

**RELATIONSHIP BETWEEN LEARNING STYLE AND ACADEMIC
PERFORMANCE IN STUDENTS OF THE PHARMACY PROGRAM
AT UNIVERSIDAD DE COSTA RICA**

**RELACIÓN ENTRE ESTILO DE APRENDIZAJE Y RENDIMIENTO
ACADÉMICO EN ESTUDIANTES DE FARMACIA DE LA
UNIVERSIDAD DE COSTA RICA**

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ABSTRACT

Learning styles can be defined as the set of features that characterize the way people learn and process information. The aim of this study is to establish the relationship between learning styles and academic performance of students who completed the fifth year of the Pharmacy Program at Universidad de Costa Rica during the years 2011 to 2013. We applied the Honey-Alonso Learning Styles questionnaire. Regarding the overall mean, we obtained that there are no differences in the preference for an active, reflective, theoretical or pragmatic style. Students don't have a pure learning style, but a combination of two or more of them, which favours the learning process as they have more tools to adapt to the teachers', the courses' and the study program's requirements.

Keywords: learning methods, student, pharmacy, academic performance, learning styles.

RESUMEN

Los estilos de aprendizaje se pueden definir como el conjunto de rasgos que caracterizan la forma en que aprenden y procesan información las personas. El objetivo del presente estudio es establecer la relación entre los estilos de aprendizaje y el rendimiento académico de los estudiantes que cursaron el V año de la carrera de licenciatura en Farmacia de la Universidad de Costa Rica, durante los años 2011 a 2013. Se aplicó el Cuestionario de Honey-Alonso de Estilos de Aprendizaje. Se obtuvo que en relación con el promedio global, no existen diferencias entre preferencias para los estilos activo, reflexivo, teórico o pragmático. Los estudiantes no presentan un estilo de aprendizaje puro, sino una combinación de dos o más de estos, lo cual favorece el proceso de aprendizaje al tener más herramientas de adaptación a los requerimientos de los profesores, los cursos y la carrera.

Palabras clave: métodos de aprendizaje, estudiante, farmacia, rendimiento académico, estilo de aprendizaje.

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INTRODUCTION

There are several definitions for learning styles; Aguilar (2010) defines them as the way people do things, a set of features that characterize the way people learn. Learning styles refer to the peculiarities of an individual and the way he/she deals with, organizes and processes information. Learning styles play an important role in teaching-learning processes, as they constitute the set of features that are in place when learning occurs (Garcia, 2013).

Aguilera and Ortiz (2010) consider learning styles as a spontaneous process that can be self-developed, a specific process that involves affective, cognitive, and metacognitive components, and that has a gradual, conscious and stable nature. Bahamon, Viancha Alarcon and Bohorquez (2013) note that learning traits show how individuals build their schemes of interpretation, contents and information, that is, learning involves the engagement of cognitive processes.

Learning styles can be determined by various factors related to each other; Gonzalez-Peiteado (2013) mentions three traits or elements:

- Cognitive traits: Aspects related to basic psychological processes, such as memory and creativity. Process of metacognition, defined as the ability that allows students to know their limitations and potentials to face educational processes.
- Emotional traits, such as motivation that causes students to want to do things. Interests and expectations of learners are part of this group, based on their level and intensity, as students prefer certain contents, classroom organization, and methodology, among others. In addition, self-esteem is associated with self-concept, which is linked to academic success.

- Physiological traits related to physical pearance, age, gender, biorhythms (there are students that perform better during certain hours) and situational elements, such as lighting, noise, space, among others.

Garcia (2013) adds environmental factors and preferences with regard to information organization and presentation. Several authors mention that learning depends on multiple variables, from the content of what is being learned to how it is being delivered, so when considering the factors that are involved during the process of leaning or that interfere with it, there is not a fixed number; it involves a mixture of reasons, previous experiences, needs and emotions, which means that the process of studying starts with the need of learning something (Aguilera and Ortiz, 2010; Bahamon et al., 2013; Figueroa et al., 2005; Salas, 2014). Other factors include different educational levels, generation, technology, group size and distance education (Robles, Cox and Seifert, 2012).

The various contributions of multiple authors have raised theories based on the number and type of key factors that allow to classify learning styles in different ways. Garcia (2013) offers a timeline noting the major contributions: some are based on the principles of duality of opposites, as in the case of Felder and Silverman, who divided them into sensory/intuitive, visual/verbal, inductive/deductive, active/reflective, and sequential/global; Kolb distinguishes four types of styles: concrete experimentation, reflective observation, abstract conceptualization and active experimentation. Kolb's model was enhanced and redesigned by Honey-Mumford in 1986 (as cited in Aguilar, 2010), and the latter model was

adapted to the context of university students by Alonso, Gallego and Honey in 1997 (as cited in Laugero, Balcaza, Salina and Craveri, 2009) who recognize four types of learning styles:

1. Active: open to new experiences and learn better in groups.
2. Theoretical: logical approach to problems, analyze and synthesize.
3. Reflective: reflect upon things before acting and look closely at different experiences.
4. Pragmatic: their strength is experimentation and implementation of ideas.

Currently, although there is not a widely held theory, several of the scales and classifications used have things in common and consider the environment, senses, cognitive and social-emotional aspects (Romanelli, Bird and Ryan, 2009), therefore when applying them one must be critical and have a broad theoretical knowledge on the subject. Their selection depends, in some cases, on the program's academic profile, given that learning strategies are adapted to the content and objectives of each course.

Bahamon et al. (2013) point out that university education is a systematic and explicit teaching of learning strategies, consequently programs should not only focus on imparting theoretical contents, but also on teaching students the best way to acquire these contents. Teachers should encourage class participation, develop more independent projects, motivate their students, generate reflective processes, and use information and communication technologies (ICTs) (Gallego, Negro, Fernandez, Raposo, Montejo and Barcia, 2010). Various analyzes indicate that there are differences between student profiles, which is to say that a particular learning style would be preferred depending on the program chosen (Bravo and Alfonso, 2007; Pulido, De la Torre, Luque and Palomo, 2009).

Works on this subject, such as the one by Borracci, Guthman, Rubio and Arribalzaga (2008), support this preference of styles depending on the program selected, something that even extends to specialties or postgraduate studies; as confirmed in previous studies, they also indicate that despite this preference, students modify their learning styles or strategies according to the specific demands of a particular course.

Therefore, for the Pharmacy program at Universidad de Costa Rica, in which students receive theoretical knowledge and train in different areas of pharmacy practice, the relationship between academic performance and learning style is essential to improve teaching processes. These findings will enable students and teachers of the program to adopt appropriate techniques and strategies that would facilitate the process and enhance their learning resources.

In that sense, the objective of this study is to analyze the relationship between learning styles and academic performance of students who were enrolled in the fifth year of the Pharmacy program at Universidad de Costa Rica, during the years 2011 to 2013.

METHOD

Design

This research is a cross-sectional observation of associative strategy, conducted during the years 2011, 2012 and 2013. The methodology was selected to establish the relationship between learning style and academic performance of participants in the study.

Participants

The Pharmacy program at Universidad de Costa Rica has a duration of five years of academic training and six months of professional internship.

The study was carried out with the student population enrolled in courses of the final year of the Pharmacy program during the years 2011 to 2013. The specific breakdown of the 125 participant students is as follows:

- 2011: 44 students of 52 total; 13 men, 31 women
- 2012: 22 students of 32 total; 5 men, 17 women
- 2013: 59 students of 59 total; 15 men, 44 women

The study was registered with the Institute of Pharmaceutical Research and had the endorsement of the Scientific Ethics Committee of Universidad de Costa Rica to use a presentation letter in order to recruit participating students.

Measures

The Honey-Alonso Learning Styles Questionnaire (CHAEA) was applied to the sample; a self-administered instrument that had previously been validated in Spanish with university students from Spain by the original authors (without having yet been validated in the Costa Rican population) and one of the tools used to assess learning cognitive aspects (Alonso et al., 1997). It consists of 80 items, randomly distributed, that allow to identify and quantify four learning styles (active, reflective, theoretical, and pragmatic). It is divided into four sections of 20 items corresponding to the aforementioned styles. The total score from each group of 20 questions corresponds, after recodification, to a category in each one of the learning styles: very low (MB), low (B), moderate (M), high (A) and very high (MA).

As for some of its psychometric properties, the original evaluation by the authors conducted with a sample of 1371 Spanish university students obtained the following average scores for each one of

the categories: active 10.7; reflective 15.37; theoretical 11.3; and pragmatic 12.1, as well as the following internal consistency values: active $\alpha = .62$, reflective $\alpha = .72$, theoretical $\alpha = .65$ and pragmatic $\alpha = .58$ (Alonso et al., 1997).

Procedure

The instrument was applied during laboratory sessions of the Toxicology course, for the last group of courses of the program; students were explained to choose the items that contained statements with which they “agreed the most”.

In order to analyze the instrument through numerical values, the total of items marked in the questions for each learning style was counted and a database was elaborated using Excel.

The general scale of interpretation proposed by Alonso et al. (1997) was used to identify the learning style. The scale contains points that measure theoretical aspects that were used to recode the scores of each style obtaining the categories MB, B, M, A, and MA for each one of them.

The dominant learning style was determined by identifying the highest score in the ordinal scale MB, B, M, A and MA. In cases where the result was the same for two or more styles, the dominant learning style was obtained from the combination of the respective categories. If a student had the same score for all four styles, this was classified as “no dominant style”.

Other information such as name, gender and overall average were obtained from the administrative records of the School of Pharmacy.

T-tests for comparing means in pairs were conducted to determine whether there were statistically significant differences or

not, obtaining a reliability of 95% and a significance of 5%.

Comparisons between the means of overall and fifth-year averages were carried out establishing differences between each one of the four learning styles. A comparison of means was conducted using the ANOVA method to verify whether these differences were statistically significant, obtaining a significance of 5%.

The statistical package SPSS 20 was used to manage files, as well as re-codings, calculations and tabulations; the MS Excel software was used to elaborate tables and graphics.

RESULTS

Table 1 shows the averages of the overall academic performance obtained throughout the entire duration of the Pharmacy program, and the averages obtained in the fifth year, corresponding to each one of the four learning styles, separated according to their five levels of preference.

According to Table 1, the overall average varies in each style, so when comparing the means using the ANOVA method, in order to verify whether these differences are statistically significant, we found that in relation to the variable of the overall average there are no differences in preferences between the active style ($p = .808$), reflective style ($p = .53$), theoretical style ($p = .53$) or pragmatic style ($p = .875$).

In the case of academic performance averages in the fifth year, even though there are no differences for active ($p = .313$), reflective ($p = .224$), theoretical or pragmatic style ($p = .572$), there is enough statistical evidence to reject the null hypothesis that the mean of fifth-year averages is equal among preferences ($p = .03$), with a significance of 5%. Because of data

distribution in the categories, it is not possible to conduct *post-hoc* tests to establish, between which specific styles, the differences in the ANOVA correspond to; however, the analysis in Figure 1 shows the effect of pragmatic style tendencies, based on grade average.

For the low and very low tendencies in the pragmatic style, average grades tend to be higher in relation to the grades of students in the high and very high tendencies; there is a difference of 0.71 points on a scale from 0 to 10 between the low and high tendencies.

It is worth noting that when comparing the dependent variables (overall average and final-year average) no significant differences were found between these, in any of the years analyzed.

The mean of averages was analyzed in order to relate the dominant learning style of the students and the grades obtained, both overall and in the fifth year, according to the different categories of dominant styles, accompanied by the respective statistical test of comparison of means.

We determined, by analyzing the variance of one factor (ANOVA), that for the fifth year average there are statistically significant differences with a .05 significance ($p = .008$). These differences are showed in Figure 2.

Figure 2 shows how the categories are divided into two subgroups, one with values above the population average, characterized by the presence of theoretical style categories, and a second one with values below the population average, where pragmatic style categories are at the bottom. The difference between the dominant theoretical style category and the dominant pragmatic style category is 0.37 points, on a scale from 0 to 10.

An analysis of variance of two factors for the data in Table 2 was performed in order

Table 1

Academic performance based on the learning style of students in the fifth year of the Pharmacy Program at Universidad de Costa Rica, 2011-2013.

| Style | Preference | Cases | Average ^a | |
|-------------|------------|-------|----------------------|------------|
| | | | Overall | Fifth year |
| Total | | 122 | 7.93 | 8.21 |
| Active | Very low | 53 | 7.84 | 8.24 |
| | Low | 23 | 8.02 | 8.28 |
| | Moderate | 32 | 7.97 | 8.17 |
| | High | 10 | 8.11 | 7.97 |
| | Very high | 4 | 7.65 | 8.18 |
| Reflective | Very low | 57 | 7.81 | 8.16 |
| | Low | 37 | 8.07 | 8.29 |
| | Moderate | 22 | 7.99 | 8.26 |
| | High | 6 | 7.93 | 8.00 |
| | Very high | 0 | - | - |
| Theoretical | Very low | 14 | 7.96 | 8.18 |
| | Low | 36 | 7.71 | 8.13 |
| | Moderate | 51 | 8.04 | 8.27 |
| | High | 18 | 8.01 | 8.18 |
| | Very high | 3 | 7.83 | 8.34 |
| Pragmatic | Very low | 66 | 7.88 | 8.25 |
| | Low | 24 | 8.03 | 8.34 |
| | Moderate | 23 | 8.02 | 8.06 |
| | High | 8 | 7.72 | 7.92 |
| | Very high | 1 | 8.07 | 8.08 |

Note: Elaborated by authors based on the academic performance records of the students.

^aWeighted average based on course credits.

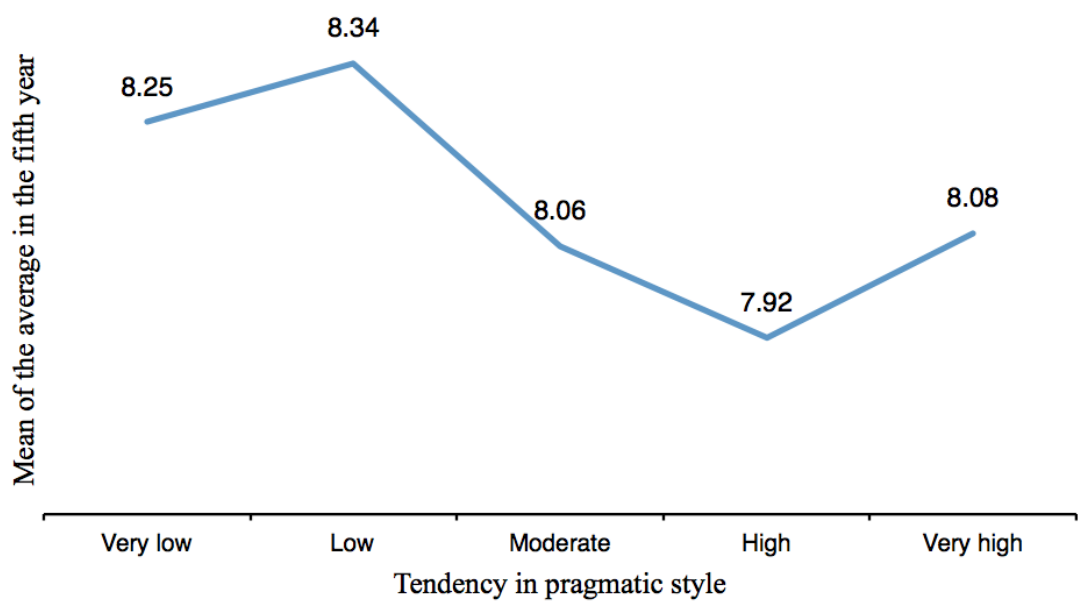


Figure 1. Means of the averages of fifth-year students in the Pharmacy program at Universidad de Costa Rica, according to the tendency in pragmatic style.

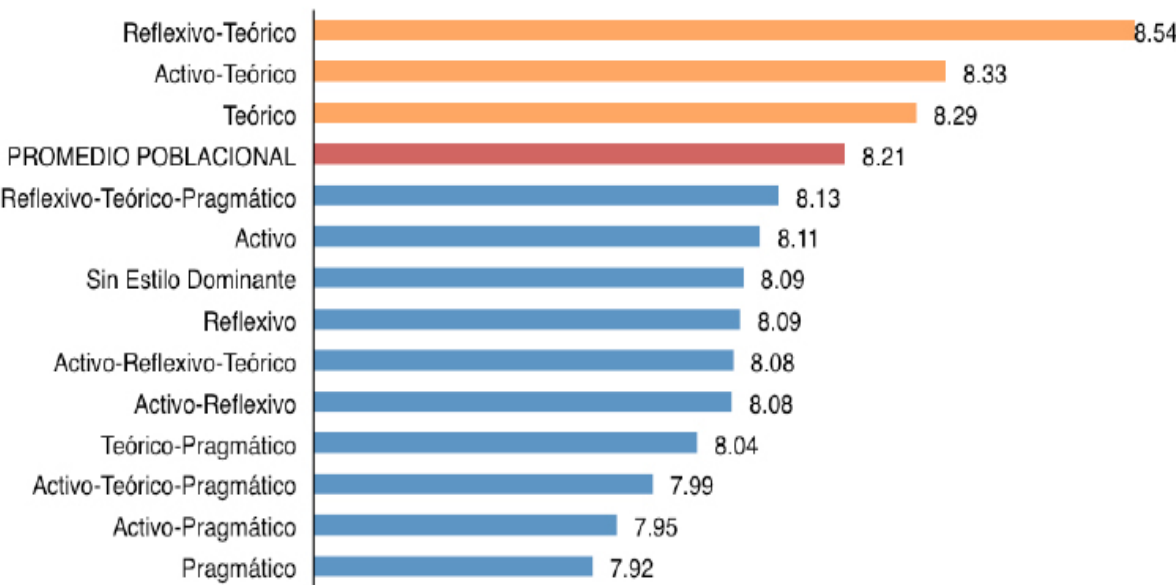


Figure 2. Mean of fifth-year averages according to dominant learning style in students of the Pharmacy program, 2011-2013

Table 2

Academic performance by gender, based on the dominant learning style of the students in the fifth year of the Pharmacy program, 2011-2013

| Dominant learning style | Gender | | | |
|----------------------------------|---------|------------|---------|------------|
| | Men | | Women | |
| | Overall | Fifth year | Overall | Fifth year |
| Active | 7.87 | 7.97 | 8.01 | 8.17 |
| Reflective | 8.59 | 8.36 | 7.77 | 8.04 |
| Theoretical | 7.43 | 8.26 | 8.06 | 8.30 |
| Pragmatic | 7.43 | 7.83 | 7.95 | 8.01 |
| No dominant style | - | - | 8.17 | 8.09 |
| Theoretical-pragmatic | 7.67 | 7.99 | 7.64 | 8.15 |
| Reflective-theoretical | 8.34 | 8.72 | 8.19 | 8.50 |
| Active-theoretical | 8.02 | 8.48 | 7.91 | 8.28 |
| Active-reflective | 7.60 | 8.08 | - | - |
| Active-pragmatic | 8.08 | 7.70 | 8.05 | 8.01 |
| Reflective-theoretical-pragmatic | - | - | 8.09 | 8.13 |
| Active-theoretical-pragmatic | 8.07 | 7.62 | 7.67 | 8.24 |
| Active-reflective-theoretical | 8.33 | 8.21 | 7.74 | 8.05 |

Note: Elaborated by authors based on the academic performance records of the students.

to determine whether there are differences in academic performance based on gender and learning style. We determined that the differences of averages found are not related to gender or style of students in the sample ($p = .784$). The study was conducted with a corrected model because of the lack of combined categories.

According to Table 2, that shows similar results in the fifth year of the program, there is not enough statistical evidence to reject the null hypothesis that all overall averages are equal among learning styles ($p = .649$); differences in the averages of the grades of fifth-year students among men and women ($p = .578$) and among learning styles ($p = .101$) cannot be established either.

DISCUSSION

Various studies support that students have a better performance when they are taught with their own learning style. According to these studies, the process gets easier if the student's learning style is taken into account when the whole educational process is being designed, which is to say that it is personalized. Ceballos and Arribas (2003) indicate that several researchers, such as Cafferty (1980), Lynch (1981), Pizzo (1981), Gardner (1990), and Alonso (1992), among others, have identified cases where learning styles and academic performance are related. Based on their results, these authors quote Alonso et al. when stating that "students learn more effectively when they are taught with their dominant learning styles" (p. 3).

At university level, some universities use CHAEA to diagnose and reduce learning problems among new students and examine cases of failure in ongoing analyses. Important studies have been conducted in many centers of higher education in Peru, Venezuela

and several Chilean, Argentinian, Mexican, Brazilian and Spanish universities (Alonso and Gallego, 2007).

Under this premise, Borracci et al. (2008) conducted a test in a cohort of undergraduate medicine students at a university in Argentina, with four objectives: to describe their style at the start of the program, to compare it with their style at the end of the program and during immediate postgraduate studies, as well as the relationship between learning style and academic performance, and the association between styles and the tendency to choose a specialty after finishing their studies in the program. Regarding academic performance, the authors found no statistically significant differences when comparing styles with final grades of the course of Anatomy (Anatomy I and II) with an ANOVA, although they observed that individuals with a pragmatic-active style obtained better grades than those with a reflective-active style in this course. This absence of difference is attributed to the size of the sample, but also indicates that the best performance not only depends on the student's learning style, but also on the type of assessments during the course. In addition, students adapt their style to the academic requirements of the course.

In addition, the authors recognize that other tests failed to find an association between learning style and academic performance when comparing grades of a single course, as in the case of other studies that used as a variable academic performance based on average grades of the entire program or in a professional practice (Robles et al., 2012), and some of the studies that found a poor correlation that used instruments for determining learning styles other than CHAEA, such as the one carried out by Bitran, Lafuente, Zuniga, Viviani and Mena (2004), who did find this correlation

in a cohort of 66 students from the School of Medicine at Pontificia Universidad Católica de Chile, using the Myers-Briggs Indicator test and the Inventory of Learning Styles by Kolb as instruments.

Meanwhile, Yao and Iriarte (2013) found a significant correlation between academic performance and theoretical style in a sample of 167 medicine students studying English as a second language at Universidad de Barranquilla, Colombia, using CHAEA as an instrument and academic performance as a variable, elaborated using the grades obtained in a mid-term exam from the English course.

The obtained results in this study show that when comparing the overall averages there are differences among learning styles, that is, that the overall averages of the program are not affected by the student's style. It is worth mentioning that this is the style that students showed in their last year, however, it is not possible to determine whether there was any change in the dominant style throughout the duration of the program. Based on the concept of "functional mobility", proposed by Witkin and Goodenough (1981) and Pascual-Leone (1995), Hederich, Gravini and Camargo (2011) suggest that those learning styles can be modified and that this should be encouraged in a bidirectional sense, which means that the objective is not to change from one style to another but, as part of the individual development of each person, to absorb the strengths of the style that is not dominant. Therefore, it is possible that students have modified their learning style preferences to suit the academic requirements of different courses.

In the courses of the Pharmacy Program at Universidad de Costa Rica, various teaching strategies are used, such as simulated and real

cases, laboratory exercises, lectures, forums, problem-based learning, research projects, and virtual platforms, among others. This variety of activities require the students to adapt and use skills that allow them to efficiently meet the demands of each course. We observed that a low proportion of students had a pure style and that there were 12 combinations with dominant styles; this allows the student to better adapt to different types of teachers, and the group can benefit from it since there is a diversity of preferences.

In regard to the modification of learning styles, Gallego et al. (2010), in his article "Evolution of Learning Styles of Students of Pharmacy in the Last Six Years," conducted a comparative research on the evolution of learning styles in 353 students of the fourth year of Pharmacy at two universities in Madrid, Spain (UCM and CEU-San Pablo); specifically, in the 2003/2004 and 2009/2010 courses.

The study showed that the students scored high in the reflective style in both cases, followed by theoretical, pragmatic, and active. It was noted that there is no tendency in learning styles throughout the program, so teachers should promote a comprehensive education where all learning styles are considered and gradually strengthened in the students.

This study found that in the averages of academic performance of the fifth year, there are not statistically significant differences among the four styles; however, there is enough statistical evidence to reject the null hypothesis that the mean of fifth-year averages is equal among preferences; in addition, the graphical analysis shows the effect of pragmatic style tendencies on grade average. Figure 1 shows that students with a lower grade average tend to use pragmatic style. This may be because of various factors, such as differences among

teachers' styles in different years or a change in the student's learning style, factors that were not measured in this study.

Some researches focus on studying the relationship between learning styles and strategies and the role of gender in students that get accepted into university, such as the test on individuals aspiring to get accepted into all the study programs of Universidad Catolica Argentina, with CHAEA. Regarding the differentiation of styles that take gender into account, contradictions about how to process and transform information were found, that conclude that learning styles are relatively stable, but can change, since opting for a style also depends on the academic profile of the program chosen, and since there are study programs that require the application of one style over the other. It is a similar case with the learning strategies, which are specifically needed based on the contents and subjects to be acquired (Aguilar, 2010).

As shown in Table 2, differences cannot be established in grade averages of students in the fifth year among men and women. These results coincide with those obtained by Sepulveda, Lopez, Torres, Luengo, Montero and Contreras (2011), who, in their article "Gender Differences in Academic Performance, Learning Styles and the Use of Strategies of Learning in Students of Pharmacy at the University of Concepcion," found no gender-related differences in the students.

Esguerra and Guerrero (2010, as cited in Morales, Rojas, Hidalgo, Garcia, and Molinar, 2013) observed that this is not a variable that influences learning style, although there are no significant differences. However, Cano (2000, cited by Morales et al., 2013) identified differences in this factor and indicates that they are very scarce and depend on the type

of study program, which is why this is not reported in many studies.

The variables analyzed in this research, such as the overall academic performance, the performance in the fifth year of the program, and the differences among learning styles according to gender, have already been analyzed in numerous studies with similar results in some cases; however, this evidence does not suggest that these variables should not continue to be studied or implemented, as they are part of a larger set of variables that influence the overall performance of the student.

CONCLUSIONS

The academic performance of a student is determined by many variables, learning style being one of them. This variable can help or hinder the process, depending on the demands of each course.

Although the data obtained in this research has already been observed in other studies, this is the first time this study was conducted in Costa Rica and with students of Pharmacy, revealing that students tend to have a profile that matches the study program's requirements, shaped by personal profile, the profile of the teachers and the content, among others, so in the future changes may occur if these modeling factors are modified.

Usually the student does not have a pure learning style, but a combination of two or more styles, which helps the learning process by having more tools to adapt to the requirements of teachers, courses, and the program.

In this study the relationship between students' academic performance and teachers' style was not analyzed, the latter being a variable included in other studies.

The influence of teachers' styles could explain the difference found in academic performance in the students in the fifth year, because they are in contact with teachers that have the same training, unlike students in the early years of the program, where they are in contact with teachers from other professional areas, such as basic sciences, social sciences, and language.

This research did not identify gender to be a variable that influences the learning process in a major way.

Recommendations and limitations

The analysis was conducted in only three generations of the Pharmacy program and was applied to students enrolled in the final year of the program, therefore, it is unknown if their style changed during their academic training.

The results may vary according to the used measuring instrument; in order to get a comprehensive view of student's style, the application of more than one instrument is ideal.

According to the data obtained, and because students do not have a single dominant style but a combination of several, teachers should consider applying different strategies for training students.

In order to determine the influence that the teacher's learning style has on students' academic performance, it is advisable to include in the analysis this relationship of variables.

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