Characterizing computing students' help-seeking behavior

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ABSTRACT

Academic help-seeking is a vital part of students' self-regulated learning strategies. Computing students' help-seeking horizon has seen several transformations in the past 15 years such that past findings no longer capture current computing students' learning environment, motivating a dedicated study on computing students' help-seeking behavior. Building on extant works that on a single course or help source, my research investigates computing students' help-seeking behavior across different contexts. By analyzing students' help-seeking records, I found substantial individual differences in the kind of help sought in office hours. Other preliminary results include correlational analysis on students' help-seeking metrics and pattern analysis on students help-seeking event sequences.

1 MOTIVATION

Academic help-seeking is a vital part of students' self-regulated learning strategies [7] and is beneficial to students' academic achievement [3]. Students' academic help-seeking behavior has been studied for many decades in the general post-secondary context [10], mostly from the educational psychology perspective with a focus on the social aspect of help-seeking. However, computing students' help-seeking horizon has seen several transformations in the past 15 years: (1) the booming growth of enrollment and class sizes in computing fields has mandated the adoption of educational technology, enabling fine-grained data collection; (2) large-scale computing classes now heavily rely on undergraduate teaching assistants (UTAs) [11] to provide help, which is not well-captured by the traditional *formal vs. informal* dichotomy of help sources [10]; (3) the covid-19 global pandemic necessitated remote help-seeking, lowering the time/space barriers for students to seek synchronous help; (4) the rise of autograders (and recently, large language models) provides students an accessible alternative to obtain constructive feedback that otherwise might need to come from social interaction.

As a result, past findings no longer capture current computing students' learning environment, motivating a dedicated study

on computing students' help-seeking behavior. Building on recent works that mostly focus on a single course, a single help source/platform, or a single snapshot in students' learning paths, my research seeks to investigate computing students' help-seeking behavior with cross-(course)-context, cross-platform, and longitudinal studies. By understanding *how* and *why* computing students seek help in different contexts, these studies can help inform better resource integration/allocation in large-scale computing classes and curriculums to support computing students' learning.

2 BACKGROUND AND LITERATURE REVIEW

Academic help-seeking is a metacognitive behavior grounded in self-regulated learning [3, 7, 9, 10]. I seek to shed light on four of the eight stages of help-seeking process outlined by Karabenick and Dembo [7]: *decide whether to seek help - decide on the type of help - decide on whom to ask - solicit help*, as well as compare the findings across different contexts to understand how this process is learned, shaped, and refined in different stages of students' academic journeys. Classical frameworks on the *type* of help resources focus on the *formal vs. informal* dichotomy [10] that separates help given by instructors and classmates, with only formal help being found significantly correlated with students' achievement [3]. However, UTAs are not entirely formal nor entirely informal, and few studies were able to quantify the efficacy of UTA help in computing classes.

The adoption of class forums and office hours queue management applications [13] enabled data-driven studies on computing students' social help-seeking behavior. Existing works on these help resources reported benchmark statistics such as wait time, interaction length, and number of visits per student in their office hours [1, 4, 5, 8], while also categorizing the kind of help students seek [5, 8, 12, 14, 17]. Other works investigated the relationship between identities and help-seeking behavior [4, 15, 16], with the only consistent finding being that female students are more likely (and frequently) to seek help than male. Relatively few works [1, 2, 18] looked into multiple resources at a time or analyzed students' preferences of all available resources.

Most of the existing works suffer from the following limitations: (1) Focus on an entire class without investigating potential differences among individual students, and therefore are unable to identify various "types" of different help-seeking behavior; (2) Focus on a single help resource without taking into account how students consciously utilize multiple resources simultaneously or *transition* between resources of different modalities (social vs. non-social, async. vs. synchronous); (3) Focus on a single snapshot of students' help-seeking behavior (in a single course at a specific stage in the students' pathway), and therefore do not shed light on how students acquire and refine their help-seeking strategies, as well as whether/how they adapt in different course contexts. These issues motivate my research agenda below.

3 KEY RESEARCH QUESTIONS

My research aims to tackle the following key research questions:

- **Individual differences**. What are the individual differences in (1) the *kind of help* students seek from each help resource, (2) the help resources they consciously use/not use, and (3) the order of usage of help resources among the used ones? Can we identify personas or types of students? What external factors influence students' individual differences?
- **Multi-resource behavioral patterns**. How do students' usage rate/frequency of one or more specific help resource(s) impact their usage rate/frequency of other help resource(s)? How do students use one or more specific help resource(s) immediately before, during, or immediately after using other help resource(s)? How do availability of a specific help resource influence students' usage of another?
- **Different Contexts.** How, if at all, do students' *help-seeking characteristics* (e.g., usage rate/frequency of each resource, preference of resource, and ordering of resource) and *kind of help needed* change across different instructional contexts?
- **Longitudinal studies**. How, if at all, do students' help-seeking characteristics evolve along their experience in the curriculum? Do students' individual differences (i.e., their revealed types) remain consistent throughout their learning paths, and why? How, if at all, do students' help-seeking behavior in a single course (as aggregated cohorts) change over time, and what factors influence such changes?

4 METHODS AND DATA COLLECTION

Most of the data used is/will be collected at a medium-size, research-oriented, private university in south-eastern US that follows the semester system. The scope of data collection is expected to cover all core courses in the CS major curriculum as well as a popular elective. The data being collected includes (1) Timestamps of every office hour interaction, identities of the student and the TA/instructor, and responses to the short surveys in the queueing app; (2) Contents on class forums, including the title and category of each thread as well as the text, timestamp, and user identity of each post/response; (3) Timestamps, scores, and feedback of each submission of an autograded programming assignment; (4) Usage preferences, frequencies, and order of usage of help resources; and (5) Demographics: race/ethnicity, gender, major, year, and prior experience.

The *how* parts of the key research questions will be answered via visualization of metrics, hypotheses testing on interaction of metrics, and exploratory analysis such as clustering and pattern mining (to find emergent types of behavior or frequent help-seeking patterns). The insights found by such analysis would motivate mixed-method studies that use qualitative interview and/or recording analysis to inform *why* parts of the key research questions.

5 CURRENT PROGRESS

My first attempt at tackling the individual differences [8] analyzed office hour interactions in 7 offerings across two courses associated with self-reported kind of help categorized by course-specific taxonomies [6, 14]. We found that most students in both courses have a "primary phase" in their problem-solving processes that account for a majority of their office hour interactions. As a consequence,

the course-level phase distributions of both courses do not well-represent the individual students, and instead more capture the distributions of the different *types* of students.

My ongoing work analyzes two social help resources (office hours and class forums) and two kinds of autograder records in more courses/offerings by fusing the datasets to construct students' chronological help-seeking event sequences at the *assignment-level*. Highlights include: (1) the social resources are neither completely complementary nor completely substitutable for the students in that neither positive nor negative correlations were found between the usage *frequencies* even after controlling for whether office hours were available at the time when students used class forums; (2) social help-seeking attempts often led to measureable progress in the autograders; (3) a substantial portion of students attempt the autograder *during* office hour interactions, and the portion is found to be significantly correlated with the design and responsiveness of the autograders; (4) students seek asynchronous help on the class forums when synchronous office hours help was available.

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