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COMPARISON STUDENT LEARNING APPROACH OF FIRST YEAR LIFE SCIENCE STUDENTS

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Abstract

Student learning approach is not a fixed characteristic of the student and normally varies between subjects. Differences had been reported depending on age, gender, level of studies, cultural and other factors. Several types of approaches can be identified, but deep and surface are the most common approaches studied. Deep approach is characterized by more reflection and comprehension and intrinsic responsibility of the students in their own learning, while surface approach is more related to a lack of reflection, a minimum effort and the learning focused on the mark. Determination of the learning approach is a key factor to choose the most suitable strategies of teaching, with the purpose of facilitating the engagement of the students in the subject and helping to maximize their learning process. Several methods have been developed to measure the student approach to learning, and the R-SPQ-2F questionnaire is one of the most used. In this study, students of first year of the Biotechnology degree of two different courses were assessed with the R-SPQ-2F questionnaire for their student approach to learning. The reliability of the questionnaire was validated for the main scales of the questionnaire, and no differences were recorded according to gender or course. On the contrary, differences appeared related to the language used as a medium of instruction (English or Spanish). Comparisons with other studies are made and factors affecting these results are discussed. Recommendations are given to encourage deep approach of the students to foster learning and engagement of the students in training.

Keywords: Student approach to learning; deep and surface approach; assessment; learning styles.

1 INTRODUCTION

Student approach to learning was developed by Marton and Säljö [1], [2]. Two main approaches have been identified [3], [4], although it depends on several factors and other approaches have been also identified [3], [5], [6]. Some students adapt a deep approach based on intrinsic responsibility, comprehension and reflection and pursue learning and understanding [4], [7]–[11]. At the other side, other students take a surface approach with an extrinsic responsibility, use of memory and lack of reflection and are more concerned about grading [7]–[9]. Deep approach has been correlated positively with assessment results [12]–[14].

Several factors affect the election of approach by the student [15], [16]. They can be divided in contextual, perceived and student factors [3], [17]. The contextual factors are determined by the environment that the student have in the subject and are caused by the institution, the teacher and their partners. Contextual factors would include the type of studies, the subject matter, classroom activities, the assessment system, the institutional setting or the year in which the subject is framed [18], [19]. The perceived factors are the way that the student perceive learning [5], [18] and vary between students in the same subject. And the last group of factors depend on the student, with items like age, gender or personality. For example, according to some studies, gender does not influence approach to learning [14], [18] but the results have been inconsistent or influenced by cultural factor [20], [21].

Several ways have been used to measure students' approach to learning, such as Revised Approaches to Studying Inventory (RASI) [22] modified in Approaches and Study Skills Inventory for Students (ASSIST) [23], [24], Learning and Study Inventory Strategies (LASSI) [25], Study Attitudes and Methods Revised Short Form (SAMS Short Form) [26], Inventory of Learning Process–Revised (ILP-R) [27], Approaches to Learning and Studying Inventory (ALSI) [6], or Inventory of Learning Styles (ILS) [28]. But one of the most widely used is the Study Process Questionnaire (SPQ) [4], which was subsequently revised (R-SPQ-2F) [3] and validated by different studies [9], [29], [30].

The R-SPQ-2F includes 20 items divided into deep and surface approach subscales. The deep approach (DA) scale includes deep motive (DM) and deep strategy (DS) subscales; the surface

approach (SA) scale includes surface motive (SM) and surface strategy (SS) subscales. Each subscale consists of five items with a 5-point Likert-type scale ranging from 1 ('rarely true of me') to 5 ('always true of me'). R-SPQ-2F questionnaire has been adapted to different languages [8], [11], [31]–[36]. The association of the questions with the scale of the R-SPQ-2F questionnaire vary depending the cultural context [37], and it have been tested in different contexts like Spain [9], Japan [8], United States [29], [30], Netherlands [35] or Norway [32]. However, more studies are needed to assess its results in different context. In the present study, the R-SPQ-2F questionnaire was used with first year students of Biotechnology degree of Universitat Politècnica de València to assess their responses and evaluate the differences with other contexts.

2 METHODOLOGY

During years 2018-19 and 2019-20 a student's approach survey was carried out in a first course subject in the Biotechnology degree at Universitat Politècnica de València (Spain). The subject, General Genetics, has six ECTS (European Credits Transfer System), four corresponding to theory sessions (40 hours) and two of laboratory sessions (20 hours). The number of students enrolled was 127 and 115, in the first and the second year analysed, respectively. The subject was organized in three different groups for the theory lectures while 5-6 groups were organized for the laboratory sessions. Spanish was used as medium of instruction for two of the theory groups per year (around 50 students per group) while English was used for the remaining group (English as a medium of instruction group, EMI group) with 25 students. Classroom activities involved active participation of the student and assessment task were written exams, online test, lab questions, reports, and presentations with screencasts of selected topics. The students had previously all the information and resources for the lectures through a learning platform based in Sakai called PoliformaT.

At the beginning of the subject SPQ questionnaire developed by Biggs [3] was submitted to the students on-line through University learning platform Sakai-based PoliformaT. The questionnaire used was a translation to Spanish done by Muñoz San Roque et al. [33] for the group with Spanish as a medium of instruction and the English version was used for the group with English as a medium of instruction. Results were analysed using Statgraphics Centurion XVII (Statpoint Technologies, Inc.) calculating correlations between factors and Cronbach's alpha values.

3 RESULTS

The questionnaire was answered by 186 students out of 238 (78.2%) with a similar response rate between groups, or gender except for year (Table 1). The students showed a higher deep approach (DA) than surface approach (SA) (Table 1) with high values of deep motive (DM) and deep strategy (DS) (Table 2) that could indicate a high level of involvement in their own learning. No significant differences were observed between the different categories observed except of the language used as a medium of instruction, with higher DA values for the English group. Also, no significant interactions were detected between the different factors analysed. Gender is one of the factors that can influence student approach to learning [16], [17]. In our sample, the ratio of female/male students was 2/1, similar to health degrees in Spain [38], but no differences were observed between gender. In general, females tend to have a more deep approach than males [4], [10] but other studies found the opposite [39] and others found no relationship [18] so the results are not clear [20]. - Two different language as a medium of instruction were used in this subject and the size of the groups were different (around 25 students in the English group, while around 50 students in each of the Spanish groups). Also, differences in the admission mark normally occur, with higher marks in students of the English group. Due to these factors, it remains unclear if the different values obtained in the student approach to learning are due to language or to other factors. However, language is one of the factors that influence learning approach [40], [41] and higher DA values have been observed in EMI groups when English is not the native language of the student [42] like in our case.

Table 1. Number of students who answered the questionnaire by subject, year, language as medium of instruction and gender.

	No. answers (% enrolled)	DA	SA	Difference DA-SA	Null hypothesis DA-SA
Subject	186 (0.78)	3.33 ± 0.04	1.90 ± 0.03	1.43 ± 0.06	*** ²
Year					
2018-19	84 (0.66)	3.29 ± 0.06	a ¹ 1.97 ± 0.05	a 1.32 ± 0.08	a ***
2019-20	102 (0.92)	3.36 ± 0.06	a 1.85 ± 0.04	a 1.51 ± 0.08	a ***
Language					
Spanish	150 (0.80)	3.28 ± 0.04	a 1.92 ± 0.04	a 1.36 ± 0.06	a ***
English	36 (0.72)	3.54 ± 0.09	b 1.83 ± 0.07	a 1.71 ± 0.14	b ***
Gender					
Female	126 (0.78)	3.33 ± 0.05	a 1.86 ± 0.04	a 1.47 ± 0.07	a ***
Male	60 (0.79)	3.33 ± 0.07	a 1.99 ± 0.06	a 1.34 ± 0.11	a ***

Values (average and standard error) of the R-SPQ-2F questionnaire scales in the deep approach (DA), surface approach (SA), difference between DA and SA and null hypothesis DA-SA.

¹Different letters in the same column indicate significant differences (P -value<0.05) between groups according to Tukey's test.

² ***: P <0.0001

Table 2. Values (average and standard error) of the R-SPQ-2F questionnaire scales in the deep motivation (DM), deep strategy (DS), surface motivation (SM) and surface strategy (SS).

	DM ¹	DS	SM	SS
Subject	3.41 ± 0.04	3.25 ± 0.05	1.54 ± 0.03	2.27 ± 0.04
Year				
2018-19	3.35 ± 0.06	a ¹ 3.24 ± 0.07	a 1.61 ± 0.04	b 2.33 ± 0.06
2019-20	3.46 ± 0.06	a 3.25 ± 0.07	a 1.47 ± 0.04	a 2.23 ± 0.06
Language				
Spanish	3.36 ± 0.05	a 3.19 ± 0.05	a 1.54 ± 0.03	a 2.30 ± 0.05
English	3.61 ± 0.11	a 3.48 ± 0.10	a 1.51 ± 0.08	a 2.16 ± 0.09
Gender				
Female	3.43 ± 0.05	a 3.23 ± 0.06	a 1.50 ± 0.04	a 2.23 ± 0.05
Male	3.38 ± 0.08	a 3.29 ± 0.09	a 1.62 ± 0.06	a 2.37 ± 0.08

¹Different letters in the same column indicate significant differences (P -value<0.05) between groups according to Tukey's test

The distribution of the responses comparing DA and SA showed that most of the students had a high DA and a low SA (86 students in sector A of Fig. 1) and a minority were in sector D with a high SA and a low DA. The rest of students were in sectors B and C indicating a high involvement in the subject. Only nine students showed a higher value of SA than DA (less than 5%). Biotechnology degree is one of the degrees with a higher admission mark [43], [44], so students are very committed with their degree and can have an intrinsic interest similar to the students in a master level degree [45]. It has been observed that first year students have higher deep approach compared with the following years and a decline has been observed while the student enrol in higher courses [46] and students adapt their learning approach depending on the learning environment [18], [19], [47]. In China, a decline has been observed between first and third year students but cultural context can influence [48] as also distant education [49]. In our case, the high values of DA can be determined, among other factors, by being first year students, high admission mark, a subject very related with their expectations or a combination of all of them.

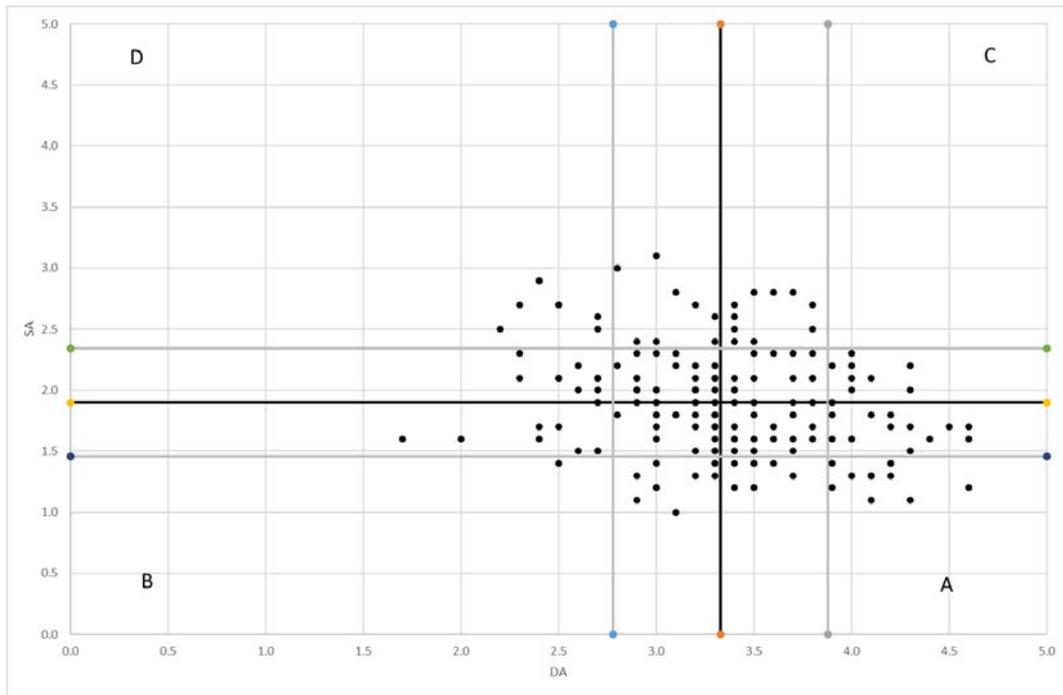


Figure 1. Deep approach (DA) and surface approach (SA) distribution of scores for each student. The black lines depict mean values for DA and SA and the grey lines the mean plus or minus the standard deviation.

Correlations between the different scales of the R-SPQ-2F questionnaire were assessed (Table 3) showing a high and significant positive correlation between DA and its related subscales and the same for SA and its related subscales. A low negative correlation appears between DA and SA. These results were already predicted by Biggs et al. [3], and can indicate the presence of two dominant factors (deep and surface) like in other studies [29], [30], [37] but a confirmatory analysis should be done with more data to assess this hypothesis in our learning context. These confirmatory analysis have done in different cultural context and showed different association of questions with the main scales but maintaining in general the results of the initial R-SPQ-2F questionnaire [3], [9], [29], [30], [32] and a similar result could be obtained in our context.

Table 3. Correlations between different factor of the R-SPQ-2F questionnaire scales.

	DA	SA	DM	DS	SM
SA	-0.28 ***				
DM	0.88 ***	-0.25 ***			
DS	0.90 ***	-0.24 ***	0.57 ***		
SM	-0.21 ***	0.84 ***	-0.20 **	-0.17 *	
SS	-0.27 ***	0.92 ***	-0.23 **	-0.24 ***	0.57 ***

***: $P < 0.0001$, **: $0.001 < P < 0.0001$, $0.01 < P < 0.001$

Deep approach (DA), surface approach (SA), deep motivation (DM), deep strategy (DS), surface motivation (SM) and surface strategy (SS).

The internal consistency of the questionnaire was assessed using the Cronbach's alpha formula (Table 4). The values were higher than 0.7 for the main scales, but lower in the subscales. This result also points out the existence of two main factors. Several studies have been done to assess the structure of the questionnaire and [3], [9], [29], [30], [32] but cultural differences have been observed [31], [34], [37], [50].

Table 4. Cronbach alpha coefficient values (95% lower confidence band) among the different R-SPQ-2F questionnaire scales of the 186 questionnaires evaluated.

	<i>DA</i>	<i>SA</i>	<i>DM</i>	<i>DS</i>	<i>SM</i>	<i>SS</i>
Subject	0.77 (0.74)	0.70 (0.65)	0.61 (0.55)	0.68 (0.63)	0.51 (0.44)	0.53 (0.46)
Year						
2018-19	0.73 (0.68)	0.67 (0.60)	0.56 (0.47)	0.62 (0.54)	0.41 (0.29)	0.55 (0.45)
2019-20	0.80 (0.77)	0.71 (0.67)	0.64 (0.58)	0.72 (0.68)	0.57 (0.50)	0.52 (0.44)
Language						
Spanish	0.75 (0.72)	0.67 (0.62)	0.56 (0.49)	0.67 (0.62)	0.46 (0.38)	0.51 (0.43)
English	0.83 (0.80)	0.77 (0.74)	0.73 (0.69)	0.71 (0.66)	0.67 (0.62)	0.47 (0.36)
Gender						
Female	0.77 (0.73)	0.73 (0.67)	0.67 (0.60)	0.60 (0.63)	0.63 (0.55)	0.55 (0.67)
Male	0.74 (0.69)	0.69 (0.68)	0.68 (0.62)	0.62 (0.51)	0.51 (0.41)	0.41 (0.68)

Deep approach (*DA*), surface approach (*SA*), deep motivation (*DM*), deep strategy (*DS*), surface motivation (*SM*), and surface strategy (*SS*).

The influence of the learning environment is one of the main factors in the student approach to learning [3], [16], [17] and active methodologies are used in the subject to promote the deep approach. Assessment is one of the main features of a subject and student perception and approach to a subject is highly influenced by its characteristics [17], for example workload is normally associated with a surface approach [51]–[53]. In these subjects, continuous assessment has been implemented together with flipped classroom in the lab sessions distributing the workload along the whole semester and has been coordinated with the other subjects of the semester with the purpose to help the students organizing their work. Also, the dynamic of the theory sessions fosters student participation with the aim of making lectures more enjoyable and promoting a learning environment. All these activities look for promoting deep approach and they are recommended but more studies should be done to check the effectiveness of these measures.

4 CONCLUSIONS

The students of this study showed mainly a deep approach to learning with no differences regarding the year or gender, and only differences appear regarding language as a medium of instruction. The reliability of the questionnaire was acceptable for the main scales but no for the secondary scales. The engagement of the students seems very high and probably is related to the degree and subject, the admission mark that is very high, the voluntary election of the degree and that the subject matches their initial expectations. More studies should be done to assess these conclusions and comparisons should be done with other subjects. Moreover, the same test can be done at the beginning and at the end of the subject to assess the influence of the teaching methodology. All this information can be used to improve the teaching activities to foster deep approach by the students.

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