Settling Standardization on Mathematical teaching and evaluation in a Polytechnic University

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Resumen

Es muy bien sabido que la gran mayoría de las Universidades alrededor del mundo se han interesado en que sus estudiantes aprendan estándares tanto en habilidades como de conocimientos en cada una de las áreas científicas y tecnológicas. Esto muy importante, debido a que las habilidades desarrolladas son las principales herramientas para el crecimiento profesional de los Egresados. Por esta razón, la gran mayoría de las academias, escuelas y/o facultades que pertenecen a alguna Universidad han ido desarrollando sus propios procesos en enseñanza y evaluación. La Universidad Politécnica de San Luis Potosí fue fundada en septiembre de 2001. Durante sus primeros semestres, había pocos maestros pero con el pasar tiempo, su número se fue incrementando. Entonces surgió la necesidad de crear una Academia de Matemáticas que administrara los procesos de enseñanza-aprendizaje para un gran número de estudiantes atendidos por la misma, y como consecuencia, una colaboración de un gran número de profesores. En este artículo se describe cómo se han ido desarrollando los procesos de estandarización de la Academia de Matemáticas, estadística de los resultados que se han logrado y las ventajas que se han ganado al aplicar ésta metodología educativa.

Prueba standarizada, Aprendizaje, Estandarizacion, Estrategias.

Abstract

It is well known that almost all Universities around the world are concerned that their students learn standards in skills as well as knowledge in every scientific or technical area. It is important because of these developed skills are the main tools for professional growth of Graduates. For this reason, most of the academies, schools and/or faculties which belong to Universities, have been developing their own processes in teaching and evaluating. The Mexican University Universidad Politécnica de San Luis Potosí was founded in September 2001. During the initial semesters of the University starting-up, there were a very few math professors. But with the pass of time, this number has increased up. Then, the necessity to create a Math Academy in our University emerged, in order to manage the processes of teaching-learning for a big number of students supported by the Academy effectively and consequently a larger number of math professors. In this article, it is described, the way the standardization processes had been developed in the Math Academy, the advantages which the math Academy has earned, and the Statistical results obtained when this didactical methodology have been implemented.

Standardized Test, Learning, Academy, Teacher


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Introduction

As it is well known, almost all Universities in the world have been implementing departmental evaluation to students by using standardized tests which its main purpose is to evaluate students and verify that they have determined standards in knowledge and competences in a specific scientific or technical field. These kinds of student assessments are regularly applied by the corresponding academy or department.

In the Webster dictionary, a Standard is defined as a) something established by authority, custom, or general consent as a model or example, b) something set up and established by authority as a rule for the measure of quantity, weight, extent, value, or quality. In regard to the learning evaluation, standardized test is a model (made by the teacher or college’s teachers) which contains the quantity and/or quality of knowledge and skills that any coursing student must have. Characteristics of standard testing are listed below (Suarez Rodriguez & Jornet Mejía, 1996; Tourón, 2009; Rositer, n.d.):

- Remove subjective factor from assessments.
- Test-takers are measured objectively on the same material.
- Shows a degree of validity and reliability.
- Provides a more accurate assessment of a particular skill group and knowledge.
- Make comparisons of students with widely different high school experiences.
- Well-defined times are established in advance based on the contents.
- You can aim the product assessment, you can evaluate the process.
- It is possible to item analyze items and indicators of basic parameters.
- They can be applied to many different types and sizes populations.

During the last years, there has been research on education standards. In (Tourón, 2008), the author mentions that standards are specific targets of knowledge and competences that students must learn where the evaluation plays a basic role:

“It is necessary to determine what we want to achieve. Clearly specifying what students know and being precise on what students do at each level and subject, what their competences and curriculum skills should be. This is specified in the performance standards, which should constitute the guidance and the direction of results we should expect”. Besides the author commented that: “The establishment of standards to carry out an approach of the evaluation which will contain a criterion-referenced (standards themselves) more than normative reference which has certain educational advantages and the feedback of the teaching and learning processes”.

Standards, criteria and indicators should be central quality indicators. They are used in program evaluation and accreditation in Western Europe countries. In (Hämaäläinen, 2003), the author mentioned what is considered important in teaching and learning in higher education and about the concept of university teaching and learning which is used in different countries:

“There are great differences in how detailed the targets of accreditation or evaluation are, on what they concentrate and how concrete they are. There are many standards for subject evaluations, but not so many for programme evaluations or accreditations. In most countries, there are only lists of evaluation targets and no real standards. In some countries, only questions are used. There are very seldom minimum standards which could be used as thresholds”.

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It is important to consider that the scope of the tests carried out in class, and/or the scope of tests made in the classroom, is where there is less acceptance of the use of standardized tests (because their conditions away are from individualized testing), but as is said in (Suárez Rodriguez & Jornet Mejía, 1996): “Standardization and individualization are not contradictory concepts, but rather, it is the type of use made by the evaluators to the test. The standardization greatly improves the conditions of objectification of the learning measure. Any teacher can evaluate standards aspects in an individualized test and conversely, with standardized testing individual learning aspects of students can be evaluated. Nevertheless, one can design standardized tests where the subjectivity of the evaluator would be minimum.

Standardization reference and the way that the system of education in Mexico solves the actual difficulties in every area of education is described next (Allan, n.d.):

“To improve the educational process in Mexico, the Ministry of Education (SEP) can apply the best education practices from countries with very high performance. In these country’s curriculum, evaluation standards have been an established mechanism for national and state standards, but it is delegated a substantial autonomy and discretion to determine the best way to help their students. The evaluation criteria are centered over the achievement, equity and quality”.

Some Universities have implemented standard evaluation in some of its departments. As the Universidad de Baja California (Mexico) in the department of Economic-Administration Sciences (Figuero Villanueva, Ching Wesman & Sóisma Carrillo, 2010).

They applied a standardized college evaluation which consist of the application of departmental test to students couring the core curriculum in a some school or faculty in the area of Business. They realized that departmental tests have some advantages with this kind of evaluation, which are: to guarantee that all groups which course a determined subject are acquiring the same level of knowledge and competence. Verify that teachers impart all the contents established in a collegial way. It allows to identify the subjects and contents that teachers and students need to reinforce. It is feedback for continuous improvement.

There are various forms and models to homogenize the processes of any area or school department. They depend on the material resources and human resources which the Institution owns as the learning conception and educational process that are developed by the institution. Since its foundation, our University has developed strategies for this matter which are mainly based on elements forming the didactic approach (Catalano, Avolio, Sladogna, 2004) which are shown in the sketch of Figure (Fig.) 1.

![Diagram of Didactic Approach]

**Figure 1** Strategies for didactic approach
We are interested in the area of mathematics. As in (Muller, 2009), where a mathematic dynamic department is defined as the department where all its members make every effort to achieve its vision and to motivate them toward meeting the department’s collective goals.

For us, we refer to STANDARDIZATION as the set of didactical strategies to uniform the topics addressed by teachers in mathematical courses and to standardize the testing, which every student acquire the knowledge and the necessary skills useful to develop mathematical thinking skills and mathematical problem solving skills.

In this article first we describe a brief History of the founding of the Universidad Politécnica de San Luis Potosí (UPSLP) and its Academy of Mathematics (AcMat). Next, we give a set of common problems occurring in the area of mathematical education in the UPSLP and their respective solutions developed in the Academy of Mathematics. Afterwards, we describe how the standardization was founded in the environment of the AcMat. Finally we give some historical stored results and the concluding remarks.

Academy of Mathematics

In September 2001, the Universidad Politécnica de San Luis Potosí (UPSLP) was created in the state of San Luis Potosí, México. The Mexican Government created this Institution to offer students with high school grade an alternative to University Education. UPSLP was open with degrees in the areas of Engineering and Business. Initially, it offered the degrees of Telematics Engineering, Information Technology Engineering, Industrial Technology Engineering, Administration and Management, International Marketing.

Four hundred fifty seven students were admitted in the first generation, which were attended by a first small group of teachers. Eight full-time teachers and approximately twenty that worked by the hour teachers were teaching at the UPSLP at that time. Inside this initial environment, UPSLP started up to provide University Education for people who are mostly from the state of San Luis Potosí (SLP), Mexico. An important characteristic of UPSLP (encouraged by the SEP, Ministry of Public Education in Mexico) is that their programs would contain characteristics of the new model of Mexican education (National Commision for Education of the Coparmex, n.d.) such as student centered education, integral education, education in transmitting values and knowledge, incorporation of new educational technologies, teachers training and settling of academic standards. This new model of education is a different way to provide education from the Traditional Universities in Mexico. As it is known in a traditional education, teaching is centered on the contents where each teacher can close the classroom door a he/she becomes completely free on how he/she gives his/her class. He is never questioned and the behavior of the student is passive (Ejea Mendoza, n.d.). Meanwhile, Education under the new model provides teaching in a way that is centered in the learning of the student and it caters more to the teaching-learning processes than the traditional model of education.

Course programs in the UPSLP are divided in the following way: a) Transversal courses which are used to view the common subjects for all college programs. Transversal courses are Mathematics, Physics, Chemistry, English, Spanish (redaction and lecture), critical thinking. And b) Vertical courses which are the specific courses for each college program.
For instance, Communications II is a specific course for the Telematics’ degree and not for rest of degrees in the UPSLP. Inside this environment, the Academy of Mathematics was established to cater to the necessities that the college programs require in the area of mathematical education and to manage the mathematical transversal courses.

The Academy of Mathematics of the UPSLP (AcMat) was created as a part of the natural growth of the University, i.e., a group of teachers were invited to give math classes for the first semester to all college degrees in the UPSLP. With the pass of time, this group of teachers began to grow and around 4 years later, approximately 2005, the UPSLP board of directors assigned a coordinator to the academy. Then, AcMat officially became in charge of the courses which are listed:

- Introduction to Mathematics: It is a course for almost all the new admittance students, except the students that obtain a good score in the mathematics admission test. It reviews topics for precalculus such as arithmetic, algebra, exponent and radical rules, trigonometry and functions.
- Mathematics I: It is imparted in all college programs. Differential and integral calculus.
- Mathematics II: There two different courses named Mathematics II: a) One course is for the engineering careers, which consists of topics of vector integration methods and parametric function calculus. b) The other one is for the Business degrees, which has topics of several variables calculus.
- Mathematics III is a course that only coursing Engineering Degrees students need to accredit. It has topics on linear algebra.
- Mathemáticas IV: It is a course that only the engineering students take. It has topics where the student learns to solve and apply the basic linear differential equations.
- Mathemáticas V is a course that only the engineering students take. It has topics on numerical methods.
- There exists other courses of mathematics, such as Discrete mathematics, Probability and Statistics which are managed as vertical courses, therefore these courses are managed by its corresponding degree coordinator.

Our principal target in AcMat is to elaborate techniques and strategies which improve the mathematical teaching-learning processes in the UPSLP. The principal tasks of the AcMat are:

- To coordinate partial-time mathematics teachers and the examinations that they do to their students.
- To give assistance to students and help them in Mathematics.
- To attend the irregularities and emerging problems related with math courses.
- To analyze the development of students in Mathematics.
- To coordinate the math laboratories, by giving assistance to the laboratory teachers and developing practices.

As mentioned above, another AcMat’s learning practice which is completely related to the communication information technologies education, is that it is obligatory for students coursing Mathematics I or Mathematics II and/or Mathematics III, to take a math laboratory. This laboratory is taken in one session class per week, where each session is two hours.

The implementation of the laboratory has been based on using the program called Maple. This program has great capacity for symbolic computing and considerably powerful to generate graphics. Besides it is oriented in a user-friendly platform.
The working methodology is to conduct a weekly practice, specifically designed with exercises related to the contents according to the program for each subject, likewise practices to solve real application problems. The staff who teaches the software in the laboratory are the teachers who impart the mathematical courses. As something to point out in our University, it is that 100% of our students have taken this laboratory. It is something that will help students in posterior courses in the UPSLP, and in their future jobs. Because our current world involves so much technology, it is necessary everybody to have skills programming some device, computer and/or the new technologies.

Actually, AcMat is formed by four full time teachers and thirty teachers that teach by the hour which attend approximately to two thousand students. It appears to be a very big number, but in recent years UPSLP has accepted from 1200 to 1400 students per year. That is usual in Mexico, teachers of mathematics do not have teaching assistance. Each AcMat teacher has to give classes, check homework and solve mathematical doubts from their students and UPSLP teachers have the precarious environment conditions that all teachers of universities of Mexico have and are mentioned in (Díaz Barriga & Rigo, 2003). With regards to clarifying students’ math questions in hours after class, almost no teachers on hours can help solve them because they are not paid for any extra hours. Nevertheless, few teachers on hours have the attitude to give his/her time to support students in their math doubts. A good thing is that due to the fact that full-time teachers stay almost the entire day in the University, we have no problem in attending students with these problems, but still there is a very large group of students to be attended in doubts clarification by only four full-time teachers. It is necessary that we integrate more full-time teachers to AcMat.

However, this matter can not be solved by the Academy. It is something that depends on the UPSLP budget.

**Solved Areas of Opportunity**

Through the time and experience, AcMat teachers have detected various aspects that represent some difficulties in the school achievement and performance. They are written in the areas embraced in the sketch of Fig. 2. They are described below with their developed solutions.

The level of students’ knowledge has been highly heterogeneous, thus it has been very difficult to follow the contents of the programs under time frame and in a formal way. Throughout our experience with groups of students and with the objective of identifying their strengths and areas of opportunity, we have recognized the importance of gathering

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**Figure 2** Main aspects where are detected some difficulties in the achievement and school performance in the area of Mathematics
The knowledge and procedures that students use. Therefore, identifying their learning styles would be useful for the teachers to design relevant activities to encourage the development of meaningful learning. Added to this, we attend students who come from two main types of upper secondary education: Bachillerato schools and technical schools (Both types correspond to the three last years of the current high school of the scholar system in the USA). In Bachillerato Schools, more general knowledge is covered in the area of mathematics compared to the technical type school (where very specific areas and issues on Exact Sciences are taught in). It is generally evident that it is more difficult for students from technical schools to pass courses with theoretical contents than students from Bachillerato Schools. We think that students’ prior experience to solve problems should be the guideline for developing confidence and skills to approach new situations creatively, adapting, modifying and combining their mathematical tools.

Teachers generally spend time on arid contents which are not related to the main themes of the course they are imparting. Since mathematics programs are extensive, we primarily considered to select the most relevant and significant contents. To develop them with different learning activities which attract the attention of students to new information. Without forgetting everything that they already know which can be useful for building new learning.

Some relevant issues are not worked on and others on the contrary, are repeated in various math subjects. Mathematics programs are closely linked to other subjects of the same area, in both Basic and Specialty areas. With the purpose of designing and implementing activities that allow students to learn contents in which they would have more cognitive resources.

And therefore avoid repetition of contents in different subjects. Thus being necessary to identify those issues which have been the basis for other courses. Moreover, we have made emphasis on techniques and strategies for solving exercises that have a direct and immediate link with the subsequent course with the intention that students incorporate new knowledge which more naturally. Usually, teachers spend time on mathematical topics which do not develop useful math skills for upper courses in graduate education. Because the mathematical curriculum is very extensive, we firstly consider selecting the most relevant and significant mathematical topics. Afterwards, with the purpose of attracting students’ attention, we select and make learning activities for students that would construct new knowledge from prior background. Furthermore, we have realized that some relevant topics have not been reviewed during the course, while other kind of subjects have. It is a phenomenon that frequently occurs, due to he fact that the math curriculum is linked to other courses. To design learning activities in which the students acquire new knowledge and developed recently acquired skills. In order to this to happen, it was necessary to identify the topics which would be the base of upper courses.

It is likely that, students will have more cognitive resources and at the same time avoid having different courses with the same topics. In the same way, it was neccessary to implement mathematical activities and learning strategies which students would practice problem solving in order to keep a direct relation with the topics of subsequent courses. It was necessary to complement, formally, the contents that teachers teach in class by giving importance to mathematical language translation and spatial geometrical relation.
For the case of math courses, we considered that the use of technological tools like calculator and computers (specifically the mathematical software Maple and the Blackboard platform) encourage to develop information and communication skills. Students could become familiarized with the computer language of a specific software by asking for help in the line command, or by elaborating different types of reports like manuscripts documents or digital documents (spreadsheet). They can develop thinking skills by using graphical or analytical procedures which foster the capability of making conjectures, explaining problems, interpreting results, modeling mathematical situations in real professional contexts; and by using maple or a calculator, recoding data set obtained from a tangible situation. Besides, with the use of technological tools, students can develop interpersonal and autonomous skills (explanation, justification, validation of solutions made by himself/herself or by a group of people; meeting the rules of the computer centers, laboratories and virtual courses). Frequently, students show a great aversion towards math courses. To attend this problem, AcMat teachers consider that it is very important to motivate students to exhibit their ideas, such as their ways of solving mathematical situations, their doubts, such that they could acquire agility, experience and self-confidence (because the lack of safety is the first cause of rejecting the science courses), active attitude. Besides, teachers encourage students to have new tools for working and to nourish themselves by exchanging opinions. Students must be supported and rewarded when they become active in their experimentation, to take risks and to be persistent in the quest of solutions.

Students easily forget subjects examined during academic semesters.

In the particular case of math courses, we observe that students need to be motivated to develop their own algorithms and/or schemes in which they can identify different procedures, properties and formulas to solve different kinds of mathematical exercises. This could be done to avoid a rote learning which is only useful to solve specific tests and useless for solving other mathematical situations which can emerge in the future.

All AcMat teachers regularly teach different levels of complexity compared to other AcMat’s teachers. In order to unify and homogenize teaching techniques and evaluation criterion, study guides for all math courses imparted at the UPSLP were departamently elaborated by AcMat teachers. These guides contain problems and exercises where different levels of complexity where some of them are problems and exercises similar to mathematical common literature. Besides, these guides contain exercises similar to those shown and discussed in class. Upper level complexity problems which require, not only a good level of knowledge, but also a good level of reasoning and comprehension where students put into practice the math techniques studied during the course, such as experimenting, making conjectures with which they can be able to prove, argue or refuse them. It is encouraged to solve these guides individually or/and in a group.

The target for students solving exercises in groups is so that they could develop abilities for evident and precise communication of mathematical aspects which are implied in problem solving, as well as for abstraction of ideas which lead students to solve problems and to manage adequately the cognitive and technological resources they have.
Besides, the solution of these guides not only encourages students to face the same kind of problems, regardless of their teacher, but to be aware of the knowledge, skills and dexterities they need to reinforce, develop and demonstrate at the ending of each learning unit.

Guides help students to identify math themes and contents which they must improve, and guides facilitate a specific, timely feedback by the teacher.

**Settling AcMat standardization**

At the beginning there was no established AcMat at the UPSLP. We were just a small group of teachers teaching mathematics. In the first meeting with math teachers, we agreed on the topics we were going to teach in our classes and we began our courses with great enthusiasm in that September 2001. As we were very few teachers, we commented, in the teacher’s lounge or in the school’s corridors, about the development of the topics which we were giving. During the first semesters we realized despite of the fact that students had taken a great number of hour classes of mathematics, they had very little knowledge in this area. Some teachers began classes by giving their students a diagnostic test on arithmetic that students should already know. As an example, if we began asking ‘How much is 3 + 5?’, the students answered correctly. But questions as ‘How much is 3 − 5?’ some of them had problems answering questions correctly where the answer was related to a negative number. Besides, fraction operation problems were even worse, i.e. a greater number of students could not make operations with fraction numbers. For this reason, in summer 2003 the AcMat decided that, depending on the results of a standardized test applied to the new generation of students that was entering to the UPSLP, we would select students who would take an introduction course during the summer.

In this standardized test we asked about very basic topics in arithmetic and basic algebraic operations. Afterwards, during the first semester of their career this new generation, they would take Mathematics I and Mathematics Integrator Project courses which were the first mathematical courses that all the new students had to take during the first four years of the UPSLP.

The courses of Mathematics I and Mathematics Integrator Project were give 10 hours per week, where each session consisted of two continuous hours. The initial propose was that during the first session we would review the contents of calculus such as limits, differential and integral calculus. And, during the second hour we would make examples, practices, and projects which if they were put in practice, they would have consisted of exercises were the student would develop his/her skills in the area of mathematics. Nevertheless, as the students’ level and knowledge in maths were very low, we needed to adequate these two courses (where each course was one hour a day five days a week) to a longer two hour a day class. In this longer course, we would review the topics of arithmetic, algebra, functions, limits, differential and integral calculus. With the pass of the semesters during the first three years of the UPSLP, another situation began to occur. It was common for the students to deny that they had taken basic topics in previous courses. When this had occurred, students made the teachers responsible for their lack of mathematical skills. As the UPSLP was admitting more students, this event began to occur with more frequency. Therefore the full-time teachers began to investigate this phenomenon. We realized that it occurred in following cases:

- Students had forgotten the covered topics and skills learned in previous semesters.
Teachers really had not seen in classes the corresponding topics to before semesters.

Nevertheless, it did not matter what happened for any of the before causes, students argued that they were not responsible for their lack of knowledge and, therefore teachers were the causal to blame this problem. The consequence was that a higher number of students failed the math courses.

In AcMat we needed to make a strategy to solve this problem. We had the experience of the three summer courses where we applied the same methodology to most students groups in classes and the same test. To achieve this, we elaborated a manual for the math introduction course. This manual contained exercises in which the students developed the skills that we want them to learn and we applied standard tests based on the exercises of this manual. This didactic practice helped AcMat teachers to uniform the knowledge taught to students. This was the first time that AMUPSLP practiced standardization.

By that time, AcMat established the purposes to decrease the index of failing grades in math and to avoid the fact that some teachers review fewer topics in the classroom than those established by the AcMat. Based on the experience of the introduction summer courses, we realized that one way to achieve these purposes is through standardization. We apply a similar strategy like the form we standardized the introduction course. For math standardization in UPSLP, we elaborated study guides which contained typical exercises of the topics seen in classes, and exercises where students improved their mathe matical thinking skills.

We elaborated math study guides for every partial test and every final semester test of all math courses in the UPSLP.

With regard to the students grades managed by Control Scholar Department, every math teacher has to report to this department three partial assessments, and a final assessment. The final semester grade of a student, consists of the three partial assessments with a 60% value and the final assessment with 40%. During the first semesters of the AcMat standardization, we ap-plied standardized evaluations for every partial and final tests, i.e. we applied four different standardized tests in the semester. Students in the same math course, took the same exam at the same hour. But, with the passing of time, the number of students became unmanageable in order for AcMat teachers to apply a standardized test every partial. Then, the unique standardized test we have been applying in the semester is the final assessment. The form we have departmentalized the partial evaluations until now is by making a proposal of a prototype test where some of the teachers of the evaluated course can collaborate to make it. This prototype is based on the contents of the corresponding guide to the partial which is being evaluated. Afterwards, the prototype is showed to all teachers who impart the evaluated course, and every teacher makes his/her tests based on this prototype and applied it to his/hers corresponding group (or groups).

A group of teachers collaborate to design the final test. As the partial tests, the final test is based on a guide specifically made for the final test. We have applied this test in a standardized form, i.e. all students who take a certain math course solve the same test at the same hour. By using this form of departmental testing, it is more probable that students who have taken a certain math course, would see in classroom almost all the contents proposed by AcMat.
With respect of the math laboratories, they form part of the student evaluation too. When a student take one of the AcMat courses mentioned above (except for Introduction to Mathematics), they must to take the laboratory of mathematics which consists of practices with the software Maple. The laboratory teacher sees the maple commands and solve examples of topics that students are taking in class. As an example, if a student is looking at the issue of calculus in classes then he/she is looking at the issues of commands to calculate derivate in Maple. Normally, at the end of the class, the laboratory teacher ask to his students a Maple practice with the topics looked in the math class session.

These practices are evaluated by the math-laboratory teacher which he gives a evaluation to the student. This evaluation corresponds between 20% – 30% of the semestral evaluation.

**Some Historical Results**

In Table 1, it is shown the Passing Percentage of Math Course (PPMC) for each math course in the first 11 years of the UPSLP. These percentages were calculated by using the database of Control Scholar Department. Each value showed in the Table 1 is obtained by dividing the number of students who passed a course in a determined semester after the regularization test by the total number of students enrolled to this course. Numbers in parenthesis listed in the first column of the table, indicates the number of semester since the beginning of the UPSLP. In the last column of the table, we can see the general percentage over all mathematical courses for each semester (in total there are listed twenty two semesters).

In the first row are listed the inspected courses which are Introduction to Mathematics, Mathematics I, Mathematics II, Mathematics III, Mathematics IV and Mathematics V. Empty places in the table means that in the corresponding semester it was not imparted the course. The last row contains a general average for each course of passing rate over all semesters.

Table 1 contains some historical relevant information of the AcMat. It shows that the maximum PPMC happened in the semester from August to December in the year of 2005. In the last row one can see that a general average of PRCM for each math course since UPSLP was founded. The two courses with the highest average are Mathematics III (MIII) and Mathematics II (MII), and the two course with lowest average are Introduction to Mathematics (Intro) and Mathematics I (MI). Mathematics III course has the best average because of students who course this subject have been attending at least three math courses. Despite Mathematics III not requiring other topics of calculus, the majority of students enrolled in this course had passed Mathematics

I. Where students reinforce their knowledge and skills that they will need for Mathematics III. Besides, students enrolled in this course are students that have been enrolled for one and half year enrolled in the UPSLP where they have had the opportunity to mature and to develop responsibilities, and reflect about their role as students. One would expect same results for Mathematics IV(MIV) course which has Mathematics II as a requirement. Nevertheless, the majority of students enrolled in this course had not seen the calculus concepts in seven months, which is a factor that affects the students’ learning.
The second best average is for Mathematics II where students, who attend this course, need to have passed the course of Mathematics I, therefore most of them take Mathematics II immediately. They have learned and approved the contents and skills needed for this course. Now, with regard to the courses with lower average, such as Introduction to Mathematics and Mathematics I, they are taken by students in their first year of college. According to records of the department of School Control Department, where information of the students is stored, the vast majority of students who desert from the UPSLP for personal causes and students who are expelled from the UPSLP for academic rules, is during their first year of college. Thus many of them did not pay attention to the subjects they are coursing, giving as a consequence that a great percentage of students fall in failure in their corresponding math subjects.

In Figure 3 is the plot of the PPMC through history of the UPSLP (which are listed in the last column of Table 1).

The general average of the columns is in figure 68.4. The maximal average, which is 81.3% occurred in semester (9). This best average was caused by the excellent average of 100.0% in the course of Mathematics II corresponding to this semester. The calculated standard deviation from semesters 1 to 11 is 13.23% with an average of 66.0%. Whereas the standard deviation from semesters 12 to 22 is 4.4% with an average of 70.71. It is believed that this has occurred for several reasons: with the passing of time, Academy teachers had more experience in managing their courses, a more reasoned selection of relevant topics that students will use, and the AcMat management of courses improved due to standardization.

Historical number recorded of the total of students which have been attended (TSA) by the AcMat is graphed in Fig. (4). It is a curve that is considerably growing with the passing of time where it is very evident that the population decreases in even semesters. This phenomenon happens because at the end of odd semesters a great number of students from first semester leave the UPSLP for personal reasons or because of the rules of the UPSLP. The maximum number of TSA is 2884 students who were treated by the AcMat in semester (21) which corresponds to the semester August to December 2011. The minimum number of TSA is 457 students who were treated in semester (1). The average of TSA over all semesters is 1035 students where only semesters (15), (17) to (22) are above this value. Standard deviation of the general average grade in the area of mathematics was in the.

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Table 1 Approval Percentage of math courses in the UPSLP (AR/S Average passing rate of all math courses per semester). Empty spaces mean that the course was not imparted during the respective semester.

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<th>Year/Dec</th>
<th>2008</th>
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Figure 3 Average of passing rate of math courses in the historical evolution of the UPSLP.

Figure 4 Historical records of students attended by the AcMat.

Concluding Remarks

During the last five years, we have realized that the process of standardization in the AcMat has given satisfactory results. If a group of teachers want or need to homogenize their processes of learning, teaching and evaluation, a kind of standardization could be the natural and effective way. We have just explained about the way standardization was formed in our University, but there are many different ways to departmentalize an education academy. The next sketch lists the principal elements of standardization used in our Math Academy:

- Coordinate in a successful way a very large number of students and teachers. In order to achieve the standards that teachers of any math academy would want for their students, an Educational Institution could homogenize their way of teaching, and that quantity and quality of knowledge taught to their students. We recommend the use of standardization as an effective way of achieving this. On the other hand, the increasing of PPMC and average grades in the Area of Mathematics reflects that students’ better learning skills, competences and knowledge in Mathematics we propose that analyzing the cause that originate the failure in PPMC and students grade average could be an excellent follow up.

Doing the following research is recommended:
- Making an analysis of the correlation of the admission test and the mathematical grades of AcMat students.
- Identifying the level of knowledge in math that students have when they enter UPSLP.
- Identifying the contents that are more difficult and relevant to UPSLP students.
- With regard to Introduction to mathematics which is a remedial course, we need to make a study which sizes the impact of this course on new students.

Once we have the results of the studies mentioned above, we will create strategies that help to increase the average in the Area of Mathematics of the UPSLP.

**Figure 5** Elements of standardization in AcMat

**References**


