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STUDENT'S APPROACH TO LEARNING PER STUDENT BASIS IN TWO SUBJECTS OF BIOTECHNOLOGY DEGREE

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Abstract

Student's approach to learning is not a fixed characteristic of the students. It can vary depending on different factors. One type of that factors are contextual factors like type of studies, curricula, subject matter, structure of the course, teaching methodology or assessment system among others. Student approach to learning is normally classified in deep and surface approach. In deep approach, the students are motivated for learning while in surface approach students are motivated by subject requirements. In the present study the student's approach to learning of two subject was assessed with the R-SPQ-2F questionnaire of the Biotechnology degree in Universitat Politècnica de València (Spain). One of the subjects (General Genetics) is located in the first year of the degree, while the other (Bioinformatics) is the third year of the degree. The questionnaire showed a high consistency for the main scales (deep and surface approach), but lower for the secondary scales (motivation and strategy). High correlation was observed between the main scales and their secondary subscales. The students showed a higher deep approach than surface approach in both subjects but with lower deep approach and higher surface approach in Bioinformatics. No differences were observed regarding gender or language used as medium of instruction. On student per basis the same tendency was observed with students showing higher difference between deep approach and surface approach in the first-year subject, but not for all the students indicating differences due to other factors than contextual. A general tendency of decrease of deep approach has been observed in several studies and it is confirmed here. Study of the reasons of these results can be used to increase involvement of students and improve learning results.

Keywords: Flipped classroom; R-SPQ-2F; motivation; teaching methodologies.

1 INTRODUCTION

Students' motivation to learning is influenced by several factors [1], [2] and those factors can be classified as personal, contextual, or perceived [3], [4]. The personal factors are related to personality, but also to sociodemographic characteristics like gender, age or cultural background [5]–[7], and also academic abilities [5]. Contextual factors can be related to type of studies, discipline, subject or teaching and assessment methodologies [8] and, finally, how the student perceives all these context factors also influence student's approach to learning [8].

Subject is one of the main factors that influence student's approach to learning [9], [10], and it is not a fixed characteristic of the student [11]. The discipline of the subject, the year where is located and the teaching and assessment system used by the teacher can make the student to choose a different approach to learning [4], [8]. Some of those factors are within teacher domain and can be modified to increment the involvement of the student [12], [13].

The student's approach to learning can be assessed with different tools like the Revised Approaches to Studying Inventory (RASI) [14] modified in Approaches and Study Skills Inventory for Students (ASSIST) [15], [16], Inventory of Learning Process–Revised (ILP-R) [17], or Inventory of Learning Styles (ILS) [18]. However, one of the most widely used is the Study Process Questionnaire (SPQ) [4], which was subsequently revised to create the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) [13]. This questionnaire uses 20 questions to assess two main approaches (Deep approach, DA and surface approach; SA) with two related subscales of motivation and strategy. This questionnaire has been assessed in several contexts [19]–[22] and has proven its validity. Deep approach is characterized by an intrinsic motivation of the student to learn, and it is related to academic performance [23], [24] while surface approach is related to students that attempt to satisfy subject requirements with the minimum effort [4], [19].

In the present study the student's approach to learning is assessed with the R-SPQ-2F questionnaire in two subjects for the same students in the first year and third year of the bachelor's degree in Biotechnology.

2 METHODOLOGY

Students of two subjects of the bachelor's degree of Biotechnology of Universitat Politècnica de València were assessed for their student's approach to learning. The students were assessed in a first-year subject (General Genetics) and two years later in a third-year subject (Bioinformatics). General Genetics is a 6 ECTS (European Credits Transfer System) subject with theory and lab sessions and 115 students enrolled in year 2019-20 and Bioinformatics is a 4.5 ECTS subject with theory and computer sessions and 105 students enrolled in year 2021-22.

At the beginning of each of the subjects the R-SPQ-SF questionnaire developed by Biggs [13] was submitted to the students on-line through university learning platform PoliformaT. A Spanish translation of the questionnaire was used [25] in the group with Spanish as language used as medium of instruction, while the original questionnaire was used in the group with English as medium of instruction. Statgraphics Centurion XVII (Statpoint Technologies, Inc.) was used to analyse the results, calculating correlations between factors and Cronbach's alpha values.

3 RESULTS AND DISCUSION

The participation in the study was higher in General Genetics than in Bioinformatics (Table 1). General Genetics is a subject of the first year and students normally participate in all the assignments proposed by the teachers. Bioinformatics is located in the third year of the degree and students of the last years are more reluctant to participate and it can explain the different rate of participation between both subjects. The DA was higher than the SA as reported in other studies [10], [26], [27] with no differences regarding the language used as medium of instruction or the gender of the student, but with differences regarding subject. Gender does not affect student approach to learning in other studies [10], [28], [29], but in some cases differences have been observed in specific contexts like distance education [28]. Language used as medium of instruction is also a factor that can influence the student's approach to learning [30], [31] and students that use other language than English can have higher DA values [2], but in our case it did not affect. One of the possible reasons is that all students had the same mother tongue in both groups, but more factors can influence. The subject was a factor that influenced student's approach to learning. Differences could be related to the year where the subject is taken as students tend to show a decline in DA as they enrol in higher years [10], [32] and students tend to be more strategic in their approach [5], [33]. Regarding the secondary scales (Table 2) differences were observed related to subject with subscales related with deep motivation and strategy but not with surface related subscales, in accordance with results of Table 1.

Table 1. Number of students who answered the questionnaire by subject (GG: General Genetics, B: Bioinformatics), language, 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)	DA¹		SA¹		Difference DA-SA¹		Null hypothesis DA-SA²
Subject								
GG 2019-20	95 (0.83)	3.37 ± 0.06	b	1.84 ± 0.04	a	1.54 ± 0.08	b	***
B 21-22	33 (0.31)	2.90 ± 0.11	a	2.19 ± 0.11	b	0.71 ± 0.18	a	***
Language								
Spanish	94 (0.59)	3.22 ± 0.06	a	1.94 ± 0.05	a	1.29 ± 0.09	a	***
English	34 (0.56)	3.34 ± 0.11	a	1.91 ± 0.08	a	1.43 ± 0.17	a	***
Gender								
Female	83 (0.60)	3.30 ± 0.07	a	1.88 ± 0.06	a	1.41 ± 0.10	a	***
Male	45 (0.56)	3.17 ± 0.09	a	2.01 ± 0.07	a	1.16 ± 0.14	a	***
Total	128 (0.58)	3.25 ± 0.05		1.93 ± 0.05		1.32 ± 0.08		***

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) subject (GG: General Genetics, B: Bioinformatics), language, and gender.

	<i>DM</i> ¹		<i>DS</i> ¹		<i>SM</i> ¹		<i>SS</i> ¹		
Subject									
GG 2019-20	3.46 ± 0.06	b	3.28 ± 0.07	b	1.45 ± 0.04	a	2.22 ± 0.06	a	
B 21-22	3.14 ± 0.11	a	2.66 ± 0.13	a	1.79 ± 0.12	b	2.59 ± 0.13	b	
Language									
Spanish	3.35 ± 0.06	a	3.09 ± 0.07	a	1.53 ± 0.05	a	2.34 ± 0.07	a	
English	3.45 ± 0.11	a	3.22 ± 0.13	a	1.55 ± 0.09	a	2.26 ± 0.10	a	
Gender									
Female	3.45 ± 0.07	a	3.15 ± 0.08	a	1.49 ± 0.05	a	2.28 ± 0.07	a	
Male	3.26 ± 0.09	a	3.08 ± 0.11	a	1.63 ± 0.08	a	2.39 ± 0.09	a	
Total	3.38 ± 0.06		3.12 ± 0.06		1.54 ± 0.04		2.32 ± 0.06		

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

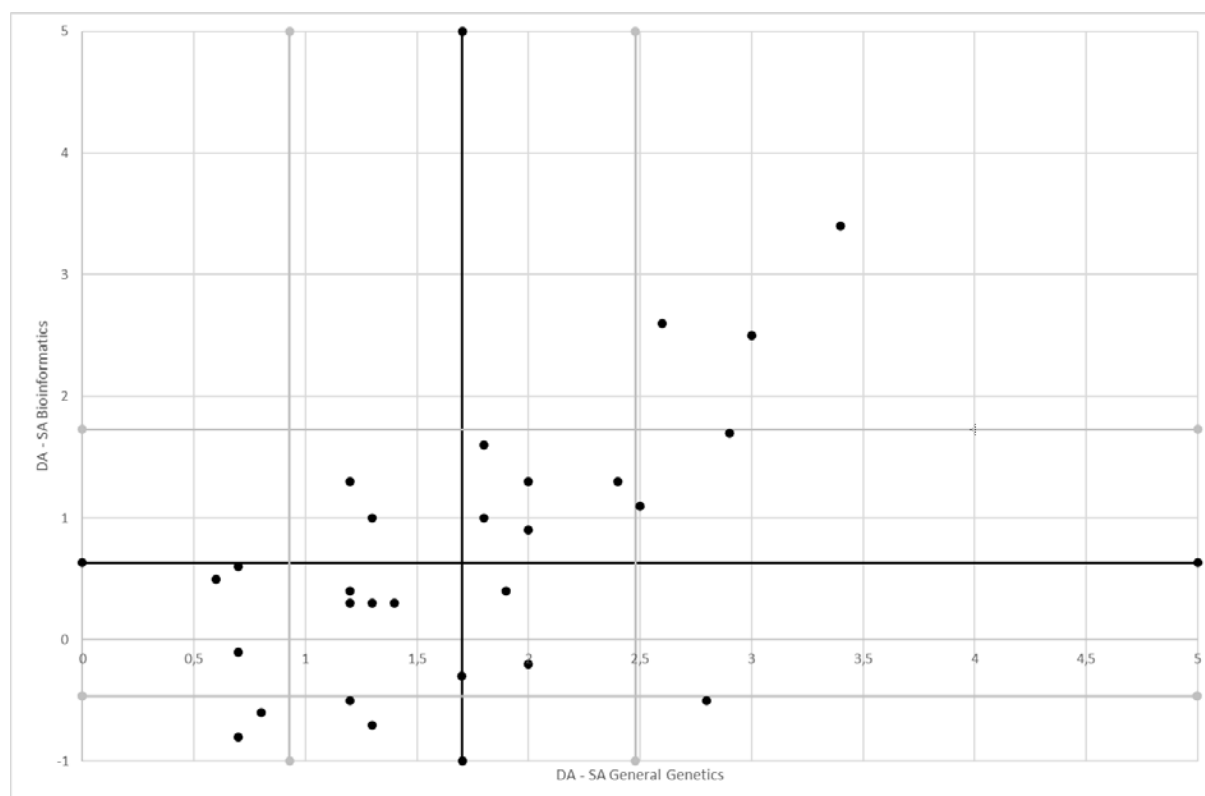


Figure 1. Deep approach (DA) minus surface approach (SA) distribution of scores for each common student of General Genetics and Bioinformatics subjects. The black lines depict mean values for DA and SA and the grey lines the mean plus or minus the standard deviation.

The comparison of student approach to learning of the same students in the first-year subject and the same students in the third-year subject (Figure 1) showed a decline in DA and increase in SA making the difference between DA and SA lower, but the decline was similar in all the common students, as students with a high DA and low SA maintained the same relationship in both subjects. Correlations between the different scales assessed (Table 3) showed high correlation with the main scales and their related subscales as showed in other studies [10], [20], [21].

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	-0.39 ***				
DM	0.89 ***	-0.32 ***			
DS	0.92 ***	-0.38 ***	0.63 ***		
SM	-0.32 ***	0.88 ***	-0.30 ***	-0.29 ***	
SS	-0.37 ***	0.93 ***	-0.28 **	-0.38 ***	0.64 ***

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

Item reliability analysis (Table 4) showed high values for the main scales but lower for the secondary scales supporting the existence of only two scales as reported in other studies [19]. The internal structure of the questionnaire has been assessed in several studies [19]–[21] and cultural differences have been observed [20], [22], [34]. Our results support the general structure of the questionnaire based in two main scales, but further studies with more data can be done to assess the structure in our context.

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

	DA	SA	DM	DS	SM	SS
Subject						
GG 2019-20	0.79 (0.74)	0.64 (0.57)	0.62 (0.53)	0.71 (0.64)	0.41 (0.28)	0.47 (0.35)
B 21-22	0.77 (0.72)	0.85 (0.81)	0.52 (0.40)	0.72 (0.65)	0.77 (0.71)	0.73 (0.66)
Language						
Spanish	0.78 (0.73)	0.73 (0.75)	0.75 (0.69)	0.69 (0.58)	0.58 (0.48)	0.48 (0.72)
English	0.85 (0.82)	0.82 (0.78)	0.78 (0.73)	0.73 (0.68)	0.68 (0.60)	0.60 (0.79)
Gender						
Female	0.80 (0.75)	0.75 (0.70)	0.63 (0.54)	0.72 (0.65)	0.65 (0.56)	0.57 (0.47)
Male	0.80 (0.76)	0.74 (0.68)	0.56 (0.45)	0.77 (0.72)	0.62 (0.52)	0.59 (0.49)
Total	0.80 (0.76)	0.75 (0.70)	0.61 (0.51)	0.74 (0.68)	0.63 (0.54)	0.58 (0.47)

Deep approach (DA), surface approach (SA), deep motivation (DM), deep strategy (DS), surface motivation (SM), and surface strategy (SS) for subject, gender, year and degree.

4 CONCLUSIONS

Student's approach to learning can be influenced by several factors related to the student, the context, and the perception of the student. Subject is one of the most important factors and the results presented here showed important differences in both subjects assessed. The differences can be due to different reasons as age, year where the subjects are located and student factors, as students become more strategic as student enrol in higher years of the degree. More studies should be done to assess the factors that influence this change in the student's approach to learning and interviews to the students can help to get more information.

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