Design and Evaluation of an Academic Integrity Module for Computer Science Students

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Abstract

Academic Integrity (AInt) violations in Computer Science (CS) have been on the rise in recent years, the CS Program at the University of North Carolina at Charlotte (UNC Charlotte) being no exception. Students are often unaware of what constitutes a violation and of its potential consequences. To address this, we design a standalone, self-paced, online Academic Integrity course module targeted at CS students. Our module aims to increase student awareness about academic misconduct, inform students about the potential consequences of academic misconduct, and educate students about strategies and resources to avoid academic misconduct, incorporating scenarios and information specifically relevant to CS throughout. In this paper, we present the details of the module and report our experiences and analysis from deploying it in eight courses within the CS program at UNC Charlotte in the Spring and Fall of 2021. Our analysis, based on responses from 314 students, demonstrates the effectiveness of the module in meeting our goals and also sheds light on opportunities for further improvement that we have already capitalized on. We envision that our module can be adopted and adapted by other CS programs and that our experiences can serve as an exemplar for the development of similar program-specific AInt learning modules, all with the overarching goal of mitigating AInt violations.

1 Introduction

Prior studies suggest that Academic Integrity (AInt) cases are on the rise in Computer Science (CS) compared to other disciplines [1, 2], likely due to the Internet facilitating ready access to abundant CS materials and personal assistance on class assignments, and due to more widespread use of violation detection tools is CS. In line with this general trend, the data from the CS program at the University of North Carolina at Charlotte (UNC Charlotte) shows a sharp increase in the number of AInt violations, rising from 12 cases in 2016-2017 to over 100 in each academic year since then. This situation continued even after our institution's academic code of conduct was reinforced and explicit policies related to academic integrity were incorporated into most course syllabi.

UNC Charlotte is an urban research institution, with more than 40% of our students coming from underrepresented backgrounds and over 6% being first-generation college students. Our CS program, in particular, has 25% students from underrepresented backgrounds. A key goal of our CS program is to foster a growth mindset [3, 4] and provide an inclusive educational experience to our students. In our experience, we have found that students often commit academic integrity

violations without being aware of it. So, educating students about what constitutes academic misconduct and what potential consequences there may be is a first and important step towards mitigating academic integrity violations [5].

To this end, we developed a standalone, self-paced, online academic integrity module targeted toward CS students. In this paper, we present the goals of our AInt module, its design, the module content, and our experiences and analysis from deploying it in six core undergraduate courses, a teaching assistant training course, and a graduate-level teaching certificate course within the CS program at UNC Charlotte , in the Spring and Fall 2021 semesters. The specific contributions of this experience report are the following:

- description of the design and development of an Academic Integrity module for a CS program;
- deployment of the module and evaluation of its effectiveness and students' experiences with it.

The remainder of this paper is organized as follows. We present the relevant literature review in Section 2. In Section 3, we describe the module goals, its design, and content. The study method, including module deployment, data collection, and data analysis, are presented in Section 4. In Section 5, we report our findings related to the effectiveness of the module and the students' experiences with it. A brief discussion on the results and limitations of our module is presented in Section 6. Finally, we end with our conclusions and planned future work in Section 7.

2 Literature Review

The Computer Science discipline has the highest number of academic misconduct cases when compared to any other discipline [6]. However, it is not certain whether this is due to 1) truly higher rates of dishonesty; 2) the existence / use of more detection tools in the field; or 3) the nature of solutions in this field, especially to programming problems (i.e., there may only be a few efficient ways to solve a given problem) [6]. A recent study examined how academic integrity and teaching computer ethics have evolved in the CS discipline over the past 50 years and found that interest in the topic only spiked around 2017-2018, despite the topics being explored to some extent in the mid-1970s, 1980s, 1990s, and 2000s [7].

Researchers have addressed the issue of academic misconduct in the CS discipline in a variety of ways. One approach is the creation of CS specific policies to address the unique nature of work in the discipline, which is often not covered by institution level policies for student conduct. For example, a study proposed a model for developing and implementing an academic ethics policy (which encompasses academic integrity) that specifically addresses the challenges imposed by information technology, through evidence-based pedagogical practices in computer science and engineering [8]. Another approach is the development / enhancement of plagiarism detection tools for CS. For example, a study developed a tool that is able to detect academic misconduct in programs that only contain a few lines of code more accurately than traditional software plagiarism detection tools like MOSS and TMOSS [9].

Malan, Yu and Lloyd in their study introduced a 'regret clause' in their syllabus that gave students 72 hours to come forward and accept their dishonest behaviour [10]. As a result, many students declared their misconduct (some of whom were not identified using plagiarism detection tools),

which then led instructors to educate their students and provide them with resources so that they would not repeat similar behavior in the future. In effect, this technique provided a learning opportunity for students instead of penalizing them right away.

Sheard et al. in their national study interviewed 30 CS educators from 25 universities and found that educators utilized a variety of strategies for reducing academic misconduct in introductory programming courses [5]. Strategies included education; empowerment; discouraging cheating (e.g., more awareness of potential consequences, making student work visible, etc.); reducing the benefits of cheating (e.g., low stakes assessments); and making cheating difficult (e.g., individualizing assessment). Education constitutes teaching students about academic integrity and providing them with relevant resources and tools. Empowerment is about supporting students, building relationships with them, and focusing on learning in contrast to grades, which in turn leads to a reduction in the chance that students would cheat. The authors point out that these strategies, and to some extent 'discouraging cheating', have a more positive focus and aim to create a learning environment in which students have less need or desire to cheat. Moreover, with these strategies, while instructors have the responsibility of informing students about academic integrity, students also have a responsibility not to cheat. This approach can help students learn to behave with integrity in contrast to approaches where instructors have the sole responsibility of stopping misconduct, even though those approaches are still needed.

Stepp and Simon in their study asked 112 students in a second programming course to invent scenarios regarding 'appropriate' collaboration practices between students [11]. Their analysis found that student responses included scenarios with inappropriate behaviours involving code and information sharing. This shows that students are not always aware of what constitutes academic misconduct, especially in the introductory programming courses.

Overall, our review of literature in this area and our own experiences helped us recognize the importance of providing more intentional and concrete avenues to help students clearly understand scenarios / actions that may be viewed as AInt violations and provide them with resources to help them avoid misconduct. Although we have a university-wide policy on student conduct and instructor-specific course policies, we observe that academic integrity cases are rising in the CS program of UNC Charlotte . To address this issue, our study focuses on designing and implementing a learning module on Academic Integrity that helps to educate and empower students about academic misconduct, especially in the context of the CS discipline.

3 Academic Integrity (AInt) Module

Our AInt module is targeted towards CS students. The specific goals of our module are as follows.

- Increase student awareness about academic misconduct.
- Inform students about the potential consequences of academic misconduct.
- Educate students about strategies and resources to avoid academic misconduct.
- Incorporate scenarios and information specifically relevant to CS.

In this section, we first present the steps taken to design the module and then explain the content of the module.

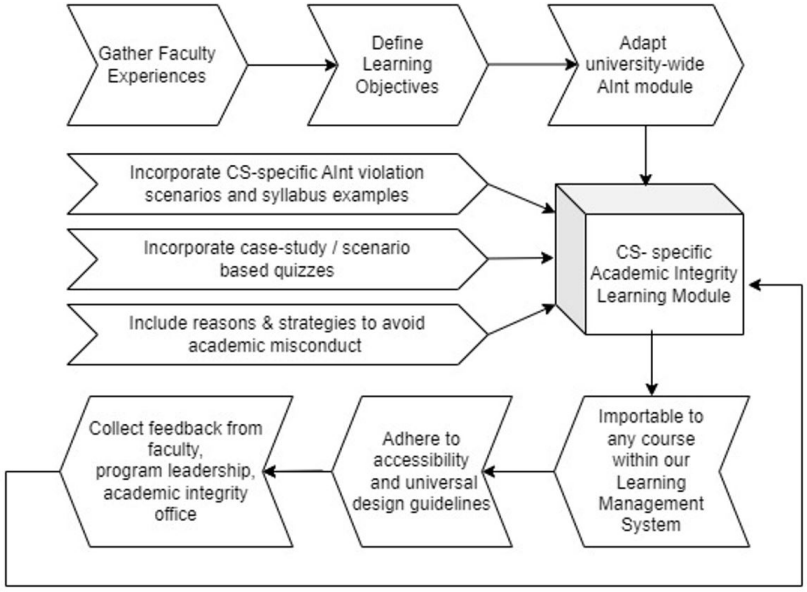

Figure 1: Academic Integrity Module Design Process

3.1 Module Design

We employed the following guidelines and process for our AInt module design (also depicted in Figure 1).

1. We gathered faculty experiences with AInt violations in their classes and collected data on the types of AInt violation scenarios they encounter, strategies they use to mitigate AInt violations in their courses, and course policies they have related to academic integrity.
2. We articulated learning objectives, sought feedback from faculty members to refine the objectives, and eventually came up with three objectives.
3. We reused and adapted content from a university-wide AInt module to avoid recreating existing content, especially related to our university's policies related to academic misconduct and types of violations as defined by our university.
4. We incorporated AInt violation scenario and syllabus examples from CS courses in an effort to make our module more relevant, accessible, and useful to our students.
5. We developed multiple quizzes with case-study / scenario-based questions and automatic feedback to help students think more deeply about what is and is not an AInt violation.
6. We included reasons to avoid academic misconduct by explaining potential consequences and provide practical strategies to avoid misconduct.
7. We designed a self-paced, online module that can be completed in just 1.5 to 2 hours.

8. We created the module within our Learning Management System for easy import into any CS course.
9. We ensured that the module content meets accessibility and universal design guidelines [12, 13].
10. We consulted with faculty, CS program leadership, and the office that handles academic integrity issues at UNC Charlotte to get feedback and improved our module based on the feedback.

3.2 Module Content

Figure 2 shows the overall layout of our module. The module begins with a brief overview of what academic integrity is, why it is important, and the module objectives. Our module has three stated learning objectives, namely, students should be able to: a) recognize misconduct in academic scenarios, b) recognize the consequences of academic misconduct, and c) recall strategies and resources to avoid academic misconduct.

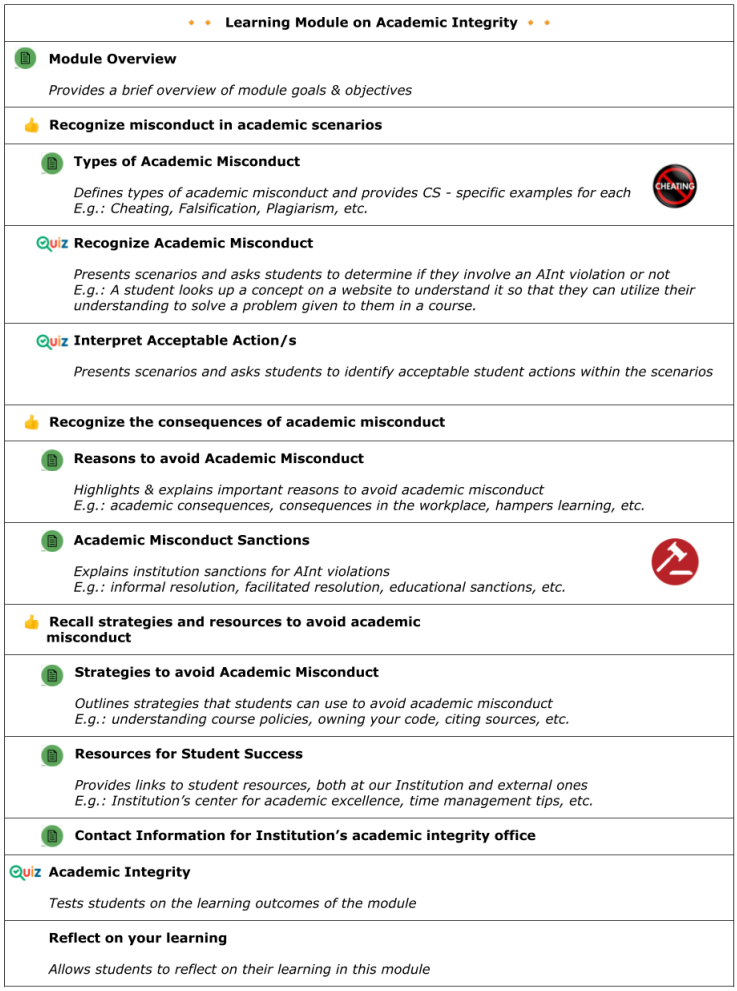

Figure 2: Academic Integrity Module Content

To meet the first learning objective, our module presents the different types of academic misconduct defined by UNC Charlotte , including Cheating, Falsification, Plagiarism, etc. In addition to defining each type of misconduct, our module provides CS-specific examples for each. For instance, under *Plagiarism*, we provide the following scenario: "Using code for a function / method written by someone else to add a feature to one's software application, without citing / mentioning the source." We assess students' understanding of this content by including: a) a quiz that presents CS-specific academic scenarios to students and asks them to determine whether or not that would constitute an AInt violation; and b) a quiz that presents anonymized case studies curated from scenarios encountered by faculty in our CS program in the past and asks students to identify acceptable student actions from a list of potential actions. A few example academic misconduct scenarios from our quiz that may be encountered in CS courses are listed below:

- A student copies program code from an online website and submits it as their own.
- A student cites an authorized resource X (e.g., a W3schools tutorial) in a course submission for which they actually used an unauthorized resource Y (e.g., CourseHero / Chegg).
- Students in a course team share the code for an assignment that students were required to work on independently.

To meet the second learning objective of helping students recognize the consequences of academic misconduct, our module discusses important reasons to avoid misconduct. For example, it explains how academic misconduct could hamper students' learning, devalue others' hard work, and result in potential consequences during their degree program and in their (future) workplace, etc. The module also describes the various sanctions that may apply to students who violate UNC Charlotte 's policies related to academic misconduct. In addition to an official record of the violations, some of the sanctions / penalties that may be imposed according to UNC Charlotte 's policies are a reduced course grade, resubmission of an academic exercise, suspension, etc.

Our module's last objective is for students to be able to recall strategies and resources to avoid academic misconduct. To achieve this objective, we provide practical strategies on how to avoid academic misconduct. Example strategies include understanding UNC Charlotte 's policies about academic integrity, the policies of specific courses that define what is and is not allowed, what online sources are acceptable to consult and how they can be cited, how to document code, and how to ask for assistance. We also present strategies that students can use for taking an exam, writing papers, and working with others. In addition to these strategies, we provide links to several resources that students can use to be successful, both resources within UNC Charlotte where students can get help, including our writing resource center, library, center for academic excellence, etc., and also external resources, including tips for note-taking, time management, learning skills development, etc. Lastly, we include the contact information for the office that manages academic integrity and student conduct-related issues at UNC Charlotte .

Our module concludes with two additional items, namely a quiz that tests students' understanding of the overall module to see whether they meet the module objectives and a survey with open-ended questions to help students reflect on their learning and experiences with the module, the second of which we discuss in more detail in the next section. Below are example quiz questions, with the correct answer choice italicized, relating to each of our three learning

objectives.

- *Question related to Objective 1:* One student gives work to another, knowing that the student is going to copy the work directly and submit it for credit. Who has committed an academic violation? *Answer choices (choose one): (1) Both the student that copied and the student that provided the material.* (2) The student that provided the material. (3) The student that copied the material. (4) Neither student.
- *Question related to Objective 2:* What are some good strategies that you could employ to avoid (accidental) violations of academic integrity? *Answer choices (choose multiple): (1) Understanding your course policies.* (2) Working on a UNC Charlotte lab computer and not logging off. *(3) Managing your time well. (4) Seeking help from an authorized resource (e.g., course instructor, TA, etc.).*
- *Question related to Objective 3:* Which of the following potential academic consequences could you face if you are found to violate academic integrity? *Answer choices (choose one):* (1) Degree revocation. (2) Expulsion from institution. (3) Reduced course grade. *(4) All of the above*.

4 Study Method

The aims of our Institutional Review Board (IRB) approved study are to investigate: 1) how effective our AInt module is in making students aware of information and issues related to academic misconduct; and 2) what the overall student experiences with our module are. In the remainder of this section, we present details about our strategies for deployment, data collection, and analysis.

4.1 Module Deployment

We deployed our AInt module in six core undergraduate courses, a teaching assistant training course, and a graduate-level teaching certificate course within the CS program at UNC Charlotte in the Spring and Fall 2021 semesters. Course instructors had the flexibility to incorporate the module at any time during the semester. As students progressed through the core courses within the CS program in these two semesters, they may have encountered this module multiple times. This was a deliberate effort to stress the importance of academic integrity and reinforce students' learning and understanding of academic misconduct in the CS field.

4.2 Data Collection

We collected data through a short, voluntary, anonymous, and online reflection survey presented to students at the end of the AInt module. The survey asks for information required for consent and information about the course in which students encounter the AInt module. The survey then asks students the following three questions:

- What information in this module were you not aware of before completing the module?
- What parts of this module were the most helpful to you?

- Please provide any additional feedback / comments that you may have.

We used the responses to the first two questions to meet our first goal of understanding our module's effectiveness in making students aware of information and issues related to academic misconduct. We used the responses to the last open-ended question to gauge overall student experiences with our module.

4.3 Data Analysis

We conducted a thematic analysis on the qualitative data collected in our study [14]. Thematic analysis is appropriate because we sought to understand the range of experiences students had with our module [15]. To start with, we (the authors of this paper) independently read student responses to familiarize ourselves with the data. We then individually used an inductive approach to find codes that identify which portions of the module students were not aware of before completing the module. In addition, we noted which parts of the module were most helpful to students. Following that, we discussed the resulting codes, looked for patterns among the codes, and reached a consensus about the categories that most accurately captured each of the codes. We then grouped these categories by similarity and identified themes for each grouping. Finally, we reviewed the themes and compared them once again with the student responses to assess whether they portrayed an accurate representation of students' experiences with our AInt module.

5 Results

In this section, we provide details about the students participating in our study, discuss results that demonstrate the effectiveness of our AInt module in making these students aware of information and issues related to academic misconduct, and present the reported experiences of the students after completing our module.

5.1 Study Participants

In Spring 2021, 10 students consented to have their responses collected and analyzed[1]. In Fall 2021, 288 students responded to the reflection survey, among which 222 students consented to the study and provided responses that related to our module (as opposed to a few responses that turned out to be related to the course in which they encountered our module, but had nothing to do with our module). In total, we analyzed 232 responses. Most of the responses were from undergraduate CS students, since we deployed our module in six undergraduate CS courses (including introductory programming, data structures and logic & algorithms). A few responses were from a teaching assistant training course that included both undergraduate and graduate CS students and from a teaching seminar for doctoral students.

[1]We received 314 responses to our reflection survey. However, our IRB was approved after the end of the semester, so we were only able to get consent from 10 respondents.

5.2 Effectiveness of the AInt Learning Module

To demonstrate the effectiveness of our AInt module in making students aware of information related to academic integrity, we analyzed students' responses to the first two questions in our survey, namely, 'What information in this module were you not aware of before completing the module?', and 'What parts of this module were the most helpful to you?'. We found that responses to both these questions mentioned several of the same categories, and hence, the same set of themes emerged from the responses to both these questions. Table 1 shows the categories and themes that emerged from our analysis. The first column shows the three overall themes that emerged, namely definitions and examples of AInt violations, resources and strategies, and consequences and responsibilities. The second column shows the categories that were grouped together to form each of the three themes. The third column of Table 1 shows the percentage of students who identified a given category of information as something they were unaware of prior to completing our module. The fourth column shows the percentage of students who identified a given category as the one that they found to be most helpful to them. We would like to note that most students highlighted *one* category they were particularly unaware of, and *one* category that was most useful to them rather than listing multiple categories. So, the percentages for each category are not large. Our primary goal here is to identify specific categories that students were unaware of and/or found particularly helpful. We briefly describe each of the three themes next.

Table 1: Effectiveness of the Learning Module on Academic Integrity (AInt)

Themes	**Categories**	**% of students unaware of of information in category**	**% of students who find category MOST helpful**
Definitions and examples	Types of AInt violations	9.48	9.91
	Scenarios not considered as AInt violations	8.19	2.16
	Scenarios considered as AInt violations	21.12	6.46
	List of examples or scenarios	0.0	0.86
	Misuse of academic materials	0.43	0.43
	Scenarios specific to CS / programming	0.0	1.72
Resources and strategies	Resources for student success	2.89	6.03
	Resources for citing / using external material	6.47	5.17
	Strategies to avoid academic misconduct	3.88	5.17
Consequences and responsibilities	Potential consequences of AInt violations	10.7	2.58
	Witnessing / reporting AInt violations	3.88	5.17
	Reasons to avoid academic misconduct	0.43	1.72

Definitions and examples of AInt violations. Our results indicate that overall, students found the definitions and examples of AInt violations in the module to be valuable. Specifically, almost 28% of the students either were unaware of or found it useful to learn about scenarios that are

considered AInt violations. For example, one student said, '*The quizzes helped me judge which scenarios counted as academic integrity violations*'. A little more than 10% of students were not aware of or found the scenarios that are *not* considered AInt violations to be useful. Around 20% of the students were either not familiar with the definitions of different types of AInt violations or found it beneficial to learn about them. As one student mentioned, they found '*learning about falsification and cheating*' helpful. In addition, some students also mentioned that the list of scenarios, misuse of academic materials, and scenarios specific to CS/programming were helpful to know. It is to be noted that most of the scenarios / examples that we included in this module are related to CS.

Resources and strategies. Students' responses indicate that the AInt module is also effective in helping educate students about the resources and strategies that they can use to avoid academic misconduct. For instance, around 10% of the students were not aware of or found it useful to learn about resources for student success such as time management, note-taking, writing centers within the university, etc. Around 12% of the students found it beneficial to learn about or were unfamiliar with how to cite existing work, whether it is appropriate to use a particular academic material or external resource, be it a person or material, and how to use it. For example, one student mentioned that they were not aware of '*how to properly submit work when working with a partner*'. Additionally, around 9% of the students indicated that they found the section on '*strategies to avoid misconduct*' in the module to be very useful or new to them. Some of these strategies include: backing up work regularly, owning your code, and understanding course policies.

Consequences and Responsibilities. Our analysis indicates that the AInt module is effective in informing students about the potential consequences of AInt violations, student reporting responsibilities, and the reasons to avoid academic misconduct. Around 13% of the students indicated the consequences of AInt violation, among whom one mentioned that they were unaware that '*if the misconduct is bad enough, you can have your degree revoked/punishment for misconduct is still an option after graduation*'. Around 8% of the students found it helpful to learn about or were not aware of the responsibilities of reporting academic misconduct that they may witness. A few students also highlighted that the section on reasons to avoid academic misconduct was beneficial to them, including one student who stated that they found it useful to realize that '*cheating or violating academic integrity is disrespectful to the owner or teacher who is trying to help learn*'.

In addition to the data shown in Table 1 and described above, 24.5% of the students indicated that they found the *entire* module to be useful and/or that *all* of the content was new to them. In contrast, 24.13% indicated that they were already aware of all the content prior to completing this module. Only 5.17% of the students indicated that they did not find anything helpful from this module.

5.3 Experiences form the AInt Learning Module

We analyzed students' responses to the third question in our survey, namely 'Please provide any additional feedback / comments that you may have.' to gain a deeper understanding of their overall experiences with our AInt module and to make improvements to the module. In general,

students found the module to be very useful and appreciated its introduction early in their degree programs. In this context, one student stated, '*I found this module very helpful in terms of awareness and setting my actions for success in this course*'. Students said the module helped them detect when academic misconduct has occurred, reaffirm their knowledge about academic misconduct, brush up on policies related to academic integrity, and learn how to avoid them. For instance, one student said, '*I believe it is good to let us know about the rules of academic conduct ahead of time instead of waiting for people to make mistakes*', while another student mentioned, '*I think this module was important because sometimes students may not realize what could be considered academic misconduct*'. Students also emphasized the importance and significance of including relevant examples, as one stated, '*using real-world scenarios helped me understand what constitutes academic dishonesty*'.

Students also provided several recommendations to improve the module. Some of the suggestions include reviewing the quiz answer choices to remove ambiguity, adding more quiz questions, adding more examples, improving the navigation of the content, adding more resources for citing external work appropriately, and adding a discussion on the severity of penalties. Based on these suggestions, we have updated the module for deployment in Fall 2022.

6 Discussion

6.1 Study Inferences

Overall, we find from our data analysis that most students identify at least some portions of our AInt module as either new or useful to them or both. Furthermore, *each* component of our AInt module was identified as new and/or useful by at least some students. This demonstrates that our module is effective in making students aware of or increasing students' awareness of information related to academic integrity, which is an encouraging result. Comments from students (including some listed in the previous section) indicate that they appreciated having gone through this module so that they could learn more about academic integrity, read university and course policies more carefully and use their knowledge to avoid inadvertently committing a violation. This aligns with our overall vision of establishing a culture of awareness, mitigation and a growth mindset towards academic integrity within our program. Students especially liked having specific scenarios / examples to help them understand policies around academic misconduct and their implications better. A few students explicitly mentioned that they liked having CS-specific scenarios. However, we would like to note that a large number of our scenarios were CS-specific, so most of the positive comments about the scenarios presented in our module relate to our CS-specific approach. Another key feedback we got is that students liked seeing concrete, practical strategies that they could use to avoid academic misconduct.

6.2 Limitations and Challenges

This study has a few limitations. First, students from the different courses self-selected into the study by consenting, and findings may be influenced by their characteristics [16]. Second, the study took place in different semesters during the pandemic, which might have affected the rate of participation, although we got a sufficient number of responses to allow meaningful analysis.

Third, this module was added on top of the existing content of the courses in which it was deployed. So, we wanted to keep our student reflection survey simple by including just three questions, which may have limited our findings. Fourth, some students might have seen this module twice in two consecutive semesters, which we intentionally did in order to raise awareness about academic integrity. However, this may have affected how those students answered the survey, since some students mentioned that they were aware of everything in the module, although we hope that it was largely addressed by the fact that there were a few months between the two surveys.

A major challenge with evaluating our module is that we do not have any baseline data about the number of AInt violations that occurred in the specific courses where we have deployed our module prior to the deployment of the module. Recently, UNC Charlotte has begun collecting course-level data related to academic integrity violations. However, due to FERPA and student privacy regulations, they are unable to share detailed data with researchers. Moreover, based on anecdotal information, we find that faculty do not consistently report all academic integrity violations due to the time-consuming nature of the process, so reported numbers may not accurately reflect the actual number of violations. Finally, even if we were to get access to accurate numbers, it is hard to make a claim that the reduction (if any) in the number of academic integrity violations is caused by our module, since there are numerous factors that may influence the occurrence of academic integrity violations.

7 Conclusions and Future Work

In this paper, we present the design and evaluation of a standalone, self-paced, online academic integrity learning module to help CS students increase their awareness about academic misconduct, inform them about the potential consequences of academic misconduct, educate them about strategies and resources to avoid academic misconduct, and present scenarios and information specifically relevant to CS. Our results, after deploying the module in the six core undergraduate courses, a teaching assistant training course, and a graduate level teaching certificate course, show that our module was effective in achieving these goals. We also improved the module content based on students' feedback. We expect that our AInt module, its design guidelines, and implementation efforts will help in the development and evaluation of similar program-specific AInt learning modules that can mitigate AInt violations. If any instructor / practitioner would like to adapt this specific module, they can contact the authors of this paper.

The success of the implementation has led our CS program leadership to recommend expanding its deployment to other courses in the program, including upper-level undergraduate and graduate CS courses. As part of ongoing work, we presented our module to all faculty who teach in the CS program at UNC Charlotte . In Spring 2023, we are deploying the module across 21 distinct CS courses, including both undergraduate and graduate level courses (with most courses having multiple sections), and in a graduate student orientation for one of our programs. We recently received IRB approval for a follow-up study that we will conduct through these deployments. For this study, we have updated the survey to collect more detailed information from students to evaluate the effectiveness of the module. We include multiple Likert-scale questions to get more

specific feedback based on the themes / categories identified in our current study. We also include questions to collect student feedback on our module and student perspectives about why academic integrity violations occur. We expect that students will encounter this module (or adaptations of it) in multiple courses. This will emphasize and reinforce the importance of academic integrity and nurture our envisioned culture.

In future work, to make our module even more relevant to CS students, we plan to collect more CS-specific scenarios from the students' experiences and incorporate them into the module. We also plan to collect further feedback on the module from faculty who are deploying the module. Finally, we plan to create a version of this module targeted at CS faculty members and teaching assistants since it is important for increasing their awareness about academic misconduct as well.

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