



Paper: Exploring How Undergraduate Chemical Engineering Students Spend Their Time Inside and Outside of the Classroom (WIP)

Alaa Abdalla, Virginia Tech

Alaa Abdalla is a first year PhD student in Engineering Education with a background in Mechanical Engineering. Her primary research interests are culture and identity, teaching and learning, and design of learning spaces. Her ultimate career goal is to bring together engineering, education, and design thinking.

Dr. Nicole P. Pitterson, Virginia Tech

Nicole is an assistant professor in the Department of Engineering Education at Virginia Tech. Prior to joining VT, Dr. Pitterson was a postdoctoral scholar at Oregon State University. She holds a PhD in Engineering Education from Purdue University and other degrees in Manufacturing Engineering from Western Illinois University and a B.Sc. in Electrical and Electronic Engineering from the University of Technology, Jamaica. Her research interests are exploring students' disciplinary identity through engagement with knowledge, curriculum design, assessment and evaluation and teaching for conceptual understanding.

Dr. Jennifer "Jenni" M Case, Virginia Polytechnic Institute and State University

Jennifer Case is Head and Professor in the Department of Engineering Education at Virginia Tech. She holds an honorary position at the University of Cape Town. Her research on the student experience of learning, focusing mainly on science and engineering education, has been published across a range of journal articles in higher education and her recent book, *Researching student learning in higher education: A social realist approach* published in 2013 by Routledge. She holds an academic development post in the Department of Chemical Engineering at UCT, and teaches in the undergraduate programme there. She is a coordinating editor for the international journal *Higher Education* and a co-editor for the Routledge/SRHE series *Research into Higher Education*.

Exploring How Undergraduate Chemical Engineering Students Spend Their Time Inside and Outside of the Classroom (WIP)

Background and Literature Review

Time is one of the most valuable resources that human beings have. Time becomes especially important during a student's undergraduate experience as they try to navigate that important stage in their lives. Faced with new responsibilities and a range of extracurricular activities to choose from, as well as busy class schedules, students may feel that they 'don't have time' to dedicate to everything that they want to. There are many reasons that may be contributing to that problem, which we will explore some of shortly, but the main purpose of this paper is not to discover the reason more than to better understand the problem itself. This study is aiming to take a close-up look at how engineering students distribute their time between in-class and out-of-class activities. Particularly, we will be looking at how students dedicate time to studying, how their time is spent in lectures and in labs, and how their time balances overall between in-class and out-of-class activities.

Reviewing the literature to see how other researchers study students' time revealed a couple of studies that particularly focus on students' time management. Case studies [1], [2] were looking at to what extent the students are able to manage their time and how that affects their academic performance. Some other researchers focused on the time spent on various activities during studying [3] to determine how time is distributed on activities like reading, solving problems, working in groups, etc. to know which activities students spend the most time on.

Another approach was framed around the concept of workload. In that case the researchers didn't directly measure or see how students spend their time, but instead they asked the students about the workload they have during the semester. Such studies quantitatively measured workload in terms of how long it takes to complete an assignment [4], [5] and then studied the connection between that and the students' academic performance and satisfaction about the course.

Some researchers approached this topic from the connection between time spent learning, and the learning achieved [6], [7] argue that learning is constructed and shaped by the students and the amount of effort they put into learning something, which requires time investment. They looked at how much students spend studying in terms of hours, and they came up with the conclusion that students don't spend enough time studying, therefore don't achieve deep learning of concepts.

Methods

Interviews were used to collect data from the participants. This study focuses on ten students in the second year of the chemical engineering program at a public land grant U.S. institution. The data is part of a larger longitudinal study that tracks chemical engineering students in six institutions across three countries for four years. The interviews selected for this paper were conducted during their second academic year in the program in the spring semester. Those ten students were chosen following purposive sampling [8] aiming for a diverse pool of participants. The table below shows the demographic breakdown of the participants in the study.

Table 1: Self-reported demographic information

Pseudonym	Gender	Ethnicity/Nationality
Sameer	Male	Asian
Jennifer	Female	White
Reed	Female	African American
Hoa	Female	Asian American
Drew	Male	White
Bret	Male	Caucasian
Frankie	Male	Caucasian
Devi	Female	Indian
Kai	Male	White/Pacific islander
Qiang	unreported	unreported

The interview questions were framed around the students' experiences in general during their time in the university, with few questions focusing particularly on how they spend their time in a given week, and the kind of activities they are involved in. The questions used for the analysis for this paper are:

Q. Could you please walk me through a recent week of studying? What does your timetable of taught sessions and studying look like during a week?

Q. Thinking about the different classes you take, comparing the lectures and labs. Which would you say you prefer or like more than the other?

Q. Think about the time you spend in class and out of class, like working or studying. How would you say the two balance out?

Results

Studying vs. Completing Assignments

Students divided the idea of studying into two categories. The first was completion of assignments, ranging from homework assignments to laboratory reports. The second was studying for the purpose of understanding the knowledge discussed in class in order to be ready for tests and examinations.

Some of the students' comments give a sense of how the idea of completing an assignment is not necessarily considered 'studying':

“[In] my Math class, I don't have any homework outside of that, so I just have to study.”-Jennifer

“The homework I would say was definitely not the time consuming part. It was definitely the studying.” -Kai

“I try to knock out homework on the weekends. Just easy stuff, something you don't have to study, just something you need to physically get done.”-Reed

This suggests that students might sometimes view assignments as a task that takes away from their 'studying' time, and not necessarily an activity developed by the course instructor to aid in that learning process.

Time Dedicated to Studying

Some students had dedicated slots in their weekly schedule when they sit down, eliminate distractions, and focus on the task at hand. Some of those students commented:

“usually after class on Mondays, Tuesday, Wednesdays, and Fridays, I'm in there [in class] for a good two hours maybe for the whole day. And then I just go home and study for four hours straight”-Reed

On the other hand, some students didn't plan when to study, or schedule it, but rather completed it between completing other tasks and seemed to be completing studying between other tasks, without necessarily dedicating a clear time slot: “I would take whatever time I had during the day to study outside of class”-Hoa. Other students completed their studying between classes, for

example: “I have a break, and classes don't start till 12:30, so usually I'll do some math homework or something in that time.”-Jennifer

Time in Labs and Lectures

We also asked the students on how they felt about the time they spend in lectures and labs, particularly about what they learn from each and how labs and lectures complement each other. We arrived at an interesting observation about how students talked about the time spent in labs. They generally expressed that it takes a lot from their time (anywhere from two to three hours at a time) and requires a lot of work.

One of the students talked about the different tasks related to completion of a lab:

“we had to do what was a pre-lab, we had to do the observation notes or whatever, and the post-lab. And it consumes all of your time pretty much because you're constantly thinking about it, so you have to remind the manual the night before, or you have to do it afterwards [after the lab].”-Kai.

Another student had a similar description of the lengthy process:

“The labs are like, you know, they're like two-and-a-half-hour blocks. You'll have a pre-lab and a post-lab write up that you have to do. It kind of helps you understand what you're doing in the labs. Then you go to the lab and then you'll kind of conduct the experiment, gather the data, and then like write up about it for next week. So it's kind of like a cycle like that, you know? Post lab and pre lab for each of the labs that you're doing.”-Sameer

A student commented on how the number of credits attributed to a lab might not be a true representative of the effort invested: “this semester they standardized it [labs], which made it very hard for just a one credit class, and it's just too much work that you have to put into it.”-Devi

Balancing in-class and out-of-class

We asked the students to reflect on how their time is being distributed between being inside and outside of the class. Out of the ten participants, five students commented on spending more time outside of the classroom, mainly dedicated to studying and completion of assignments. There were three students who felt that their time balances out between inside and outside of class.

One of the students highlighted how the class meeting time is relatively limited, which leaves the majority of the day to the students to spend however they like: “there's definitely a lot more time

outside of class, just in general. For most of my classes, we meet twice a week, so definitely a lot more time on my own with that kind of material.”-Drew.

Another student expressed a similar thought: “I would say this semester especially, I’m spending a lot more time out of class.”-Bret

One of the student’s schedule helped to divide the day such that all the classes occurred consecutively rather than being scattered throughout, which allowed the student to have a neatly divided day. “I think I’ve spent equally as much time in class and out class most of the time. All my mornings goes into in class while my evenings goes out of class was just that perfect balance for both”-Devi

Also, the way time is divided doesn’t stay constant throughout the semester. Students adapt their schedule to account for times when they may need to put in extra study hours for exams. We see the students saying things like: “I think it depends. Normally, I spend like half-half. The outside time is just work on the homework. But if the test was coming, you may need to spend the whole day to work on it.”-Qiang

Discussion

In the first section of the data analysis we focused on the out-of-class activities, or in particular studying. When analyzing the data we had studying defined as any time or effort put outside of the classroom or the lab to complete assignments or to gain knowledge for those subjects e.g. reading, watching YouTube videos to better understand a concept, etc. We noticed a distinction made by the students. They tended to describe homeworks and lab worksheets as tasks that may get in the way of studying. In their schedule they also separated the time dedicated to each, with the time dedicated to studying considered more important to them. This will be one area that needs further exploration to find out why students don’t treat assignments as a component to studying.

The students’ comments about how they felt towards the time they spend in labs gets at the distribution of number of credits to specific courses and the curriculum structure. The students generally felt that labs take a lot from their time in terms of physically being in the lab from two to three hours at a time, to completing a pre-lab, post-lab, and sometimes a lab report too. Even though they saw the value in those assignments, they felt the effort put in should be equivalent to more than one credit on their transcript.

It was interesting to see the students’ comments about how they felt their time inside and outside of the class balances out. Before analyzing the data we were expecting the majority of the students to be spending most of their time outside of the classroom. The lectures durations in U.S. universities usually span either fifty minutes or an hour and fifteen minutes at a time, which

is relatively short, but also students will typically have two to three of these sessions in a given week for a three-credit course. That might block a big chunk of their schedule. Those students who felt that their time balances out might be having all of their classes occurring in such a way that it is back to back, which leaves them with a block of time in the second half of their day to spend outside of the class. It is also important to keep in mind that this is only their schedule at a given semester, which differs from one semester to the other.

The preliminary results from this work-in-progress study show the value in close-up interviews with students about their learning. We note fascinating findings on how students value different out-of-class activities, and also an interesting range on how they perceive the balance between in- and out-of-class activities. Further analyses will aim to characterize these findings in more detail.

References

- [1] M. Mukwevho, "Time Management Challenges on Students' Academic Performance: A Case Study of a Rural University in Limpopo Province, South Africa," *J. Polit. Econ. Soc.*, vol. 8, no. 2, pp. 81–99, 2018.
- [2] A. J. Swart, K. Lombard, and H. de Jager, "Exploring the relationship between time management skills and the academic achievement of African engineering students - a case study," *Eur. J. Eng. Educ.*, vol. 35, no. 1, pp. 79–89, Mar. 2010.
- [3] J.-R. Ruiz-Gallardo, J. L. González-Geraldo, and S. Castaño, "What are our students doing? Workload, time allocation and time management in PBL instruction. A case study in Science Education," *Teach. Teach. Educ.*, vol. 53, pp. 51–62, 2015.
- [4] D. R. Simmons, J. Van Mullekom, and M. W. Ohland, "The Popularity and Intensity of Engineering Undergraduate Out-of-Class Activities," *J. Eng. Educ.*, vol. 107, no. 4, pp. 611–635, Oct. 2018.
- [5] Y. B. Kurata, R. Marie, L. P. Bano, and A. C. Matias, "Effects of workload on academic performance among working students in an undergraduate engineering program," 2015.
- [6] S. Kolari, C. Savander-Ranne, and E.-L. Viskari, "Do our engineering students spend enough time studying?," *Eur. J. Eng. Educ.*, 2007.
- [7] L. K. Son and N. Kornell, "Simultaneous decisions at study: time allocation, ordering, and spacing," vol. 4, pp. 237–248, 2009.
- [8] B. Johnson and L. B. Christensen, *Educational research : quantitative, qualitative, and mixed approaches*. Sage Publications, 2008.