

Investigating Computer Science Students' Identification with the Course and Their Perceptions of the Content Taught

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Abstract. *Brazilian public universities have several high-level and traditional Bachelor courses in Computer Science (BCS), of which quality is largely recognized in society. However, informal talks with students from these courses reveal a recurrent concern with the content taught and their readiness for the industry. In this study, we investigate the relationship between the students' social identity with their BCS and their perceptions about the content taught. For this purpose, we conducted an opinion survey with students from a traditional BCS course. The study findings reveal that the students tend to feel they belong to their BCS, recognizing its distinctive view in the industry. However, we found that the students with higher identification with the course also tend to be more critical about the content taught.*

1. Introduction

Just walk a few minutes around the campus of Brazilian public universities to see dozens of students wearing merchandise suggesting how proud they are to be a member of their university and how they identify themselves with their course. After all, being in that environment represents a long journey of dedication to studies, the dream of being part of a high-rated university, and having a promising professional future.

While the initial expectations are quite high, informal conversations with students of Bachelor of Computer Science (BCS) courses may indicate that students are insecure regarding the knowledge they need to acquire for good performance and productivity in the industry, such as learning the most used programming languages, modern architectures, and frameworks. As suggested by [Peters and Pears 2013], students' doubts about future engagement are often due to a perception that the discipline lacks meaning, which leads to a tendency to dissociate themselves from Computer Science as an area of further study.

Even considering that undergraduate students are not mature enough to evaluate the training received in terms of knowledge and skills in the long term, possible dissonance between the students' pride about the course and their perceptions of the content taught may be a factor that negatively impacts the teaching-learning process. In this sense,

Peters and Pears, [Peters and Pears 2013] suggest that “identity is seen as a critical issue in the endeavor to increase students’ engagement in Computer Science and related fields.”

Despite the students might identify themselves with their courses, they might be also unsatisfied with them due to different reasons, including taught content, budget restrictions, or even structural issues. In this paper, we report an empirical study aiming to characterize the influence of the Computer Science students’ social identity [Tajfel and Turner 1979] with their course over their perceptions about the content taught in the course. The study findings reveal that a solid social identification with the course contributes to developing a critical view of the content they taught.

2. Background and Related Work

In our study, we employ two theories from social psychology for supporting data collection and data analysis: *social identity* theory and the *cognitive dissonance*. In social psychology, the *social identity* refers to how we see the groups that we are part of as part of ourselves. To achieve this, we use attributes that differentiate members of the group that we are a part of from other groups. The groups we see ourselves as part of have an important influence on our behavior and self-perception [Tajfel and Turner 1979, Abrams and Hogg 2011, Hogg and Vaughan 2017].

Luhtanen & Crocker introduced a specific questionnaire that can be used to identify someone’s identification with a group, which we will adapt and use for our research [Luhtanen and Crocker 1992]. Their method involves asking a specified set of questions divided into four categories, which represent four different dimensions of social identity (see survey questionnaire for our adaptation). Once an individual has a positive identity with a certain social group, such as his working team or his Bachelor’s course, it is expected that this identity will reflect in his social behavior, for instance, publicly sharing the pride of being part of that group.

The second theory we address in this study is the *cognitive dissonance* theory. When somebody’s actions do not align with what they believe because they have contradicting views on a topic, they are in a mental state that we call cognitive dissonance. Usually, individuals experiencing cognitive dissonance try to resolve the resulting tension by changing or rejecting their beliefs [Hogg and Vaughan 2017, Festinger 1962, Cooper 2007]. In the long term, unresolved cognitive dissonance may be a concerning source of anxiety, leading also to negative feelings such as anger, shame, and regret.

In our research, we are interested in observing whether BCS students might be experiencing dissonance between how they see the course content and how they identify with it. While there is previous research that links social identity with a course to improved academic performance [Ana-Maria Bliuc and Hendres 2011, Huang et al. 2015, McGrath 2020] and higher identification with a job to improved work performance [Karanika-Murray et al. 2015], we could not find previous work investigating the relationship between the perception about the content taught in a course and social identity.

For instance, [Huang et al. 2015] found an association between the students’ identification with highly recognized institutions and worse academic performance. This behavior may be explained through the called “the big-fish-little-pond effect” phenomenon, where students have a lower self-concept in more recognized institutions, leading to lower

academic performance [Marsh 2005]. In contrast, a study conducted with mature university newcomers found a positive impact of social identity with their course on the learning approach chosen by the students [Howard and Davies 2013].

There are also works investigating how to promote social identity between students. For instance, the low prevalence of female students in Computer Science courses demands actions to strengthen their identity with the course, raising the feeling of belonging with their courses to prevent evasion [Bacelo et al. 2019]. Regarding the students' expectations about the course, Berardi and Bim [Berardi and Bim 2017] investigated whether Information Technology students create false expectations about the course, besides verifying how this perception is built.

3. Study Plan

In the following subsections, we present the settings of the empirical study that we conducted aiming at *characterizing the relationship between the BCS students' social identity with the course and their perceptions of the content taught*. Our study aim to answer the following research questions.

RQ1 How is the social identity of BCS students with their course?

RQ2 How do BCS students express their identification with their course?

RQ3 How do BCS students perceive the course content?

RQ4 What is the influence of the students' social identity over their perceptions of the course content?

We will apply the *survey* method for gathering students' opinions. For Linåker et al., the basic idea of survey methodology is to collect information from a group of people by sampling individuals from a large population [Linåker et al. 2015].

3.1. Target Audience and Sampling

We recruited a sample of students from a traditional and highly rated computer science course offered by a Brazilian public university. In this study, we are interested in gathering opinions from students who declare having some experience with the BCS course, which excludes newcomers once they have not experienced BCS classes yet. Besides, we want to let the students feel free to participate and express their opinions. In this sense, we opted to send the survey invitation through a Telegram group exclusive to BCS students after authorization. This group was conceived for the students' mutual support and integration.

3.2. The Survey Questionnaire

We used the Google Forms¹ to compose the survey questionnaire. We distributed the survey questions into the following four main categories, concerning the *participant characterization*, the *social identity with the BCS course* (Table 1), the *perception about the content of the BCS course* (Table 2) and an open question to the participants providing suggestions for improvement. The complete set of questionnaire items and the students' answers is available online², including the applied translated version of the questionnaire items (in Portuguese).

¹<https://www.google.com/forms/about/>

²<https://anonymous.4open.science/r/WEI-2024-DC18>

Table 1. Questions about the student's social identity with their BCS course.

Dimension	Question	Type
Belonging to the group	Q9. I see myself as part of the BCS.	Likert
	Q10. I am used to interacting with the other students at the BCS.	Likert
	Q11. I am used to interacting with the teachers at the BCS.	Likert
	Q12. I often demonstrate or verbally express my identification with the BCS when I am at the University.	Likert
	Q13. What makes you identify yourself with the BCS group?	Open
	Q14. What do you do to demonstrate your identification with the BCS course?	Open
Importance of being in the group	Q15. For me, it is important to be part of the BCS.	Likert
	Q16. The student body's behavior at the BCS influences my way of acting.	Likert
	Q17. The faculty's behavior at the BCS influences my way of acting.	Likert
	Q18. In your opinion, what are the characteristics that positively influence your participation in the BCS group?	Open
Public collective self-esteem	Q19. In general, the BCS is well seen by other computing courses in its region.	Likert
	Q20. I believe, that BCS is well seen by other groups at the University	Likert
	Q21. I believe, that BCS is well seen by the information technology market.	Likert
	Q22. Overall, people note the recognition of BCS among industry professionals.	Likert
	Q23. Overall, people note the quality of education regarding my course.	Likert
	Q24. How do you believe people see the BCS course in general?	Open
Private collective self-esteem	Q25. My course is an important reflection of who I am.	Likert
	Q26. Students at the BCS are cooperative	Likert
	Q27. In general, belonging to the BCS is an important part of my self-image.	Likert
	Q28. Students at the BCS are committed to the learning activities.	Likert
	Q29. Students and teachers work in harmony on academic activities.	Likert
	Q30. Describe how you are influenced by other students and professors at the University.	Open

Table 2. Questions addressing the student's perceptions about the BCS course content.

Question	Type
Q31. The content of my BCS course contains relevant knowledge for my professional future.	Likert
Q32. It is important, that the content of my BCS course prepares me for my professional future.	Likert
Q33. The difficulty of my BCS course content is adequate.	Likert
Q34. Overall, I am satisfied with the content of my BCS course.	Likert
Q35. Describe how you perceive the quality of your BCS course.	Open

4. Results & Analysis

We did not offer any reward to stimulate participation. During one week, we collected complete responses to the survey questionnaire from 16 students. The results from our survey are presented and analyzed in the following sections.

4.1. Participants' Information

Of our participants, 87.5% declared that they had completed more than half of the mandatory content offered in the BCS course. The average age of our participants is 25.3 years, Most participants perceive their academic performance as high or very high, with nine responses in these categories. Only two students rated it as low. Regarding the participants' experience in the field, students answered that they are involved in university internal activities such as participation in extension projects (9), entrepreneurship projects (9), and scientific initiation projects (4). The professional experience in industry predominantly consists of novice workers with up to one year of experience (7) and workers having between one and four years of experience (7).

The characterization of the study participants indicates that, despite the relatively small sample size, we could reach an active and engaged group of students for our research proposals. The characterization indicates that the students are compromised with the BCS course content and activities. Besides, we gathered responses from students with different levels of academic and industry experience.

4.2. Social Identity

4.2.1. Belonging to the group

Regarding belonging to their BCS course (Q9), the frequency of students who reported identifying with the course was high (12). The median for this question was relatively high, with a value of 6.5 (scale 1-7, see Figure 1).

Looking at the habit of interacting with other students (Q10) and professors (Q11), a central trend points to a slight agreement, with median=5 for interaction with students and median=4 for interaction with professors. Regarding demonstrating or verbally expressing identification with their course at the university (Q12), the results show that is not very much common as we obtained median=3 for the answers to this question.

We applied open coding to analyze the open questions. Addressing what leads students to identify themselves with the BCS group (Q13), the *behavioral affinity* (8) and

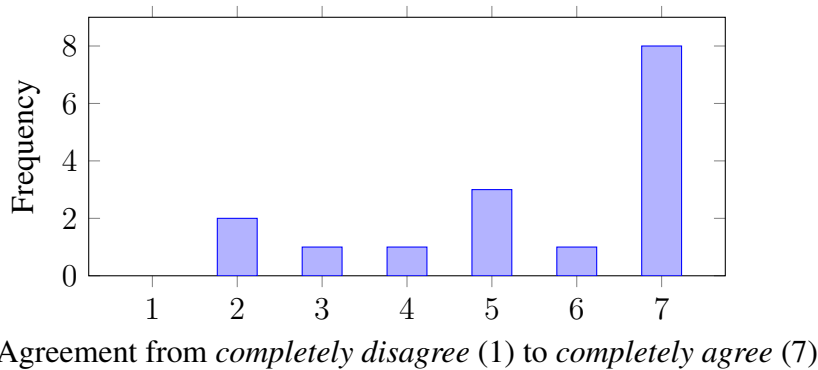


Figure 1. Social Identity - Belonging to the group (Q9)

studying together at the campus (3) were the answers that had the highest frequencies. Regarding actions demonstrating their identification with the BCS course (Q14), the most frequent behaviors are *not demonstrating* (6), *talking to other people* (5), and *dedicating to the course* (4). Contrary to our initial expectations, *wearing t-shirts* (1) and *communicating on social media* (1) were mentioned only once.

Therefore, to answer *RQ2*, we note that most of the students understand that they somehow demonstrate their identification with the BCS course. However, these demonstrations tend to be reflexive and informal.

4.2.2. Importance of being in the group

Regarding the importance of being in the group, the results indicate a certain neutrality, except for working together with teachers. The aspects related to the student body's (Q16) and the faculty's behavior (Q17) at BCS to the influence on the students' behavior presented medians of 4 and 6 respectively, indicating a strong influence of professors on students. The students' answers to the importance of being part of the BCS course (Q15) reached a median of 4.5 due to the diversity of their opinions (see Figure 2).

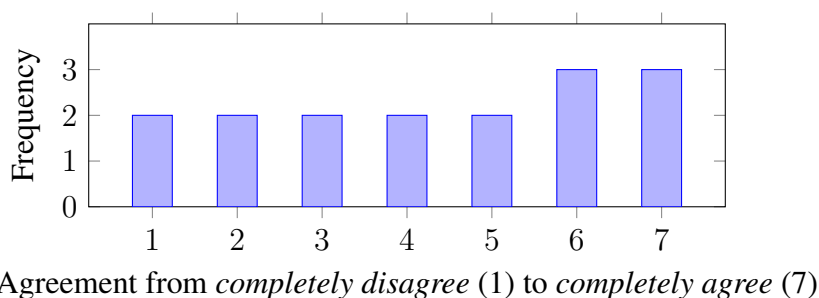


Figure 2. Social Identity - Importance of being in the group (Q15)

As an open question, students were asked about what are the characteristics that positively influence their participation in the course (Q18). The answers indicate as the most frequent aspects: *community sense* (3), *interest from teachers* (2), *course's internal organization* (2).

4.2.3. Public collective self-esteem

Students reported that they perceive public recognition, especially about the industry and among its professionals. When asked if, in general, the BCS is well seen by other computing courses in its region (Q19), the answers reached a median of 4.5. The perception regarding the vision of other groups (Q20) was also indicated to be neutral, with a median of 4.5. Students tend to believe that their course is well seen by the information technology market (Q21), presenting median 6, and among industry professionals (Q22), presenting median 5. Similarly, they tend to believe that their course is recognized by the industry as having good quality (Q23) presenting median 5.

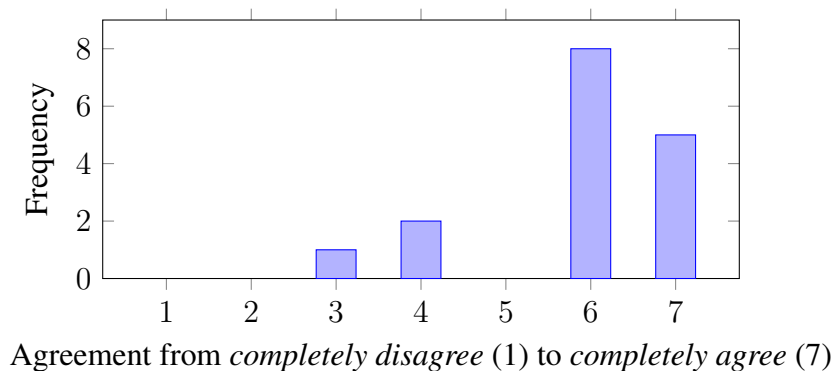


Figure 3. Social Identity - Public collective self-esteem (Q21)

As an open question, students were asked about how they believe people see their course (Q24). The answers to this question confirm the students' positive answers to the previous questions. Half of the students stated that people see their course as a high-level one. In contrast, two students believe that people are indifferent to the course.

4.2.4. Private collective self-esteem

In the section about private collective self-esteem, students demonstrate neutrality, with a tendency to be unsatisfied with aspects related to interaction with other students and between students and professors. When asked if the course is an important reflection of themselves (Q25), we found a trend to neutrality (median=4).

In other factors that can help understand the dimension of private collective self-esteem, the answers also tend to be neutral or disagree. For cooperation between students at BCS (Q26), the median obtained was 4, while for belonging to BCS as an important part of my self-image (Q27), the median found was 3.

In the dimension of private self-esteem, negative perceptions about the learning process stand out. While the students themselves believe that their colleagues at BCS are not committed to the learning activities (Q28), presenting a median of 3.5, students are generally unsatisfied with achieving harmonious work with the teachers on academic activities (Q29), with a median of 3 (see Figure 4).

In an open question (Q30), students were asked to describe how they are influenced by other students and professors at the university. The results demonstrate the

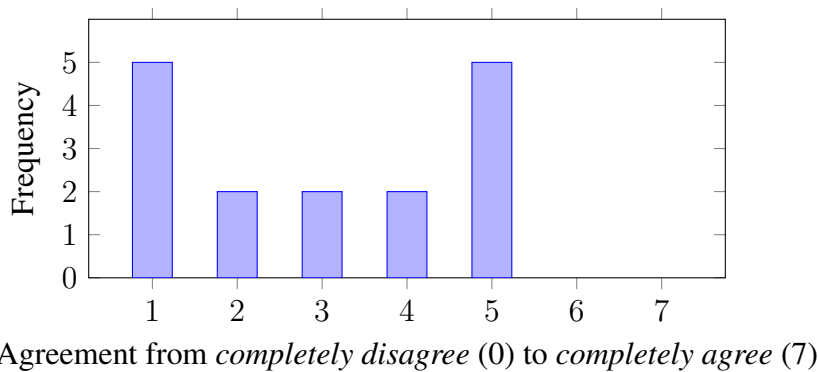


Figure 4. Social Identity - Private collective self-esteem (Q29)

importance of the university community in achieving the course objectives, in addition to the power of influence of teachers to positively or negatively impact the personal and academic lives of students. The most frequent responses were: *ways of studying* (7), negatively impacted by *relationship problems* (6) and *professors' attitudes* (6).

4.3. Summarization

Based on the answers to the four dimensions of social identity, we found that students partially identify themselves with the course, showing more cohesive and positive results in the belonging to the group and the public collective self-esteem dimensions. On the other hand, the students investigated tend to demonstrate neutrality regarding the importance of being in the group and negative results for the dimension of private collective self-esteem, especially regarding the influence of the BCS course over the student's self-image. In this way, our answer for *RQ1* is that *students are proud to be part of the BCS course, recognizing the relevance of the course for themselves and its positive image in the industry*. However, they tend not to see the course as an expression of themselves, mainly due to a perceived lack of a cooperative and harmonic environment.

4.4. Perception about the course content

When asked how much they agree to the statement “The content of my course at BCS contains relevant knowledge for my professional future” (Q31) on our agreement scale from one to seven, participants replied with a median of 5.0 (see Figure 5). While on the other hand, the participants agree to the statement “It is important that the content of my course at BCS prepares me for my professional future” (Q32) with a median of 7.0, with a total of 10 out of the 16 participants fully agreeing to this statement (Figure 5). Regarding the adequateness of the difficulty of the content of their BCS course (Q33), the students considerably diverge, reaching a median of 3.5. Similarly, the students also diverge on the extent to which they are satisfied with the course content (Q34, median=4).

Regarding how the students perceive the quality of their course (Q35), we could summarize their answers in the following codes: *Good* (7), *Outdated* (4), *Too theoretical* (3), *Not good in general* (1), *Too generic* (1). These codes indicate that the students diverge in their perceptions about the course quality. Besides, the ones that tend to negatively see the quality of the course typically point to major reasons for it.

Therefore, to answer *RQ3*, we found that, *despite the students agreeing that the course should prepare them for their professional future, they considerably diverge on*

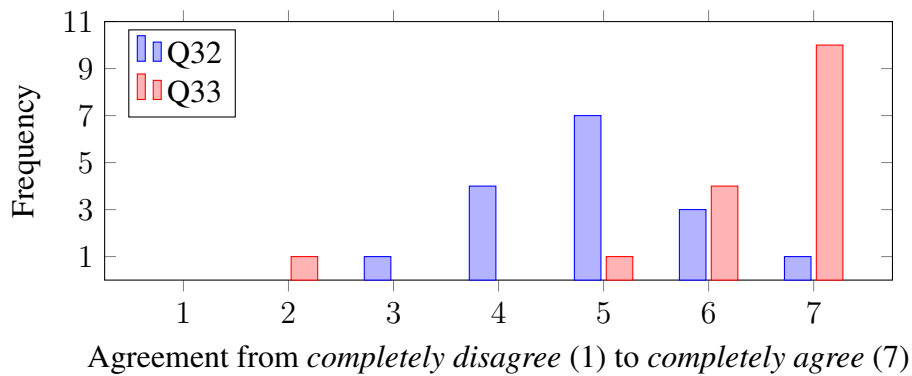


Figure 5. Participants' views on the relevance of their course to the industry (Q31 and Q32)

whether this purpose is properly addressed by the course content. Although they tend to agree that the course contains relevant knowledge, they considerably diverge about their satisfaction with it, tending to perceive the course content as fairly adequate in difficulty. The main issues raised by the students about the course content quality are the incidence of excessive theoretical and outdated content.

4.5. Social Identity and Satisfaction

To answer *RQ4*, we first separated the study participants into two groups based on their identification scores. One group is composed of students with higher identification with the course, and another is composed of students with lesser identification with the BCS. Then, we compared the perceptions coded from each group about the BCS course (Q35). The student's identification score (IdS) was calculated based on the average of each student's answers to the 17 Likert-scale questions addressing the four dimensions of social identity (see Figure 1).

Surprisingly, Figure 6 shows that the group of students less identified with their BCS course ($IdS \leq 4.5$) were those provided more positive views about the BCS content, while the group of students with higher identification ($IdS > 4.5$) shared more frequently negative ones (Figure 7). One possible reason for these results is that having a high identification with a social group may lead the individual to build a more critical but constructive view of the group. Once these students have a high identification, they may feel more attentive to quality concerns, such as the content they should learn.

These findings also suggest cognitive dissonance among some students regarding their course. Cognitive dissonance tends to be unconscious, leading individuals to search for consonance. In this search, it is common for individuals to ignore aspects of reality. Thus, students less identified with the BCS course may try to reach consonance by running the course while ignoring issues about the course content. However, more studies are needed to confirm this hypothesis.

We also performed Spearman's rank correlation coefficient to compare the distribution of the student's IdS with the distribution of the answers given for the overall satisfaction with the content of the course (Q34). However, we could not identify a statistically significant correlation.

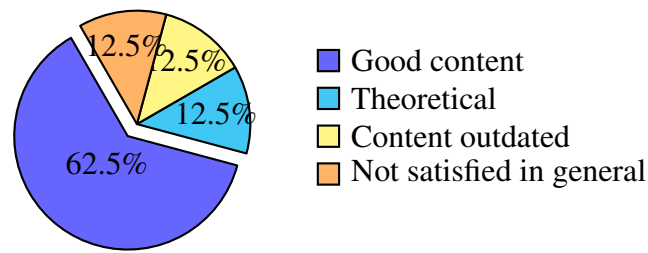


Figure 6. Perception of course's content in relation to identification with BCS - Students less identified.

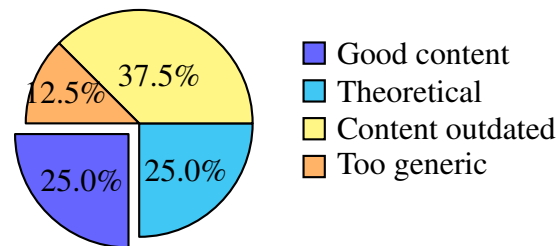


Figure 7. Perception of course's content in relation to identification with BCS - Students more identified.

Based on our findings, our answer for *RQ4* is that *the students more identified with their BCS course tend to be more critical when asked the course's content. It demonstrates the importance of promoting the identification of the students with their courses to engage them to support continuous improvement.*

5. Conclusion & Future Work

In this paper, we reported the first execution of an opinion survey, aiming to investigate the relationship between the social identity of students with a BCS course and their perception of the content taught in this course. Our findings indicate that, despite the students' feeling belonging to their course, and recognizing its positive public view, they also tend to show little satisfaction with the course content. In this way, we found that students with more identification with the course also provided more critical comments about the course content. Besides, we observed the risk of cognitive dissonance among the students less identified with the course. However, it should be confirmed in future studies. The focus of our study was investigating students thoughts and behavior.

Despite further studies are needed, the results presented in this paper indicate the importance of promoting the social identity of students with their courses to establish an effectively open environment for continuous feedback. BCS students are highly connected to the market and may not perceive the whole importance of the academic content they learn, but their opinions also represents a key source for identifying important opportunities for updating the courses' content. As next steps, we intend to replicate this study with students from other BCS courses with different characteristics, including new courses and courses from other countries.

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