Exploring Novice Programmers' Homework Practices: Initial Observations of Information Seeking Behaviors

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ABSTRACT

There are many factors that contribute to the success of students learning to code. For students in introductory programming classes, one source of complexity is the availability of a wide variety of information sources. In this paper, we report observations of students seeking information when working on programming homework assignments. Our data was collected from a think-aloud protocol embedded into semi-structured, individual interviews with students enrolled in a CS1 course. We analyze our data through the lens of information seeking behavior. We observed students using multiple sources of information, including referring back to course materials and searching for information online, and discussing how they sought help from friends, classmates, and family members. Herein, we discuss implications for teaching and future research based on our initial observations. For example, instructors could consider designing early homework assignments that would prompt students to seek information and follow up this assignment with an in-class discussion about homework strategies. Future research could investigate the mechanisms by which students progress from haphazard to more strategic information seeking behaviors.

CCS CONCEPTS

• **Social and professional topics** → **Computing education**; **Computer science education**; **CS1**; *Student assessment*.

KEYWORDS

Computer Science Education; Information Seeking Behavior; CS1; Homework.

ACM Reference Format:
Silvia Muller, Monica Babeş-Vroman, Mary Emenike, and Thu D. Nguyen. 2020. Exploring Novice Programmers' Homework Practices: Initial Observations of Information Seeking Behaviors. In *The 51st ACM Technical Symposium on Computer Science Education (SIGCSE'20), March 11–14, 2020, Portland, OR, USA.* ACM, New York, NY, USA, 7 pages. https://doi.org/10.1145/3328778.3366885

SIGCSE '20, March 11–14, 2020, Portland, OR, USA

ACM ISBN 978-1-4503-6793-6/20/03…$15.00
https://doi.org/10.1145/3328778.3366885

1 INTRODUCTION

Universities are seeing tremendous enrollment growth in computing classes and are faced with the challenge of teaching programming at scale [23]. As part of the effort to provide quality instruction to a large number of students in introductory computer science courses, it can be helpful to apply instructional design best practices and consider the larger context of the overall learning environment in the course and in the Computer Science major. The components of a course–lecture, recitation, homework, and exams–do not exist in isolation. Rather, these components are designed to complement and supplement each other as students interact with them in various ways and at various times over a semester. The interactions (and potential interactions) of these course components can add to the cognitive challenges already present in coding tasks and programming assignments.

As part of a larger investigation related to the broad research question, "What are the experiences of students in the CS1 course as they complete homework assignments and submit them through an autograding system?", a more specific research question emerged as we started interviewing students: *What are the sources of information that students use when they get "stuck" while working on homework assignments in a CS1 course and how do they navigate multiple sources of information?*

Homework is typically viewed as a tool to help students gain a better understanding of the course material and how to use it to succeed in the class [18, 26]. It remains an essential component of beginning programming courses because "goal-directed practice coupled with targeted feedback are critical to learning" [1], and programming assignments are the tools of choice for providing this hands-on practice. From the students' perspective, time spent doing homework represents a large portion of their exposure to the material of the class, and, ideally, it would be the largest portion of time spent on programming tasks.

Traditionally, homework is an aspect of the course that instructors have very little opportunity to observe, much less direct the way in which students engage with the assigned problems. Consequently, instructors are left wondering whether students have a clear understanding of their information needs when doing homework or not. When students do not know the next step for a homework assignment, they must work out how to find that information [28]. How do students understand their information needs as they are working to solve programming problems? This

is a question that has received attention in the field of information science as information seeking behavior and numerous theoretical frameworks have been used to explain these search patterns in low-guidance settings including Dervin's theory of sense-making [12, 31] and Bates' "berrypicking" model [20].

The process of seeking out information potentially involves humans available to answer questions and/or information resources including materials provided as part of the course and those external to the course (e.g. information on the Web). Now, more than ever before, information is available online both through curated websites for support and to teach programming, as well as in open-contributor/open-access forums where anyone can post their code (e.g., GitHub [16]) or homework solutions (e.g., Chegg [8], Slader [33]). It is important to understand how students navigate this expanding information space, especially because it is likely that students in a CS1 course have varying degrees of expertise and comfort navigating such resources. It is also important to understand how students use the material they find–whether as a thinking aid, as a piece of code they can copy into their program, or as a pattern they can imitate without much thinking. Ultimately, success or failure with this navigation and utilization process has the potential to influence the students' meta-cognitive interpretation of how they are doing with their task. To the best of our knowledge, information seeking behaviors have not been fully examined as a potential source of problems for CS1 students engaged in the challenging work of learning programming.

To investigate the CS1 students' experiences working on homework assignments, we designed individual, semi-structured interviews with students enrolled in our CS1 course. During the interview, students participated in a think-aloud format where they worked on a homework assignment and were prompted to describe in real time what they were doing and why they were doing it. During the course of the interviews, we noticed that students were approaching the need for information in different ways, and, therefore, the interviewer started to specifically ask participants about how they searched for information and how they decided between potential sources of information. As the interviews progressed, we saw that the information seeking behaviors of the students engaged with their homework were more varied (including searching through course materials and external online resources), and, in some cases, more at odds with the purpose of the programming assignment than desired.

2 RELATED WORK

Computer Science Education is a growing field. A comprehensive literature survey classified the existing computing education research efforts by curricula, pedagogy, and programming languages [24]. Another review discussed tools used in teaching CS [13].

Observing Students' Homework Processes: Instructors typically do not watch students working on their assignments or even have the opportunity to do so. To bring the instructor into the homework process, systems such as Pensieve [41] and OSBLE+ [7] were developed. While these systems help instructors see what questions students have and allow them to give answers, the larger questions on how students actually behave and how instructors should use this information to design courses and course materials still exist and should be explored. For introductory computing students, research that is closest to ours explores why novice students seek or avoid asking for help while programming and how they ask for help differently when working with another person compared to a computer tutor [25]. In a related study, a Markov chain was built to predict students' help seeking strategies in an intelligent tutoring system [38]. Our work differs from these because we were interested in students' overall information seeking behaviors: when they use online resources compared to when they ask humans for help and how they use online information, class material, etc.

Information Seeking Behaviors: Researchers have studied student information seeking behaviors in general [32, 36] and in specific fields such as math [30], biology [6] and programming [19]. While the latter work and others [5, 14, 22, 40] focused on information sources available to students, we became interested in understanding how and why students seek information when doing their programming homework. We were also interested in exploring how students think about and weave together course material prepared for them with other available information sources, such as material available on the Internet. Our area of investigation involves discussions of topics traditionally explored in the field of information science [3].

Search Engines and Homework: We found that some CS1 students used search engines to find answers when they were stuck on their programming assignment. Other work studying student information seeking behavior has looked at the factors involved in selection of help sources [15] and why search tasks fail [21]. A related paper addressed the concern that search systems deter the development of information literacy in those who use them [34], and they proposed ways to change search systems to enhance the creation of "context literacy". Our work is focused on identifying CS1 students' information seeking behaviors beyond the use of search engines.

3 RESEARCH DESIGN, METHODS, AND CONTEXT

Individual interviews were conducted with 14 CS1 students. The 30-100 minute interviews were audio recorded, and students' work was captured using Morae's screen capture feature [37]. We designed our overarching qualitative study using a phenomenological research methodology [4, 11]. Phenomenology focuses on people (in this case, CS1 students) experiencing a specific phenomenon (in this case, working on programming assignments). Audio from the interviews were transcribed verbatim, and the transcripts were analyzed [17, 35]. While analyzing the transcripts using a constant comparison method with emergent codes, the interviewer and two members of the research team identified instances that illustrated the variety of information seeking behaviors observed in the interviews. Data from this sample of participants is not sufficient to make general claims about the entire population of students in the course. However, these data can serve to generate hypotheses about the experience of students as they work on homework assignments that could be explored in future work. This study was approved by Rutgers' Institutional Review Board.

When outlining the history of the field of information science, Wilson [39] defined *information behavior* as encompassing all "human behavior in relation to sources and channels of information,

including both active and passive information seeking, and information use" (p. 49). In computer science education, *information behavior* would include reading course materials, listening to a lecture, discussing assignments with classmates, connecting a basic programming concept to an idea in other courses, or reinforcing ideas about programming by writing programs for homework. A specific subset of *information behavior* is *information seeking behavior*, which occurs when individuals recognize a need to know something necessary to solve a problem or to make progress towards a goal [39]. In computer science education, *information seeking behavior* would include a student searching for a piece of code or referring back to an example set of code presented in lecture slides, but it would not include a student trying to remember the specific syntax needed to solve a coding problem or plotting out the logical steps needed to control the flow of a program. Given its broad definition, it was inevitable that all students would engage in information behavior during the interviews; what interested us was the range of information sources they engaged with, how they engaged with the information sources, how they used the information, and what is the cognitive process behind the students' information seeking behaviors.

Course Context: This study was conducted at Rutgers University, Computer Science Department. The CS1 course enrolls approximately 1,200 students in the fall semester and another 600 in the spring semester. Students intending to major or minor in CS make up the majority of the students in the course (~70%), although other students enroll in CS1 because of general interest or to fulfill a requirement. The course contains 11 CodeLab [9] assignments, 12 programming assignments automatically graded by Autolab [2], two written assignments, two written exams, and a written final exam. CodeLab assignments are interactive short programming exercises with unlimited tries until the due date. Assignments graded by Autolab involve writing longer programs to satisfy a problem specification with limited attempts. Learning Assistance conduct small recitations focused on problem solving and interaction. Students also have access to a community space staffed with lab assistants who are available to answer questions.

Research Participants: The interview participants (N=14, Table 1) over-represent both female students (43%) and first-year students (71%) in the course (which were 25% and 64%, respectively).

4 DATA AND RESULTS

When we observed students working on homework problems during the interviews, it became clear that students were interacting with a wide range of information sources during this task. These ranged from materials that are deliberately constructed for student use in the class (such as lecture notes, homework prompts, and other course materials) to small information cues such as hint systems or color coding features in their programming environment.

Although students were not afforded the opportunity to ask for outside help during the think-aloud interviews, they were asked about the resources they might use for different kinds of information needs they encounter while doing their homework and whether a given resource was appropriate help or not, given the context of the homework problem they were solving. In response to these questions, students mentioned learning assistants, friends also taking the class, family members with programming experience, and online forums as sources for help. It has been noted that the students' abilities to navigate multiple sources of information with varying degrees of credibility and convenience is not fully developed at this stage in their careers [29]. In the next sections we describe the information seeking behaviors we observed in the interviews.

Table 1: Interview participants. (*Considering CS; **Formerly CS)

Week	Pseudonym	Gender	Year	Intended Major
5	Amelia	Female	1st	ITI
5	Demetrius	Male	1st	CS
5	Julius	Male	1st	CS
7	Rosalind	Female	1st	CS
7	Tiberius	Male	1st	CS
8	Achilles	Male	1st	BME*
8	Miranda	Female	2nd	ITI**
8	Valentine	Female	3rd	CS
10	Juliet	Female	2st	Microbiology
10	Lear	Male	2st	CS
10	Rosencrantz	Male	1st	CS
10	William	Male	1st	CS
14	Audrey	Female	1st	CS
14	Iden	Male	1st	CS

4.1 Information Seeking Behaviors

A summary of the online information seeking behavior for each participant is provided in Table 2, along with an indication for whether the behavior was observed during the interview or discussed by the student as an activity he/she engages in while doing homework. Table 2 does not include checking the homework prompt because we expected students to engage in this behavior as part of working on programming assignments. Exemplar passages from the interviews are provided as evidence of the ways we observed students experiencing homework, engaging in information seeking behaviors, and navigating sources of information and help. Direct quotes are edited for clarity, removing some false starts and filler words such as "um" and "like".

Because students were interviewed at different times in the semester (Table1), participants worked on different homework assignments during the interviews. Earlier homework assignments appeared to be more straightforward, and students are less likely to encounter an information need when solving them. Of the participants who sought information during the interview, some dove right into writing code, only engaging in information seeking after receiving feedback from the compiler. Other students began seeking information almost immediately, which suggests that, from the beginning of the process, they thought they did not have the necessary understanding or knowledge to write the code or solve the assignment. It is difficult to say which group of students (if either) had correctly assessed their own understanding.

We observed four students directly engaging in information seeking while doing their homework. The proportion of time that three out of the four spent searching for answers online compared to working on their code was relatively small. Juliet, for example,

Table 2: Information seeking behaviors that were either observed (O) or discussed (D) during the interviews.

Student	Information Seeking Behavior
Valentine	Searched course site for sample code. (O) Discussed searching slide decks for sample code and searching websites for information. (D)
Rosalind	Searched course site for instructor's lecture notes with sample code. (O)
Juliet	Searched lecture notes for sample code. (O) Discussed searching course site for sample code. (D)
William	Searched CodeLab for sample code. (O) Searched Google for sample code. (O) Discussed using Codingbat.com for finding helpful examples. (D)
Lear	Used information search (brief mention). (D)
Rosencrantz	Used Piazza for information gathering. (D) Used GitHub. (D)
Tiberius	Sought help, but not code examples, in Piazza. (D)
Miranda	Used Piazza and other online forums for finding sample code and help. (D)
Julius	Opened internet searches for Java code. (D) Sought examples in Piazza. (D) Used GitHub. (D)
Amelia	Used open internet search for Java functions. (D)
Iden	Used open internet search for Java functions. (D) Used GitHub. (D)
Audrey	Used open Internet search for Java functions. (D) Used GitHub. (D)
Demetrius	None.
Achilles	None.

worked on a recursive method to concatenate the same text a given number of times. When she did not know what to do, she checked the homework prompt for guidance. Then, she decided she needed the syntax for a particular method and switched browser tabs to go back to the course site. After scanning through the list of available slide decks from the lectures, she opened two files and read through the materials in the second file to find relevant examples. When asked by the interviewer about other sources of sample code from the class, Juliet switched to another part of the course site that contained a code repository and identified the samples. Juliet explained why she evaluated the sample code snippets in the code repository to be less useful than the code examples in the lecture notes: *"I feel like it's more helpful to see it on a slide maybe [be]cause it has the prompt with it."* While she was searching the course site for information to solve her problem, Juliet read from a lecture slide and said, *"...this just gave me an idea."* Then, she quickly finished the homework.

In this particular stretch of the interview, Juliet searched for about four and a half minutes, and only a few seconds were spent answering the interviewer's question about sample code outside of the lecture notes. Juliet's experience with searching was fairly contained; she did not leave the course site when looking for materials and throughout the interview she seemed to have a pretty clear idea of what she was looking for and where that information was likely to be found. Rosalind and Valentine engaged in similar strategies as Juliet, and they both described also searching the course site or lecture slides for sample code. It is interesting to note that Rosalind commented that students were always aware of a vast repository of search possibilities by opening up another browser window.

Although ten participants did not directly seek information to solve the homework problem during the interview, eight of these students described a kind of low-key search they do when they need information. Four of the eight "low-key searching" students discussed making use of Piazza as a source of either sample code or helpful information. Five "low-key" students discussed using Google searches and other resources on the Internet. One student's description was inexact as to what kind of online searches he did when encountering difficulty. All of these behaviors overlap with the four students whose information seeking behavior was directly observed in the interview. Two students did not engage in, nor discuss information seeking during their interviews. Both of these students were interviewed in the fifth week of the class before the homework programming problems had increased in difficulty.

Students exhibited a number of broad patterns to engage with information sources and there are two specific patterns that could be suggestive of future directions for research in this area and potential changes to the course: what are the online sources of information that students use when needing help and how do students navigate between human help and online resources.

4.2 Online Information Searching

During our interviews, we noticed that some students who encountered errors in their code preferred to search for information in a variety of online sources rather than try to fix the errors themselves using what they already understood about the problem. The interviewer did not attempt to stop this practice. In some cases, this kind of information seeking lasted for several minutes because the students were trying to remember where they had seen specific information or because they were unable to find relevant material during open searches on the Internet.

We present William as a case study for the type of digressive information seeking behavior that appears to deviate significantly from instructor's intentions when designing programming homework assignments. Although William was the only interview participant to engage in an extended online search, from a phenomenological perspective, his experiences are valid and contribute to our understanding of how students, as a group, experience homework in CS1. To determine whether William is representative of or an outlier among the hundreds of students enrolled in the CS1 course, we will need to collect more data, through observations or self-reports.

The Case of William: While working on converting a number into a character string, William believed that, to complete his code, he needed to look online to find a table of characters. He explained that he was looking for *"a particular method or some kind of thing where I can identify if there's a number value."*. After the interviewer explained to William that he was allowed to use any source of information that he would normally use when doing homework, William opened up a Google search in a web browser. He navigated to CodeLab because he said he did not remember ever being *"given"* the information he needed in lecture notes, but that it was *"mentioned in a CodeLab assignment."* William said, CodeLab was *"good*

for practice, for sure." He went on to explain that he also liked using CodingBat [10] because *"if you make a mistake, [...] they tell you what you currently have, what you currently return, versus what you should return. That is very valuable, because if you make a mistake [in CodeLab], often you don't know where your mistake is."*

After searching CodeLab for the specific example, William returned to the editor window and made some additional changes in the code that he had started, then, he returned to CodeLab to continue searching for information to resolve (or reduce) his uncertainty. He explained, *"I will go through the CodeLab eventually and find it, I think."* The interviewer asked William if he used textbooks or online materials, to which William responded, *"I know they give us a sheet of methods. However, [CodeLab] is kind of our online textbook, I guess."* He added, *"I feel like CodeLab is more like a practice tool, not so much as a database [...] For the most part I feel as if it's not particularly helpful."*

When asked what other strategies he would use, William said, *"I'd probably just look it up online."* At this point, William opened up another tab in the browser and began keyword searching for the information he thought he needed, trying several combinations of keywords and relying on the auto-fill feature in Google to identify better ones.

Throughout the majority of the think-aloud part of the interview, William was observed switching between multiple sources of information as he navigated between what was available in the course material and what was available from various online sources. He said he would consult people for help only after trying to find information for himself. Fittingly when asked about his overall homework practices, William identified himself as someone who possibly is *"too stubborn"* about sticking with one idea or one strategy to be able to readily shift between approaches. He explained: *"When I do work, especially for CS, [...] I get so caught up in how I think, or how in a certain way I want it to be done, even if it's not the easiest method or easiest way–. I'll think about how the problem should be solved. Then I'll want to do it a certain way, and then even if I come across problems, I'll just keep on trucking that way. I won't consider other alternative methods as much, I suppose."*

Of the first thirty minutes he spent on the homework problem, William spent about twenty minutes seeking information through CodeLab and open Internet searches. For William, online information searching appeared to be an integral part of doing his homework, and it might be something that is inadvertently reinforced by the homework becoming gradually more difficult over the course of the semester. When asked if he had shifted his homework strategies as the homework had gotten harder, he said that his *"pattern hasn't really changed."* He described his pattern as: *"first try it out myself, followed by look up resources that are relevant to this, and then other methods, then followed by asking friends or recitation people. For the first couple [of assignments], I would only really need to, at most, look up resources [and] certain methods, but now I have to ask other people for help for certain aspects."*

4.3 Navigating Among Human Sources of Help

Because the nature of the individual interview did not allow students to ask other people for help, all the data related to seeking information from human help was confined within the participants' discussions about what they do when they work on homework assignments. As described previously, William demonstrated an intense commitment to online searching and appeared to have some hesitation about initially approaching human sources of help.

One of the final questions William was asked in the interview was how he determined what information he was supposed to know for doing the homework as opposed to information that he was meant to look up. He responded: *"I think if we've gone over it in recitation, I usually have a very good understanding of it. I think that is the information I should know."* He continued to explain that there were fewer students in recitations than in lecture and that the smaller class size meant there was time for questions; in his words: *"It's just a different environment to go up and ask, you know?"* For William, the lecture period *"ends up being an introduction to an idea"* so students are aware of a concept and have a *"vague understanding"* of how to apply it. He said he would *"look up"* this information if he encountered them in a homework assignment. Concepts included in recitation, on the other hand, were something that he thought he *"should know"*.

Although William did not appear to place much emphasis on initially seeking help from human resources, other interview participants were more likely to describe addressing their questions to the professor, recitation instructor, classmates, friends, or family members. Iden, for example, mentioned he would ask other people, such as his roommate and once someone in his dorm. For the students who were more interested in reaching out to human sources of help, one challenge was that not all human sources were available at all times. For example, Juliet explained that she had not asked someone because her *"schedule this semester is really crazy"* and she only had free time at night. Although she knew other people in the class, Juliet said those students usually had the same questions, so they are unlikely to be able to help. It is interesting to note that the community space is open in the afternoons and evenings because students are free at night. The fact that some students are not aware of this schedule points to a need to better communicate to students the availability of the resources they have access to.

The size and format of the recitation sections provide an opportunity for students to ask questions to a human resource that can appear untenable in the larger lecture sections. In addition to recitations, another opportunity for human-to-human interactions is available at the department's community space where lab assistants are available to answer questions. Yet most of the interview participants did not mention this resource. Lear mentioned that he was aware of the community space as a place to ask for help, but he clarified that some people cannot go there because they do not have time. The community space records a large number of questions coming from CS1 students, but the overall proportion of CS1 students who use it is relatively small. Overall, online resources represent a more convenient option for many students, but there may be more that instructors need to know about student behaviors in this regard to help students develop the self-assessment strategies to identify when they really need to work with human sources of help.

5 DISCUSSION

Findings from our interviews shed some light on the ways students seek information as they work on homework in a CS1 course.

These preliminary findings generate interesting questions that warrant further investigation and suggest potential implications for teaching.

For example, students appear to be navigating multiple sources of information, some within the course (e.g., lecture notes) and some external to the course (e.g., Google search). The expanding universe of resources available to CS1 students potentially increases the complexity of solving the information problems that arise during the course, which could also increase the challenge of succeeding (that is, learning the concepts and skills needed for more advanced courses) in the course. Students who engage in external source hunting might think they are "doing homework", but this activity is not the kind of engagement with skills, concepts, and cognitive processes that instructors hope for when they develop homework assignments. The variety of information sources–and a willingness on the part of students to consult them in ways ranging from haphazard (for example, William's Google searching) to purposeful (for example, Juliet's searching through lecture slides)–suggest that some students might need additional scaffolding so that they can develop better ways to regulate their consulting of information sources and develop their meta-cognitive skills.

From our initial evidence of William's digressive searching, and subsequent frustration when he was not able to quickly find the sample code he was searching for in CodeLab, we are interested in knowing how many other students in the course appear to struggle with their ability to interpret their own information needs or find appropriate sources of information (whether human, static, or algorithmic). For any such struggling students, online searching might seem like one of the only accessible option. If this is the case, is it possible to develop interventions to teach students how to use this information or design scaffolded assignments to help such students move beyond this kind of behavior?

Finally, we observed that some students appeared more willing or eager than others to engage in information search as opposed to thinking through a solution. We wondered if some students might believe that their own abilities to find relevant information were stronger than their programming skills. Or, perhaps students were choosing to avoid expending the mental energy required to work through a solution by searching for a "quick fix". (This latter explanation has grounding in cognitive science: humans form mental models for their experiences and observations, and one of the characteristics of mental models is that they "tend to minimize expenditure of mental energy" [27].) We would need to extend our interview protocol to explicitly explore these potential cases.

Limitations: All interview studies are limited by the self-selection process, which creates the potential to miss information because certain groups of the population might not be willing to participate. Therefore, the findings of our study are limited by the participants who volunteered for the study and who had the time available to be interviewed, the timing of the interviews, and the nature of observation as a research method. The act of observing a situation has the potential to change a person's behavior. It is possible that students behaved differently while doing their homework in front of an interviewer than they would when working on their own. To try to minimize observational effects, the interviewer reminded students that there were no right or wrong ways to do their homework and that we were interested in their authentic homework processes.

Implications for Teaching: As we learn more about students' experiences with programming homework assignments, we have the opportunity to evaluate our teaching practices and consider changes that are informed by these findings. Our data suggest that students have prior mental models about the kinds of help they can and should be seeking from people, from course materials, or from online sources while doing their homework. Instructors could consider addressing these existing mental models through a discussion or activity in lecture or recitations. Not only could such a discussion provide information to the instructor about the students expectations, students will hear about other students' approaches, and, hopefully, reflect on the productive or unproductive nature of their own beliefs and behaviors. To address the students who, like William, might fall into the trap of haphazard online searching, it may also be worthwhile to establish some early homework exercises to demonstrate appropriate searching strategies and how online resources could and should be used.

Implications for Future Research: Because investigating information seeking behaviors emerged during the course of a study that was larger in scope than described herein, our interview protocol was not designed to specifically address the nuances of this behavior. There are several avenues of research that could be explored related to this construct, such as: What proportion of time is the student engaged in the educational purpose of the assignment, how long are they engaged with the logistics of the homework system, and how long do they spend seeking for information? How do students interact with human resources, either in person or through online resources, such as Piazza? How is "doing homework" in CS1 similar to or different from "doing homework" in other kinds of STEM courses? How do these similarities and differences affect, if at all, the expectations and experiences of CS1 students engaging with their homework? While it is unlikely that think-aloud protocols will provide the data necessary to answer these emerging research questions, interviewing a few students multiple times over the course of the semester, observing discussions of homework assignments in recitations, reviewing homework diaries, and conducting focus groups are potential research designs that could be employed to try to answer these questions.

6 CONCLUSIONS

In this paper, we have described observations from think-aloud interviews with 14 CS1 students working on programming homework assignments. We focused our analyses on information seeking behaviors as part of an effort to understand how students experienced homework, and made sense of the various support structures and information sources available to them during their efforts. In future work, we will investigate the prevalence of these information seeking behavior patterns in the population of CS1 students.

ACKNOWLEDGMENTS

This work was partially supported by a Google Computer Science Capacity Award.

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