

## The construction of a selection process model for a postgraduate program

## La construcción del modelo de proceso de selección de un programa de posgrado

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### Abstract

Postgraduate programs in Mexico have high rates of dropout and delay. This problem has led HEIs and evaluating agencies to implement strategies to ensure program quality and that candidates who enter these programs complete the curriculum in a timely manner. In this context, the objective of this research is to identify the individual and social factors that predict the academic performance of Master in Educational Research (a program offered by a public university in southeast Mexico) students. These results are used in the construction of a selection process model that guarantees the admission of the students most suitable to meet the demands of the program. The study was developed under the quantitative paradigm and is correlational in nature. We worked with graduates of the 2004-2014 cohorts. The results indicate that study habits and research experiences are variables that impact academic performance, so they should be considered as performance indicators in the admission process, along with other suggested aspects.

**Keywords:** academic performance, students' selection, admission, college readiness

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ISSN: 0719-0409      DDI: 203.262, Santiago, Chile  
doi: 10.7764/PEL.54.1.2017.4

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## Resumen

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Los programas de posgrado en México presentan altos índices de deserción y rezago. Este problema ha llevado a las IES y los organismos evaluadores a implementar estrategias, buscando garantizar la calidad de los programas y que los aspirantes que ingresen a éstos concluyan en tiempo y forma el plan de estudios. En este contexto, el objetivo de esta investigación es identificar los factores personales y sociales que predicen el rendimiento académico de los estudiantes de la Maestría en Investigación Educativa (programa ofertado por una universidad pública del sureste de México), de manera que estos se utilicen en la construcción de un modelo de proceso de selección que garantice el ingreso de los estudiantes más aptos para satisfacer las demandas de dicho programa. El estudio se desarrolló bajo el paradigma cuantitativo y es de alcance correlacional. Se trabajó con egresados de las cohortes 2004-2014. Los resultados señalan que los hábitos de estudio y las experiencias en investigación son factores que condicionan el rendimiento académico, por lo que deben ser considerados como indicadores de desempeño en el proceso de ingreso, junto con otros aspectos que se proponen dada la importancia de la información que refieren.

**Palabras clave:** rendimiento académico, selección de estudiantes, ingreso, preparación para la universidad

Growing demand of higher education has caused the rise of a large number of private institutions and diversification of the educational offer, not only in terms of educational programs and entities, but also regarding their quality. This situation has resulted in an increase on the demand for those institutions considered within the range of high academic level, since graduates from low profile institutions, hardly position themselves within the labor market. This situation has originated a new problem for prestigious public institutions: the applicant selection for their programs (Fernández, 2007).

In this context, most of the countries from the European Union have suffered changes regarding their higher education systems creating alternative ways of access and making curricular changes, in regards of length, program modality and number of enrolled students (Valor, 2010). These changes, formalized in the Bologna Declaration (1999), promote universities focusing more on the competences of the applicants and on the identification of selection criteria which allow to choose students with a higher development of the abilities established by profile of the educational entities (Teichler, 2007).

As examples of these changes, Santelices (2007) mentions that in Germany besides a standardized test (Abitur), particular criteria of selection are established, according to the context of the educational programs and institutions. Regarding this, Heine, Briedis, Didi, Haase & Trost (2006) state that among the most frequently used selection criteria in Germany are: grades on specific subjects, interviews, essays, extracurricular activities and specific knowledge tests.

Santelices (2007) also adds that in Spain, admission to higher education depends on pre-university achievements and on an admission test called "Aptitude Testing for University Entrance" (ATUE). In the United Kingdom, admission is determined by the result of bi-annual tests evaluating pre-university curricular contents, an online application, a personal essay and a recommendation letter (Bürger, 2007).

In the United States, the selection process for higher education applicants considers: 1) Ability to perform and learn, evaluating academic, personal and learning skills; 2) Effects of education on the person, in which the potential of obtaining benefits from the institution and resilience are evaluated; and 3) Potential to contribute to the institution, appreciating personal characteristics and the way in which they contribute to the group to which the applicant will belong. Moreover, other attributes such as previous acknowledgment, extracurricular activities and courses (from other institutions), working experience and family records, are also considered. This data is collected through interviews, recommendation letters and essays (Perfetto, 1999; cited in Santelices, 2007).

In Latin America, particularly in Chile, universities which take part from to the Council of Rectors of Chilean Universities (Consejo de Rectores de las Universidades Chilenas, CRUCH), established since 2004, the University Selection Test (Prueba de Selección Universitaria, PSU), which assesses the minimum compulsory contents in Mathematics, Language and Communication, History, Social Sciences and

Sciences. This test is developed by the Department of Assessment, Measurement and Educational Records from the University of Chile. Due to the cognitive nature of the test, the University itself promotes measurement of non-cognitive attributes on selection processes, considering among them: motivation; personal, intellectual and social development; critical thinking; proactivity and, social and metacognitive skills (Reyes y Torres, 2009).

In the case of Mexico, during the last five years, HEI aspiring to obtain accreditation of their programs, have considered the fact that a selection process must consider a broad range of aspects which will influence the permanence of the students, optimizing their performance.

Although most of the studies focus on the process of selection for undergraduate or bachelor's degree, most of these strategies can be extrapolated to postgraduate courses.

In this regard, authorities from the Faculty of Education from the Autonomous University of Yucatan have emphasized the importance of improving the selection process for the applicant to the Master of Educational Research (Maestría en Investigación Educativa, MIE), due to its incorporation to the National Program of Quality Postgraduate Courses of the National Council for Science and Technology (Consejo Nacional de Ciencia y Tecnología, CONACYT). Thus, in order to maintain the accreditation, factors which promote academic performance of the students have been identified in the process of application, considering that these competences (knowledge in social sciences, contemporary world, English communication, information search, use of digital tools, and willingness to face challenges in education and investigation), follow the standards from the applicant's profile.

It is important to point out, that at the moment of this research, MIE's selection process was evaluating five aspects: 1) Bachelor's degree average; 2) Score in EXANI III (test elaborated by the National Center of Assessment); 3) Results from the interview with the selection committee; 4) Score on English test; and 5) Score on the test of thinking abilities (which measures the ability of the applicant to analyze information and to communicate in a written manner).

Additionally, applicants are asked for a complete certificate of studies and their bachelor's degree. Several information can be found on these documents, such as the number of failed subjects, time between graduation and the diploma and degree, grade point average, and the relationship of the bachelor's degree with the educational field. Also, through a survey of sociodemographic nature, information about the socioeconomic status, employment situation, marital status, and professional and research experience. however, even if this information is gathered, is not actually used to make the final decision regarding acceptance of the applicants.

From this, it can be observed that there are coincidences between the criteria and the instruments used throughout the selection process of the program (MIE), and those implemented by the universities from other places, which could be related to the internationalization of the programs, driven by the accreditation entities.

## **Problem Statement**

One of the biggest problems, worldwide in every educational level, is desertion and delay. Particularly, in higher education, these phenomena reach a 26% in countries such as Spain (Lopez-Justicia, Hernández, Fernandez, Sanchez & Chacon, 2008). This situation could be explained due to the fact that many students lack the ability to understand and analyze texts, and also the ability to learn autonomously (Nuñez & González-Pienda, 2006).

Mexico and Chile have similar problems regarding educational delay and dropout in school, because of the low percentage of people starting primary education and finishing high school having also, low coverage in this level. Also, many of the students seem to have similar situations to the ones from Spanish students (low cultural capital, lack of conditions and educational experiences, necessary to meet the requirements of universities). This situation promotes low rates of study completion (CINDA, 2010; National Plan of Development, 2013-2018).

In this sense, Rivera (2011) explains that during 2007 in Mexico, rates of completion were a 13.7%, pointing out that the proportion of dropout in postgraduate studies, was of 20%. Particularly in Chile, according to the figures of the National Council of Education (2010), around a 50% of the students who enroll on a university or a technical training center do not finish the program, while for professional institutes, numbers reach a 60%.

Concern about increasing these rates arises from the need to maximize per student costs, through the completion of the educational programs in time, and through the commitment of HEI to contribute with human resources to the resolution of educational problems. Moreover, this would represent a quality indicator for accreditation entities, allowing HEI to rely on a scholarship system for their students, avoiding exclusion of students who otherwise would not be able to afford their education.

Regardless of the concern, rates of completion remain low, in the case of Mexico below 12% (INEGI, 2005). This percentage represents a waste of economic and human resources, which could be used more efficiently if more trustworthy and appropriate filters were defined from the beginning. Here lies the importance of carrying out studies which allow to identify the factors that influence academic performance, with the aim of measuring or observing them in the applicants, through the admission process, in order to predict academic success.

Specifically, in the program being researched on this study, the completion rate is of a 29.6%; this figure compromises accreditation, generates doubts regarding its implementation and about the predictive capacity of the admission process carried out on the applicants. regarding their academic performance.

Thus, the purpose of the present study is to build a model of the selection process for the MIE program, to assure the admission of the most suitable students aligned with the requirements of the program, to obtain the degree within the corresponding period (2.5 years, more or less since the start of the program), to avoid dropout and delay, which postpones the completion of the program.

To accomplish this, the following question has been raised: Which personal and social factors that predict academic performance of the students from the program, are feasible to be measured or observed on the applicants through the selection process? To answer this, the following objective was formulated.

### **General Objective**

To identify personal and social factors which could predict the academic performance of the students from the program, in order to build a model of the selection process to guarantee the admission of the most suitable students to satisfy the requirements of the postgraduate program.

It is important to mention that for the construction of the model, information for students who did not enter the program was not considered, which represents a limitation regarding the predictive ability of the model, existing the possibility of a more suitable one.

### **Theoretical background**

Literature indicates the existence of key elements on the construction of the selection process of an educational program, related to the academic performance of the students. Thus, this study about the factors which have an impact on the performance is considered useful to make the admission processes more efficient, given the low predictive power of the selection exam scores (Rivera, 2011).

Although the study of the factors determining academic performance is not new, research remains very active since these factors and their consideration vary depending on the education program. In this sense, despite the fact that research on this area has existed for a long time, there is no consensus regarding the terminology used throughout the different disciplines to refer to types of factors influencing the students' learning. This has caused confusion about which factors turn out to be more important, and thus, which one is the most appropriate way to measure them (McGarrah, 2014).

In this way, some researchers such as Nichols-Barrer, Place, Dillon and Gill (2016) propose a standardized system to evaluate admission of students to public schools, gathering information about how the students may prepare themselves successfully in schools, while others, such as the National Research Council (2012), propose a classification of the factors determining academic performance in three types of abilities: cognitive, intrapersonal and interpersonal. For this study, Garbanzo's (2007) classification was used (personal, social and institutional factors); however, in this article only personal and social factors are considered, given the objective of constructing a model on the selection process for the program, and the information obtained from this.

The decision of only considering personal and social factors is supported by authors such as Cervini (2002), who states that there are numerous studies that affirm social and personal factors as influential on the students' academic performance, and that institutional factors have an almost nonexistent effect. This author emphasizes importance of social factors such as sex, when it comes to explain school academic performance.

### **Social factors and academic performance**

In regards of this type of factors, Gorman-Smith, Tolan and Henry (2005) point out that the characteristics of the environment in which students live (neighborhood, services, etc.) have an impact on their academic performance; that is to say, young people who live in neighborhoods with economic problems, high levels of crime, violence and disorganization, are more susceptible to exhibit problems on their academic development.

In the same way, Mendez (2011) affirms that the social class determined by family income, the parents' educational level and the location and the value of the house, represent variables that influence the students' school performance. This author also emphasizes that social factors consider a cultural factor, that sometimes is reflected in the lack interest and support from the parents, regarding their children's educational processes, which has a direct and negative impact on their performance.

Within the context of higher education, particularly for postgraduate students, this support is replaced by that offered by their own children and partners, given the age of the students, having most of them their own families, being this support equally or more significant that the one from their parents. Either way, it is essential to have a net of social support the student's academic development.

A broader viewpoint of these factors is proposed by Bridgeland, Bruca & Harirahan (2013) explaining that when social learning is promoted, students commit and achieve intrapersonal skills of problem solving and rates of absenteeism, drug abuse, bullying and violence, decrease. This vision proposes that although students may not possess these skills beforehand, they could develop them afterwards, explaining why it is important to consider them through the selection processes, with the aim of developing strategies to promote them.

On the other hand, Rubin (2004) mentions that one of the social factors that influences academic performance are the students' relationships with their friends, since they validate interests, hopes and fears, as well as providing support and emotional safety, which are constantly configured and re-configured throughout the students' career. These factor ends up being particularly important for those students who need to move to the place in which the educational institution is located, because of the interruption caused regarding their friends and family.

Since human beings do not live in isolation, it is fundamental to have a support group through the process. Particularly, during postgraduate studies, students have family and friends support, who provide company during the program, being fundamental for them to exhibit personal characteristics, which contribute to the person's development.

### **Personal factors and academic performance**

Several investigations report the importance of non-cognitive personal factors on the academic performance. Studies regarding self-regulation indicate that the abilities and skills of the individuals do not completely explain variability of academic performance, which emphasizes the importance of deepening into this topic, with special interest in the field of motivational processes and self-regulation (Zimmerman, 2008).

In regards of motivation, Garreli and Rinaudo (2012) explain that “what” and “how much” students learn, depends on their motivation, strongly influenced by emotional states, beliefs, interests, goals and individual thinking patterns. For these authors, intrinsic motivation promotes creativity, critical thinking and natural curiosity, being the intrinsic motivation catalyzed through tasks that the student perceives as ideal in terms of innovation and difficulty, as well as relevant to their interests.

Wigfield and Eccles (2000) contribute to this notion of the importance of motivation, finding on their investigations that the students’ beliefs about their capacities and their success expectations are better predictors of future academic performance, than the previous performance itself.

Another factor analyzed regarding its influence on academic performance is self-esteem. Kususanto, Ismail and Jamil (2010) indicate that there is a direct relationship between these two factors and the behavior of the teacher. In the same way, Carreras Fuentes y Tomas (2012) conclude that self-esteem has an impact on the development of teenagers, personally and academically speaking. Moreover, Cruz and Quiñonez (2012) emphasize the importance of the same factor within the cognitive and affective processes.

On the other hand, there is consensus in considering the intrinsic motivation as the most successful learning style, and thus, the one to promote on students. Self-regulation and the use of profound strategies are key elements; that is to say, students with a successful learning style who know their abilities, the knowledge they possess, what to do in order to learn and also, are aware of how demanding tasks are (Vazquez, Noriega and Garcia, 2013).

In the same way, Toro (2008) considers that appropriate study habits and guidance are elements which allow the student to have a better performance. At the same time, Corvey (2003) defines study habits as the intersection between knowledge, ability and desire; in other words, it refers to what to do, how, and the will to do it.

Confirming the importance of learning styles and strategies, Barca, Almeida, Porto, Peralbo and Brenlla (2012) point out that these, along with academic goals, are positive determinants of the academic performance, explaining around a 30% of the variation of the performance. The importance of identifying styles or strategies to learn for a successful performance, is that these can be modified, giving the chance of promoting them among every student (Toro, 2007).

From a different point of view, Tejedor and Garcia (2007) report that from the teachers’ perspective, the variable that has more impact on the students’ performance is the low level of previous knowledge of the students. Likewise, Alonso, Tauriz and Choragwicka (2009) suggest that the best predictor for the future performance of the students is the past behavior. In other words, these authors affirm that the students’ performance during pre-university periods could indicate their performance during posterior educational levels.

Regarding the importance of the different types of factors for the performance prediction, there are studies, such as the one from Mella and Ortiz (2009), in which it is affirmed that although there is some influence of the social factors, it is minimal when compared to the personal factors.

### **Definitions on academic performance and study habits**

To offer an operational definition of academic performance is a complex process. In this regard, Diaz (2009) points out that for predictive studies this definition is highly relevant, since it must gather

characteristics which allow to determine the real importance of the predictors. This author comments that the use of a single variable to measure performance, such as grades, devalues the effects of other factors on the students' development. According to the author, although the acquired knowledge should be considered in order to continue studying, entering the working world and life in general, the criticism on the use of grades to determine performance is strong, but it is still, the most considered factor.

In this sense, several studies are oriented to determine the factor that influences academic performance with very simple measurement. An example of this, is the study carried out by Torres and Merino (2010), defining it as an average score determined in relation to the grades from the different courses. To identify factors which have an impact on the students' performance, these authors used comparative processes (t test for independent samples and ANOVA depending on the nature of the variables and the groups compared), as well as correlation coefficients.

Meanwhile, Ibarra and Michalus (2010) define academic performance as the average of failed subjects per year. Additionally, they point out that in their contexts, it is often used the coefficient between the number of passed subjects and the time of the student on the program in which they were selected. These authors studied the factors having an impact on academic performance through a LOGIT model, since it was considered more suitable than the multiple linear regression model, due to the categorical nature of the predictive factors.

Furthermore, Tejedor (2003) claims that operationally, there are two ways to classify the definitions of academic performance: 1) related to immediate performance and 2) based on what the author calls, delayed performance. First type puts value to the performance through the ending of the program, percentage of passed subjects and grades (or averages). On the other hand, delayed performance definitions focus their appreciation on the usefulness of the received information.

This author indicates for the methodology, the use of four statistical techniques for the predictive indicators of academic performance: 1) multiple regression to check the predictive or explanatory nature of the indicator and to establish their importance; 2) factorial analysis to identify existence of factors (dimensions) which would facilitate an explanation of the predictive indicator; 3) cluster analysis to identify groups of individuals with similar characteristics, in terms of the variables; and 4) discriminant analysis in groups of low and high performance.

Another technique used for the prediction of the academic performance is presented by Miñano and Castejon (2011), with an analysis based on a model of structural equations that allowed them to analyze the effect of cognitive-motivational variables, such as previous performance, aptitudes, academic self-concept, causal attribution, goal-oriented skills and learning strategies. Results of this investigation reported that the variables considered for the research, explained around a 70% of the academic performance.

From these analyses and others, it was concluded that the most frequently used technique to study predictive indicators of academic performance, is the multiple linear regression. However, it is observed that the predictive power of this method, is low, not exceeding a 19%. Additionally, it was determined that the method of discriminant analysis only manages to appropriately classify a 64% of the individuals, which reveals the need of using other techniques to analyze the effects of social and personal variables on academic performance.

## **Method**

### **Type of investigation**

The present study belongs to the positivist paradigm, it is non-experimental, it corresponds to an applied investigation, it has a correlational nature and it classifies as a cross sectional research (Hernandez, Fernandez and Baptista, 2006).

## Participants

Study population was constituted by 186 graduates from cohorts 2004-2014 from the MIE program. Sample was determined through a stratified sampling, considering as categories, high performance students (graduates who obtained the diploma in 2.5 years more or less, from the moment they got into the program onwards) and delayed students (those who did not complete the program within the appropriate period of time). Size of the sample was calculated in 127 graduates, 39 high performance and 88 delayed students. However, only 126 were able to answer the instrument (39 out of 58 high performance and 87 out of 128 delayed). Regardless of this situation, according to Scheaffer, Menddenhall and Ott (1987), the estimated sample size using 0.5 for  $p_i$  and  $q_i$  delivers a sample size larger than the needed, this. The sample is representative.

It is important to mention that the percentage of graduates who decided not to participate from the research, was practically zero, which could represent the awareness shown towards activities involving recollection of information through surveys, due to the focus of the research of this program.

## Instrument

To recollect the information, a questionnaire was developed, gathering sociodemographic information, academic records and personal and social factors from the graduate students' point of view, of that they consider could have had an impact on their academic performance. Personal factors were: use of ICT, statistical knowledge, English communication, critical thinking, raking, team work ability, expectations, self-esteem, psychological wellbeing and goal orientation. For the last three, Rosemberg (1989), Bielps-A de Casullo (2002) and Diaz Loving, Andrade and La Rosa's (1989) scales were used, respectively. Regarding social factors, the ones considered for this study were: employment situation, marital status, economic dependents, family environment and cultural capital of the family (see Appendix 1).

## Information analysis

Initially, relationships between the previously mentioned variables and academic performance were studied. For this, indicators on a scale from zero to a hundred were calculated for the factors: experience in research, ICT use, statistical knowledge, English communication, psychological wellbeing, self-esteem, study habits, work team, critical thinking, goal orientation, expectations, socioeconomic status, risk factors, family environment and cultural capital. These indicators were built through the following formula:  $Indicator = \left( \frac{P-m}{M-m} \right) \times 100$ , where P represents the score on the section of the instrument corresponding to the specific factor. M and m, are the minimum and maximum possible values for the factor, being the final value, the average of every score calculated.

For some factors such as, age, bachelor average, failed subjects and months to obtain the diploma since ending of the program, the figures obtained directly from the questionnaire were used. The ranking was defined as the quotient between the position of the graduate and the average of the cohort, and the number of students from this group.

Also, an indicator of academic performance was built based on the operational definition of the construct, which makes reference to the execution of four academic activities that show acquisition of general skills for the program: 1) Participation in an annual congress (national or international) with an academic product derived from the students' thesis; 2) To demonstrate the selection of at least one subject outside the basic offer of the program under observation; 3) To carry out investigation with a scholar from a different institution for a minimum of 30 days and; 4) To get the degree within a period of 2.5 years from the moment in which the student began with the program. One point is given by each of the activities.

Once the indicators were constructed, the study of these relationships was carried out through the Student's T test for independent samples, Chi Square Test of Independence, Pearson Correlation coefficient, and previous confirmation of the assumptions for the application.



Subsequently, the analysis was carried out through multiple linear regression (MLR) by Stepwise method, resulting in models for each type of factor (personal and social), considering as dependent variable the academic performance indicator, and as the independent one, the previously mentioned factors.

Then, the discriminant analysis technique was used, classifying students in two groups: high performance and delayed students. A group of variables would have the ability to predict academic performance, if the percentage of good credit ranking of the discriminant function was at least 80%.

The use of these three techniques aimed to identify those factors which consistently turned out to be good predictors of the academic performance for MIE students, that is to say, the factors which were considered as significant in more than one of the three techniques. Likewise, the techniques seek to observe the behavior of the predictive capacity on the selected factors, when analyzed as a group, since it could be different from the same factors analyzed in isolation (Fernandez, 2007),

Finally, to confirm the identified relationships through the three statistical techniques and to support the theoretical background of the relationships through data, a structural equation model was used, considering all statements from the Likert scale as observable variables, and the respective indicators associated to these, as latent variables. This analysis was carried out regardless of the size of the sample ( $n= 126$ ), due to the simplicity of the model, number of parameters, and estimates carried out through the maximum likelihood method, as mentioned by Nevitt and Hancock (2004) and Jackson (2003) as quoted by Kline (2011).

## Results

In this section, results from the analyses are presented for each one of the stages previously described on the methodology for this study. Thus, statistical processes carried out during the first stage were designed to observe behavior of the academic performance of the students on different levels of the selected factors, such as proficiency, development, performance or intensity. The analyses revealed that an effective management of ICT, experience in research through participation in projects or during the thesis, internship months, self-esteem, habits of study and psychological wellbeing, determine the academic performance of graduate students of the program, while social factor do not (see Table 1).

Table 1  
*Individual effects of the factors on the academic performance*

Variable analyzed	Statistical test	Significance value	Procedure
Personal Factors			
Sex	5.400	0.065	Chi-Square Goodness-of-Fit Test
Age	0.620	0.537	
Promedio de licenciatura	0.640	0.552	T-Test
Asignaturas reprobadas en licenciatura	0.200	0.836	
Licenciatura de procedencia	0.180	0.913	Chi-Square Goodness-of-Fit Test
Ranking	0.099	0.415	
Meses de pasante	0.290	0.030	
Uso de las TIC	0.303	0.009	
Conocimientos estadísticos	0.160	0.951	
Comunicación en inglés	0.014	0.903	
Pensamiento crítico	0.107	0.367	
Experiencia en investigación	0.267	0.025	Pearson's Moment
Trabajo en equipo	0.191	0.106	
Study Habits	0.448	0.001	
Expectativas hacia el programa	0.008	0.945	
Autoestima	0.302	0.010	
Motivación al logro Bienestar	0.175	0.216	
Psicológico	0.270	0.021	
Social Factors			
Entorno Familiar	0.006	0.957	Pearson's Moment
Factor socioeconómico	0.161	0.178	
Factores de riesgo	0.878	0.645	
Capital cultural	6.063	0.194	Chi-Square Goodness-of-Fit Test

On the second stage of analysis, the importance of the different factors of the study was identified, as well as the coherence of the factors which turned out to be relevant during the first stage. For this purpose, multiple linear regression was used, through the Stepwise method. The analysis revealed that personal factors which are decisive for academic performance are: bachelors' degree grade average, months of internship, experience in research and study habits, explaining a 58.3% of the variability in academic performance.

One finding from this study, shows a negative sign of the estimated regression parameter for the factor average, showing an inverse relationship with academic performance. This could be explained by the operational definition of academic performance which has been used, based on what it is known as delayed results (finalization of the degree, participation in congresses, accreditation of at least one subject in a different institution, and internship of at least 30 days), without considering grades or the average. This emphasizes the importance of the operational definition on the identification of the relevant factors.

In the same way, the negative sign of the estimated regression parameter for the factor months of internship is not surprising, since it is natural to think about students who spent more time on the program, as having a lower performance than those who finished the program in a shorter period of time.

Likewise, the analysis revealed that neither of the social factors has a significant impact on academic performance. Also, explained variance by the regression model was only of a 6.7% (see Table 2).

Table 2  
*Analysis of the importance of factors as predictors of academic performance*

Personal Factors					
Factor en estudio	Coefficientes $\beta$	p	Factor en estudio	Coefficientes $\beta$	p
Edad	0.020	0.371	Autoestima	0.015	0.096
Promedio de licenciatura	-0.029	0.025	Hábitos de estudio	0.028	0.044
Asignaturas reprobadas	0.044	0.577	Maestría	0.028	0.241
Meses de pasante	-0.010	0.027	Competitividad	-0.016	0.060
Uso de las TIC	0.011	0.419	Trabajo	-0.006	0.711
C. estadísticos	-0.003	0.613	Deseabilidad social	-0.009	0.392
Inglés	-0.008	0.184	Aceptación	0.005	0.652
Pensamiento crítico	-0.018	0.189	Autonomía	0.017	0.051
E. en investigación	0.012	0.022	Vínculos	-0.003	0.772
Trabajo en equipo	-0.011	0.438			
Expectativas	-0.012	0.089			
Constante				R <sup>2</sup>	
0.513				0.583	
Social Factors					
Factor en estudio	Coefficientes $\beta$		p		
Indicador de riesgo	0.019		0.168		
Nivel socioeconómico	-0.077		0.911		
Entorno familiar	0.011		0.716		
Nivel de capital cultural	-0.483		0.116		
Constante				R <sup>2</sup>	
-1.203				0.067	

From the analysis of tables 1 and 2, it can be deduced that experience on research, study habits and months of internship turned out to be decisive for academic performance. This fact suggest that they have more predictive capacity than a single analysis technique. Factors being significant depending on the technique, could be related to the instruments used for the measurement, or the interactions among them, since they could hide or modify the effects over academic performance (Montgomery, 2004).

During the third part of the investigation, in order to determine the global effect of all the factors considered for the study, the multiple discriminant analysis classified the students in two groups: high performance and delayed students, with a good rating of 92.9%. However, according to the principle of parsimony, a new discriminant function was calculated due to the difficulty of analyzing every factor involved, using only those factors which turned out to be simultaneously significant on stages 1 and 2 (experience in investigation, study habits and internship months). This function reported a percentage of good rating of an 80%, which indicates that the group of factors selected for the methodology, has the ability of predicting academic performance (see Table 3).

Table 3  
*Discriminant function with determinant factors of academic performance*

Factor	Coefficientes de la función discriminante
Research experience	0.144
Study Habits	0.772
Meses de pasante	0.410
Porcentaje de buena clasificación	80%

It is important to make sure that the purpose of using different statistical techniques during each stage, besides attempting to search for coherence of the factors and their importance, was also to determine the different type of relationships (linear and covariance) between the factors and academic performance, verifying through structural equations demanding specification of the factors as input.

Thus, with the intention of verifying the identified relationships between the factors and academic performance and determining the minimum indicators of achievement to be included in the MIE selection process, a structural equation model was used, considering those factors which turned out to be significant in any of the stages (experience in investigation, self-esteem, study habits, psychological wellbeing, bachelor's degree average and internship months).

The suggested model considered the different types of relationships identified during each stage (linear and covariance), excluding those factors which according to the FIT analysis, were not significant. In this way, Figure 1 shows a path diagram of the resulting model.

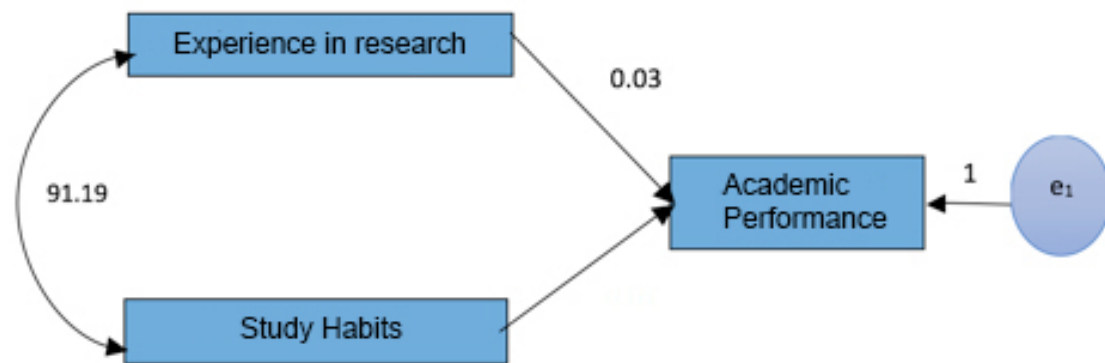


Figure 1. Structural model of the selection process.

This model suggests that for the selection process of the program, some elements such as investigation experience and study habits, should be considered, not excluding the use of other elements that the faculty may consider necessary, given the information they gather or because they are imposed by accreditation entities.

Analysis of the general adjustment was carried out by using absolute, incremental and parsimony measurement. The degree in which the model predicts from the matrix of initial data, was analyzed with absolute measurement, resulting in values of  $X^2=0.792$  with a significance of  $p=0.374$ ,  $GFI=0.995$  and  $RMSEA=0.001$ . improvement for the goodness of fit of the proposed model when compared to the null model (the one assuming variables are not related) was analyzed with incremental measurement of CFI and TLI equal to 1. The adjustment reached by every coefficient or parameter estimated, was studied with the parsimony RMR, with a value of 0.001.

These values fluctuate among the established parameters for a nice fit, which confirms the identified relationships between the factors constituting them.

### Conclusions and Discussion

One of the first conclusions is related to the fact that no effect from personal variables such as sex and age regarding academic performance was observed, in opposition to what had been reported by Cervini (2002), who claims that the effect of these type of factors is reported as significant in a coherent way. This difference regarding the results, could be explained by the different educational levels included on this research.

These inconsistencies are also seen within the groups of factors identified as determinants of academic performance for each stage of the analysis. For instance, the results of Kususanto, Ismail and Jamil (2010); Carreras, Fuentes y Tomas (2012); and Cruz and Quiñones (2012) explain self-esteem as an important factor in the students' academic performance; this study analyzed the importance of this factor, for each stage. Likewise, the fact that there are no social factors as determinants of the academic performance, as also explained by Tejedor (2003), could be related to resilience students have developed to reach the level of expertise given by the experiences they have gone through, or due to the instruments used for measurement, not only regarding validity but also to the measurement scale for the obtained data.

Within this context, controversies are common regarding inclusion of social and non-cognitive personal factors regarding the postulants selection, not only due to the difficulty to measure them through existent scales (length, cost and time), but also, due to the diversity of meanings of these, which usually cause confusion when it comes to decide which ones would be really important to study (McGarrah, 2014), as well as because of the establishment of segregationist selection criteria for social factors.

The dilemma of measuring social and non-cognitive personal factors for the postulants of the program, still remains, although some countries such as Germany, the United Kingdom and the United States, have tried to measure them through interviews and personal essays (Santelices, 2007). This strategy has been put into practice for the MIE program, being difficult to implement due to the variability of the criteria of appreciation of the teachers, due to their lack of instruction and experience in this field.

On the other hand, the fact that study habits consistently resulted to be significant for academic performance, similarly to Vazquez, Noriega and Garcia (2013) and Tejedor's (2013) previous research, raises the question regarding validity of the measurement scale and it suggests that some might be inappropriate (self-esteem, psychological wellbeing and ICT use), which only turned out to be significant for some stages of the analysis.

In the same way, modifiable nature of this factor (study habits) through curricular interventions (Toro, 2007; Covey, 2003) and the persistent influence on academic performance, show that along with experience in investigation and months of internship, the methodological proposals is refined for the study of the factors having an impact on this construct, since it allows to consider the possibility of improving selection routes, instructional processes, reducing delay and dropout rates.

Finally, regardless that during the three stages of analysis study habits, experience in investigation and months of internship turned out to be significant, the structural equation model does not consider the latter, although FIT analysis rules out not only the existence of a linear relationship with academic performance, but also any other (covariance). Similarly, this model suggests that study habits and experience in investigation are elements to be considered for the selection process to MIE, not only due to trustworthiness reflected by the measurement of adjustment calculated, but also because of the explicit presentation of the relationships between the factors which are involved, which is a feature not always present on models, although its simplicity needs to be recognized.

The original article was received on September 23<sup>rd</sup>, 2016

The revised article was received on January 19<sup>th</sup>, 2017

The article was accepted on April 3<sup>rd</sup>, 2017

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**Apendix**

**Factores Personales**

**Instrucciones:** Marca con una X o llena el espacio en blanco tu respuesta

1. Sexo:	<input type="checkbox"/> Mujer	<input type="checkbox"/> Hombre	2. Edad al momento de iniciar los estudios:
3. Promedio de licenciatura:	4. Número de asignaturas de licenciatura reprobadas:		
5. ¿Qué licenciatura estudiaste?	6. ¿Cuántos compañeros de generación de licenciatura tenías?		
7. ¿En qué lugar te ubicas en tu generación de licenciatura respecto del rendimiento académico?			
8. ¿Cuántos meses transcurrieron desde el inicio de tu pasantía hasta tu titulación en licenciatura?			
9. Durante tus estudios de maestría, ¿realizaste alguna estancia de investigación en alguna institución nacional o internacional?			<input type="checkbox"/> Sí <input type="checkbox"/> No
10. Durante tus estudios de maestría, ¿cursaste alguna(s) asignatura(s) en alguna institución nacional o internacional?			<input type="checkbox"/> Sí <input type="checkbox"/> No
11. Durante tus estudios de maestría, ¿tuviste por lo menos una participación en un congreso con alguna ponencia relacionada con tu tema de tesis?			<input type="checkbox"/> Sí <input type="checkbox"/> No
12. Programa:	<input type="checkbox"/> MIE	<input type="checkbox"/> MINE	
13. Año de ingreso a la maestría:	<input type="checkbox"/> 2004 <input type="checkbox"/> 2005 <input type="checkbox"/> 2006 <input type="checkbox"/> 2007 <input type="checkbox"/> 2008 <input type="checkbox"/> 2009 <input type="checkbox"/> 2010 <input type="checkbox"/> 2011 <input type="checkbox"/> 2012		
14. A partir del mes de agosto del año en el que terminaste tus estudios, ¿cuántos meses transcurrieron hasta que conseguiste el grado?			

**Instrucciones:** Indica el grado de acuerdo con cada una de las siguientes afirmaciones remontándote al momento de iniciar la maestría, utiliza la escala:

1= Muy en desacuerdo 2= En desacuerdo 3= De acuerdo 4 = Muy de acuerdo

Al estudiar la maestría contaba con la habilidad o conocimiento para:	Acuerdo			
	1	2	3	4
15. Elaborar documentos en Word				
16. Poner encabezados en un documento				
17. Cambiar tipo y tamaño de letra				
18. Determinar el espaciado entre líneas				
19. Determinar el tamaño de las sangrías				
20. Insertar tablas e imágenes				
21. Crear hojas de cálculo en Excel				
22. Dar formato a celdas				
23. Insertar y ocultar filas				
24. Seleccionar casos				
25. Buscar elementos en la hoja de cálculo ( una palabra en específico)				
26. Crear gráficos				
27. Elaborar presentación en PowerPoint				
28. Cambiar plantilla				
29. Cambiar diseño				
30. Copiar diapositivas de una presentación a otra				





69. Trataba de fusionar mis ideas con las de los otros miembros del equipo				
70. Consideraba las opiniones de todos para tomar decisiones sobre el trabajo				
71. Hacía comentarios y presentaba ideas sobre el trabajo o tema tratado.				
72. Me gustaba tomar la iniciativa en el equipo				
73. Cuando se me asignaba una tarea la realizaba en tiempo y forma				
74. Me responsabilizaba por las decisiones de equipo aunque no fueran acertadas				
75. Asignaba roles a los miembros del equipo				
76. La idea de investigación que tenía al iniciar la maestría, cambió superando mis expectativas				
77. Las habilidades y herramientas que adquirí resultaron tan útiles como creía que iban a serlo				
78. Me percaté de que el nivel de conocimientos de los maestros era tan bueno como lo imaginaba antes de iniciar mis estudios				
79. Las experiencias de mis profesores resultaron tan enriquecedoras como lo imaginaba antes de iniciar mis estudios				
80. El comportamiento ético profesional de los profesores resultó ser tan apropiado como lo imaginaba antes de iniciar mis estudios				
81. Fui sintiendo que incorporarme al programa fue una decisión correcta				
82. Los conocimientos adquiridos resultaron útiles como lo imaginaba antes de iniciar				
83. En general estaba satisfecho conmigo mismo				
84. A veces pensaba que no era bueno en nada				
85. Tenía la sensación de que poseía algunas buenas cualidades				
86. Me sentía capaz de hacer las cosas tan bien como la mayoría de personas				
87. Sentía que no tenía demasiadas cosas de las que sentirme orgulloso				
88. A veces me sentía realmente inútil				
89. Tenía la sensación de que soy una persona de valía, al menos igual que la mayoría de gente				
90. Ojalá me hubiera respetado más a mí mismo				
91. En definitiva, tendía a pensar que era un fracaso				
92. Tenía una actitud positiva hacia mí mismo				
93. Contaba con un sitio definido para estudiar				
94. Tenía un horario de estudio definido				
95. Respetaba mi horario de estudio excepto ante muy buenas razones				
96. Tomaba apuntes sin pasar por alto nada de lo que el profesor decía				
97. Tomaba apuntes con mis propias palabras				
98. Tomaba nota de las lecturas que hacía				
99. Marcaba en las lecturas que hacía las partes que consideraba importantes				
100. Discutía mis dudas con mis compañeros de grupo				
101. En ocasiones hacía cuadros o diagramas para orientar mis ideas				
102. Leía más sobre el tema de lo que se me pedía				
103. Regularmente recurría a la biblioteca de la escuela				

104. Consultaba mis dudas con mis profesores				
105. Me sentía bien estando en la escuela realizando mis trabajos sin importar la hora				
106. Participaba activamente en la clase				
107. Cuando me enfermaba me ponía al día con algún amigo o el profesor				

**Instrucciones:** A continuación encontrarás una serie de oraciones que usarás para describirte al momento de iniciar tus estudios de maestría, en donde el 7 representa un mayor grado de acuerdo con la frase, es decir, que siempre eres así, y el 1 un menor acuerdo con ella, o sea, que nunca eres así. Contesta tan rápido como puedas, sin ser descuidado, dando una sola respuesta en cada cuestión.

<b>Motivación al logro</b>	7	6	5	4	3	2	1
108. Soy trabajador(a)							
109. Me gusta resolver problemas difíciles							
110. Cuando tengo éxito lo comparto con mis compañeros							
111. Me es importante hacer las cosas lo mejor posible							
112. En asuntos controvertidos me uno a lo que la mayoría piensa							
113. Evito contarle a los demás de mis fracasos							
114. Logro lo que me propongo							
115. Me disgusta que otros sean mejores que yo							
116. Me esfuerzo por superarme							
117. Me hierde que otros desapruében mis metas							
118. Me preocupa fracasar en la realización de mis tareas							
119. Para mí es importante hacer las cosas cada vez mejor							
120. Me disgusta cuando alguien me gana							
121. Disfruto cuando el trabajo de los demás se ve mal junto al mío							
122. Con tal de ser el primero soy capaz de todo							
123. Soy ordenado(a) en las cosas que hago							
124. Hago las cosas lo mejor posible							
125. Ganarle a otros es bueno tanto en el juego como en el trabajo							
126. Me esfuerzo más cuando compito con otros							
127. Soy cuidadoso en las cosas que hago							
128. Me enoja que otros trabajen mejor que yo							
129. Soy dedicado(a) en las cosas que emprendo							
130. Me importa mucho hacer las cosas mejor que los demás							
131. Me gusta que lo que hago quede bien hecho							
132. Me esfuerzo por ganar							
133. Me siento realizado(a) cuando logro lo que me propongo							
134. Una vez que empiezo una tarea persisto hasta terminarla							
135. Por ser el primero aceptaría hacer cualquier cosa							
136. Soy exigente conmigo mismo							
137. Me causa satisfacción mejorar mis ejecuciones previas							

138. Me encanta competir							
139. Disfruto cuando puedo vencer a otros							
140. Me enorgullece quedar en primer lugar							
141. Respondo responsablemente a las tareas que me asignan							
142. No estoy satisfecho(a) hasta que mi trabajo queda bien hecho							
143. No estoy tranquilo(a) hasta que mi trabajo queda bien hecho							
144. Es importante para mí hacer las cosas mejor que los demás							
145. Hago las cosas bien hechas							
146. Lo importante para mí es ganar							
147. No descanso hasta que las cosas que debo hacer queden terminadas							
148. Me satisface hacer bien las cosas							

**Instrucciones:** A continuación se te enlistan una serie de proposiciones, señala el grado de acuerdo o desacuerdo que tengas con cada una, utiliza la siguiente escala:

1 = Muy en desacuerdo 2 = En desacuerdo 3 = De acuerdo 4 = Muy de acuerdo

Durante el desarrollo de mis estudios de maestría:	Acuerdo			
	1	2	3	4
149. Creía saber lo que quería hacer con mi vida				
150. Si algo salía mal podía aceptarlo, admitirlo				
151. Me importaba pensar qué haría en el futuro				
152. Podía decir lo que pensaba sin mayores problemas				
153. Generalmente le caía bien a la gente				
154. Sentía que podía lograr las metas que me propusiera				
155. Contaba con personas que me ayudaban si lo necesitaba				
156. Creía que en general me llevaba bien con la gente				
157. En general hacía lo que quería, era poco influenciable				
158. Era una persona capaz de pensar en un proyecto para mi vida				
159. Podía aceptar mis equivocaciones y tratar de mejorar				
160. Podía tomar decisiones sin dudar mucho				
161. Encaraba sin mayores problemas mis obligaciones diarias				

**Factores Sociales**

**Instrucciones:** Remontándote al momento en que estudiaste tu maestría, llena el espacio en blanco con la información que se te solicita o marca tu respuesta.

1. Lugar de residencia:	
2. Estado civil:	
3. Tiempo que tardabas en trasladarte de tu casa a la escuela en minutos:	4. Ingreso familiar mensual:
5. Número de personas con las que vivías:	6. Habitaciones que tenía tu hogar:
7. Número de personas que aportaban al gasto familiar:	8. Horas a la semana que trabajabas:

9. ¿Contabas con equipo de cómputo?	<input type="checkbox"/> Sí <input type="checkbox"/> No	10. Número de hijos:	
11. Número de dependientes económicos:		12. ¿Contabas con Internet en tu hogar?	<input type="checkbox"/> Sí <input type="checkbox"/> No
13. ¿Contabas con automóvil?	<input type="checkbox"/> Sí <input type="checkbox"/> No	14. ¿Contabas con algún tipo de beca?	<input type="checkbox"/> Sí <input type="checkbox"/> No
15. ¿El ingreso percibido era suficiente para cubrir tus necesidades?	<input type="checkbox"/> Sí <input type="checkbox"/> No	16. ¿Tenías pareja, novio, novia?	<input type="checkbox"/> Sí <input type="checkbox"/> No

**Instrucciones:** Indica el grado de acuerdo con cada una de las siguientes afirmaciones, utilizando la escala: 1 = Muy en desacuerdo 2 = En desacuerdo 3 = De acuerdo 4 = Muy de acuerdo

Al momento de estudiar la maestría	Acuerdo			
	1	2	3	4
17. Contaba con el apoyo de mi familia				
18. Alguien que vivía conmigo consumía drogas				
19. En mi familia constantemente había peleas o discusiones				
20. En mi familia había reglas establecidas				
21. Mi familia se preocupaban por que tuviera los insumos para las tareas				
22. Mi familia se interesaba en mis estudios				
23. En mi casa contaba con un lugar adecuado para estudiar				
24. Tenía familiares con enfermedades				
25. Tenía buena comunicación con mi familia				
26. Me sentía solo				
27. Había problemas económicos en mi familia				
28. En mi familia cada quien hacia lo que se le antojaba				

**Instrucciones:** Marca tu respuesta remontándote al momento de realizar tus estudios de maestría

29. Nivel de escolaridad	Padre	Madre	Nivel de escolaridad	Padre	Madre
Primaria incompleta	<input type="checkbox"/>	<input type="checkbox"/>	Carrera técnica incompleta	<input type="checkbox"/>	<input type="checkbox"/>
Primaria completa	<input type="checkbox"/>	<input type="checkbox"/>	Carrera técnica completa	<input type="checkbox"/>	<input type="checkbox"/>
Secundaria incompleta	<input type="checkbox"/>	<input type="checkbox"/>	Carrera incompleta	<input type="checkbox"/>	<input type="checkbox"/>
Secundaria completa	<input type="checkbox"/>	<input type="checkbox"/>	Carrera completa	<input type="checkbox"/>	<input type="checkbox"/>
Preparatoria incompleta	<input type="checkbox"/>	<input type="checkbox"/>	Maestría	<input type="checkbox"/>	<input type="checkbox"/>
Preparatoria completa	<input type="checkbox"/>	<input type="checkbox"/>	Doctorado	<input type="checkbox"/>	<input type="checkbox"/>

30. Tipos de libro que había en tu hogar al momento de realizar tus estudios de maestría:

Clásicos	<input type="checkbox"/>	Diccionarios	<input type="checkbox"/>	Poesía	<input type="checkbox"/>	Textos	<input type="checkbox"/>
Novelas	<input type="checkbox"/>	Divulgación	<input type="checkbox"/>	Enciclopedias	<input type="checkbox"/>	No hay	<input type="checkbox"/>
31. ¿En tu casa se compraba el diario?	Todos los días		<input type="checkbox"/>	Los domingos		<input type="checkbox"/>	
	Sólo algunos días de la semana		<input type="checkbox"/>	Nunca		<input type="checkbox"/>	

32. ¿Qué tipo de revistas se compraban en tu casa?		Espectáculos y entretenimiento		<input type="checkbox"/>			
		Ciencia y tecnología		<input type="checkbox"/>			
		Deportes		<input type="checkbox"/>			
33. ¿En tu casa alguien tocaba algún instrumento?	<input type="checkbox"/> Sí <input type="checkbox"/> No	34. ¿Algún miembro de tu familia gustaba de ir al teatro?		<input type="checkbox"/> Sí <input type="checkbox"/> No			
35. ¿Algún miembro de tu familia gustaba de ir al cine?	<input type="checkbox"/> Sí <input type="checkbox"/> No	36. ¿Algún miembro de tu familia gustaba de asistir a museos o exposiciones?		<input type="checkbox"/> Sí <input type="checkbox"/> No			
37. ¿Algún miembro de tu familia realizaba algún deporte?	<input type="checkbox"/> Sí <input type="checkbox"/> No	38. ¿Alguien de tu familia había viajado al extranjero?		<input type="checkbox"/> Sí <input type="checkbox"/> No			
39. Señala los tipos de música que escuchaban en tu casa:		Clásica	<input type="checkbox"/>	Para bailar	<input type="checkbox"/>	Pop	<input type="checkbox"/>
		Folclórica	<input type="checkbox"/>	No se escucha música	<input type="checkbox"/>	Jazz	<input checked="" type="checkbox"/>
40. Señala los tres tipos de programación más frecuentes que acostumbraban ver en tu casa:		Culturales	<input type="checkbox"/>	Películas	<input type="checkbox"/>	Musicales	<input type="checkbox"/>
		Deportes	<input type="checkbox"/>	Caricaturas	<input type="checkbox"/>	Espectáculos	<input type="checkbox"/>
		Noticias	<input type="checkbox"/>	Series	<input type="checkbox"/>	Telenovelas	<input type="checkbox"/>