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CHANGE OF STUDENT LEARNING APPROACH IN TWO DIFFERENT SUBJECTS OF A LIFE SCIENCE DEGREE

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Abstract

Student learning approach can change due to different factors than can classified as contextual, perceived, or personal. The contextual factors can include the type of studies, institutional setting, assessment, or classroom activities, subject or course where the subject is framed. Students can choose between a deep approach, where meaning and comprehension is sought, or a surface approach, with lack of personal connection and reflection, use of memory and minimum effort. Assessment of the learning approach can help to select the most suitable strategies of teaching, with the purpose of facilitating the engagement of the students in the subject and to maximize their learning process. Some questionnaires have been developed to assess the student approach to learning of the student, and the R-SPQ-2F questionnaire is one of the most used. In this study, students of the Biotechnology degree were assessed with the R-SPQ-2F questionnaire for their student approach to learning in one subject of first course (2018-19). The same students were assessed in the following year (2019-20) in another subject of second course. Results allowed the validation of the reliability of the questionnaire for the main scales of the questionnaire but no for the subscales. Differences were recorded according to the subject for the deep approach but not for the surface approach. No differences were observed according to the language used as medium of instruction and differences regarding gender were observed for the surface approach. On student basis, deep approach decreased from first-course subject to second-course subject while surface approach increased, but some students showed the opposite behaviour. Results showed that students can vary their student approach to learning according to the subject.

Keywords: R-SPQ-2F; deep and surface approach; assessment; learning styles.

1 INTRODUCTION

Higher education faces the challenge not only to teach students but to form lifelong learners and experts in their own fields [1]. Students should be motivated and participative in their learning process [2] and assessment of how students learn can improve teaching [3]. The conceptualization of student approach to learning was developed by Marton and Säljö [4], [5], and later was continued by Entwistle [6], [7] and Biggs [8]. Student approach to learning can be classified in deep approach (DA) and surface approach (SA) [9]–[11], although some other approach has been also described [8], [12]. When students adopt a surface approach their main aim is to meet course requirements, with extrinsic motivations such fear to fail or keeping out of trouble [3], [13]–[15], and normally memorizing is one of their tools of learning [16]. Anyway, some students use deep memorizing to understand [10], [17], [18]. SA has a negative correlation with academic performance [19]. Several factors can favour the use of this approach by students like unclear teaching goals or insufficient time, for example [3], [8], [20]. Deep approach (DA) by the other side, is pursed by students that seek a need-to-know, use strategies to learn and enjoy learning [3], [13], [14], [21] and it has shown positively correlated with academic performance [19], [22]–[24].

Student approach can vary due to different factors such as personal, contextual or perceived factors [8], [25]. Personal factors are factors that come from the student him/herself like personality, age, gender, previous education or prior knowledge abilities [8], [19], [25]–[27]. Gender is one of the most studied factors, but inconclusive results arise from different studies [24], [26], [28]–[30]. The age of the student is also a factor that can affect student approach to learning with an increase of deep approach related to age [27], [30]–[32] possibly because they have more intrinsic motivation [33]. The kind of studies or other circumstances can also influence [34], as well as cultural differences [9], [14], [18], [19], [35], [36].

Contextual factors can include type of studies, discipline, structure of the course or assessment system [8], [25], [37], [38]. Students can change their approach in different subjects and years. For example, increment of SA in the last years of a degree has been noted [1], [37], [39]–[41]. The general

assumption is that the students' approaches to learning develops towards a deeper approach in higher education [1], [25], [42]. Teacher performance and the system of teaching used affects student approach to learning [31], [38], [43]–[48]. And the last group of factors that can affect the student approach to learning are the perceived factors. This factors represent the way the student perceives the academic environment [8], [25], [37], like workload, clarity of goals, or the perception by the student of the assessment system [25], [38], [44], [48].

Student approach to learning is useful as an outcome of teaching [3] ,and it can be used to select the teaching methodology [35], [49]. The results can be used to adjust aspects of teaching and learning environment [14], [50] and even to try to change or modify student approach to learning [48], [51]–[53]. To measure the student approach to learning several tools can be used [54]. Among them it can be found the instruments Revised Approaches to Studying Inventory (RASI) [55] modified in Approaches and Study Skills Inventory for Students (ASSIST) [56], [57], Study Attitudes and Methods Revised Short Form (SAMS Short Form) [58], Inventory of Learning Process–Revised (ILP-R) [59], Approaches to Learning and Studying Inventory (ALSI) [7], Learning and Study Inventory Strategies (LASSI) [60], or Inventory of Learning Styles (ILS) [61]. Study Process Questionnaire (SPQ) developed by Biggs [8] consists of three dimensions: deep, surface and achieving with two sub-dimensions (motive and strategy) each of them [8], [62]. The questionnaire was later revised and reduced to 20 items in the Revised 2 factor version (R-SPQ-2F) with two factors: deep and surface and two subscales motive and strategy [9]. The questionnaire does not assess the student general approach to learning but specific responses to particular subject or situation [9], [14], [17].

The R-SPQ-2F questionnaire has been adapted to different languages [13], [35], [54], [63]–[65]. The consistency of the R-SPQ-2F questionnaire has been assessed [9], [66] and its psychometric properties explored [14], [21], [35], [36], [63]–[65], [67]. Different models have been proposed, but the most accepted structure is the one with two first order factor structure (deep and surface) [68], [69].

In the present study the student approach to learning of the same group of students was assessed in two consecutive years. The R-SPQ-2F questionnaire was answered at the beginning of two subjects: General Genetics in year 2018-2019 and Molecular Markers in year 2019-2020. In this way, the student approach of the students was determined, and the evolution of their approach can be assessed between two different subjects and years.

2 METHODOLOGY

Two subjects of the bachelor's degree in Biotechnology were chosen for this study: General Genetics (GG) is a first-year subject with 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 in year 2018-19 was of 115. The other subject was Molecular Markers (MM), in the second year, with six ECTS, three of theory sessions (30 hours) and three of practical sessions (laboratory and computer sessions). The number of students enrolled in year 2019-20 was of 115. The subjects were organized in two different groups, one using Spanish as medium of instruction and the other using English (EMI). The teaching system was organized with theory sessions with different activities that later were experimented in the practical sessions. All the materials and resources were available through a Sakai-based learning platform called PoliformaT.

At the beginning of each of the subjects the SPQ questionnaire developed by Biggs [9] was submitted to the students on-line through University learning platform PoliformaT. For the Spanish group a translation of the questionnaire was used [70]. Statgraphics Centurion XVII (Statpoint Technologies, Inc.) was used to analyse the results, calculating correlations between factors and Cronbach's alpha values.

3 RESULTS

The participation was higher in General Genetics (66.1%) than in Molecular Markers (56.5%) (Table 1). Forty-eight students responded the questionnaire in both subjects of the possible 110 common students. In both subjects, students showed a higher DA than SA with higher values of DA for General Genetics subject (Table 1). Differences appeared for gender, with a higher SA value for males. The ratio female/male was 3 to 1, similar to health degrees in Spain [71]. In general, males tend to have a lower deep approach than females [8], [27]. However, other studies report no relationship [37] while others found the opposite [72], so the results are not clear [73]. No differences were observed for language

used as medium of instruction (Table 1). Language used as medium of instruction can affect learning approach [24], [74] and higher DA values have been observed in EMI groups when English is not the native language of the student [43].

Table 1. Number of students who answered the questionnaire by subject (General Genetics, GG, and Molecular Markers, MM), language used as medium of instruction and gender. 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.

	No. answers (% enrolled)	DA[1]		SA[1]		Difference DA-SA[1]		Null hypothesis DA-SA[2]
Year								
GG 2018-19	84 (0.66)	3.29 ± 0.06	b	1.97 ± 0.05	a	1.32 ± 0.08	b	***
MM 2019-20	65 (0.57)	3.00 ± 0.08	a	2.10 ± 0.07	a	0.90 ± 0.12	a	***
Language								
Spanish	127 (0.66)	3.16 ± 0.05	a	2.02 ± 0.04	a	1.14 ± 0.08	a	***
English	22 (0.44)	3.20 ± 0.13	a	2.08 ± 0.11	a	1.12 ± 0.21	a	***
Gender								
Female	105 (0.61)	3.14 ± 0.06	a	1.97 ± 0.05	a	1.17 ± 0.09	a	***
Male	44 (0.64)	3.22 ± 0.09	a	2.16 ± 0.07	b	1.06 ± 0.13	a	***
Total	149 (0.62)	3.17 ± 0.05		2.03 ± 0.04		1.14 ± 0.07		***

[1]Different letters in the same column indicate significant differences (P-value<0.05) between groups according to Tukey's test
*[2]***: P<0.0001*

For the secondary scales of the R-SPQ-2F questionnaire differences were also observed for the deep motivation (DM) and deep strategy (DS) scales (Table 2), with higher values for the General Genetics subject. No differences were observed according to language or gender.

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) for subject (General Genetics, GG, and Molecular Markers, MM), language used as medium of instruction and gender.

	DM[1]		DS		SM		SS	
Year								
GG 2018-19	3.35 ± 0.06	b	3.24 ± 0.07	b	1.61 ± 0.04	a	2.33 ± 0.06	a
MM 2019-20	3.15 ± 0.08	a	2.85 ± 0.09	a	1.69 ± 0.07	a	2.51 ± 0.09	a
Language								
Spanish	3.26 ± 0.05	a	3.07 ± 0.06	a	1.63 ± 0.04	a	2.41 ± 0.06	a
English	3.28 ± 0.15	a	3.11 ± 0.15	a	1.75 ± 0.11	a	2.41 ± 0.14	a
Gender								
Female	3.24 ± 0.06	a	3.05 ± 0.07	a	1.58 ± 0.04	a	2.36 ± 0.06	a
Male	3.30 ± 0.10	a	3.13 ± 0.11	a	1.80 ± 0.07	b	2.52 ± 0.09	a
Total	3.26 ± 0.05		3.07 ± 0.06		1.65 ± 0.04		2.41 ± 0.05	

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

The comparison of DA and SA values of the common students of both subjects showed slight variations on per student basis in both subjects (Figure 1). Students reduced their DA approach comparing first-year and second-year subject. However, it was not a general behaviour, as some students incremented their DA approach in the second-year subject. These results indicate that student approach to learning is not a fix value [8], [25] and varies between subjects.

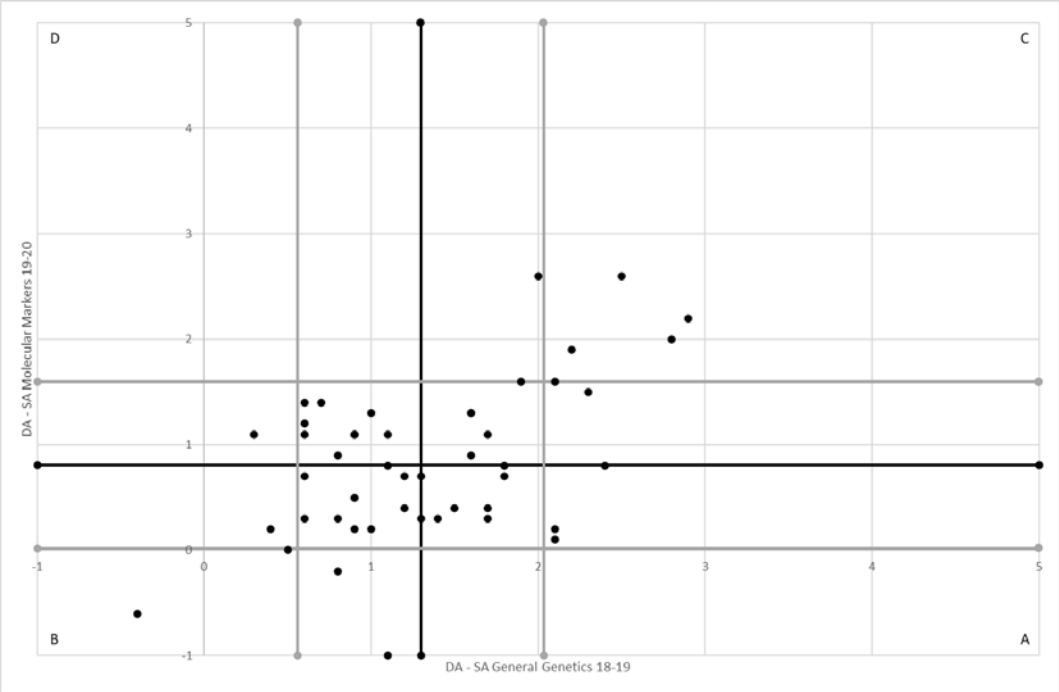

Figure 1. Deep approach (DA) minus surface approach (SA) distribution of scores for each common student of General Genetics and Molecular Markers subjects. The black lines depict mean values for DA and SA and the grey lines the mean plus or minus the standard deviation.

High correlations between the main scales and their subscales were observed (Table 3), as expected from by Biggs et al. [9], and revealed the existence of two dominant factors (deep and surface) like in other studies [18], [36], [64]. Confirmatory analysis have been carried out in different cultural contexts and different number of factors have been proposed, although most of the studies support a two factor structure of the R-SPQ-2F questionnaire [9], [35], [36], [64], [67].

Table 3. Correlations between different factors of the R-SPQ-2F questionnaire scales. Deep approach (DA), surface approach (SA), deep motivation (DM), deep strategy (DS), surface motivation (SM) and surface strategy (SS).

	DA	***SA***	***DM***	***DS***	***SM***
SA	-0.30 ***				
DM	0.89 ***	-0.25 **			
DS	0.92 ***	-0.28 ***	0.65 ***		
SM	-0.16 NS	0.85 ***	-0.15 NS	-0.14 NS	
SS	-0.34 ***	0.92 ***	-0.28 ***	-0.33 ***	0.58 ***

****: P<0.0001, ** 0.001<P<0.0001, NS>0.01*

The internal consistency of the questionnaire was assessed with the alpha Cronbach value (Table 4). The values were higher for the main scales and acceptable according the 0.7 value [75], but not for the secondary scales, supporting again the existence of two main scales [35], [36], [64], [67].

Table 4. Cronbach alpha coefficient values (95% lower confidence band) among the different R-SPQ-2F questionnaire scales of the questionnaires evaluated. Deep approach (DA), surface approach (SA), deep motivation (DM), deep strategy (DS), surface motivation (SM), and surface strategy (SS) for subject (General Genetics, GG, and Molecular Markers, MM), language used as medium of instruction and gender.

	DA	***SA***	***DM***	***DS***	***SM***	***SS***
Year						
GG 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)
MM 2019-20	0.81 (0.79)	0.74 (0.71)	0.61 (0.56)	0.72 (0.68)	0.51 (0.45)	0.63 (0.58)
Language						
Spanish	0.78 (0.73)	0.73 (0.70)	0.70 (0.64)	0.64 (0.57)	0.57 (0.47)	0.47 (0.68)
English	0.81 (0.76)	0.76 (0.75)	0.75 (0.70)	0.70 (0.69)	0.69 (0.62)	0.62 (0.70)
Gender						
Female	0.79 (0.75)	0.71 (0.65)	0.63 (0.55)	0.68 (0.60)	0.44 (0.31)	0.61 (0.52)
Male	0.76 (0.71)	0.69 (0.62)	0.51 (0.40)	0.69 (0.62)	0.46 (0.33)	0.54 (0.43)
Total	0.78 (0.73)	0.71 (0.65)	0.59 (0.49)	0.68 (0.61)	0.47 (0.34)	0.59 (0.50)

Results showed different student approach to learning in both subjects, with lower values in Molecular Markers than in General Genetics. Both subjects share discipline, structure and even some teachers so no big differences appear. However, student's perception was different. It is not clear if it is due to the subject or the year of study. Although the general trend was to low the approach in the second-year subject, some students showed the opposite trend, indicating that student approach to learning is not a fix value. It is generally assumed that the students' approaches to learning develops towards a deeper approach in higher education [1], [25], [42]. However, some studies showed that deep approach does not change during studies [76]–[79], while others showed a decline in either surface approach [80], [81] or in deep approach over the years [41], [77], [82]. Our results agreed with the last ones, but more studies in different years and subjects should be done to confirm the results.

4 CONCLUSIONS

The student approach to learning of both subjects was very high, with a higher deep approach than surface approach. However, the values were lower in the second-year subject, which suggests that students vary their approach to learning depending on the subject and year of study. This result should be considered to promote the deep approach in higher courses of the degree.

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