

It's Okay Because I Worked Really Hard! – Student Justifications for Questionable Collaboration while Solving Computer Labs

Camilla Björn
Dept. of Theoretical Computer Science
KTH Royal Institute of Technology
Stockholm, Sweden
cabjorn@kth.se

Katharina Munz
Dept. of Computer and Information Science
University of Konstanz
Konstanz, Germany
katharina.munz@uni-konstanz.de

Pontus Haglund
Dept. of Computer Science
Linköping University
Linköping, Sweden
pontus.haglund@liu.se

Filip Strömbäck
Dept. of Computer Science
Linköping University
Linköping, Sweden
filip.stromback@liu.se

Abstract—In this full research paper we examine questionable collaboration from a student perspective. Collaborating while solving computer lab assignments is often considered an important part when learning computer science, as it allows students to discuss their work, while also practicing working together. However, it also introduces risks, such as students collaborating in ways negatively impacting their learning outcomes and leading to inaccurate grading. Hence it is important to work towards reducing the use of these poor collaborative practices. In order to ameliorate the problem with academic misconduct, we need to understand students' justifications for deviating from acceptable practices. In this paper we therefore investigate how students justify their collaborative practices during computer lab assignments in situations they experience as questionable. The justifications were collected through 15 semi-structured interviews with students experienced in pair programming, majoring in computer science and other technical fields from two large well-known European universities.

The justifications from the interviews were analysed using phenomenography resulting in seven categories: external pressure, lack of interest, spending time on the assignment, understanding the end product, contributing to the process, learning from the assignment and reflecting on the purpose of the learning. These describe in which situations students might deviate from the rules and can be used by institutions to prevent such behavior.

Index Terms—collaboration, plagiarism, cheating, justifications, phenomenography, computer science education

I. INTRODUCTION

Solving programming assignments, henceforth known as computer labs, is a common part of computer science courses at institutions of higher education across the world. In many cases students are encouraged to collaborate with fellow students while solving these computer labs. In Sweden, computer labs are commonly tackled in small groups, often in pairs. As part of their learning process, these small groups are often not only encouraged to collaborate internally, but also with

other groups. In this context, we consider collaboration to be any interaction between multiple individuals or groups that involve the solution to a computer lab. Of course, the type of collaboration expected inside a group and between groups differ. Collaboration is a complex topic and a significant part of learning computer science at Swedish universities. Performed correctly, it can both help the students in the learning process and teach them valuable skills for their future work life. However, performed incorrectly, it can jeopardise the students learning outcomes as well as result in unfair assessment. To ensure that the students are aware of what is considered acceptable collaboration, Swedish universities publish rules to govern collaborative practices. Yet, research has shown that academic misconduct is a problem amongst students [1], which might be caused by students having trouble drawing the line between encouraged collaboration and academic misconduct [2, 3]. Additionally, there are reports indicating an increase in academic misconduct during the remote situation caused by the pandemic [4, 5]. This study will therefore explore students' justifications for their questionable collaborative practices when solving computer labs, and how knowledge of these justifications can be used to discourage academically dishonest behavior. In the context of this paper we use questionable collaboration to refer to collaborative behaviors that students find morally questionable in some way. We thus aim to answer the following research questions:

- RQ1** What types of justifications do students use to justify practices they would otherwise consider questionable?
- RQ2** How could knowledge of the justifications be used to discourage students from academically dishonest behavior?

The remainder of this paper is structured as follows. Section II introduces related work, followed by a description of the student cohort in section III and the method in section IV. The results are then presented in section V and discussed in section VI. Finally, the conclusion is presented in section VII.

II. RELATED WORK

While students are expected and encouraged to collaborate while solving computer labs, it is not always easy for them to navigate the gray zone between acceptable and unacceptable collaboration. However, the problem is not limited to students not knowing where the line is. In an Australian survey study from 2002, the authors revealed that 85.4% respectively 69% of the IT students at two different universities claimed to have cheated at least once [6]. In another study, as many as 90% of the students reported to have participated in some kind of academic misconduct [1]. Although a few years have passed since these studies were conducted, the topic is still relevant. For example, the Swedish Higher Education Authority reported a 61% increase in academic misconduct between the years 2019 and 2020 [5], and Jenkins et al. [4] found that cheating in online classes was more common than in classes in-person.

Although CS students might not always know what constitutes acceptable behavior when collaborating in computer science, Stepp and Simon [3] found that students often find mitigating circumstances that allow them to participate in collaborative practices that they would otherwise not find morally acceptable. However, the issue of students finding mitigating circumstances allowing them to participate in illegal practices is not exclusive to collaborative work. Many studies have reported that students are good at rationalising their behavior in cases they know could be questionable, even in more general situations [7]. For consistency with the work in this paper, we will henceforth use the word *justification* in places where others may have used rationalisation.

One common justification, is that the plagiarised work is only used as *inspiration* [8]. Other studies found that students also justified their plagiarism with the amount of effort they had put in to the assignment [2] or the fact that they had only plagiarised part of the original code [9, 10]. These justifications are not directly connected to the students learning, which presumably was the main objective of the assignment. However, several studies conclude that there are students justifying their use of code written by others, by the fact that they understand it (or the assignment) [2, 9, 10]. Furthermore, Simon and Sheard [10] found that some students instead argue that plagiarism is allowed if they learn from it.

Results from Dick et al. [11] show that students may be more inclined to cheat if they do not understand the educational value of their work. Simon and Sheard [10], for example show that some students justify their questionable collaboration practices and self-plagiarism (reuse of code), with the fact that these are common practices in professional settings. Further, Simon and Sheard [10] show that the students may also be more prone to use questionable practices if the

management of the course is poor. The students may also be more likely to resort to illegal practices if they get stuck and can not find a way to solve the problem Simon et al. [9] or if they lack interest in the material [12].

There has also been indications that students use external factors to justify their questionable practices. For example, in a study in the USA [13], over 40% of the students claimed that financial factors could make them more susceptible to cheating. The students in this study also answered that “non-engaging (boring) subjects, curved grading, pressure to succeed and the idea that ‘everybody else is doing it...’ ” [13, p. 1136] could be additional reasons for cheating.

Although several studies have been conducted with the aim to better understand students reasoning for various forms of cheating, few, if any have used a purely qualitative approach. Many also focus on plagiarism from a broader approach than collaboration within computer lab assignments. Finally, few of the studies mentioned above used a rigorous theoretical framework for the analysis of the data. By narrowing the scope, and analyzing the issue using the qualitative research approach phenomenography, we believe this paper can contribute with a deeper understanding of how students justify their questionable collaborative practices.

III. DESCRIPTION OF THE STUDENT COHORT

Due to the recent increase in cases of academic misconduct, possibly due to the remote teaching mandated by the pandemic, we selected students who had taken at least one course conducted in-person and one conducted remotely. As this paper aims to investigate justifications for collaborating with computer lab assignments, we also require that these courses involve solving programming assignments in small groups (typically pairs).

To make sure the students matched these criteria we invited students whom had taken a data structure and algorithms course during the remote teaching mandated by the pandemic. Having taken this course during the pandemic ensured that they had completed another computer science course on-site prior to the pandemic. In total, 311 invitations were sent out to students from KTH Royal Institute of Technology and 210 invitations to students from Linköpings University on a first-come first-serve basis. A total of 15 students accepted the invitation and were interviewed. Students were compensated with a cinema ticket for their participation. All interviews were conducted via video conference in Swedish, and were then transcribed in full. Because of the language barrier the Swedish researchers conducted and transcribed the interviews. Seven of the respondents came from KTH Royal Institute of Technology and eight from Linköping University. Three of the students from KTH Royal Institute of Technology and five from Linköping University were majoring in computer science, the remaining students majored in other STEM areas but were taking the courses required to fill our criteria.

IV. METHOD

The goal of this paper is to investigate how students justify collaborative practices in questionable situations. In particular, we aim to find different types of justifications for collaboration rather than examining which justifications are more common than others. As such, we have used phenomenography as our research approach. Phenomenography is a qualitative research approach that aims to find and describe how a cohort experience a particular phenomenon [14, 15]. In this context, the cohort is the student group described above, and the phenomenon is the students' justifications for collaboration. This research approach is often used to describe students' understanding of something that has been taught to them, and the results are subsequently often used to inform improvements to teaching of the subject [16]. However, this approach is general enough to be applied in this context as well. Phenomenography describes understanding in terms of the relationship between a person and an object, and highlights different ways of understanding the object in terms of how complex this relationship is. In our study, we aim to examine the relationship between a student and their reasoning regarding why certain kinds of collaborations are morally acceptable. In this framework, the relationship between the two is expressed through justifications for why some particular collaboration should or should not be deemed acceptable. Data was collected through interviews with 15 students. In the interviews, students were first asked to describe how they and their partner collaborated while solving the lab assignments. Once the student described some form of collaboration, they were asked whether or not they felt the collaboration was morally acceptable, and their reasoning for it. The interviewer then aimed to lead the student towards a modified scenario where the student express their uncertainties about whether or not the practices were morally acceptable or not. The interviewer had a number of prepared scenarios in case the student did not present any scenario they perceived as questionable. One such example is a scenario where one student has written most of the code, while the other one has been present, but not as active in producing the code that makes up their solution. At each stage of this process of finding scenarios that students find questionable, the interviewer would ask the students to justify their reasoning. One example of such a question is: "Where would you draw the line between the kind of collaboration that is morally acceptable and the scenarios that are not acceptable?" Each interview lasted between 30 and 60 minutes.

When all interviews had been conducted, the recordings were transcribed. After selecting relevant quotes from the interviews, they were translated into English by the Swedish-speaking authors and then sorted by all researchers into different categories. Each category representing different types of justifications for collaborative practices during computer lab assignments in situations the students experienced as questionable. As is the case with most phenomenographic work, the process of structuring and interpreting the data was performed in several iterations. After each iteration,

the authors discussed and resolved any disagreements that surfaced during coding. Initially, the categories that emerged from the data represented surface aspects of the utterances, but as the researchers got more familiar with the data, a few different categories describing the data emerged. With help of the quotes, each of these categories was then described in detail, alongside the connections between the categories.

V. RESULTS

The phenomenographic investigation resulted in seven categories as shown in table I, which is the answer to RQ1. In the remainder of this section we first describe each of the categories, followed by a description of the relationship between them.

A. The Categories

In the quotes below, we will use K1–K8 to refer to students from KTH Royal Institute of Technology, and L1–L7 to refer to students from Linköping University. The interviewers are denoted using their first initial (i.e., C, P and F).

1) *Pressure*: This category describes a relationship between students and their reasoning in terms of justifications involving external pressure. This pressure takes different shapes, which is represented by two subcategories: social pressure and time pressure. The first, social pressure, is illustrated by student K5. In general, the interviewed students did not consider it morally acceptable to send their solution to an assignment to another student who had not yet finished it. However, they were willing to make exception under certain circumstances which is shown in the following answer to a question about when it is acceptable to send code to another student:

K5: Well it depends. I wouldn't send my code to just anyone. It depends on who the person is. [...] But if I know who they are, or if it's my friend, or if I know that they have tried for a really long time, or if they are really stressed [...] or if there are like external factors in play. [...] But okay, you are having a really hard time, in that case I can give you my code, here it is.

In this case, we can see that student K5 used social factors to justify a certain type of collaboration that they would not otherwise find morally acceptable. We can also see the student mentioning that the other person feeling stressed could justify helping them. In this situation it is unclear whether this stress was due to time pressure or not. We did, however, find other students who justified collaborative practices in terms of time pressure. One example of this is student L1, who stated that it is generally not acceptable to copy solutions from the Internet, but found it to be more acceptable when being under time pressure during a discussion about the amount of code that is morally acceptable to copy:

L1: Because sometimes the situation is that you have 2 hours left to spend on this lab. And you can't spend more than 2 more hours because there isn't time in the schedule. [...] So when it comes to this kind of time pressure and you are stuck, then I feel you can get away with a bit more than what you would have otherwise.

TABLE I
SUMMARY OF THE PHENOMENOGRAPHIC CATEGORIES (1–7) AND THE ASPECTS CONSIDERED BY STUDENTS IN EACH CATEGORY (A–G).

Category	A	B	C	D	E	F	G
1 a. Feeling <i>social pressure</i> b. Feeling <i>time pressure</i>	External pressure	The course	Individuals' effort	The end result	The group	Learning	Purpose
2 Lack of <i>interest</i>							
3 <i>Working</i> , spending time on the assignment							
4 <i>Understanding</i> the end product							
5 <i>Contributing</i> to the process							
6 <i>Learning</i> from the assignment							
7 <i>Purpose</i> of learning							

A similar position is held by student L6, who described a situation where they solved large portions of the labs themselves due to a lack of time. Despite that the labs were supposed to be done in pairs, and that this would negatively impact their lab partner's learning:

L6: And then it was one of the latter labs, and there I felt that we... that we started to run out of time. [...] And then I started to look at it at home and like... well, managed to solve it somehow and then, because I felt that, well it didn't feel good to work on something that was meant to be done together by myself.

2) *Interest*: This category describes a relationship between students and their reasoning in terms of justifications involving interest in the course material. This category is illustrated well by student L4, who described a situation where their partner had written most of the code for the lab assignments in the course:

L4: Yes, that happened towards the end, especially that I tried to focus and keep up, but it was... It wasn't really a course that interested me either. I don't think I really wanted to understand either, because it was so like incredibly abstract, on such a low level with regards to the code. So it became, well, mostly it was... it wasn't something that interested me from the start.

From this quote, we can see that the student initially had ambitions to help solving the assignments, but failed to do so and used their lacking interest in the course content to justify them not helping out as much as they initially aimed to do.

3) *Working*: This category describes a relationship between students and their reasoning in terms of justifications involving the work they have done in the course. In this context, we use the word work to refer to the effort a student has put into the collaboration. As such, having done work does not necessarily mean doing something that is useful in achieving the goal of the assignment, and in some situations it might be enough to simply be present. This focus on work or effort is illustrated by student L5. They described a situation where they collaborated with two other students, but felt that at least

one of the group members were mostly idle while the other two solved the assignments. When asked to elaborate on their feelings about this collaboration, they said the following:

L5: In that kind of lab course everyone gets a pass as long as the group passes. [...] Based on what I know, some of my friends have felt like this: "Well this person doesn't deserve to get a pass in this lab course, since he doesn't understand as much". [...]

C: Thanks, could you elaborate a bit more? For example, how would you motivate that this person should get a pass even though they don't understand as much?

L5: [...] One passes because one has completed the assignment together, not that one learned the exact learning objectives.

From this quote, we can see the focus on solving the assignment together, rather than what was learned. In this case, solving the assignment together simply meant that all members had to be present, not necessarily that all participants were actively contributing.

Student K3 also expresses the importance of work, although in this case in a more general sense, not as a justification for questionable collaboration. This is shown by their response when asked to give a hypothetical first year student guidelines for evaluating whether some type of collaboration is acceptable or not:

K3: Where do you draw the line for what is your own work? [...] What have you produced to learn this? How much effort have you put in to learning the things that are part of the course? Did you spend effort by sitting in the computer lab, listening to other groups? Is that really the same amount of effort as scanning through pages of code or watching tutorials on Youtube?

In this answer, the student proposed that it is important to consider the work spent when determining if some kind of collaboration is acceptable. The sentiment of this guideline is that some collaboration is more likely to be acceptable if one has worked hard enough, for example by looking at code

or watching tutorials, rather than listening to other students discussing their solutions in the computer lab.

4) *Understanding*: This category describes a relationship between students and their reasoning in terms of justifications involving their understanding of the solution to the assignment. In this context, understanding the solution does not necessarily mean that students have learned enough to produce a solution to a similar problem. They are, however, able to explain their solution and reason about why it is suitable when demonstrating it to a teacher. This way of justifying collaboration is illustrated by student L4 when they described a situation where they felt like they were doing less work than their partner in a course:

C: [...] If you consider an ethical perspective. [...] The reason you were not active was because the course did not feel relevant?

L4: Yes, definitely, at least partially. I even skipped the exam in that course because I felt I couldn't pass it. But the labs... I finished the labs and I, like, understood it well enough to be able to explain what we had done.

From this answer, we can quite clearly see that the student described that they understood the final solution of the labs, at least well enough to explain it to the teacher and thereby passing the labs. However, the student did not feel that they had learned enough of the course content to attempt taking the final exam. Thus, this example illustrates the difference between understanding enough to pass the labs and learning the course contents. This was a particularly ambiguous situation for this student, and they later expressed hesitation regarding whether or not understanding the solutions was enough to justify this collaboration.

This type of reasoning is also used by student L2 to justify submitting a solution that their partner had produced when they were absent:

L2: Well, it was in the first [course] labs, when you started doing labs. Then it was me and my lab partner, and then it might happen that I failed to attend one lab session, and they wrote code during that session. Like code to solve an assignment, and then submitted it next time for both of us. But then you had still, like... Then you had read through what the code is doing and said: yes, it works.

As with the previous quote, we can see that the student emphasized the fact that they understood what the code is doing, even though they were not present when the code was written or contributed to the process.

5) *Contributing*: This category describes a relationship between students and their reasoning in terms of justifications involving each member's contributions to the solution. This is illustrated well by student K7 when asked to elaborate on their views on the division of work during lab assignments:

P: [...] does it feel like you... work equally hard, or is it that you solve an equally large part? [...] maybe you solve half the lab in a couple of hours, but I need eight hours to solve the component I was assigned.

K7: I don't think so. It depends a bit on your scenario there. But if we sit together and solve something. As long as you give input to the solution, then... even if I do most of the work, you are there and try to help and understand, and keep up. Even if the situation is that I pull you along, and pull you through the solution. I think that is okay. [...]

From this quote, we can see that the student emphasized the contributions to the shared solution by both parties, and since they considered both parties to have contributed enough they find the collaboration morally acceptable, even if one party has done more work than the other.

A similar view is held by student L1. When discussing a scenario where they could not get the necessary software working on their computer, they did not view it as problematic to let the other party write the actual code since they could still contribute. While this quote does not illustrate a questionable scenario, it is a good illustration of how students reason in general:

L1: [...] I have had courses where it is like, well, because I could not get the right software to work on my computer, we used the other person's computer, and that person writes all the code. But as long as you have still been active in, like, making decisions and making suggestions and such, and there has still been a dialogue. Then it is completely okay.

Again, we can see that the student justified the situation based on how much they have contributed to the solution. Similarly to the previous case, these contributions were in the form of ideas rather than code.

6) *Learning*: This category describes a relationship between students and their reasoning in terms of justifications involving what all students in the group have learned from the collaboration. This is illustrated by student L1 when they continued the discussion presented in the *Contributing* category above:

L1: [...] But I prefer to be present during all parts of it [the solution process]. But as long as you understand and, like, take part of the knowledge the lab is designed to give, then I feel it could be okay.

[...]

L1: [...] I think that if you don't understand the things, then why are you taking the course? You are there to learn, and if you don't learn...

From this quote, we can see that the student extended their previous reasoning about contributions to also include learning. Even though the student used the word *understand*, which we use to describe a surface-level understanding of a solution, the context makes it clear that the perceived goal of the collaboration is that everyone should learn.

Many other students expressed the importance of learning in a similar manner. Another example is student K5 when asked to elaborate on their justifications for why a situation where one student worked more than the other was acceptable:

K5: [...] or it is okay that lab partners started at different levels, because it will always be like that. But as long as both have developed during the course, and have been able to avail themselves the course contents, and that maybe by the end of the course they could do something that they could not do themselves in the beginning. Then it is okay.

7) *Purpose*: The final category describes a relationship between students and their reasoning in terms of justifications involving whether the *important* parts of the assignment has been learned. In this case, what is *important* is either something the student believe they will need later in their career, or something that is perceived to be the purpose of the course. One example of the former is student L5 when they described their thoughts regarding a situation where both students in a group collaborated in the problem solving part of the assignment, but only one of them wrote the actual code:

L5: [...] Maybe one thinks more about, like this: it should be equally divided what one does... [...] But if you are at a company, then the most important thing is that the problem is solved, kind of...

From this quote, we can see that the students considered the justifications both from an educational perspective (i.e., in school, they should divide the labor more equally), but also from the perspective of their future self and what skills are important in that situation.

As previously mentioned, what is important to learn can also be determined from the perceived purpose of the course. This is illustrated by student K4 when justifying a collaboration similar to the one described by student L5: the pair produced a solution in pseudo-code together, and one of the participants implemented the final solution in a programming language.

K4: Yes, I think it is a fairly okay way to... Because it is... We have solved the assignment together. We solved the problem, and developed the algorithm together. I don't think writing down the code is a part of the lab, as long as it is not explicitly stated.

In this case, the purpose of the course were perceived to be developing data structures and algorithms. Writing the code in a programming language was considered a necessity that was not part of the learning objectives of the course.

B. Relationship Between the Categories

As previously mentioned, the seven categories represent aspects that describe an increasingly complex relationship between students and their reasoning, and this relationship can be seen as taking the form of justifications for collaborative practices. This increasing complexity is illustrated in the right-hand side of table I in terms of seven aspects (labelled A–G) of students' relationship to their reasoning. As such, these seven aspects each highlight a particular type of reasoning a student may include in their justifications. They are as follows:

A: The first category (*external pressure*) represents the most fundamental aspect found. It describes the relationship

between a student and external factors, such as *social pressure* and *time pressure*.

B: The second category (*interest*) adds the aspect of the course, which in this case is expressed as a student's interest in the course.

C: The third category (*working*) adds the aspect of the effort put into a student's work in the course. Thus, the third category encompasses both the course and the effort spent, often in terms of hours spent rather than what is produced.

D: The fourth category (*understanding*) adds the aspect of the end result of the course (i.e., the solution to an assignment in this case). This allows a student to consider not only the effort put into a solution, but also how well the end result is understood.

E: The fifth category (*contributing*) adds the aspect of the group. This allows a student to consider their effort and understanding in relationship to other students' effort and understanding. This perspective thus allows considering the work in terms of each individual's contributions towards the end result.

F: The sixth category (*learning*) adds the aspect of learning. This allows reasoning in terms of the learning goals of the course, and whether everyone involved in the collaboration achieves these goals.

G: Finally, the seventh category (*purpose*) adds the aspect of the purpose of the learning. This allows students to put their learning into the perspective of what part of the learning might be useful in their future career or further studies.

It is worth emphasizing that this progression does not imply that all discerned aspects are considered to be of equal importance. Rather, our findings indicate the opposite: for each category, the most complex aspect is often perceived as being the most important, and thereby the main component in a student's justifications. The less complex aspects are still experienced and considered in the justification, but are often seen as necessary preconditions for considering the more complex aspects. A good example of this is student L5's reasoning in the description of the *Purpose* category above. The student does consider simpler aspects, such as contributing, but finds learning the important parts to be most important.

This observation suggests that students who use justifications as described by category 4 (*understanding*) finds the aspect of the end result (D) to be the most important. The less complex aspects of external pressure (A), the course (B) and their effort (C) are still perceived, but are seen as less important, or as prerequisites for the more complex aspects. For example, they could have considered external pressure (A) and found that it is low enough that they have time to understand the solution, they have some interest in the course (B), and have spent enough effort (C) to at least understand the solution. It is, however, important to note that these less complex aspects are used differently by different students and

in different situations.

VI. DISCUSSION

As the work described in this paper is qualitative work, it is based on the answers of a fairly small portion of the entire cohort. There is always the risk of failing to capture some view that is only expressed by a small minority of the students. We do, however, believe that the number of participants is adequate for the phenomenographic work done here since our results are a description of the cohort as a whole, and should thereby be used to address overarching concerns rather than being expected to apply to an individual. During the latter interviews, repeating justifications became commonplace and no new views were found, which is a common indicator of a large enough sample in qualitative research.

While the studied cohort consists only of students from two universities in Sweden, we expect the results are representative for other Swedish universities and colleges. It is also reasonable to expect the results to be representative for institutions that have similar academic cultures in other countries as well.

No students in this study used the code of conduct to justify collaborative practices in an ambiguous situation. The code was, however, mentioned a few times during the interviews. When mentioned, the students did not talk about the code of conduct as the reason for the collaboration being okay, but rather why it was morally acceptable in spite of it. Our hypothesis is that this is likely because students have considered, at least the spirit of, the code of conduct in order to find a situation questionable in the first place. Therefore, students describe their justifications in terms of why it is morally acceptable to deviate from the code of conduct, rather than examining it closer and explaining why the collaboration is acceptable according to the code of conduct. Thus we do not think that the absence of the code of conduct from the justifications should be interpreted as it not being of importance to students, but rather that the design of this study does not capture the relationship between students and the code of conduct.

With many student's engaging in academic misconduct [1, 6] and more cases being reported during the pandemic [5], understanding why students engage in these types of harmful collaborations is important. Here we explored this from the perspective of justifications and found a number of different categories of justifications used by student to motivate ambiguous collaborations as morally acceptable. The descriptions of students' justifications for collaboration can be used to complement work done with the aim of reducing cheating. By understanding why students choose to collaborate in ways that cross the line into dishonesty, parts of a course can be designed to avoid these justifications becoming relevant.

A. Reducing Academically Dishonest Behavior

In this section, we aim to answer RQ2 by suggesting ways that academically dishonest behavior can be reduced based on the categories found and described in this study.

1) *External pressure*: Feeling social pressure is dependent on inter-personal relationships among the students. A commonly suggested approach to mitigate this issue, is to foster a culture amongst the student groups, where one does not engage in, nor asks others to engage in, collaborative practices which are harmful or crosses the line in to academic dishonesty [11, 17]. In doing this, it is important to take the values of students into account [18]. This is dependant on the students being aware of what harmful collaboration is as well as the code of conduct.

Feeling pressured for time is something that we argue can be mitigated in a few ways. Students need to acquire the tools necessary for planning their studies early. Supported by the issues reported by Simon and Sheard [10], courses need to be planned in a way where students have as few conflicting deadlines as possible, even between different courses. Further, enough time needs to be allocated to allow students to finish their tasks.

2) *Interest*: A lack of interest in the task or subject from the students side is a factor contributing to dishonest behavior [12]. From the perspective of the university, it should be the goal to present the materials that are taught in an as interesting way as possible, as well as underlining its relevance to the students. It is also important for students to know about the educational value of tasks [11]. As an example, it may be uninteresting for students to implement a queue [10] from scratch (since the availability of such solutions is abundant), but if it is presented as practise for the analysis of algorithms, it could help motivate the students.

3) *Working*: According to Simon et al. [2], justifying dishonest behavior through the time spent on an assignment is common. While students may lack the maturity and experience necessary to put their work in a greater context than the time they spend. The teacher can make resources available to prevent students from feeling stuck and not progressing regardless of how much work they put in. The feeling of lacking other alternatives has previously been found to be a factor in why students engage in collusion [9]. Granting students access to skilled TAs is one way of avoiding this.

4) *Understanding*: Understanding the end product is not only a justification found in this study. It is also something that previous research has found to be an important factor to students feeling comfortable using code written by others [2, 9, 10]. The reality is that when a lab is demonstrated, a TA is commonly responsible for assessing that demonstration, checking whether the students understand the proposed solution or not. As such, it is quite easy to understand why students would think this is the only important part of solving a lab, thus only learning at a surface level. The teaching staff could become better at catching students whom share solutions with each other or find them elsewhere. Another approach is to make it harder to do so [19]. But as an alternative to getting into an arms race of plagiarism and counter measures, we propose to work with making students aware of the purpose of the labs, for example that learning to optimize a data structure is not the same as understanding what one solution

to that problem does. Enforcing that student then achieve the objectives could be achieved through a form of examination that can be conducted in a controlled environment.

5) *Contributing*: Contributing to the process can be a dangerous justification for students to employ. Students are at risk of feeling like they contributed while they have skipped large parts of the learning objectives and/or tasks involved in an assignment. This depends in large part on what the students consider to be valuable contributions. Again this comes back to students needing to be aware of what the learning objectives of the assignment actually are and having a clear understanding of what constitutes academic dishonesty. Even if contributing to the process is an important part of equitable collaboration, students should be wary of thinking that what they are doing is allowed just because they feel like they are contributing.

6) *Learning*: Learning from the assignment is actually a fairly good justification for why a form of collaboration is good. It is however not without its challenges. Students have been known to think that violating the code of conduct is allowed as long as they learn from it [10]. As such, while a form of collaboration may actually be quite good for a student's learning outcomes, it is important that they still consider the code of conduct when engaging in it. Further, the implications of these kinds of justifications are very dependent on the students perception of what they are supposed to learn, how they learn, what they have actually learned, and whether or not this learning aligns with the goals of the course.

7) *Purpose*: Purpose of the learning is the most complex category of justifications found in this study. Even though these justifications, like those in the previous category could be beneficial for the students' learning, they are still potentially problematic since learning is more or less orthogonal to the code of conduct. If you plagiarise and learn from it, and you learn from it in a way that is important to your future career, it is still plagiarism and can have harsh consequences. Again, analogous with previous research [10, 11], the implications of these justifications are highly reliant on students' perception of what they are supposed to learn, not just in the context of the course, but also in the context of their future studies and/or careers.

B. Further Observations

The progressive nature of the categories presented in table I shows that each progressively more complex category depends on its antecedents. Thus, this implies that it would be beneficial to focus preventative measures towards factors related to justifications earlier in the progression. The argument being that a student whose justifications are more complex, considers aspects in less complex categories, but not vice versa. Therefore if one focuses on addressing factors relating to more complex categories, such as learning, a students whose only considering the pressure their currently under may be unaffected, while alleviating some of that pressure could be beneficial across the board.

An interesting observation from the results is that the progression presented in table I is essentially unrelated to typical

descriptions of academic honesty. Thus, it is not the case that a student with a more advanced experience of their justifications is less likely to collaborate in a way that would fall under academic dishonesty. For example, a student who mainly justifies their collaborative practices using their contributions (category 5), may stay clear of academic dishonesty, while a student who mainly uses learning (category 6) or the purpose of learning (category 7) could cross the line to academic dishonesty by justifying that it is morally acceptable for their partner to write all the code since both of them learned the theoretical part, or whatever was perceived as important in the course or exercise.

While the main focus of this paper is to explore students' justifications in general, the fact that students had experience with collaborating both in-person and remotely let us gain some insights into differences between the two scenarios. In general, the fundamental justifications were the same in most situations, but in some cases students found that the difficulties of working remotely could be used to justify some practices that would otherwise not be morally acceptable.

VII. CONCLUSION

In this paper, we explored how students justify collaborative behaviors they perceived as morally questionable. The phenomenographic analysis used to do so uncovered seven different ways of experiencing such justifications, ranging from external pressure (such as time or peer pressure), to justifying not doing a part of the assignment since they perceive it as not being relevant for their future studies or career.

To mitigate the effect of the categories of justifications on academic dishonesty, the results of this study indicates that it is important to foster a culture among the students where good collaborations is the norm. They further suggest courses should be designed with the students overarching schedules in mind and that students needs to be provided adequate support. The students also need to be aware of the code of conduct as well as their learning objectives for the course and the individual exercises they take part in.

The categories of justification in this paper are progressively more complex. These finding indicate that it is necessary to address the least complex categories first in order to prevent students from justifying academic misconduct. Worth noting is that this progression of complexity is essentially orthogonal to the typical behaviors that makes violations of the code of conduct likely. As such a justification fitting in a category of higher complexity than another is not necessarily less likely to justify behavior that could constitute academic misconduct.

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