

# STUDENT'S LEARNING STYLES IN SOIL SCIENCE: AN ECUADORIAN CASE STUDY

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## Abstract

In the framework of Soil Science education, learning aspects of this science have been poorly treated and specifically the study of learning styles in students who receive instruction about this science, have not yet been dealing in the literature. This study aimed to identify the preferences of learning styles and their relationship to gender in students from the Agronomy career at the University of Cuenca. For this purpose a descriptive study based on the application of the CHAEA questionnaire was carried out to identify learning styles in a group of students who receive introductory courses of this science. The results show that there is a general preference in students towards pragmatic and activist styles. Furthermore, there are marked differences by gender, being men more pragmatic than women, while women are more active than men, and also women show a tendency to be more theoretical and reflective than men. These results suggest that the planning for Soil Science teaching has to take into account the diversity of students based on their learning style preferences.

**Keywords:** CHAEA, Edaphology, education, gender

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## ESTILOS DE APRENDIZAJE DE ESTUDIANTES EN LA CIENCIA DEL SUELO: UN CASO DE ESTUDIO ECUATORIANO

### Resumen

En el contexto de la educación de la ciencia del suelo, aspectos como el aprendizaje de esta ciencia, han sido poco tratados y específicamente el estudio de los estilos de aprendizaje de los estudiantes que reciben esta ciencia no han sido todavía abordados en la literatura. Este trabajo tuvo como objetivo el identificar las preferencias de estilos de aprendizaje y su relación con el género en estudiantes de la carrera de Ingeniería Agronómica de la Universidad de Cuenca. Para este fin se desarrolló un estudio descriptivo basado en la aplicación del cuestionario CHAEA para identificar los estilos de aprendizaje en un grupo de estudiantes que reciben cursos introductorios de esta ciencia. Los resultados muestran que existe una preferencia general por los estilos pragmáticos y activistas en los estudiantes y que además existen diferencias marcadas por el género, siendo los hombres más pragmáticos que las mujeres, mientras que las mujeres son más activas que los hombres y que además ellas también muestran una tendencia hacia ser más teóricas y reflexivas que los varones. Estos resultados sugieren que la planificación de la enseñanza de la ciencia del suelo tiene que tomar en cuenta la diversidad de los estudiantes basados en sus preferencias de estilos de aprendizaje.

**Palabras clave:** CHAEA, Edafología, educación, género

## I. INTRODUCTION

Nowadays soil science is undergoing several changes and its importance is growing due to a renewed interest to study soils in relation to environmental degradation, climate change and world-food production. [1] Therefore, soil science has been recognized as a unique discipline dealing with a complex material that is a constituent of several natural and utilitarian systems, [2] nevertheless, teaching and learning soil science, where students and teachers are highly involved, is not an easy task. Fundamental purposes of teaching this science are to impart knowledge, insight, and inspiration, [3] and in an overall education context, both educators, curriculum developers, and policy makers are interested in improving the quality of higher education institutions' graduates around the world. [4] However, several studies have put their attention only in teaching aspects of this science; [2,3,5-8] while the learning aspects have been neglected, having in the literature just one study where there is an attempt to this topic, [9] and there is no one in specific aspects such as the learning styles of the students of Soil Science in institutions of higher education. Therefore, since students fulfill a fundamental role within the education system, more emphasis needs to be put on the student's characteristics.

Under this context, if learning can be defined as a relative permanent change in the behavior resultant from the experience, [10] then the Learning Styles can be referred as the ways that people learn information. [11] Therefore, it has been demonstrated that every individual has a preferred human cognitive preference or learning style. [12,13] Thus, having an audience of learners with a range of different learning styles and characteristics, learning tools should be designed considering the diversity of knowledge, gender, age and development of individuals. [14]

Regarding to research about learning styles applied to specific sciences into academic programs in institutions of higher education, there are several studies that have been developed for example in Business, [15-17] Statistics, [4,18] Biology, [19,20] Pharmacy, [21] but there is no information for soil science. This study has the following objectives: i) to identify learning styles of students who receive

introductory courses of soil science in the Faculty of Agricultural Sciences of the University of Cuenca in Ecuador, and ii) to assess the relationships among the student gender with the learning style. Thus, this study will contribute to plan strategies to reach the best development of students and teachers in the higher education national system regarding to this renewed science.

## II. METHODS

### Data collection

The population of this study consisted of 82 students, who age ranges from 19-21 years old. They received introductory courses of soil science into the period March 2015 to February 2016. The introductory courses of this science are imparted in two semesters. The first semester belongs to the subject of "Edaphology" and the second semester belongs to the subject "Soil Classification and Soil Mapping", these two subjects are directly related to the general structure of the International Union of Soil Sciences, [22] focusing into the Division 1: "Soils in Space and Time" and Division 2: "Soil Properties and Processes". These subjects are dictated into the regular academic program of the Career of Agronomy in the Faculty of Agricultural Sciences of the University of Cuenca, in the Republic of Ecuador.

The learning styles data was obtained by the application to the student population of the Honey-Alonso Learning Styles questionnaire, known like the CHAEA questionnaire. [10] This questionnaire is an instrument that has been widely used also in Spanish-speaking students. [20] Questionnaires were applied at the beginning of two semesters consecutively (March and September, 2015) during the period before mentioned. The students, previously to the application, were informed about, both the objectives of this questionnaire and the objectives of this study, and that their participations could be voluntary, and also the confidentiality of the information will be guaranteed. Regarding to the questionnaire, this has 80 randomized questions to characterize four learning styles like activists, reflectors, theorists, and pragmatists (Table 1), for each style there are 20 questions and the predominant learning style is given by the cumulated scores for each style, being 20 points the maximum. [23,24] The identification of the learning style preference of each student is

not linear and it is different per style therefore we use the scale proposed by the same authors of the questionnaire. [10]

**Table 1:** Learning Styles Characterization According To Honey And Mumford.

Learning styles	Characteristics
<b>Activist</b>	Enthusiastic, improviser, pathfinder, bold, and spontaneous
<b>Reflector</b>	Prudent, conscientious, receptive, analytical, and exhaustive
<b>Theorist</b>	Methodical, logical, objective, critical, and organized
<b>Pragmatist</b>	Experimenter, practical, direct, effective, and realistic

Taken from reference [23].

### Statistical analysis

In order to analyze the learning styles, descriptive statistics were used. Contingency table analyses were used to describe levels of preference among learning styles. All statistical analyses were performed using R 3.3.0 software. [25]

## III. RESULTS AND DISCUSSION

### Predominant Learning styles

From the total students (82 students), 84% answered the questionnaire. Most students are “Pragmatist” followed by “Activists” since they show the highest level of preference (“Very high” category) for these two learning style (Table 1). In this regard, despite this science covers a wide spectrum, from pure to applied studies, this one is usually skewed towards the practical application (applied science) of its findings. [26,27] Therefore it can be expected that students, who pursue a degree related to agricultural sciences where soil science is a core subject into the academic program, they should have learning styles around the praxis (for example the pragmatic style of learning). Furthermore, since Edaphology subject is imparted into an engineering career in the University of Cuenca, these results are comparable with a study developed in the “Universidad Central de Chile”, where students enrolled in engineering careers also showed to be Activists and Pragmatists. [28]

On the other hand, there are students that have more than one style learning’s preference according to the

applied CHAEA questionnaire, thus approximately 56% have one style preferred, 25% have two, 16% have 3, and 3% have no preferences (they prefer all the learning styles at equal level). Respect to this topic, the ideal scenario would be that the high level of preference needs to be reached for all categories since this would mean that students could learn in any situation [10] and this study reports a very low proportion of students under such conditions.

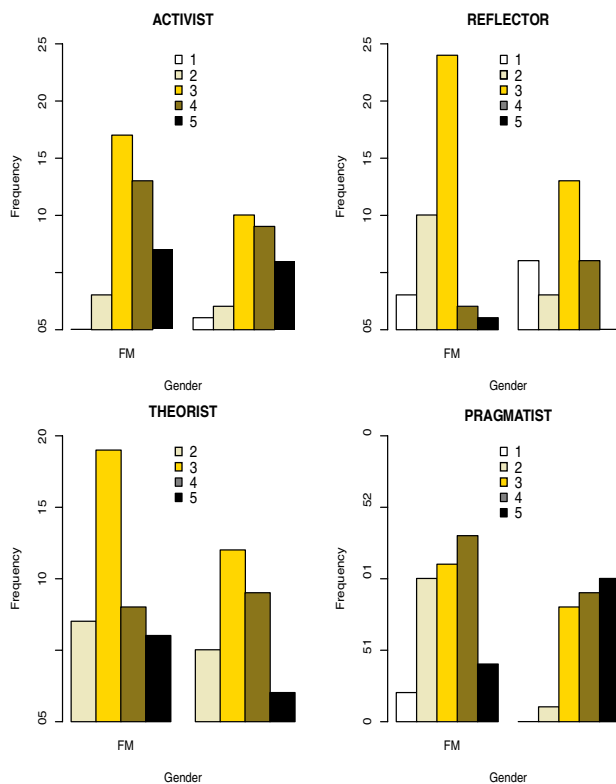
**Table 2:** Levels Of Preference (%) For The Learning Styles In Students Of Soil Science In The Faculty Of Agricultural Sciences, University Of Cuenca.

Learning Style	Levels of preference (%)				
	Very low	Low	Moderate	High	Very high
<b>Activist</b>	1.5	7.4	39.7	32.4	19.1
<b>Reflector</b>	13.2	19.1	54.4	11.8	1.5
<b>Theorist</b>	0.0	17.6	45.6	25.0	11.8
<b>Pragmatist</b>	2.9	16.2	27.9	32.4	20.6
<b>Average</b>	<b>4.4</b>	<b>15.1</b>	<b>41.9</b>	<b>25.4</b>	<b>13.2</b>

### Gender and Learning styles relationships

With regarding to gender of the students and their learning preferences, 59% were women from the group of students that answered the questionnaire. This growing number of women students in careers where soil science is imparted, has not been noted only in the local context but also at global, for example USA, Canada, Netherlands, Australia, and New Zealand, all of them have experimented this up-growth in female students during the last years. [8,29]

In relation to the dominant (“Very High” preference) learning styles according to gender, male students are more pragmatists than women, but women are more activists than man. On the other hand, female students are more theorists and reflectors than male students (Fig. 1). This shows that learning styles are affected by the gender, in that regard, according to Severiens & Ten Dam, [30] women prefer the abstract conceptualization mode of learning, which is directly related to theorists, and this is in line with our findings. Differences in learning styles conditioned by gender have also been described in several studies from different careers and countries, for example in Computer Science, [31] Medicine, [32–34] Public Health, [35] Information Technology, [36] Optometry, [37] and even differences were described in students with learning disabilities. [38]



**Fig. 1:** Level of preference for learning styles according to student gender (F = Female; M = Male). Preference levels: 1 = "Very low"; 2 = "Low"; 3 = "Moderate"; 4 = "High"; 5 = "Very high".

All this suggests that the diversity in learning styles needs to be taken into account for planning the teaching strategies for any science, and particularly for soil science is of utmost importance to take a multidisciplinary approach to teaching, using real-life applications and practical examples to catch the attention and interest of students, and also taking advantage of the current information and communication technologies (ICT's).

Nevertheless, for Ecuador this is a challenge, because currently there are a low number of students who are directly involved in careers where soil science is imparted, this is the case of the University of Cuenca, one of the biggest universities in Ecuador that has only approximately 2.5% of students coursing Agronomy, a career where soil science is a core subject in the student's formation. On the other hand, soil science is a neglected science into the academic programs in institutions of higher education, and this is reflected by the very low number of people in charge of teaching this science that really hold a high level of academic formation, specifically

in this science, at level of master or PhD degree. However, it is expected that this reality will change with the new initiatives at global scale to re-launch this science, such as the declaration of 2015 as the International Year of Soils and also the declaration of the "International Decade of Soils, 2015-2024".

#### IV. CONCLUSIONS

Soil science students from the Agronomic Engineering career in the University of Cuenca are mostly Pragmatists and Activists. The student's gender is a factor that is affecting learning styles preferences. In the overall context of an ideal learning scenario, it has been detected a low proportion of students who present a uniform preference for all learning styles, it suggests the application of teaching methods to promote a wide range of learning skills in students of soil science to reach the goal of maximization of their potential during their formation and their future profession.

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