Skills for learning: a day in the life of a college student

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Abstract

The learning skills used by students at a technical college to fully participate in their classes were the focus of this investigation. Researchers shadowed two full-time students for one full day as they each went to their classes in a technical college in Qatar. An observation schedule was used to record what students did in their classes (for example: solve problems, listen to the teacher, ask questions). At the end of the day students were interviewed and asked to comment on the importance of the learning skills that they used, how they built the skills they needed and how to become a better student. It was found that students used a variety of learning skills throughout a typical day and that they had their own ideas about learning. The learning skills the two students used most during their classes were not the same, owing partly to the format of the courses and partly to personal learning approach. The four learning skills students identified as most important were: understand and apply concepts to current work; concentrate and maintain focus; follow written instructions; and ask questions. The information gathered in this investigation can be used to inform students, instructors and course planners about the skills students need to be active participants in their classes and to ensure that educators support the development of required learning skills.

Introduction

Educators should be aware of the skills today's students actually use as they participate in classes and of how to support students as they develop the skills needed to participate fully in their learning. Learners need developed reading, listening, note-taking, questioning and thinking skills. Educators have an obligation to be deliberate and teach students the skills they need to succeed in learning, not only in acquiring content knowledge, but also in engaging and participating fully in the learning *process*. Learning is also supported by sub-skills such as keeping class notes organized by date and topic, using headings and keywords in note taking, highlighting new vocabulary and recording questions for further investigation. Basic study skills often become such an ingrained part of 'student-ness' that they are later taken for granted.

It is important for educators to reflect on the teaching-learning dynamic. This research was inspired by Grant Wiggins' (2014) blog post *A Veteran Teacher Turned Coach Shadows 2 students for 2 Days – A Sobering Lesson Learned*. We wondered what skills today's college students need to be active and effective learners. We also wondered whether students had any notion of having been consciously taught or encouraged to develop those skills. Our curiosity prompted this small research project.

In order to clarify what skills our students use in their classes and to help instructors at our college support student skill development, we investigated what students actually do during their classes. We also asked students to identify which learning skills they thought were important and for their advice on how a student might improve their learning.

We (two researchers) each shadowed one student over their regular day. We went to all the students' classes and observed. We were not concerned with the details of the course content but with what the

students did or were asked to do during class (e.g. read, discuss, reflect, solve problems, listen, ask questions).

Context

We undertook this research in our roles as faculty members of the Centre for Teaching Excellence (CTE) at the College of the North Atlantic - Qatar (CNA-Q), Qatar's premier comprehensive technical college.

CNA-Q was established in September 2002 through an agreement between the State of Qatar and the College of the North Atlantic in Canada and is now one of Qatar's largest post-secondary institutions, with over 2200 students and 650 staff. CNA-Q is co-educational (approximately 60% male, 40% female) with a student population made up of about 63% Qatari nationals. One key characteristic of the college is that it is an English medium institution where most students use English as a Foreign Language (EFL). Another is the importance of student sponsorship: over half the students are supported by local companies.

Areas of study at CNA-Q combine a Canadian curriculum and industry expertise in five disciplines: Health Sciences, Information Technology, Business Studies (including a Centre for Banking and Financial Studies), Engineering Technology and Industrial Trades (the Technical Certificate Program).

The Centre for Teaching Excellence (CTE) is a professional development unit that supports teaching and learning, provides faculty development, supports learning initiatives and conducts research. The CTE includes two divisions, the Centre for Teaching and Learning and the Advanced Learning Technologies Centre.

The mission of the Centre for Teaching Excellence is to bring people together to enrich teaching and learning and to identify and support the use of current pedagogies and educational technologies to enhance student learning. The vision of the CTE is to act as a transformative educational hub that leads by example, advocates quality in teaching and learning and empowers faculty.

Literature review

Students need skills that support their learning and help them participate fully in their learning to be successful at school (Murray & Nallaya, 2016; Turner, Peak, Flanders & King, 2013). Although terminology is not always identical, the general topic of learning skills has received significant attention from educators and researchers alike. Learning skills can simply be defined as those skills which are necessary for students to succeed in studies (Center for Student Success, 2007). Identifying and defining the skills that students use are only the precursors to any investigation of how students acquire skills or use them effectively and successfully (Prevatt, Li, Welles, Festa-Dreher, Yelland & Lee, 2011).

College students today need to develop reading, note-taking and test-taking skills (Ellis & Toft, 2006) if they enter college without sufficient proficiency in these skills (Murray & Nallaya, 2016). These skills support all studies: reading and note-taking are required in every subject, even in online courses where books may be replaced by online articles, e-books and by a variety of media. Note-taking helps students gather important information that they can review later or study further. Test-taking is still an essential part of formal education so test-taking skills are also a necessity.

Students also need essential literacies which include critical thinking, communication and technology (Ellis & Toft, 2006; Fallows & Steven, 2000; International Society for Technology in Education (ISTE), 2015; Keane, Keane & Blicblau, 2016; Milne, 2000; Pollock & Ford, 2009). Critical thinking and communication are important not only during studies but also because many jobs require such skills.

Students are often expected to think critically, make comparisons, take decisions, review and critique their work and contribute to group or class discussions. Students also need to be effective listeners, speakers and general communicators. Skills such as being able to use technology to communicate, and to access and use information effectively are important for students during their studies as well as for their lives after graduation in the modern work-place (ISTE, 2015).

Methodology

In order to clarify what skills CNA-Q students use and need in order to participate in their classes and to help identify these skills so that instructors can support student skill development, we decided to investigate what students actually did during their classes. Researchers shadowed students each over their regular day (see Appendix 1: Student schedules on the observation day).

Participants

Volunteer recruitment was done by the Student Affairs Office, which sent out a request for volunteers by email. Research participants included two second-year students, one male (Fahad) and one female (Naila); these names are pseudonyms. Naila was enrolled full-time in Engineering and Fahad was in the Information Technology program. Students were 21 and 22 years old respectively.

Both students reported themselves as being active in college life, eager to volunteer and having 'good' marks (instructors confirmed the latter). They were both also self-confident and out-going.

Ethics

Students consented to be observed and interviewed, and their instructors agreed to allow the researchers to conduct observations during regular class time. Students and instructors were guaranteed anonymity; however there were practical limitations on this because all class members were fully aware that an outside observer joined their class.

It was explained that instructors would not be identified, critiqued, or reported on in any way and that there were no special requirements or expectations for the class. The instructors of the students' classes had no responsibility connected to this research. Anonymity for instructors was required to eliminate pressure to perform in a particular way, to remove fear of judgment or embarrassment and to ensure classes were not 'staged' for observers. The focus was on the student, not the teacher.

It is not uncommon at the college for a class to have a visitor but it is somewhat unusual; so anonymity of all participants is compromised. All students in the class could see that the observer joined their class and was watching one of their classmates. No information was offered to other class members about the research but it is possible that student participants in this research could be identified later by members of their class who remember an observer visiting their class; the student volunteers were aware of this possibility. It is less likely that instructors might be identified, but it is also possible; the instructors were also aware of this possibility.

Research design

This study follows a phenomenological research design (Cohen, Manion & Morrison, 2000; Crotty, 1998; Lester, 1999). Qualitative research such as this involves "trying to understand the essence of a phenomenon by examining the views of people who have experienced that phenomenon" (Boyd, 2016). In this case, college students' experiences and views were investigated, using data from observations and interviews.

Procedure

Each researcher observed one student in class over the course of one full day of normal classes. Students had been told that observers wanted to see what they did on a normal day in their classes and the researchers did not want to see anything special, just what normally happened. The students participated in classes as they usually would. Observers noted the kinds of learning activities in their classes and the skills required of students to participate in those activities (e.g. learning activity: lecture; skills required: listening, note-taking, asking/answering questions).   Researchers recorded what students were required to do, or asked to do and the length of time each student spent using learning skills.   During the observations the researchers did not interact with the participants, with other students or with the instructor.

Researchers developed and used an observation schedule titled "What do students have to do during classes?" for note-taking purposes (see Appendix 2). This observation schedule was informed by Wieman and Gilbert's Teaching Practices Inventory (2014) as the starting point for the types of student behaviours that might be observed. Wieman and Gilbert's inventory was developed for use in science and mathematics courses to allow comparisons of teaching. The inventory was selected because it was designed for recording observable behaviour in active and collaborative learning environments, relevant in our context, and allowed modification as needed.

The list of observed behaviors provided in the original inventory was modified by adding and deleting items as students were observed throughout the day. A number of learning skills were used concurrently; however they were recorded individually as separate skills because they were clearly identified on the inventory.

Following the classroom observations, each researcher interviewed the student they had observed. Each student was shown the list of the skills that they had demonstrated over the course of the day. The list of observed skills was presented to students on strips of paper (one skill per strip and in random order). Students were asked to comment on the importance of each of the skills and to rank the skills from most important to least important.   Researchers took extensive notes during the interviews and photographed the final rank ordered strips for the record.

Students were also asked how confident they were that they had (or were able to use) the skills required in their classes. We also asked the students to identify any specific learning skills they had been taught (either formally or informally) over their lifetime as students, and to suggest advice for other students on how to become a good learner. We hoped Naila and Fahad would be willing and able to give advice since both had a high grade point average (GPA) and described themselves as good students. Research on the characteristics of successful learners indicates that 'commitment to learning' (Miura, 2011) and a positive mindset (Stoke & Burke, 2013) are important characteristics and that successful and unsuccessful learners use different cognitive, affective, and psychomotor-based strategies learning strategies (Archer, Chetty & Prinsloo, 2014; Bleicher, 2014; Canpolat, Kuzu, Yildirim & Canpolat, 2015; Hernández, 2002; Poole, 2014).

Data analysis

Data from observations and interviews was reviewed for each student separately and then further analysis was completed to find similarities and differences.

The procedure for data analysis was as follows:

- Calculate percentage of time each observed learning skill used per class for each student. An estimate of how much time was spent on each skill was made using the time notations in the

observation notes (e.g. 9:00 - 9:05). This was used to calculate percentage of time per class that each skill was used.

- Rank observed skills from most to least observed for each student (in terms of the percentage of time spent per skill).

- Review and compare observation data to identify similarities and differences between the students.

- Review and compare each student's rankings of the skills they each reported as important to their learning and academic success.

- Review data for each interview question for each student.

- Compare interview data to identify similarities and differences between the students.

Results

Observations

Observations revealed differences in the learning skills used most by each of the two students in their classes. These differences may not be attributable to student choice but to subject matter, discipline, course requirements or activity design. In general, Naila spent more time listening than using other learning skills in her Engineering classes while Fahad spent more time completing assignments (i.e. coding and practical computing assignments) than using other learning skills during his Information Technology classes.

Table 1: Learning skills used on observation day, grouped by amount of use.

	Learning skills used by Naila in Engineering classes	Learning skills used by Fahad in Information Technology classes
80-100% of time	• Concentrate, maintain focus • Listen to the teacher	• Understand and apply concepts to current work • Solve problems, find errors and troubleshoot • Use a computer, use specialized computer software
60-80% of time	• Ask questions	• Complete assignments • Work independently • Keyboard
20-60% of time	• Be organized – manage files, document records, and course handouts	• Research within own files
1-20% of time	• View demonstration/simulation	• Read paper documents • Follow written instructions • Read electronic documents

For Naila, concentrating, maintaining focus and listening were observed as the learning skills used most (and concurrently) during the day (see Table 1). Fahad spent most of his time using three learning skills concurrently: understanding and applying concepts to current work; solving problems, finding errors

and troubleshooting; and using a computer with specialized software. See Appendix 3 for a complete list of learning skills observed and Appendix 4 for a complete list of learning skills in order of time spent using them.

Interviews

In the interviews, students identified many learning skills as being important to their learning and explained why those skills were important. Students also shared their ideas about what skills students need and how they can build these skills. Student answers to the interview questions are summarized below.

How important are these skills?

Naila and Fahad sorted and grouped skills in order of importance, grouping some together as having equal importance. The common learning skills that both students identified as important were: 'understand and apply concepts to current work', 'concentrate and maintain focus' and 'ask questions'. Fahad ranked 'ask questions' higher than did Naila. This may have been because of the pattern of his day. He was actively completing assignments that required solving problems and coding during his Information Technology classes and he needed to ask questions to continue his work. Naila spent much of her time listening to her instructors so waiting to ask a question would not have been as pressing. Another difference between the two students was that Naila gave a succinct list of skills while Fahad reported many skills as important.

Table 2: Learning skills grouped by perceived importance.

	Learning Skills Identified by Naila	Learning Skills Identified by Fahad
Most important	• Understand and apply concepts to current work	• Understand and apply concepts to current work • Solve problems, find errors and troubleshoot • Complete assignments • Use a computer, use specialized computer software
Second most important	• Work independently	• Answer questions • Ask questions • Listen to the teacher • Follow oral instructions • Follow written instructions • Explain problems
Third most important	• Concentrate, maintain focus	• Concentrate and maintain focus
Fourth most important	• Follow written instructions • Make decisions based on academic knowledge • Ask questions	• Be organized – manage files, document records and course handouts • Take notes on paper or electronically, keep records

Table 2 shows the learning skills identified by each of the students as having high levels of importance; more detail is given in Appendix 5. For learning skills ranked by students as important compared with

the time students were observed using those skills in lessons, see Appendix 6 (Naila) and **Error! Reference source not found.** (Fahad).

Why are the highest level skills important?

This question was asked after sorting was complete. Naila's explanation of why these skills were important focused on her needs when in a classroom learning environment. She reported that concentrating and maintaining focus is important because concepts are technical and understanding the relationship between concepts can be difficult. She reported that losing focus might create mistakes later when attempting to apply learning in assignments or projects. She said that asking questions can help focus because this requires thinking about the course material and making connections. Things become clearer when the instructor answers questions.

Fahad's explanations of why these skills were important were also very straightforward. Fahad reported that understanding and applying concepts is important because if you do not understand you will not be able to apply knowledge and skills elsewhere. Memorizing is not enough, especially in Information Technology, in which logic is key to the discipline. Solving problems was explained as the best way to understand, and he said that it was important to learn from mistakes, that correcting errors helped him to learn and to build the essential skill of being able to troubleshoot. He also said that completing assignments is necessary to prepare for exams. Using computers and software is necessary for his course of study.

Looking at the list of skills ranked second, Naila said it was to work independently. Fahad said it was important to: answer and ask questions to stay involved and focused; listen so it was not necessary to ask questions again; follow instructions to assist in finding the best way to approach a task; and explain problems and give details to help others understand and 'sometimes to understand ourselves'

In your opinion what are three things that students can do to become better students?

Naila suggested three things students can do to become better students: attend classes, ask questions, and talk with other students. She recognized that attending class was important for learning. Technical or complicated material is difficult to learn independently and the expertise of the instructor often provides context for new concepts. Naila also felt that asking questions allowed students to clarify their thinking and make connections between ideas. In addition, talking with other students during class also provided a way to process new information and apply it.

Like Naila, Fahad recommended that students attend classes. He felt attendance is important because much content is missed whenever a student is absent. His other recommendations for becoming a better student were to listen and to practice. Listening is important because students have to pay attention, focus and take notes or critical ideas will be missed. Practicing is necessary both during and after class. Learning is assisted by repetition and practice.

How did you build the skills you need? How did you learn to be a strong student?

Naila did not identify that she had consciously or formally developed learning skills in any context. As she reflected, she referenced older siblings who had given her tips for how to get through some particular courses when she was in grade school; otherwise, she did not associate learning to learn with a particular person or a particular setting. She attributed her success as a student to her own drive to perform well.

Fahad attributed his learning skills to a credit course he had taken on "Effective Learning" which focused on how to learn, take notes and study. He said that although he had known the importance of learning,

note-taking and studying before taking the course, he had not really applied these skills and described himself as a "bad student". Later he applied the learning skills to assist him in pursuing a scholarship. He found the skills actually helped him in practical ways and he began to consciously focus on his learning. Today he is an outstanding student, according to both himself and his instructors, and this is substantiated by his high marks and class standing.

Discussion of the results

The skills that the students were observed using most in their classes and that they identified as important were sometimes the same. In Naila's case there were two learning skills among those she was observed using most that she identified as being important to learning (see Table 3). These were to concentrate and maintain focus and to ask questions. For Fahad there were four learning skills among the skills he was observed using most that he also identified as important (see Table 3). These were: solve problems, find errors, and troubleshoot; understand and apply concepts to current work; complete assignments; and be organized (including managing files, document records, and course handouts).

Table 3 : Learning skills both used and identified as important.

Naila	Fahad
• Concentrate, maintain focus • Ask questions	• Solve problems, find errors and troubleshoot • Understand and apply concepts to current work • Use computer, use specialized software • Complete assignments

The match between learning skills most used and students' perceptions of the skills' importance may be due to the students' recognition of what they are often required to do in class.

There was not a complete match between the skills used by students and their perceptions of what skills were important. Perhaps this is due to a difference between what instructors consider important (and therefore make time for in class) and what students consider important. For example, instructors may feel that listening to an explanation of a concept or completing assignments is important and so they plan activities for students with this in mind. Other possible reasons for differences between the use of skills students felt were important and the skills that they used are: student behaviour or choices made at the time of the observations, nature of the course work or the subject matter, design of course activities or course or the class schedule.

Although there were no obvious cultural elements noted during class observations, one of the students spontaneously mentioned concerns related to the local context in a Canadian college in Qatar. These were concerns about language and culture.

The challenges of learning in a foreign language pose a barrier for students. English-as-a-foreign-language (EFL) students naturally find studying in English a challenge both to understanding and to having the confidence to ask questions or for assistance. In an EFL environment the students' level of English language skill is an important factor that influences the ability to learn and pay attention and the personal confidence to ask questions or display confusion.

In our context, a college in the Middle East where English is the language of instruction, it is essential that students build the English skills necessary to participate in their classes, to learn and to communicate effectively. In all observed classes the students used English in a variety of ways (listening,

reading, writing and speaking) but English skills were not measured here as separate skills as they were inseparable from other learning skills (e.g. asking questions, solving problems).

When students first enter the college, their English skills are assessed; and those students who need to improve their English skills take preparatory classes. The students in this study were not in preparatory classes but in regular programs where English is the medium of instruction rather than the focus of instruction. As noted, despite their enrollment in regular programs, one student did mention language skills were an issue and commented that confidence and ability to use English have an impact on students' learning.

Another cultural factor brought up by the same student was cultural differences and how these may affect students' understanding of what the instructor expects. Sometimes students find it difficult to understand assignments, what they must do in class, how to behave, and how to succeed. This can be complicated further when the culture of the instructors and the students are different and assumptions about behavior and products (assignments and expectations about format and content) differ. Of course, this is important for instructors and course designers to take into account when planning or when teaching.

Learning is a complex endeavor, and students use many learning skills. The students did not use the same skills or to the same degree in every class and there were differences between the two students in the learning skills used. In each of Naila's classes she used concrete skills such as reading, and more abstract skills such as decision-making. She did not always recognize that she had or was using these skills for learning. She commented that using such skills was "just the normal thing" students do. Throughout the day Naila mainly sat and listened. She asked questions and worked alone or with others to solve problems or complete tasks. She also used special computer software to create scenarios and compare them. Fahad solved problems in all his classes and he constantly multi-tasked. He referred to the assignment and handouts provided during the class as well as his course notes, checked for information on the Internet, read, paused to answer questions and/or assist classmates, used a testing/validation tool many times and listened whenever the instructor shared instructions or comments with the class or with him individually. He also stayed on task and focused on an assignment while doing these additional tasks.

As noted earlier, students need to develop basic note-taking and test-taking skills (Ellis & Toft, 2006). These skills were not, however, observed. Neither of the students in this small research project took notes on the observation day although they did refer to notes they had taken earlier. Fahad took temporary notes only (e.g. he copied code into a document so he could refer to it quickly and then deleted it when he was finished with it). In addition, there were no tests administered in any of the classes observed.

Students have their own ideas about how they should learn and what is important. The skills that Naila identified as most important for her learning did not always align with the skills she used most during her classes. For example, she did not always have the opportunity to ask questions. She expressed some frustration with the lack of opportunity in class to apply concepts she had learned. She felt, however, that the level of technical information she needed to perform out of class assignments was high; gleaning as much information as possible from lectures/ verbal instructions helped her feel confident that she could complete out of class assignments to a high standard.

Fahad worked hard to finish each task during class so that he would not have to complete as much work on his own time. He explained this as a practical choice, not a learning choice and he focused on this throughout the day. He worked through his breaks and went directly from one class to the next.

Additionally, he did not eat at lunch time as he volunteered at a student event. His focus on assignment completion and his volunteer work at lunch may have contributed to his admission at the end of the day that he was exhausted and had a headache.

Although there were differences regarding what the two students identified as important learning skills, both students identified the four skills below within their top priorities: to understand and apply concepts to current work; to follow written instructions; to ask questions; and to concentrate and maintain focus. The first three of these skills are essential literacies (critical thinking and communication) and match with students' needs (Ellis & Toft, 2006; Fallows & Steven, 2000; Milne, 2000; Pollock & Ford, 2009). Additionally, Fahad used technology most of the day to do his in class work. Naila also used special computer software to create and compare scenarios. This connects well with the development of skills and knowledge needed to learn and to live in a digital society (ISTE, 2015).

It is interesting to note that learning to learn is not always a conscious endeavor. Naila did not identify that she had consciously or formally developed learning skills in any context. On reflection, she recognized that over her time from grade school to college she had developed organizational skills and habits of questioning that had served her well. She saw such development as natural, and considered the alignment between her goals and what needed to be done to reach them as a personal achievement. Fahad, on the other hand, explained in the interview that he had made a conscious effort to become a 'good' learner. When he entered college, he took a required 'student success course' and he credited that course with giving him ideas that he consciously began to apply to his own learning and to improve his learning skills. Thus, it seems likely that although a student like Naila cannot clearly identify or articulate how they develop their learning skills others, like Fahad, may make a conscious effort to improve their skills.

Conclusions

The purpose of this research was to identify the skills students at our college use and need. We investigated what skills our students actually used in their classes. Additionally, we asked students to identify the learning skills they thought were important and for their advice on how a student might improve their learning.

Some of the learning skills that the students in this investigation used and identified as important are consistent with the literature about the skills that college students need to succeed. Critical thinking and problem solving were important and almost equivalent to the importance of the application of knowledge. Collaboration was evident but limited and communication was important but mostly one way, with instructors delivering and students receiving information. There was no real evidence of the use of creative thinking during their classes and no recognition by the students of its importance. It is possible that students were doing more creative thinking outside of class, perhaps during activities such as the voluntary lunchtime event that Fahad took part in.

The information gathered in this investigation about the skills students used during a regular day of classes can be used to inform and guide students so that they identify essential learning skills, inform the college community about the skills that our students need to develop, guide individual instructors who want to scaffold skill development within courses to help students develop learning skills and improve course design so that the development of learning skills is supported.

If students are able to (or are helped to) identify the learning skills they need, they could make deliberate efforts to gain these skills and improve their ability to participate fully in their learning and achieve academic success.

It is the responsibility of the college community to support students' learning. Unfortunately, this support is often limited to courses and specific academic subject matter rather than to the support and development of learning skills.   More awareness of student learning needs and skill development will empower individual instructors, curriculum designers, tutors and faculty to develop materials, design courses and provide individual student support to encourage and scaffold learning skill development (Center for Student Success, 2007).

The findings of this small-scale reflective project suggest that CNA-Qatar and other educators can support their students by recognizing that students need a range of learning skills to be able to participate fully in their classes and use different learning skills in their classes as necessitated by the context. Students may spend less time using the learning skills they identify as most important for success and more time using learning skills that their study context requires. As well, it is of interest that students do not always know how they developed their learning skills. Of course, students need support to identify and build the learning skills they need for success and also require 'invisible' support built into their courses and programs to ensure that learning skill development is integral and not supplemental or peripheral to course content.

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Appendix 1   Student schedules on the observation day

Schedule Student 1 (Fahad, Information Technology Major)

7:30 – 9:20   Website Development Using Microsoft Technologies

9:30 - 11:20   Object-Oriented Programming

11:20 - 12:30   Lunch, including volunteer duties at a campus event

12:30 – 2:20   Database Design and Implementation

2:30 – 3:30   Tutoring appointment to assist another student

Schedule Student 2 (Naila, Engineering Major)

7.30 – 8.20   Free

8.30 – 9.20   Solid State Motor Controls

9.30 – 10.20   Programmable Logic Controllers

10.30 – 11.20   Electrical Practices I (lab)

11.30 – 12.30   Electrical Power Generating Facilities

12.30 – 1.20   Lunch, including a meeting with an instructor about course work

1.30 – 3.20   Technical Reporting II

Appendix 2 Observation schedule and sample of notes

What do students have to do during classes?

Per class % of time	
1-60% / 60-80% / 80-100%	Listen to instructor [who presents content, gives results, presents a problem, explains process]
1-60% / 60-80% / 80-100%	Students present content, give results, present a problem, explain process
	Sit
	Stand or move to board/wall to do activity
	Move or change seats
	Watch video
	Take notes
verbally / in writing	Answer questions
	Give a response using a personal response system of some type [hands up, vote with colored card or electronic tool]
	Join in small group – discuss or problem solve
	Join discussions on why material is useful and or interesting
	Work collaboratively on a longer term project
	View demonstration, simulation or video clips
	View demonstration, simulation of video where students first record predicted behavior and then afterwards compare observations with predictions
individual/group	Present, individual/group
individual/group	Solve a problem, individual/group
written / oral	Complete an assessment [marked or unmarked]

paper/online	Read
paper/online	Read/view materials for upcoming class session
paper/online	Read/view materials for upcoming class session and complete assignments or quizzes on it shortly before class or at beginning of class
	Research using computer or mobile device
	Research using book/notes
	Make a choice about topic or how to prove learning
written / oral / online	Give feedback to instructor
written / oral / online	Reflect [one min paper, briefly answer questions, reflect on lecture/learning]

Time	Task / what student does

student ●
class/date/time

What do students have to do during classes?

< 10
< 10

Per class % of time	
1-60% / 60-80% / 80-100%	Listen to instructor — *indiv. assistance*
	[who presents content, gives results, presents a problem, explains process]
1-60% / 60-80% / 80-100%	Students present content, give results, present a problem, explain process
	to instructor as explain problem - indiv. task ♀
	Sit
	Stand or move to board/wall to do activity
	Move or change seats
indiv w/teacher	*ask questions, listen to answers* Watch video
	Take notes
	→ follow instructions
verbally / in writing	Answer questions
	Give a response using a personal response system of some type [hands up, vote with colored card or electronic tool]
	Join in small group – discuss or problem solve
	Join discussions on why material is useful and or interesting
	Work collaboratively on a longer term project
	View demonstration, simulation or video clips
	View demonstration, simulation of video where students first record predicted behavior and then afterwards compare observations with predictions
individual/group	Present, individual/group
constant individual/group	Solve a problem, individual/group
written / oral	Complete an assessment [marked or unmarked] *— assignment*
	own
paper/online	Read *✓ programming code*
paper/online	Read/view materials for upcoming class session *→ assignment*
paper/online	Read/view materials for upcoming class session and complete assignments or quizzes on it shortly before class or at beginning of class *during class*
	→ checking code, troubleshooting, tester tool
	Research using computer or mobile device
	Research using book/notes
	coding → word doc in own files
constant ✓	Make a choice about topic or how to prove learning
written / oral / online	Give feedback to instructor
written / oral / online	Reflect [one min paper, briefly answer questions, reflect on lecture/learning]

constantly
keyboarding
reading for accuracy
troubleshooting
attn. to detail
understand & apply coding concepts
check understanding

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student will leave early as volunteering at
music performance for CS

Time	Task / what student does
9:35	T arrives + says carry on w/ your assignment
	signs in
	opens NET Beans 8.0
	asks T question re problem - troubleshooting
	describe error, what tried
	T asks ● to open so we can walk thru
	opens own files
	opens platform folders - locates files
	opens folders, closes; waits for code to display
	takes screenprint using snipping tool
	uses single skip
	repeats process
	closes sc print
	opens code
	- copy, paste code, edit
	- keyboarding
	- troubleshooting
	- on screen reading
	- refer back to own notes - assignment
	- troubleshooting, problem solving
	- copy/paste edit/delete/clean up
	- apply concepts of coding - repeated code
	can be copy/pasted etc.
T comes 8:45	● almost fixed - is it random?
	- T you must understand random numbers
	- T draws on paper as st. gives random number
	- T moves paper, now is it random
	patterns will be the same
	- ● asks will it be ~~
	- T go to Random Bag Creator - change this
	+ get ~~, roll dice in 290 bag search
	~~ etc
	- ● asks if -
	- T no, 95% search, 5% event
	- ● is it ~~
	- T no
	- ● I'm confused now ~~
hard concept *	- T no, a bunch of random events
	- T explains again
	- T adds more
	- ● if I do this ~~, using program, enter code
	pulls up screen prints
	- ● make sure x, when I do x
	- T not right, run again, change this ~~
	this is OK, now ——, now ——

→

Appendix 3   List of learning skills observed

Complete assignments
Remember, recall information
Read paper documents
Understand and apply concepts to current work
Use a computer, use specialized computer software
Solve problems, find errors and troubleshoot
Listen to the teacher
Follow oral instructions
Follow written instructions
Answer questions
Ask questions
Concentrate, maintain focus
Be organized-manage files, documents, records, and course handouts
Work independently
Create diagrams/simulations
Write/draw solutions
Research within own files
Research on Internet
View demonstration/simulation
Assess diagrams
Read electronic documents
Read online
Make decisions based on academic knowledge
Explain problems
Be organized – manage files, document records and course handouts
Take notes on paper or electronically, keep records
Keyboard
Read paper documents
Read electronic documents

Appendix 4   Learning skills ranked by total time observed.

Rank	Naila					Rank	Fahad		
1	Concentrate, maintain focus			Listen to the teacher		1	Solve problems, find errors, troubleshoot	Understand and apply concepts to current work	Use a computer, use specialized computer software
2	Ask questions					2	Complete assignments	Work independently	Keyboard
3	Be organized – manage files, document records, and course handouts					3	Research within own files		
4	View demonstration/simulation					4	Be organized - manage files, document records, and course handouts		
5	Assess diagrams	Use a computer; use specialized computer software	Read paper documents	Work independently	Create diagrams and/or simulations	5	Read paper documents	Follow written instructions	Read electronic documents
6	Solve problems, find errors, troubleshoot	Remember, recall information	Understand and apply concepts to current work	Make decisions based on academic knowledge		6	Concentrate, maintain focus		
7	Write/draw solutions					7	Ask questions / Explain problems / Listen to the teacher / Follow oral instructions		
8	Follow written instructions					8	Remember, recall information		
9	Follow oral instructions					9	Take notes on paper or electronically, keep records		
10	Work with others					10	Answer questions		
11	Answer questions					11	Research on Internet		
12	Complete assignments					12	Read online		

Appendix 5   Learning skills identified by the students as important for success as a student.

(ranked by perceived importance)

Rank	Naila				Rank	Fahad					
1	Understand and apply concepts to current work				1	Solve problems, find errors, troubleshoot	Understand and apply concepts to current work	Use a computer; use specialized computer software	Complete assignments		
2	Work independently										
3	Concentrate, maintain focus										
4	Ask questions	Make decisions based on academic knowledge	Follow written instructions		2	Answer questions	Ask questions	Listen to the teacher	Follow written instruct-tions	Explain problems	Follow written instruct-tions
5	Solve problems, find errors, troubleshoot	Use a computer; use specialized computer software	Create diagrams/ simulations	Follow oral instructions	3	Concentrate, maintain focus					
6	Listen to the teacher				4	Be organized – manage files, document records, and course handouts	Take notes on paper or electronically, keep records				
7	Assess diagrams	View demonstration/simulation			5	Research within own files	Work independently	Keyboard			
8	Remember, recall information				6	Read paper documents	Read electronic documents				
9	Write/draw solutions				7	Research on Internet	Remember, recall information				
10	Work with others				8	Read online					
11	Read paper documents										
12	Be organized – manage files, document records, and course handouts										
13	Complete assignments										
14	Answer questions										

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Appendix 6   Learning skills ranking comparison (Naila) (time observed/ importance as identified in interview)

Rank (observation)	Learning skills (observed time)				Rank (interview)	Learning Skills (perceived importance)			
1	Concentrate, maintain focus				1	Understand and apply concepts to current work			
2	Ask questions				2	Work independently			
3	Be organized – manage files, document records, and course handouts				3	Concentrate, maintain focus			
4	Listen to the teacher				4	Ask questions	Make decisions based on academic knowledge		Follow written instructions
5	View demonstration/simulation				5	Solve problems, find errors, troubleshoot	Use a computer; use specialized computer software	Create diagrams / simulations	Follow oral instructions
6	Assess diagrams	Use a computer; use specialized computer software	Read paper documents	Work independently / Create diagrams and/or simulations	6	Listen to the teacher			
7	Solve problems, find errors, troubleshoot	Remember, recall information	Understand and apply concepts to current work	Make decisions based on academic knowledge	7	Assess diagrams	View demonstration/simulation		
8	Write/draw solutions				8	Remember, recall information			
9	Follow written instructions				9	Write/draw solutions			
10	Follow oral instructions				10	Work with others			
11	Work with others				11	Read paper documents			
12	Answer questions				12	Be organized – manage files, document records, and course handouts			

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Appendix 7   Learning skills ranking comparison (Fahad) (time observed/ importance as identified in interview)

Order	Learning Skills Fahad Used in Order of Time Spent on Observation Day			Order	Learning Skills Fahad Identified as Important for His Success as a Student in Order of Importance					
1	Solve problems, find errors, troubleshoot	Understand and apply concepts to current work	Use a computer; use specialized computer software	1	Solve problems, find errors, troubleshoot	Understand and apply concepts to current work	Use a computer; use specialized computer software	Complete assignments		
2				2						
3	Complete assignments	Work independently	Keyboard	3	Answer questions	Ask questions	Listen to the teacher	Follow written instruc-tions	Explain problems	Follow written instruc-tions
4	Research within own files			4	Concentrate, maintain focus					
5	Be organized – manage files, document records, and course handouts			5	Be organized – manage files, document records, and course handouts	Take notes on paper or electronically, keep records				
6	Read paper documents	Follow written instructions	Read electronic documents	6	Research within own files	Work independently	Keyboard			
7	Concentrate, maintain focus			7	Read paper documents	Read electronic documents				
8	Ask questions	Explain problems	Listen to the teacher	Follow oral instructions	8	Research on Internet	Remember, recall information			
9	Remember, recall information			9	Read online					
10	Answer questions									
11	Research on Internet									
12	Read online									

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