave (1996), that learning occurs is not the problem; what is complexly problematic is what is learned. Wenger (1998, p.8) notes that "even failing to learn what is expected in a given situation usually involves

learning something else instead". If learning is always present through participating in practice, what are the central themes when we come to analyze educational institutions, as universities? This perspective suggests analyzing the ways different institutions create *learners*, *learning*, and *things to learn* as products of the socially situated practice (LAVE, 1996). In this article, one of the main topics of analysis is the socio-cultural construction of different kinds of mathematics learners at the university freshman year.

Following these ideas, success and failure in mathematics cannot be viewed as attributes of individuals. Instead, they are socio-cultural constructions, positions inside communities and social processes that are usual and active. Success and failure are also socially organized identities (LAVE, 1996). Then, failure is a problem in which many people are involved: teachers, students, classmates, parents, curriculum designers and educational researchers (McDERMOTT; VARENNE, 1995).

In mathematics education, much research has been drawn on the situated learning theory (e.g. WATSON; WINBOURNE, 2008; PINTO DOS SANTOS, 2004; WATSON, 1998). However, the construction of success and failure in mathematics using situated learning theory is still an underexplored issue in mathematics education research.

Using this theoretical perspective, the main aim of this article is to describe and analyze the relationships existing between a university community of practice, on one hand, and the identity development of freshman students, on the other hand, focusing particularly on the socio-cultural construction of success and failure in mathematics.

PROJECT OVERVIEW AND RESEARCH METHODOLOGY

The research was carried out on a Computer Science degree program where mathematics has a strong presence in the curriculum. The first semester curriculum includes three courses: Calculus, Algebra and Logics. The syllabus of the latter includes mathematical notions such as propositional calculus, quantifiers, recursion and induction proofs.

The research was conducted using a qualitative methodology. The nature of the research problem is compatible with such kind of methodology since it allows "the interpretative understanding of the individual's experiences within the context in which they were lived" (GOLDENBERG, 1997, p.19). Since the research aimed at studying the first-year experience at the University capturing the interrelations between the communal and individual facets of the experience, the participants of the study were first-year university teachers and freshman students.

Ethnographic fieldwork, focused on the Logic course, was conducted for six months during the first semester of 2008. It involved sharing with a group of freshman students and first-year teachers lessons, lunches, and free time. Their everyday activities and conversations were observed and recorded. Ethnographic fieldwork allows capturing and analyzing the ways people see themselves, their own experiences and the world

around them (ANDRÉ, 1995; GUBER, 2004). Hence, it provided a suitable method since the study sought to analyze the processes of identity development within a context characterized by high failure rates.

Six freshman students and three first-year teachers agreed to participate in the research. The students joined the University bearing different previous educational and work experiences. A brief characterization of these students is presented in Table 3. None of them had a job at the time the study took place. The teachers –Paul, John and Lara– had also different academic trajectories and started teaching at the University in 1997, 2002 and 2005 respectively.

TABLE 3 – Characterization of the students involved in the research.

Name*	Age > 21	Prior learning experiences
Gabriel	Yes	Other computer science degree program (incomplete)
David	Yes	Work not related to the degree
Jane	No	Economics degree program (incomplete)
Faye	No	High School
Mary	No	High School
Frank	No	High School

* Pseudonyms are used in order to preserve the identities of all the research participants.

Semi-structured individual interviews were carried out with four of the students – Frank, Faye, Gabriel and Jane – and the three teachers at the beginning of 2009. In the interviews, research participants were encouraged to narrate their experiences at University, whether as students or teachers.

Audio files collected during the course of the fieldwork and during the interviews were transcribed. Following a grounded theory approach (GLASER; STRAUSS, 1967; LINCOLN; GUBA, 1985), all this material and field notes were analyzed seeking to identify a set of common, emergent aspects that might describe and deepen our understanding of the first-year experience. In the process of analysis, triangulation between different sources – field notes, audiotapes, interviews –, peer debriefing and member checks were developed in order to establish credibility of the research outcomes (LINCOLN; GUBA, 1985).

RESULTS AND ANALYSIS

The students involved in the research followed different trajectories inside the degree program community. They performed differently in the first semester courses. Faye, David and Mary did not meet the requirements set for any of the final exams. After that, Faye decided to leave the University while David and Mary decided to stay and take a second chance attending all the courses again. Frank and Gabriel passed some of the exams while Jane managed to pass all the exams set for the first semester.

The analysis of the collected data gives rise to different emergent and intertwined categories: the labels to categorize the students and their developed identities, the relationships established between teachers and students, the different ways of understanding withdrawal and the differences between high school and higher education. They will be presented below.

DEVELOPMENT OF IDENTITIES AND LABELS TO CATEGORIZE THE STUDENTS

In the process of crafting an identity during the first year of the degree program a set of labels used to categorize the students proved especially important. Those labels were present in daily practices and teachers had an important role in their construction. Hence, when the three teachers involved in the research spoke about their students, they defined two interrelated and clearly separated groups. During an interview, the teachers described the first group as follows:

> I believe we can always count with a certain number of really good students. […] We have a 10% or 15% of excellent students; they'll do great [at the program]. (John)

> They've joined the university already endowed with a gift –I don't know where it comes from– for formal work, and for them it's as natural and obvious as it is to anyone who's been trained in manipulating formal symbols. (Paul)

> These are guys who deal better with abstraction. I don't know why. They understand very well the notions. They've grasped and understood the meaning of each symbol. (Lara)

When referring to these "good" students, teachers could easily identify them. Nevertheless, it proved much harder for them to explain why these students were "gifted" or why these students had the competences to deal with abstraction or formal symbols.

One of the characteristics that teachers assigned to these students was the existence of a sound mathematics background that ensured them a good performance in the first year. Such being the case, it seems that the teachers' role loses weight and becomes indefinite, being largely relegated to merely recovering previously acquired knowledge. Teachers had high expectations about the "good" students' performances and they trusted they would be able to continue their degree program successfully. Umbach and Wawrzynsky (2005) stress that behaviors, attitudes and expectations created by educational practices affect students profoundly. It might be assumed that the high expectations that teachers had for this group of students would contribute to improve their performances.

Teachers described the second group as follows:

> We're faced with a group of students that join the University with little idea of where they are coming to. A group that will not engage deeply with what they are doing in any way. There is a huge range of students that depend on us for motivation, for assisting them in finding a suitable pace that may allow them to make progress, to pass exams. (John)

> There is a very clear distinction between those who don't struggle and those who struggle. Students who perform poorly are confused with syntax. They don't comprehend what a variable is. They don't understand how a computer works. (Lara)

According to the teachers, the students "who struggled" had a rather blurred, ill-defined idea of the degree program. Consequently, it was difficult to motivate these students into studying curriculum topics that were not naturally interesting to them. Teachers' work should focus on specially supporting such students in catching up. In addition, the difficulties exhibited by this group related to their lack of understanding of basic mathematical notions. As a result, different observations were used to describe the students of this group: lack of accurate information about the degree program, difficulties in following the pace of the courses, and conceptual problems.

The students involved in the research perceived clearly these two groups as well. In their daily conversations the references to these labels usually appeared. In words of Frank:

> There were people who were attending a lot of courses for the second time and I was able to perform at heir level and sometimes I also helped them. There were also people who seemed to really get it and they were doing really very well.

The group of students "who really got it" or "who were geeks", as some of the students involved in the research used to call them, embodied the meaning of being successful in mathematics. The identities the students crafted during the first year were always related to these labels. Among the students involved in the research, three of them passed some of the first-year courses attaining a certain degree of success. Nevertheless, none of them considered themselves a member of the group defined as "those who are gifted". They worked hard to pass the exams so identifying themselves among "those who were gifted" would have meant not to acknowledge that their performance was the result of their hard work. For example, Jane said "I was not a gifted student, I studied more". David perceived himself closer to the group of "those who struggle" expressing his difficulties to follow the pace of the

courses with sentences like "this program overwhelms me". Frank saw himself in an intermediate position:

> I wasn't doing as well as some other students but I wasn't doing as bad as others, either. I performed somewhere in the middle, as an average student; [I was] a normal student.

For the students the spectrum of possible positions between success and failure was broader since, without disregarding the two extremes recognized by the teachers, they were able to locate themselves in intermediate positions inside the degree program community.

This analysis shows that the first-year practices involved the situated construction of different kinds of mathematics learners and of the identities developed around them. The labels to differentiate these learners were based on three ideas. Firstly, success in mathematics; secondly, the possession of outstanding abilities and, thirdly, the effort a student should make in order to pass the exams. The importance that first-year participants gave to these labels suggests that the degree program community was trained in searching and locating differential performances. Thus, none of the first-year participants could ignore or be unaware of them.

Besides, the labels that categorized successful students were intertwined with labels categorizing students with difficulties, the former being defined by the latter and vice versa. Hence, the students labelled as "those who struggle" enabled the perception of such others labelled as "those who don't struggle". The data analysis, echoing McDermott and Varenne's (1995) conclusions, suggests that success or failure during the first year of the degree program proved not to be two separate issues but two sides of the same coin.

THE TEACHER-STUDENT RELATIONSHIP

Consistent with other studies focused on the first-year experience at university (WILCOX; WINN; FYVIE-GAULD, 2005; McGIVNEY, 1996), another important theme arising from the data analysis was teacher-student relationships. Regarding the case under study, teachers defined these relationships in terms of the two groups described in the previous section.

In the case of "gifted" students, teachers were able to build harmonious relationships, based on the possibility of empathizing with them:

> When I was a student learning came easily to me, I had a very good performance. So, I identify myself with them [he refers to "gifted" students] and am able to understand what's on their minds. (John)

> If you take a look at the classroom they're the only ones you notice […] You don't get to analyze why the students doing well exhibit good performances because that's what's perceived as normal, that's what you understand [she refers to the way the students solve the problems]. (Lara)

Teachers' trajectories as students and their years of membership in communities related to Computer Science and Mathematics played a fundamental role in the kind of relationships they could establish in turn with their own students as well as in the way they got to perceive and categorize them. This suggests that the ideas around success and failure during the first year of the degree program were, also, historical constructions.

Although teachers claimed they wanted to help the "students who struggle", the relationships they could craft with these students were problematic:

> These people are a bit hard to deal with. Because you look at them and think: you are not understanding a single thing! Zero! To be honest, it's a bit hard because I don't know how to cope with that. (Lara)

> It's really difficult for me to understand what goes on with students who arrive and bear previous difficulties. I don't know whether they are not studying enough, or are trying and failing [in solving the exercises] […] I can't seem to understand them […] I can't put myself in their shoes. (John)

Frustration and lack of resources managed to pervade the relationships that teachers constructed with this group of students. According to the teachers, such students were "those who have arrived with previous difficulties", exhibiting poor mathematical background. Those difficulties, they argued, had been developed before joining the University and were not the responsibility of first-year teachers. It was difficult for those teachers to recognize certain connection between their students' problems and their teaching practices.

It appeared likewise hard for teachers to realize that some topics of the course syllabus could prove really tough on their students. They continuously made assertions concerning the students' lack of comprehension of some topics and about their teaching approaches to overcome such difficulties. For example:

> [This topic] isn't difficult, it's just that the students aren't familiar with it. (John)

> I produced an elementary school work for them, I mean, I did all the calculations [he refers to having solved a problem step by step on the board]. (Paul)

So, in their daily practices, teachers constantly showed their point of view about which topics and activities were relevant, which notions were worthy of being known

and which practices were important enough to deserve more time being spent on them. Teachers did not seem to be very flexible about that. Conflicts arose inevitably when these ideas did not match their students' ideas about which topics were difficult or not.

This situation emphasized the teachers' struggle for putting themselves in the place of students with difficulties. Gabriel was one of the students that clearly perceived this problem and made a complaint:

> If you asked a question, they [the teachers] would merely repeat the same speech and explanations delivered before […] But you're one step behind and you just can't make the connection: What's he [the teacher] talking about? What does this have to do with the whatever I already know? I was unable to make that connection. I wonder how it's possible for a teacher to misinterpret the student addressing him.

Gabriel's words emphasize the communication problems between students and teachers. All four students mentioned, to a greater or a lesser extent, that during the lessons, the teachers would address an interlocutor with "a higher level" or with "more knowledge" than themselves.

The analysis of the relationships between students and teachers brings forth some of the forms of participation that the community established for their members. Teachers spoke about certain mathematical topics in particular ways. This allowed them to communicate fluently with some freshman students. However, for other students, participation in these conversations resulted a difficult task because they could not establish connections between their current knowledge and the teachers' knowledge.

WAYS OF UNDERSTANDING WITHDRAWAL

During the data analysis, different ways of understanding withdrawal emerged. Each one of them illuminated a different aspect of the problem. Lara's view on this issue stressed the gap between students' expectations about the degree program and the reality they actually find when they effectively begin to attend the courses:

> They [the students] come here intending to perform as they've seen in movies. Then they find that this [the degree program] is quite something else. I think that if they do well they'll continue their studies and if they do poorly they'll give up. (Lara)

The words of Frank and Faye, two students who had no previous experience on programming, support Lara's point of view:

> I had this killer idea! [I thought that if] I started studying computer science I would find myself sitting in front of a computer listening to music with my headphones on, and learning how to program. I didn't picture that programming would be related to logic, and mathematics, and that it would be so complicated. (Frank)

> I've never programmed before, so I said: Ok! Let's give it a try! I thought it would be easier. (Faye)

As Mechur Karp and Hare Bork (2014) underlined, the popular images of post-secondary education provide little guidance to freshman students. In our case, the students' perspectives –supported by popular images of the programming activity– was not consistent with the conceptualization of programming underlying the course –a formal activity deeply related to mathematical logic–. This situation generated tensions, confusion and frustration. These findings resonate with those of Ozga and Sucknandam (1998). These authors affirm that compatibility of choice, i.e. "the extent to which students' choices fulfill their expectations and also the extent to which students fulfill the institution's expectations" (p.322), constitutes an important factor when considering undergraduate non-completion. As Devlin (2011) advocated, this problem cannot be solved merely through institutional actions focused on stating the expectations universities have regarding students. Adequate and accurate information is a first step, but many more actions have to be developed in order to assist students in meeting these expectations.

In addition to this aspect, students mentioned different intertwined factors to explain withdrawal:

> [Withdrawal] happens because you feel bad about you performing poorly at the exams, I think it's normal. Many people think that they fail to understand a single thing, that they have to study too many topics, that teachers go too fast, and that the courses workload is heavy. […] [In reference to] the degree program] It usually turns out it's not what you thought. (Frank)

> There is usually an underlying reason: you don't like the degree program […] But I don't think this reason may by itself explain the huge amount of people who give up […] I think it's because of the change in the pace of study and the demands that not everyone is willing to bear. (Jane)

From the students' point of view, several factors were associated to withdrawal. As Wilcox, Winn and Fyvie-Gauld (2005) pointed out, withdrawal is a multifaceted and complex issue. Although some of these factors were personal – for example, a student's dislike for the courses –, others were strongly related to the demands of the community

upon the freshman students. Not all of them wanted or were able to follow the pace imposed by the courses, or cope with the amount of study topics and the workload in general. In this sense, the students' words also tell us a lot about how the program community actively imposed demands that led to their withdrawal.

Test marks were signaled by all research participants as being of great importance when considering staying or leaving the degree program. In Faye's words:

> I dropped out because I failed the exams and felt I didn't fit in […] After the exams I realized that I hadn't learnt anything, so, why would I continue wasting my time?

Thus, in the process of developing an identity as a freshman student test marks resulted extremely important. Passing the tests was a fundamental indicator of membership in the degree program community. When Faye said "I didn't fit in" she was underlying that her membership in the community, her identity as a member, had been jeopardized. Teachers were also aware of this role played by test marks. As John explained:

> I think that in this system structured on assessment, in which it's "all or nothing" […], students are prone to feel that way … […] it seems to me that they join the program determined to either complete the whole course or to quit if they get stuck in some topic and can't move forward anymore.

The responsibility for failure was yet another issue related with the assessment system. From the students' perspective, to fail an exam was an experience that spoke about who they were, locating the problem within their individual sphere. They would always state: "**I** didn't learn anything", "**I** failed". According to the students, failure was an experience that stressed the fact that they lacked certain skills. It was very difficult for them to even consider that other people might be involved in their failure experience. Only Gabriel was more critical about the learning opportunities the degree program offered to him:

> What about the time I dedicated to the degree program? Where does my effort go? That's what I don't quite understand. What is it I'm doing wrong that hinders me from obtaining what I want?

Gabriel's words bring forth that relying merely on the personal effort or persistence of freshman students will not provide a feasible answer to the failure problem. There are students, like Gabriel, that really persevered and made important efforts during the first year; yet, they failed to succeed at the program.

In addition, Gabriel's quote underlines that students are not passive receivers of the cultural practices that situate some of them in vulnerable positions at the degree program community. Instead, they engage with those practices and, within their scope of action, challenge them, as Devlin (2011) pointed out. Gabriel developed his identity, partly, in criticizing his teachers and struggling with the constraints the community imposed to newcomers.

DIFFERENCES BETWEEN HIGH SCHOOL AND HIGHER EDUCATION AND THE COLLECTIVE CONSTRUCTION OF DIFFICULTIES

The students highlighted several differences between their experiences as high school students and as university students:

> There are very few high schools that have this kind of mandatory study load. That proved tough on me […] There is a substantial change regarding the pace of study, a very dramatic change, compared to the high school experience. (Jane)

> University changes your study methods […] Compared to the high school experience you're faced with a lot of topics to study. (Frank)

> The difference lies in how much more demanding the courses prove to be. [At the degree program] you can't distract yourself for a second because you get lost. (Faye)

Becoming a member of the degree program community was a process that transcended the conceptual differences between high school and university and demanded a lot of identity work: students needed to learn how to deal with their course load, study methods, concentration, and pace of study.

Course load and workload were also among the main difficulties they mentioned during their first-year experience:

> Course load really gets to you, because you get home exhausted and you can't think, it is not that you don't want to, you simply can't. (Frank)

> I came home at six p.m. in the evening, I ate, I took a shower, and I began to study. It was so exhausting; you already felt tired from spending all day at the University. It was consuming to come back [home] and deal with studying again. I think I studied for four more hours and then went to bed. (Faye)

In this exhaustive first-year experience, membership in the community pervaded much of the time in the students' lives. Becoming a member of this community was a

full-time experience for the students, which involved managing their time in order to attend classes, trying to solve exercise guides at home, overcoming their tiredness, and studying for exams.

Another major problem the students mentioned was their difficulty in coping with the pace of study:

> They [the teachers] *would deliver their lessons too quickly*, they taught a lot of topics in a single day, in a single lesson, in a single practical lesson. You had to be present every single day and you couldn't miss anything. (Frank)

This difficulty worsened at the time students tried to solve the exercises proposed by the teachers. These exercises were unlike those the students were familiar with: to be able to solve them was not a trivial task and the time employed was greater:

> To me, the exercises proved hard. I had to consult different books, or seek guidance from other classmates, or post questions on the course webpage. I couldn't solve it [an exercise] so I would erase it and start over again. It took too long to finally solve it. (Faye)

> You have to find the way to solve it [...] and too often this involves time, time you lack because the test date is getting closer. (Frank)

In order to follow the courses study pace, students had to develop new study habits such as consulting classmates and a variety of textbooks, seeking help through the course webpage, looking into textbooks and lecture notes in order to find a clue for solving an exercise, or trying different paths towards problem resolution. Mechur Karp and Hare Bork (2014) underlined that first-year university students have to learn new study habits and time management strategies. Using the situated learning perspective, the need for developing habits that allow a student to cope successfully with the pace of study can be understood in terms of membership in the degree program community of practice: those who fail in this endeavor face the risk of being left behind occupying peripheral or precarious positions inside the community.

The teachers spoke about the gap between high school and higher education mainly in terms of conceptual differences. In this sense, they underlined that student preparation for university was poor and that this was a recurrent problem generating tensions inside the community. In Paul's words:

> Many people have already raised the issue: students arrive from high school poorly prepared. How can we improve this situation? Well, there is a tension between

> 'let's make the program easier because high school students are poorly prepared' versus 'we shouldn't lower the program level.

This quote highlights the struggles in which some members of the community became involved with. Some teachers perceived the program prestige was strongly related to its "level". Some members were wary about lowering the program level in order to better fit the needs of the student population. This fact puts in evidence the tensions related to the reproduction of the community over time revealing that community transformation is not a simple or neutral process.

Regarding this vision of the program's prestige, in several opportunities the gap between high school and the program was mentioned in order to underline the idea that "the degree program was a tough one". For example, the following quote is an excerpt of a talk that senior students gave to freshman students:

> First year is difficult, it'll be hard on you because it's quite a leap forward versus what you were used to in high school, it involves a different way of thinking […] You'll never grasp the topics at once, you'll be addressing very difficult topics, you'll have to try, and try, and try again [to understand].

Senior students were not the only ones that stressed that the program was a difficult one, demanding a lot of hard work, devotion, and effort from freshman students. The warning Frank received from his high school mathematics teacher seems to point to the same direction:

> My math teacher studied here and he told me: you've enrolled in one of the toughest faculties, it's very, very hard but if you manage to graduate you'll be a very good professional. (Frank)

Hence, many community members engaged in the construction of the idea that the "degree program was difficult". On one hand, this idea made it possible to comprehend the problems the students faced in understanding some of the topics. In this sense, it made their life easier because it acknowledged they were trying to understand "very difficult topics". On the other hand, this idea contributed to naturalize failure in the freshman year: if the degree program is a very difficult one then it is natural that many students should fail. It might be considered that, to a certain level, this perspective prevented debates that would present as a problem the high failure and withdrawal rates.

DISCUSSION AND FINAL REMARKS

Data analysis allowed gathering the experiences and points of view of different first-year participants. The emergent categories presented in the previous section enabled to draw a complex landscape. The process of developing an identity as member of the Computer Science degree community became strongly related to the labels used to categorize students, the kind of relationships established between teachers and students, and test marks. At the same time, participating in the community of practice involved developing a set of habits and strategies in order to cope with the demanding course load and pace of study. This was not a simple task for the students involved in the research, and many of them considered it as the main reason for explaining dropout rates. Joining the degree program implied becoming a member of a community very different from that in high school, with a prestige and a "level" that old members wanted to preserve. Inside the community daily conversations and practices focused on the difficulty of the program, "the gifted students", or on "those who struggle", contributed to the socio-cultural construction of success and failure.

This research was conducted on a specific university degree program using a qualitative perspective. Therefore, the results are context-specific and cannot be automatically generalized and transferred to other contexts. However, the research community may benefit from local studies –particularly if they are developed in little explored contexts– since they can reveal new aspects of our research problem.

In the case of the present article, the articulation of rich data from different first-year participants revealing implicit and explicit conceptions and experiences is an important contribution. Additionally, the fact that the emergent categories described in this article resonate with other research results helps to gradually construct analytical models that allow us to better understand the first year of the university experience and to recognize similarities and differences with other school settings characterized by failure and withdrawal.

This article has implications for the debates around withdrawal from university and failure in mathematics. Firstly, the data support the importance of avoiding a simplistic approach when analyzing success and failure. In agreement with Devlin (2011), the current article proposes to emphasize the socio-cultural nature of learning and teaching mathematics. University practices are developed within and by socio-cultural communities. These communities hold certain conventions and rules about the discipline, about their students and about how the students must learn the discipline. The teachers' quotes included here reflect many of these conventions and rules belonging to the studied community. Becoming a university student is about becoming a member of a community, developing an identity that articulates students' past experiences, students' expectations about their future and the affordances and constraints the community offers to newcomers. The analysis presented reveals that this process is not neutral. Rather, it can be described as a struggle were different members negotiate their positions and often impose their points of view.

In Argentina there are no explicit mechanisms that prevent a person from enrolling in a university degree program. There are no national standardized tests limiting the chances or preventing anyone from studying a degree program at any given public university. There are no pre-established students' quotas per degree. These conditions are important in order to democratize universities, allowing access to all kind of students. Nevertheless, the research results revealed that this setting is not free of tensions and emphasized that attention has to be paid on teacher education. In our country, it is necessary to assist university teachers in providing engaging learning experiences to mathematics students and to redesign the first-year curriculum in order to better meet the diverse needs of the student population. As Tinto (1997) suggested, encouraging the constitution of learning communities seems to be a possible and rich path. This is not a simple task since it requires the transformation of both community cultures and old timers' identities.

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