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MATHEMATISATION: PROCESSUS SOCIAL & PRINCIPE DIDACTIQUE

Emotional experiences of high school students in a mathematics class

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Cognitive psychology emerged in the 1970s, when psychologists began to analyze whether or not they could provide the necessary tools for the study of affect and emotion. Certainly, cognitive psychology, found no problem in explaining facts such as that the same question could be perceived from different perspectives. This was already encouraging, because the ability to look at a situation from different perspectives attracted attention as the fact, that different people often experience different emotions in response to the same event.

Ortony et al. (1988) state that there are three kinds of emotions, which are the result of focusing on one of the three prominent aspects of the world: events (eg joy and compassion) and their consequences, agents (eg, pride And reproach) and their actions, and objects (love and hate) pure and simple.

Reactions to agents differ in four emotions, which encompass the attribution group, and reactions to objects, which lead to the attraction group. Another aspect that is taken into account is the intensity of the emotions, since it varies according to the situation and the different people. For this, the authors elaborated a valuation structure, classifying it into three variables desirability, plausibility and attractiveness.

In this research, 30 students concentrated in groups of 8, 6 and 5 members were interviewed by adhering to an interview script. In group 1 there are 5 students and one interviewer. Below is one example of the analysis of one-hour interview that was performed in group 1. The presentation will show the complete analysis of two groups and preliminary results. One example:

Type of emotion: Boredom.
Trigger Situations: Teacher's Bad Explanation
Variables that affect the intensity: The continuous repetition of a single subject, The teacher does not dominate the content, The subject is not useful for life.

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Affective factors and mathematical thinking. emotional experiences of mathematics teachers

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Abstract. We interviewed mathematics teachers to find out which emotions they experience in their dayly activities. OCC theory was our base. We found emotions classified as Reactions, Group, Trigger Condition, Type of Emotion and Variables that affect the Intensity of Emotion.

Résumé. Nous avons interviewé des enseignants de mathématiques pour apprendre quelles émotions ils connaissent dans leurs activités quotidiennes. La théorie d'OCC était notre base. Nous avons trouvé des émotions classifiées comme les Réactions, le Groupe, la Condition de Gâchette, le Type d'Émotion et de Variables qui affectent l'Intensité d'Émotion.

File preparation and submission

The aim of this research was to identify the emotions experienced by active high school mathematics teachers during their activities.

Data were collected through extensive open-ended interview questions. The voluntary participation of 5 Mathematics professors in the "Víctor Mercante" Liceo pre-school of the National University of La Plata allowed extensive interviews with their personal history as students of Mathematics, his personal history as teachers of Mathematics, his self-concept as mathematicians and as teachers.

All the interviews were transcribed, which were video recorders in some cases and in others only recorded in audio, and analyzed according to the Theory of Cognitive Structure of Emotions (Ortony, Clore and Collins, 1988) mentioned here as OCC Theory. Identifying the triggering situation, words to signal the emotion, type of reaction, group of emotion belonging and variables that affect the intensity of the emotions.

The emotional experiences identified in the participants were classified according to Reactions, Group, Trigger Condition, Type of Emotion and Variables that affect the Intensity of Emotion. For the different types of Emotion identified, the respective transcription was analyzed, and we discussed the categories already mentioned by which they are recognized.

As for the evaluation of the emotional experiences in the class activities in front of the students, the reactions appear before the events and before the agents.

In the first case, the teachers have their predictions as to what is planned to carry out the mathematics class in order for the students to reach some level of achievement in the domain of the mathematical content at stake during the class, the mechanism to assess the goals, more specifically these events and according to the desirability as variable that intensifies the emotional reaction, were calculated with reference to the Goals of type I (interests). We analyze this as teachers refer to such reactions as "I am happy, satisfied with today's class," interpreting such a statement as a desirable event that has led to the emergence of a positively valued reaction.

In the second case, in contrast to the actions of the students, being in these cases the agents, it is the attribution variables that underlie the actions of the same and that the teachers value from the norms as a model of behavior. This analysis can be demonstrated, for example, in the statement: "Then, you see it as a frustration because, that is, I liked to live it, solve it, I liked solving things, finding solutions to problems. And now I see that it is a burden that is put on them: make them solve an exercise, right? ".

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Teaching practice as an object of reflection for the mathematics teacher: a proposal of intervention

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Abstract. In this article we present an ongoing research whose aim is to identify how the (high school) mathematics teacher transforms his or her own practice by reflecting upon it in benefit of a better-quality teaching in low socioeconomic contexts. This is an exploratory study and, for data collection, it involves video recording of classes of teachers (participants) as well as implementation of a course to discuss real teaching practice in the classroom through collaborative work. The theoretical framework is reflection-in-action. As results, we look forward to contributing to the improvement of teaching practice and seeking to close the gaps in mathematics learning.

Résumé. Dans cet article, nous présentons une recherche en cours dont l'objectif est d'identifier comment le professeur de mathématiques (du lycée) transforme sa propre pratique en la réfléchissant au bénéfice d'une amélioration qualitative de l'enseignement dans des contextes socio-économiques faibles. Il s'agit d'une étude exploratoire et, pour la collecte de données, il s'agit d'un enregistrement vidéo de classes d'enseignants (participants) ainsi que de la mise en œuvre d'un cours pour discuter de pratiques pédagogiques réelles en classe par un travail collaboratif. Le cadre théorique est la réflexion-dans-l'action. En tant que résultats, nous sommes impatients de contribuer à l'amélioration de la pratique pédagogique et cherchent à combler les lacunes dans l'apprentissage des mathématiques.

1. Introduction

Teacher training and refreshing, at any educational level, is a key factor that has an effect on the quality of education and the academic performance of the student (Adler, Ball, Krainer, Lin, & Novotna, 2005; Jaworski & Wood, 2008). In the last decades, education in Mexico has faced adversity partly because of a lack of teacher training. Sometimes, the way in which the high-school teacher teaches mathematics does not favor the curricular objectives, leading to the loss of interest among the students to continue learning. This is a severe problem in institutions located/placed in unfavorable contexts (e.g. poverty) since their teachers often have little to no experience. Reports indicate that 35% of the high-school teachers in Mexico have four years or less of experience; 80% of these teachers work at institutions whose students have vulnerable socioeconomic backgrounds (INEE, 2015). Recently, different programs to develop teaching skills have been implemented; however, a great deal of them are only training courses or short and sporadic workshops that often take place far from the reality in the classroom. Thus, there is no link between the mathematics curriculum and real teaching (Jaworski, 2006; Martínez-Rizo, 2013); in addition, they are specific refresher proposals, independent from one another. Interested on the problem described above, we have developed a research project regarding reflection on mathematics teaching practice (at high-school level) through collaborative work (Sfard, 2005). The aim of the work is to identify how that reflection helps teachers transform specific aspects to provide better quality teaching in vulnerable socioeconomic contexts. In this article we describe the theoretical and methodological proposal we will carry out to achieve the objective presented.

2. Reference framework

Mathematics teachers have the ability to reflect on the actions related to their practice and that reflection may arise in situations that for them could be problematic situations. Schön (1983) considers that "Stimulated by surprise, they [professionals] turn thought back on action and on the knowing which is implicit in action" (p. 50). A situation becomes a problem when teachers resort to the knowledge available to them in the moment, but that knowledge turns out to be poor or inadequate to face the situation. Reflection then demands teachers build the knowledge needed to confront the situation, thus improving their teaching practice. As Gilbert stated,

Reflection-in-action occurs when new situations arise in which a practitioner's existing stock of knowledge–their 'knowing-in-action'–is not appropriate for the situation. It involves reflecting on 'knowing-in-action'. 'Reflection-in-action' is a process through which hitherto taken for granted 'knowing-in-action' is critically examined, reformulated and tested through further action. It is a *process* of *research* through which the development of professional knowledge and the improvement of practice occur together (in much the same way as in action research). (1994, p. 516)

3. Methodology

This is an exploratory study in which mixed techniques to acquire information are used. It involves designing an intervention to promote reflection in (high-school) mathematics teachers and value the transformation of their teaching practice. The aim of the intervention work is to "the researchers stress that their studies are done *with* the teacher rather than about her, that they go to classrooms to listen to the teacher and to think with her rather than to tell her what to do, and that they [researchers] 'support teachers and learners to develop their own powers… rather than trying to make changes for them'" (Sfard, 2005, p. 401). To collect data, we will adapt a standardized observation guide focused on the pedagogical knowledge of the content, the use of resources and the teachers discourse and contents related to algebra and analytic geometry. The instrument will be applied to each participant, before, during, and at the end of the intervention. After each time the instrument is applied, we will observe and video record two classes per teacher. The data analysis will allow us to identify the dimensions of the practice on which the design of the intervention will be based. The intervention will consist of a course whose aim is to create reflection among the participants regarding their practice and for it. The course will promote collaborative work among researchers and teachers (Kieran, Tanguay & Solares, 2011; Sfard, 2005). To do so, activities will be implemented for the teacher to analyze and discuss his or her practice with other colleagues and the researchers involved. This kind of discussion will take place in terms of an action of reflective practice (Gilbert, 1994; Schön, 1983). Given the kind of study, the methodology agrees with that proposed by Guzmán, Marín e Inciarte (2004), where the participants analyze their practice, locate their real competences, determine the characteristics of teaching by competences and lay out the need of accompaniment during training. The participants will be ten high-school teachers, working at schools in low socioeconomic contexts.

4. Results and conclusions partial

The project here described is in its initial phase. We are currently designing the diploma course and reviewing the literature to determine the mathematics, algebra and analytic geometry contents that present a greater difficulty to the high-school teacher and whether this difficulty is linked to the way of teaching in the classroom. We have found that high-school teaching practice is poorly studied and of increasing importance due to the fact that high school is mandatory in Mexico. Particularly, little is known regarding how the teacher appropriates his or her practice and transforms it. We are interested on teachers of schools located in vulnerable socioeconomic contexts because they face greater challenges than their peers, who work in environments of less exclusion and poverty. We consider it is necessary to design and implement refresher actions that impact teaching practice in the short and long term and contribute to reduce the learning gap between high-school students. For example, we seek to implement intervention programs focused on providing students with spaces where the reality of the classroom can be subject of study. Besides collaborative work, we turn to reflection so that teachers analyze and transform certain areas to improve the quality of education and contribute to the students' learning. This research may provide valuable results to improve the current state of teaching practice. It particularly contributes to the need of knowing how teachers learn from their practice and how they can be given new opportunities to promote mathematics learning.

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Homo matematicus: the measure of all things

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Abstract: Where does it stem from that mathematics is not a subject beloved by all students? Probably because it is perceived as difficult, but also because its relationship to the real world often remains unclear. In this paper, I propose an approach that aims to illustrate the extend of how much mathematics lies within us, starting from the human body itself.

Résumé. D'où vient-il que ces mathématiques ne sont pas un sujet aimé par tous les étudiants? Probablement parce qu'il est perçu comme difficile, mais aussi parce que sa relation avec le monde réel reste souvent incertaine. Dans cet article, je propose une approche qui vise à illustrer l'étendue de la quantité de mathématiques qui se trouve en nous, à partir du corps humain lui-même.

1. Introduction

Thinking about the meaning of mathematics at school I was very impressed by the following consideration: "Everyone knows that something is wrong. The politicians say 'we need higher standards.' The schools say 'we need more money and equipment.' Educators say one thing and teachers say another. They are all wrong. The only people who understand what is going on are the ones most often blamed and least often heard: the students. They say 'math class is stupid and boring,' and they are right." (Lockhart, 2009).

For years, I conducted a highly significant investigation (although not statistically rigorous) about the relationship between students and mathematics. I set up a survey of middle and high school students that consisted of the following two questions:

1) How many of you love, or appreciate, math?

2) How many of you believe that math plays an important role in our society?

As a reaction to the first question, generally one or two hands arise. In response to the second question, I nearly get the consensus of all students.

Consequently, I am of the opinion that these outcomes should initiate a turn of action in regard to the teaching of mathematics, but all I can hear from the math teachers is the claim that "Unfortunately, there is nothing to do."

These questions were the basis from which I started my case study. In this study, I mostly applied common objects (Drivet, 2013) in order to explain how students approach mathematics. I have used many different artifacts, some with obvious disciplinary connotations (Abacus, Dice, Geoboard, Napier's Bones, Tangram, etc.), and others which are just a starting point to explore more or less usual mathematical themes (Bicycles, Glasses, Potatoes, Spaghetti Measures, T-Shirts, etc.). At the end of the implementation, which took two very intense hours, I observed that the students were still highly concentrated. What I realised further was that mathematics entails more than mere abstraction, memorization of formulas, procedures, and definitions to be repeated.

In general, this experience has strengthened my hypothesis that it is necessary to introduce students to a concrete approach to mathematics first, and then develop a more profound and systematic work.

One possible approach might be to connect mathematics with the formation of the human body and thereby adapting the teaching of the sophist philosopher Protagoras who claimed that "Man is the measure of all things".

How are we supposed to understand this sentence? Are we allowed to interpret it literally?

Is it possible to conclude that *homo matematicus* means that it is a "mathematical object"? It should be emphasized that the term "homo" does not have any gender significance.

Perhaps da Vinci was of this opinion when he drew the Vitruvian Man (Sinisgalli, 2006), one of the most famous symbolic unions of art and science.

2. Some examples

The ideal body

1,618… is the number which expresses the relationship of proportions called golden proportion, golden section, or divine proportion (Akhtaruzzaman & Shafie, 2011). The ideal body, according to ancient Greeks, was a body that had such a proportion.

For example, if you divide the height of the statue of Venus de Milo for the distance between the ground and her navel, you get this number.

The model and actress Laetitia Casta has been awarded the prize "woman of the new millennium". Interestingly, the proportions of her body are very close to the proportions of the golden section just like those of the Venus de Milo (Figure.1).

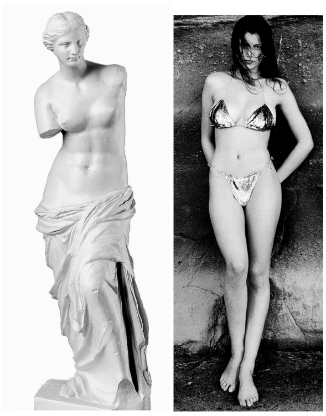

Figure 1. Venus de Milo and Laetitia Casta

The ideal face

Dr. Stephen R. Marquardt is a former maxillofacial surgeon in California. During the last decades, he has been working on a standard for judging the beauty of the human face.

He has determined the "Phi Mask" or "face mask" which is based upon segments of lines and forms that are related to each other through the golden proportion (Figure 2).

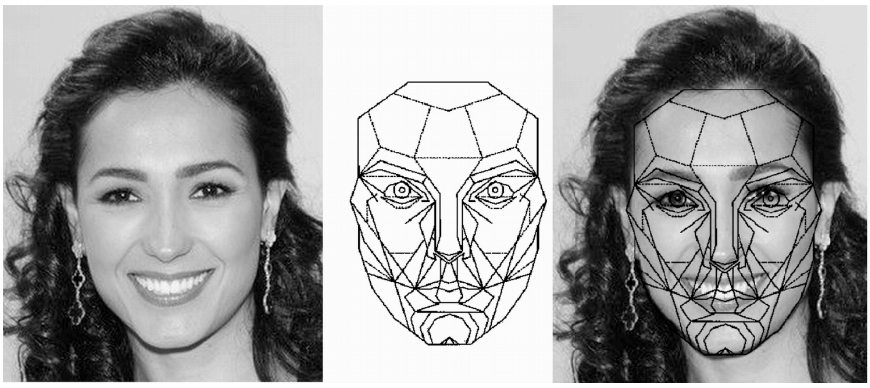

Figure 2. The mask is applied to the TV presenter Caterina Balivo

Hand and food

How can your hand be a suitable tool to determine the ideal amount of food? In order to do so, the human hand offers, for example, the following units of measure: the palm of the hand, the hand with stretched fingers, a clenched fist, the index finger, the tip of the index finger, the tip of the thumb, or cupped hands. (Figure 3) provides concrete examples:

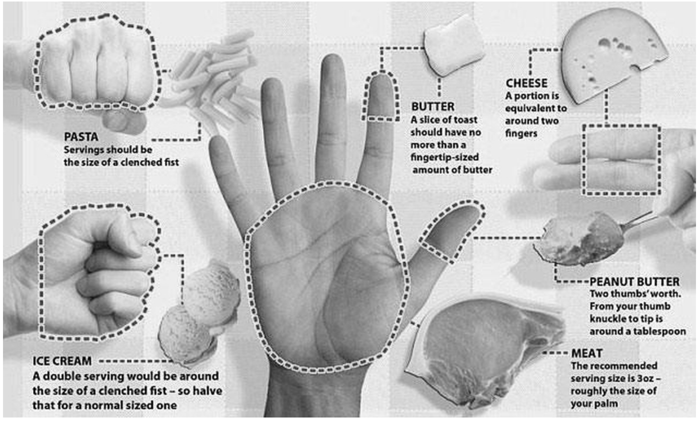

Figure 3. Examples of the relationship between hand and food

Hand and sky

If we stretch the arm and the fingers of the stretched arm, we are able to measure an angle of about 20° in the sky. If we spread our thumb but hold the other fingers tight, the estimated angle will be about 15°. If we hold all fingers tight together, the measured angle will be about 10°. The distance between the knuckles of the index and the little finger of the fist is equal to about 9°. The diameter of the thumb approximately equals about 2° and 30' while that of the the index finger corresponds to approximately 1° (Figure 4).

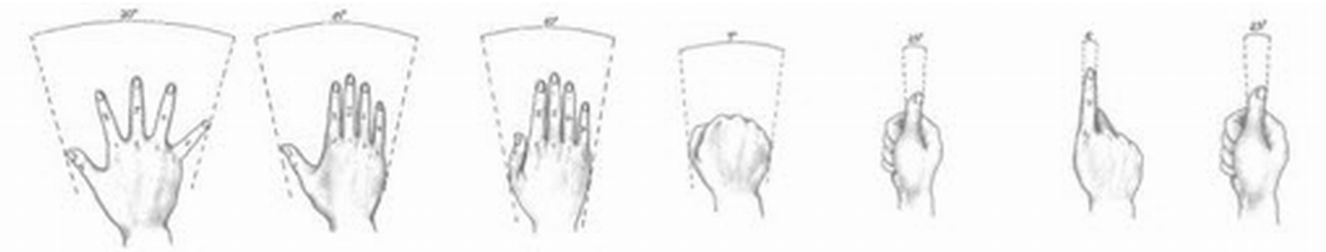

Figure 4. The estimated angles

Arm, foot and cathedrals

Originally, measurements of length took their names from parts of the human body and, in common usage, some of these measures still exist today.

In the Middle Ages, the builders of the beautiful French cathedrals applied a measuring instrument that consisted of five articulated rods of different lengths. These measures corresponded to (Figure 5):

- palm, equal to the width of a hand, excluding the thumb;
- 4 fingers, equal to the distance between the index and the little finger of an opened hand;
- span, equal to the distance between the thumb and the little finger of an opened hand;
- arm (or cubit), equal to the measured length of the forearm from the elbow to the end of the middle finger.
- foot, equal to the footprint length of the foot of a man.

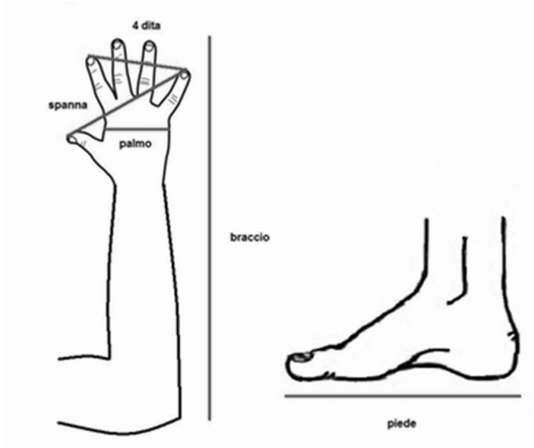

Figure 5. Arm and foot as measuring instruments

Skin and blood

The body surface area (BSA) is a very important anthropometric parameter. In medicine, for example, it is used to individualise nutritional or therapeutic programs.

The BSA is measured in m^2 and can be indirectly calculated on the ground of different equations, the simplest of which is Mosteller's that is based on the height (h) in cm and weight (p) in kg:

$$BSA = \sqrt{\frac{h \cdot p}{3600}}$$

The volume of blood of an individual can be calculated approximately by values of height (h) and weight (p) by using the Nadler's formula for males (V_m) and females (V_f):

$$V_m = 0{,}3669 \cdot h^3 + 0{,}03219 \cdot p + 0{,}6041$$
$$V_f = 0{,}3561 \cdot h^3 + 0{,}03308 \cdot p + 0{,}1833$$

Heart and love

The heart is a hollow muscular organ at the center of the chest cavity.

But is there an equation that shows in the shape of a heart in a diagram curve (which would at least be useful to impress your partner)?

The answer is positive (Figure 6):

$$(x^2 + y^2 - 1)^3 - x^2y^3 = 0$$

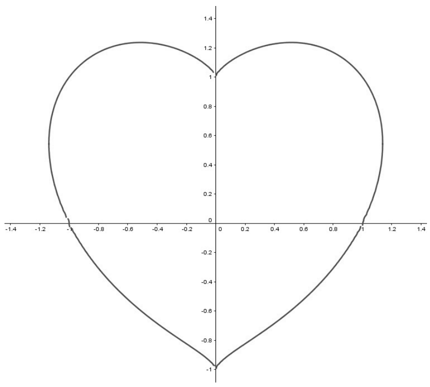

Figure 6. The heart curve

Could this be the secret formula of love, such as a chemical or a magic filter, that helps to classify one's feelings? Only mathematics can give us the tools for the best answer.

Is it possible to find a soul mate with a good approximation? We could think of the possibility of finding the right person relying on the "optimal stopping theory".

Underlying this theory is an algorithm that explains what you should do. You should reject 37% of the first

experiences and pick the next person that is better than everybody that you have seen before.
Of course, this does not guarantee to find a soul mate, but it optimises the chance of meeting a "good catch"

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Sitography

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http://patient.info/doctor/body-surface-area-calculator-mosteller
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https://www.ted.com/talks/hannah_fry_the_mathematics_of_love

Use of variety of models in teaching calculus as an effective means to enhance the interest to the subject, improve understanding and stimulate creative thinking of engineering students

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In this forum, we are going to demonstrate our long-term experience of using different models (mental, physical, handmade, graphical, or computer visualization of mathematical concepts or processes) in study of one or multivariable calculus in our college and we intend to hold a discussion on the matter too.

Despite of the growing tendency to use more and more computer models and mobile telephone application of mathematical concepts (which using also be discussed) we widely use the tangible models as well. We want to emphasize that tangible - it's not just visual, visual - it's not just what student can see on the picture or on the computer screen, but what he can see and touch physically and hold in the hands. We always try (and think that it is very important to learning process) to encourage our students to make an appropriate model by their own hands and by using of improvised materials. This kind of activity needs creative engineering thinking and can give positive impact to professional development of engineering students.

> *Our experience shows that such approach improves the understanding of important abstract notions and facts of Calculus. It also promotes creative engineering thinking of the students and stimulates their interest in learning of Calculus and its various applications.*

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Some teaching motivations among Latin American teachers

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Abstract. We made a research which purpose was to identify factors that have motivated to some mathematics teachers to choose the teaching as a career. The study was made with mathematics teachers which wanted to get admission in the Mathematics Education Program of National Polytechnic Institute. The results found are similar to those reported in the literature. The love of mathematics and teaching stand out as the main factors.

Résumé. Nous avons fait une recherche quel but était d'identifier des facteurs qui ont motivé à certains enseignants de mathématiques pour choisir l'enseignement comme une carrière. L'étude a été faite avec les enseignants de mathématiques qui ont voulu recevoir l'admission dans le Programme d'Éducation de Mathématiques d'Institut Polytechnique national. Les résultats trouvés sont semblables aux annoncés dans la littérature. L'amour de mathématiques et d'enseignement ressort comme les facteurs principaux.

The aim of this research was to identify the emotions experienced by active high school mathematics teachers during their activities. The purpose of this project was to investigate the reasons or factors that led a group of mathematics teachers to choose their career. Using the virtual platform Moodle was possible to interview a group of mathematics teachers about their own motivations about this topic.

The characteristics of respondents in relation to their teaching practice were widely varied, such as the years of teaching service, the educational level and subjects taught, undergraduate studies, and even their place of residence, since the research involved teachers from Mexico and some Latin American countries. This allowed us to analyze if some of these characteristics had any repercussion in the reasons or factors that the teachers reported, for later contrast those motives with the findings that have been reported in previous research on the subject like Watt & Richardson (2012) or Bastick (2000).

The analysis of the information led us establish a categorization of the reasons that originated the entrance of this teachers to teaching. This factors were related to career "advantages" (job stability, holidays, working hours, etc.) or with an intrinsic desire to become teachers (appreciation for teaching, mathematics, working with children or young people, etc.). The love of mathematics and teaching stand out as the main factors.

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