

STUDY OF STUDENT LEARNING APPROACH IN TWO DIFFERENT SUBJECTS ON THE SAME YEAR

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Abstract

Biggs' R-SPQ-2F questionnaire has been widely used since its release in 2001 to assess the student approach to learning, identifying two main approaches: Deep and Surface Approaches. The results of the questionnaire help to evaluate the teaching system as students' approach to learning depends, among other factors, on the current teaching context and therefore, it is not a fixed quality of the learner. Based on this, the approaches of 74 first-year students of the Degree in Biotechnology at Universitat Politècnica de València have been analysed under two different teaching frames: a first-term subject in Genetics and a second-term subject in Business Economics. Although some students maintain their approach to learning, differences between both subjects have been found significant for the main scales and most of the secondary ones, although not for language used as medium of instruction or gender. The item reliability analysis showed a high consistency for the main scales, but not for the secondary scales of the questionnaire. These data contribute to reinforce the theory that students establish a learning approach according to the demands of the subject and context and modify their approach to learning.

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

1 INTRODUCTION

Science and Health studies at University seek to develop a reflective, life-long learning and professional environment related learning students [1]–[3]. A deep approach to learning is necessary to reach these goals [4]. Student approach to learning can be divided in two different approaches: deep approach (DA) and surface approach (SA) [5]–[7]. This classification arise from the interest in the nature of student learning in higher education [8]. The student's approaches to learning (SAL) theory was initially developed by Marton and Säljö [9], [10], and their work was later continued by Entwistle [11], [12] and Biggs [13]. Assessment of how students learn can improve the outcomes of teaching [14]. Surface approach is characterized by the effort of the student to pass the course requirements, without intrinsic motivations [14]–[17], and normally memorizing is one of their main tools of learning [18]. Academic achievements are often negatively correlated with surface approach [19]. Factors that can make the student choose this approach are unclear: teaching goals, assessment system or workload have been proposed [13], [14], [20]. By the other side, deep approach is chosen by students with an intrinsic motivation that use strategies to learn and enjoy learning [14]–[16], [21] and it has shown positively correlation with academic success [19], [22]–[24].

Learning is not an isolated process and vary depending on the context and the requirements of the different disciplines [25]. For example Biggs [13] described a different approach to learning in Science and Arts students. A model with three steps (presage, process and product) was proposed by Biggs [26]. Several factors can affect student approach [8], [13], [27]. Some of the factors are personal and refer to the student, like gender, age, personality, social context, previous knowledge or skills [13], [19], [27]–[29]. Age and gender are two of the most important demographic variables [27], but for the gender factor different results arise from different studies [24], [28], [30]–[32]. An increment of deep approach has been observed related to the age of the student [29], [32]–[34], possibly because older students have more intrinsic motivation [35].

Contextual factors can include the curriculum of the degree, the type of studies, the discipline, the teaching methodology or the assessment system [13], [25], [27], [36]. Students' approach to learning can change in different subjects and years of a degree [3], [25], [37]–[39]. It is generally assumed that higher education promotes deep approach [3], [27], [40]. However, results of previous studies give different results depending on the context. For example, a decline of deep approach was observed between first-year and third-year students in some studies [13], [39], [41], [42]. Other studies showed that deep approach did not change [41], [43]–[45], while others showed a different behaviour with a decline in surface approach [46], [47]. This behaviour can be affected by teacher performance [33], [36],

[48]–[53], but also by external factors and perceived factors. Perceived factors are those influenced by the student point of view [13], [25], [27], like workload, teaching system, clarity of goals, or the assessment system [27], [36], [49], [53]. As an example, students are able to change their approach to learning depending on the perception of course requirements [54].

Teaching should take into account student approach to choose teaching methodologies more appropriate [55], [56]. The assessment of student approach to learning can be used to modify teaching and learning environment [16], [57]. This could drive the student to a more deep approach, although is difficult to change their initial approach [53], [58]–[60]. Several tools can be used to measure student approach to learning [61]. Study Attitudes and Methods Revised Short Form (SAMS Short Form) [62], Inventory of Learning Process–Revised (ILP-R) [63], Revised Approaches to Studying Inventory (RASI) [64] modified in Approaches and Study Skills Inventory for Students (ASSIST) [65], [66], Approaches to Learning and Studying Inventory (ALSI) [12], Learning and Study Inventory Strategies (LASSI) [67], or Inventory of Learning Styles (ILS) [68] are some of the instruments developed. One of the most used is the Study Process Questionnaire (SPQ) developed by Biggs [13]. This questionnaire initially consisted of three dimensions: deep, surface and achieving, with two sub-dimensions (motive and strategy) each of them [13], [69]. However, the questionnaire was revised and its structure changed to only two factors (deep and surface) and two subscales (motive and strategy) in the Revised 2 factor version (R-SPQ-2F) [5]. As stated previously, the questionnaire does not assess the student general approach to learning but specific responses to a particular subject or situation [5], [16], [70].

The R-SPQ-2F questionnaire has been translated to different languages [15], [56], [61], [71]–[73]. Moreover, the internal consistency of the R-SPQ-2F questionnaire has been evaluated [5], [74] and different models have been proposed with different association of the factors of the questionnaire, but a two factor structure is the most accepted [75], [76].

In the present study, the student approach to learning of the same students was assessed in two subjects, General Genetics and Biotechnology Business Economics, in year 2020-2021. Both subjects are from the first year of the Biotechnology degree, one in the winter term and the second in the spring term. To assess the student approach to learning, the R.SPQ-2F questionnaire was used at the beginning of each of the subjects. With the resulting data, the evolution of student approach to learning can be assessed in the student per basis in two different subjects of the same year and degree.

2 METHODOLOGY

Two subjects of the first year of the bachelor's degree in Biotechnology in 2020-21 were chosen for this study: General Genetics is a first-term 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 was of 107. The other subject was Biotechnology Business Economics of the second term, with six ECTS, three of theory sessions (30 hours) and three of practical sessions (classroom and computer sessions). The number of students enrolled was of 103. Two groups were organized, one group with Spanish as language used for instruction and the other with English as language used for instruction. The teaching system was organized with theory sessions with different activities that later were experimented in the practical and computer sessions. The learning platform based in Sakai called PoliformaT was used to deliver all the materials and to perform assessment activities.

The R-SPQ-2F questionnaire developed by Biggs [5] was submitted to the students at the beginning of each of the subjects on-line through University learning platform Sakai-based PoliformaT. The original questionnaire was used for the English group while for the Spanish group a translation of the questionnaire was used [77]. Statgraphics Centurion XVII (Statpoint Technologies, Inc.) was used to analyse the results calculating correlations between factors and Cronbach's alpha values.

3 RESULTS

The rate of response of the students was high (83%, ranging from 74% to 93%) (Table 1). No significant differences in percentages of participation were observed regarding subject, language, or gender. Mean DA values were significantly higher than the SA values in both subjects, and this pattern was also observed when analysed considering language or gender (Table 1).

Table 1. Number of students who answered the questionnaire by subject (General Genetics, GG, and Biotechnology Business Economics, BBE), 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	SA	Difference DA-SA	Null hypothesis DA-SA ²
Subject					
GG	99 (0.93)	3.41 ± 0.05	a ¹ 1.79 ± 0.04	a 1.62 ± 0.07	b ***
BBE	76 (0.74)	3.27 ± 0.06	a 1.99 ± 0.05	b 1.28 ± 0.09	a ***
Language					
Spanish	105 (0.78)	3.33 ± 0.05	a 1.91 ± 0.04	a 1.42 ± 0.07	a ***
English	70 (0.92)	3.38 ± 0.07	a 1.83 ± 0.05	a 1.54 ± 0.10	a ***
GG Spanish	63 (0.90)	3.33 ± 0.06	a 1.82 ± 0.05	a 1.51 ± 0.09	a ***
GG English	36 (0.97)	3.54 ± 0.09	b 1.74 ± 0.06	a 1.80 ± 0.12	a ***
BBE Spanish	42 (0.66)	3.32 ± 0.08	a 2.03 ± 0.07	a 1.29 ± 0.12	a ***
BBE English	34 (0.87)	3.20 ± 0.10	a 1.93 ± 0.08	a 1.27 ± 0.15	a ***
Gender					
Female	115 (0.84)	3.35 ± 0.05	a 1.82 ± 0.04	a 1.53 ± 0.08	a ***
Male	60 (0.82)	3.34 ± 0.06	a 1.99 ± 0.04	b 1.36 ± 0.08	a ***
Total	175 (0.83)	3.35 ± 0.04	1.88 ± 0.03	1.47 ± 0.06	***

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

²***: P <0.0001

Regarding the subject, DA levels shown by students in both subjects were similar. On the contrary, SA levels in Economics were significantly higher than in Genetics. Differences were not found when considering language as a medium of instruction in both courses, but they were present when considering only the Genetics course, where DA level was higher in the English group (Table 1). One of the factors that can influence student approach to learning is language competency [24], [78]. In some cases, when a subject is taught in English for students with a different mother tongue, deep approach can raise [48], which supports that language, direct or indirectly, is one of the factors that affects students' approaches to learning. Differences were observed in SA regarding gender. Gender is not a factor that vary student approach to learning as reported in other studies [32], [79], although in distance education differences between gender have been reported in some cases [80], [81].

Results were also studied for the secondary factors of the R-SPQ-2F questionnaire [5] (Table 2). Consequently, with results above, values of Deep Motivation (DM) and Deep Strategy (DS) were higher than the ones of Surface Motivation (SM) and Surface Strategy (SS). The comparison between subjects led to significant differences in all secondary factors but the one of DM. No differences were found when considering language neither in the general sample nor when focusing by subjects, except from the values of DS in the Genetics course, where students of the English group showed a higher level. In relation to gender, no differences were observed but for the SM levels, where females showed lower levels than males (Table 2).

Comparing results on a per student basis (Figure 1) only 3 out of 76 showed a higher SA than a DA. Although some individuals showed a common approach in both subjects, differences were observed in most of the students (Figure 1). Several factors affect the student approach to learning and can be classified as contextual, perceived, or student factors [13], [27]. Student approach is not considered a stable psychological trait [60], [82] and can change between different subjects and years [39]. In our case, no big differences were observed between both subjects, although some students varied their approach, indicating an influence of contextual or perceived factors.

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 Biotechnology Business Economics, BBE), language used as medium of instruction and gender.

	DM ¹		DS		SM		SS	
Subject								
GG	3.40 ± 0.05	a ¹	3.41 ± 0.06	b	1.46 ± 0.04	a	2.12 ± 0.05	a
BBE	3.38 ± 0.07	a	3.16 ± 0.07	a	1.65 ± 0.06	b	2.33 ± 0.06	b
Language								
Spanish	3.36 ± 0.05	a	3.29 ± 0.06	a	1.57 ± 0.04	a	2.24 ± 0.05	a
English	3.44 ± 0.07	a	3.31 ± 0.08	a	1.50 ± 0.05	a	2.17 ± 0.07	a
GG Spanish	3.34 ± 0.06	a	3.32 ± 0.07	a	1.49 ± 0.05	a	2.16 ± 0.07	a
GG English	3.49 ± 0.09	a	3.58 ± 0.10	b	1.42 ± 0.07	a	2.06 ± 0.08	a
BBE Spanish	3.39 ± 0.09	a	3.26 ± 0.09	a	1.70 ± 0.08	a	2.37 ± 0.08	a
BBE English	3.38 ± 0.10	a	3.03 ± 0.11	a	1.58 ± 0.08	a	2.28 ± 0.10	a
Gender								
Female	3.38 ± 0.06	a	3.31 ± 0.06	a	1.48 ± 0.04	a	2.16 ± 0.05	a
Male	3.41 ± 0.06	a	3.28 ± 0.08	a	1.67 ± 0.05	b	2.31 ± 0.06	a
Total	3.39 ± 0.04		3.30 ± 0.05		1.54 ± 0.03		2.21 ± 0.04	

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

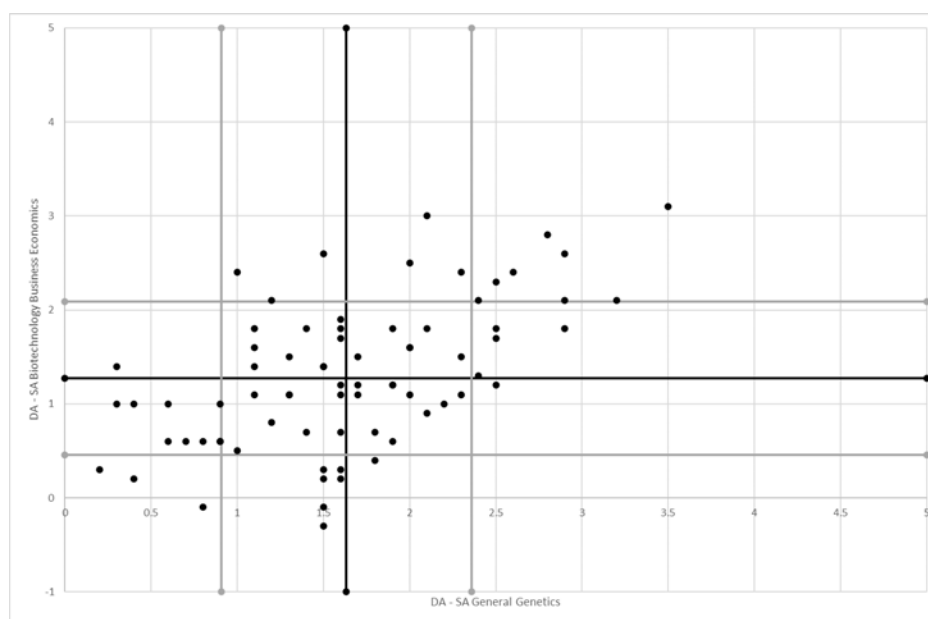


Figure 1. Deep approach (DA) minus surface approach (SA) distribution of scores for each common student of General Genetics and Biotechnology Business Economics subjects. The black lines depict mean values for DA and SA and the grey lines the mean plus or minus the standard deviation.

Studying the different correlations that affect the subdivision of DA and SA, significant relations were detected (Table 3). High and positive correlations were observed between DA and DM and DS, as well as between SA and SM and SS. As expected, significant negative correlations between DA and SA and their corresponding strategies and motivations were shown. Other studies showed a similar result [72], [83], [84], as the work of Biggs et al. [5] predicted.

Table 3. Correlations between different factor 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 ***	-0.26 ***			
DS	0.91 ***	-0.27 ***	0.62 ***		
SM	-0.19 *	0.86 ***	-0.19 *	-0.15 *	
SS	-0.32 ***	0.92 ***	-0.26 ***	-0.31 ***	0.59 ***

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

The internal consistency of the questionnaire was evaluated by the Cronbach's alpha (Table 4). Obtained values are close or higher than 0.7 in the main factors and showed lower levels in the secondary factors, mainly in SM and SS. Results in the same pattern were observed in other studies [19], [21], [71], [72], [84], [85] indicating that the questionnaire has a strong association with the two main factors, but lower for the secondary factors.

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 Biotechnology Business Economics, BBE), language used as medium of instruction and gender.

	DA	SA	DM	DS	SM	SS
Subject						
GG	0.72 (0.66)	0.62 (0.55)	0.39 (0.27)	0.67 (0.60)	0.37 (0.24)	0.44 (0.32)
BBE	0.78 (0.74)	0.74 (0.69)	0.62 (0.55)	0.63 (0.56)	0.59 (0.50)	0.57 (0.48)
Language						
Spanish	0.72 (0.67)	0.67 (0.67)	0.67 (0.61)	0.61 (0.46)	0.46 (0.35)	0.35 (0.62)
English	0.78 (0.74)	0.74 (0.72)	0.72 (0.67)	0.67 (0.55)	0.55 (0.46)	0.46 (0.72)
GG Spanish	0.68 (0.62)	0.63 (0.56)	0.32 (0.18)	0.62 (0.54)	0.33 (0.19)	0.41 (0.29)
GG English	0.76 (0.72)	0.59 (0.51)	0.55 (0.45)	0.72 (0.66)	0.48 (0.37)	0.49 (0.38)
BBE Spanish	0.78 (0.74)	0.69 (0.63)	0.65 (0.58)	0.63 (0.56)	0.60 (0.51)	0.50 (0.40)
BBE English	0.78 (0.74)	0.78 (0.74)	0.61 (0.53)	0.62 (0.54)	0.58 (0.49)	0.64 (0.57)
Gender						
Female	0.79 (0.74)	0.73 (0.68)	0.61 (0.53)	0.67 (0.60)	0.58 (0.49)	0.55 (0.46)
Male	0.63 (0.56)	0.52 (0.43)	0.11 (-0.08)	0.66 (0.59)	0.21 (0.05)	0.43 (0.31)
Total	0.75 (0.70)	0.69 (0.63)	0.50 (0.39)	0.66 (0.59)	0.51 (0.40)	0.51 (0.41)

4 CONCLUSIONS

Being aware of the learning approach of students is a powerful instrument for teachers to address their courses. Both personal and environmental factors have been proved significant in the way students engage with the subject. This study has analyzed the learning approach of the same group of students in two different moments of the same academic year, using the R-SPQ-2F questionnaire developed by Biggs et al. [5]. Each of the measures has been made in a different context, within the frame of a Genetics subject in first place and in an Economics subject, later. Results showed higher levels of Deep Approach in both subjects rather than Surface Approach, although some of the factors also proved significantly different between the subjects, being higher in the Genetics course. The influence of the course or the term remains as a studying factor for future research.

Data gathered in the study pointed to the fact that students adopt a strategy and can vary their learning approach according to the context and the requirements of the course. Further analyses should be carried out to be able to identify the elements of the context that enable the activation of the DA and DM.

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