# Influence of Interpersonal Interactions on Student Engagement: Online Undergraduate Engineering Students' Perspectives

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## Abstract

In recent years, universities have seen an increase in online course enrollment. With better schedule flexibility, lower costs, and pacing, online courses offer specific benefits that face-to-face courses cannot. These benefits allow students to complete the course around their schedule, which allows non-traditional students (veterans, working full-time, married, married with dependents, transfer students, etc.) to enroll in online courses. Although online courses offer some benefits compared to traditional courses, online courses have been criticized for their potential negative effects. Online courses offer limited interaction with peers, content, and instructors. Interactions are often facilitated through online discussion boards, Zoom, and other online facilitators. These facilitators offer sparse interactions, which lead to feelings of isolation and a lack of motivation. Students in online courses drop out for a variety of reasons including lack of time, course difficulty, lack of support, etc. These factors provide larger dropout rates for online courses compared to traditional courses.

This study will specifically highlight how interpersonal interactions affect engagement in online engineering courses and answers the following research question, 'How do undergraduate engineering students enrolled in online engineering programs perceive interpersonal interactions and how do these interactions influence their engagement?' Online undergraduate students from a large public university in the US were invited to participate in a screening survey of this research study and four participants were selected. These four participants were invited to participate in a 45-60-minute interview. The interviews were conducted online (Zoom), and were audio recorded and transcribed. The participants were from the following engineering majors: two students from information technology, one from software engineering and one from graphic information technology. The participants' age ranged from 25 to 65, two participants identified as male, one identified as female, and one identified as Genderqueer/Gender Non-Conforming.

The qualitative data was deductively coded to examine the three types of interpersonal interactions: interactions with course content, interactions with peers, and interactions with instructor. The data showed that students' interactions with instructors and peers positively influenced their engagement in the online engineering courses. However, students' interactions with the course content gleaned mixed responses. Some participants said it helped them engage with the course material and others said it did not help them engage in the course content.


## Introduction

In recent years, college universities have seen an increase in online course enrollment [1-2]. In 2005, online enrollment began to increase, with 3.2 million people enrolling in online courses [1]. During the Covid-19 pandemic, online course enrollment skyrocketed, with 11.8 million undergraduate students taking online courses [3]. However, even with classes returning to regular in-person in the fall of 2021, the number of students enrolled in online courses was larger than pre-pandemic levels [4]. With better schedule flexibility, lower costs, and pacing, online courses offer specific benefits that face-to-face courses cannot [1-2][5-6]. These benefits allow students to complete the course around their schedule, which allows workers and busy students to enroll in previously inconvenient courses [6].

Although online courses offer various benefits compared to traditional courses, online courses have been criticized for their potential negative effects [4][7-8]. Fully online courses offer limited interaction with peers, and interactions with instructors [7][9]. Interactions are often facilitated through online discussion boards, an online platform (Zoom, Microsoft Teams, etc.), and other online facilitators. These facilitators offer sparse interactions, which lead to feelings of isolation and a lack of motivation [10][11]. According to a study by Onah et al., (2014), students in online courses drop out for a variety of reasons including lack of time, course difficulty, lack of support, feeling of isolation, reduced engagement, etc. [12]. These factors give rise to larger student dropout rates in online courses compared to traditional in-person courses. This study will specifically examine how interpersonal interactions (interaction with course content, peers, and the instructor) influence students' engagement and persistence decisions in online engineering courses.

## Literature Review

Interpersonal interactions are those between a student and the course content, student and student, and student and instructor. Interpersonal interactions have been shown to promote student engagement, a sense of belonging, student satisfaction, and persistence within online courses [11][13-15]. Fig 1 shows a visual representation of the influence of interpersonal interactions on different factors and influences within those factors. Although online courses give students important interpersonal interactions, online courses struggle to offer quality interpersonal interactions with content, peers, and instructors. Without quality interactions, students have been shown to drop out at higher rates [13][15].

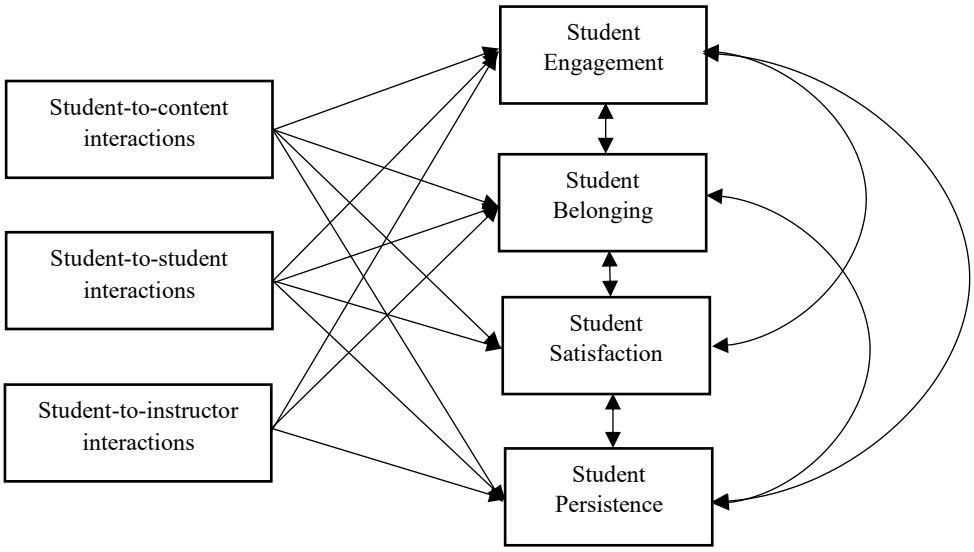


Fig 1. Influence of interpersonal interactions on different factors [11-12], [27-28]

Student-to-content interactions refer to the interactions that take place between the student and the course layout and course materials [16]. The structure of online course content can be designed in numerous ways and modified to fit the course's needs. Studies have shown that student-to-content interactions provide students with more satisfaction [13] and engagement in the course [17]. If the course content does not provide the required and right materials, it can affect the students' abilities to learn the course material and leave them feeling dissatisfied [18]. Moreover, the design of the

course content is crucial for students' learning. A complicated and unhelpful design has the potential to impede the learning of some students. These interactions provide the students with essential information and details they might need to be successful in the course, so the design of the course is crucial for the students' learning [19-20]. Of the three types of interactions, student-to-content interactions have been found to be the strongest indicators of engagement in an online learning environment [21]. The study [21] showed that student-to-content interactions made higher learning engagement by reducing boredom and increasing enjoyment in the course. Based on the existing research studies, we infer that student-to-content interactions affect students' learning, satisfaction, and engagement in online courses.

Student-to-student interactions are the interactions that occur between the students in an online course setting [16]. Traditional courses provide students with plenty of opportunities to interact with fellow students throughout the semester. However, online courses have minimal interpersonal interactions between peers because of the medium of instruction. Online courses have limited networks to facilitate social interactions and social presence. According to Miao and Ma (2022), social presence has a positive impact on how students engage in the online course [22]. Additionally, the virtual aspect of online courses can leave students feeling isolated from their peers. Social presence is believed to be the reason behind student isolation and loneliness. Students are not given proper systems to relay their social and emotional needs. Student-to-student interactions are vital for student learning because they allow students to feel connected, satisfied, and engaged in the course and their learning [13][22-23].

Student-to-instructor interaction is the communication and knowledge of course materials provided to the students by the instructor [16]. The instructor of a course communicates the information about the course and any learning materials the students might need. It provides the students with the necessary knowledge needed to complete the course. In an online course setting, the interactions with the instructor are limited to online lectures, emails, and discussions. According to Martin & Bolliger (2018), student-to-instructor interactions were most important for students to feel engaged in the course work. The students wanted instructors who listened and engaged with them. It made the students feel supported in their coursework which allowed the students to have better learning experiences [24]. Additionally, student-to-instructor interactions were helpful in building a sense of community for students. Instructors can build these relationships for students through support, encouragement, discussions, and required participation [25].

In summary, interpersonal interactions play a significant role in influencing online students' engagement, feelings of connectedness, and persistence among other factors. There are several research studies published in the online education space however, there are limited research studies that specifically focus on online engineering education. There have been quantitative studies to find the disparities in engagement between online and traditional courses. However, this study hopes to find out why these disparities occur using qualitative research design. This study will specifically highlight how interpersonal interactions affect engagement in online engineering courses and answers the following research question, '*How do undergraduate engineering students enrolled in online engineering programs perceive interpersonal interactions and how do these interactions influence their engagement*?'

## Methods

### *Participants*

The research participants for this study were recruited from an ABET accredited online engineering programs from a large public university in the US. The first author recruited the participants by sending emails to the program chairs of the online undergraduate engineering programs to share it with potential participants. The participants were required to complete an initial screening survey and based on those responses; participants were invited to participate in the interviews. The participants were provided with a $25 Amazon gift card for their participation in the interview. Participants recruited in this study had differing backgrounds and the demographic information collected includes gender identity, race/ethnicity, age, etc. We were intentional in selecting the research participants as we intended to capture as many diverse experiences as we could. The research participants' demographics are presented in Table 1.

Table 1. Participants demographics

| Pseudonyms | Gender Identity | Race/Ethnicity | Age | Major | Other Details |
|---|---|---|---|---|---|
| Participant 1 | Male | Black or African American | 43 | Information Technology | Married, working full-time |
| Participant 2 | Male | Black or African American | 65 | Software Engineering | Married |
| Participant 3 | Female | Asian | 31 | Information Technology | Transfer student, working full-time |
| Participant 4 | Genderqueer/Gender Non-Conforming | Hispanic or Latinx | 25 | Graphic Information Technology | Transfer student, working full-time |

### *Data Collection, Coding and Data Reduction*

Before we recruited the research participants, a pilot interview was conducted to ensure that the interview questions would yield the necessary data to answer the research question. Based on the experiences with the pilot interview, the interview questions were accordingly updated. Four participants were recruited for an approximate of 60-minute interview each, to answer the research question '*How do undergraduate engineering students enrolled in online engineering programs perceive interpersonal interactions and how do these interactions influence their engagement*?' This study was IRB-approved. The interview questions are presented in Appendix A. The interviews were conducted online using Zoom, audio recorded, and transcribed. The transcribed interviews were thoroughly reviewed to make sure no important information was left out. The transcribed interviews were coded in NVivo to analyze the data.

The transcripts were coded in three phases [26-27]. First, the transcripts were coded to find common themes and important ideas that might relate to the research question mentioned above. Each line of the transcript was read and considered for a possible code. The codes were manually named and labeled. The first coding phase resulted in 40 codes that relate to the research topic under investigation. Second, the codes were reviewed and analyzed to find redundancies and codes that did not relate to the research question. These codes were eliminated from the pool of codes. The second coding phase reduced the codes from 40 to 27 major codes. In the last phase of the coding process, the remaining 27 codes were mapped/categorized into three main themes. These

themes were premade based on the research question. The themes being “Interactions with Course Content”, “Interactions with Peers”, and “Interactions with Instructor”. Details about the coding steps can be found in Table 2.

Table 2. Coding phases and example codes

| Phase | Details | Examples |
|---|---|---|
| 1 | 40 Codes | • Course content requirements<br>• Instructor requirements<br>• Instructor and problems<br>• Overall opinion of course content<br>• Using other resources |
| 2 | 27 Codes | • Challenges with instructor<br>• Peer interactions and engagement<br>• Course content and belonging<br>• Instructor and helpful interactions<br>• Improvements on peer interactions |
| 3 | 3 Themes with 27 codes | • Interactions with Course Content<br>- Course content and belonging<br>- Challenges with course content<br>- Course content and engagement<br>- Course content requirements<br>- Finding external sources<br>- Improvements on course content<br>- Course content and helpful interactions<br>- Course content and overall opinion<br>- Course content and academics<br>• Interactions with Peers<br>- Peer interactions and engagement<br>- Peer interactions and successful completion<br>- Improvements and peer interactions<br>- Peer interaction requirements<br>- Peer interactions and belonging<br>- Peer interactions and academics<br>- Challenges with peer interactions<br>- Peers and helpful interactions<br>- Peers and overall opinions<br>• Interactions with Instructor<br>- Challenges with instructor<br>- Instructor and engagement<br>- Instructor interaction requirements<br>- Instructor interactions academically<br>- Instructor and engagement<br>- Improvements on instructors<br>- Instructor and helpful interactions<br>- Instructors and learning experiences<br>- Instructor and overall opinions |

## Findings

In this section, the findings are presented. The three main themes are drawn from the data described in greater detail below.

### *Theme 1: Interactions with Course Content*

In this section, we present the findings related to students' experiences of student interactions with the course content. First, students' experiences, with their course content interactions and its influence on their engagement in online courses, are presented. Second, the challenges associated with course content interaction and searching for more sources of information is discussed. Through the interview questions, we explored whether course content interactions influence student engagement in online engineering courses. Studies in the past have shown that student-to-content interactions provided the students with more engagement in the courses [21], [28]. However, the data from the interviews shows mixed responses. The participants expressed interactions with course content to be occasionally important for their engagement in the online course. Two participants believed the course content helped with their engagement in the course content. These students were always using their course management system, so an engaging system allowed them to be engaged in the course. Without it these students believed they would have had trouble in their course.

> *"Oh yeah, totally. Especially like the most recent one that I just completed, which is regarded as like a pretty difficult one without something like that. I probably would have been snowed under like pretty quickly. Without having that tool in place, like even [even] with my own time management or my own, you know, like self. Like regulating skills like I probably would have been overwhelmed without it."* (Participant 4)

> *"I think if it did, it probably did it in like a more positive way. Because for me as a student, I always was in canvas probably every day, especially when there was. A class that I had a class I was in canvas all the time."* (Participant 3)

However, because of some unpleasant experiences with the interactions with the course content, one participant believed that the course content did not affect their engagement in the online course, but the interaction with course content was required to successfully pass the course.

> *"No, because in the end you had to interact with the course content in order to pass, so even if you thought it was horrible, you better work with it and get it done."* (Participant 2)

A couple of the participants expressed challenges they had to deal with when interacting with the course content. Interaction with course content is important; however, if the course content is not well designed, it can lead to confusion or extra work for students. Two students mentioned finding additional outside sources to supplement the existing course learning materials. They further stated that their course content materials were not sufficient by themselves. Below are the excerpts from two students.

> *"So there have been instances like that and that was kind of difficult because it wasn't up to date. The course content was hard to follow, especially when the class needed like a certain program to. To (to) do the course and then the (the) course content or the assignments were actually out of date. And then so you as a student would have to*

*go through and figure it out on your own. And there were some. Sometimes there were like assignments where it was. Like I said, was outdated but like it. It you couldn't go back to the course content to get help or get like solutions on why you ran into an error. So you would have to see like outside help. You would have to go (go). To Google and stuff."* (Participant 3)

*"With myself to just use the books. And the lectures that the instructor provides, I go beyond that. You know, just do the research. For example, if you're studying about. The impacts of, for example, of the cyber attacks on a private organization. The book only describes the types of cyber attacks that exist and whatever and instruction may. Cover that and give some examples, especially if you're talking about on private companies. When you go to a school early. It's hard now. You are able to get more information. You know from other researchers that discuss the same thing ..."* (Participant 1)

***Theme 2: Interactions with Peers***

In this section, online undergraduate engineering students share their experiences about peer interactions in their online courses. Another part of the research question this study focused on finding out was whether interactions with peers facilitate student engagement in the online engineering courses. The participants believed that peer interactions were crucial for their engagement in the course. The peer interactions allowed them to learn from one another about the course, which allowed the course material to be engaging. Additionally, the interactions allowed more engaging conversations in the course because of different student personalities. Below two students explain how their peers helped with their engagement in the course.

*"Definitely because you, when you were talking to peers, you came to understand that some of your difficulties were universal. You found that some of your difficulties had already been mastered by other students, and they share showed you how to overcome what you were struggling with, and then other times you had opportunity to help other people. So I found that to be often more instructive than the course material."* (Participant 2)

*"There are some people that I guess were just naturally very emotive. And even just through the medium of, you know, text with a discussion, something like that like. You could see. Like their level of enthusiasm and it affected other people, but that was just them and their personality."* (Participant 4)

Not only did peer interactions help with student engagement in the online class, but it helped enhance students' feeling of sense of belonging. The students believed they were struggling with the class together, and they shared a common goal to finish the class. It allowed the students to learn the material together and create a sense of belonging. A couple of students shared their thoughts on how peer interactions helped them feel less isolated and alone in the class.

*"In the sense that you (you) met with people who had a common goal, they had a common struggle. And as opposed to every man and woman for themselves, you actually took the time to help each other, and everyone move forward together. That's, to me, the definition of community."* (Participant 2)

*"Uh, sometimes it was it was purely technical. It was just like, hey, here's another way to do this. Or here's this extra tool or YouTube video or whatever it is that was*

*supportive and then other times it was … , like feeling that shared sense of like, alright, I'm not alone in this and there's people that are doing the same thing and (and) it's. It's an achievable goal."* (Participant 4)

Although these interactions were crucial for engagement in the online course, there were some problems and improvements that should be noted. Specifically, one student mentioned the difficulty of organizing peers together for group collaboration and working on projects. Many online students are non-traditional students, meaning they have full-time jobs, are married, have children, etc. Interacting with peers in online classes is crucial. However, for non-traditional students', time is an important factor as they need to manage both their personal and professional life.

*"Most of the posts they are not live. You're not real time, so you have to wait for a response and. I think if we can have a real time. This I mean discussions that allow you to have a real time communication. I think that'll be better. Because then you have to wait until they respond later anyway."* (Participant 1)

*"I think because it was online there was an advantage of if we did get on zoom some people didn't want to put their camera on and then some people also didn't want to interact like via Zoom Call. They would rather text or message each other."* (Participant 2)

***Theme 3: Interactions with Instructor***

In this section, we present the students' experiences of interactions with their instructor in an online course. One of this study's aims was to find whether the interactions with the course instructor provide the student with enhanced engagement in online engineering courses. The interview data shows that the interactions with the instructor does provide student engagement opportunities in the online courses when the instructor is active in discussions and leads student learning. This quote is from a participant whose instructor was active in the discussions. Discussing the content and material with the instructor allowed the student to become more engaged in the course material and the course.

*"Ohh yes. Yes, you always brought that incentive because he also. So one of the good things that the instructor also. Was integrated with the discussions you could come and pose and bring a challenge. You know, say we bring one, I bring one argument and the other. The peer brings a different argument and he comes. And he made rebuttal both arguments and say, OK what about this? So he will. I mean most of the instructions were always involved even on the regular discussions. So not only like responding, replying to requests in questions. But most of the instructors were always involved in the discussions, which was a really great thing."* (Participant 1)

However, the instructor must be actively involved in the class for the students to feel engaged. Some students had expressed that instructors were not fully providing their availability and time to students in the course, and they felt discouraged to engage in the course work. For example, one student expressed that their instructor was not being active in their online course. The student felt demotivated and started to lose interest in the class.

*"It (it) demotivates you on your own work in that course and then you start to not care so much at the end of it. So I think it is better for the instructors to be present and be*

*active. That is what motivates you to do well. As a student and I've had that. A couple of times I would say like maybe. Maybe 40% of my classes had like instructors like that, but the other part of it which is, you know, bigger chunk, it's not been that many interactions. They just say one thing and then. They just, yeah, they just let all the students do the rest."* (Participant 3)

Similarly, one student expressed that the instructor played an important role in creating a sense of belonging in the online environment. Teachers who helped in the discussions and assignments helped the students belong. The student liked when the instructor came down to their level and tried to discuss the material. It allowed the student to learn the material and feel less isolated. One student shared the following example.

*"Well, one thing (is one thing is) because some instructors will give you assignments and things to do and they just create it and don't have any communications feel like they're all in the top. And we are isolated. As as peers, what I liked about the instructor and. It's a more of a decentralized learning. He comes down to our level. So hey, I have more knowledge than you. But I'm gonna sit with. I'm gonna sit with you. And be part of the discussion. We may bring up something that he never brought it up and. And that's part of the process … regardless if he has much more knowledge than us, we can bring up, we can bring something to the table by doing some research."* (Participant 1)

Although many of the students' experiences with their instructors were positive, there were some challenges with the interactions with instructors. One student found that some instructors would post office hours and not honor the hours posted which would leave them dissatisfied in the course. The other student found that many of their instructional videos were other instructor's content. Below two students share their challenges with past instructors.

*"There were office hours that were posted, but I also found that in the vast I find that in the vast majority of classes, even though there are office hours, they often or almost universally get canceled or postponed. Or I actually had one professor tell me he was too busy to answer my question during office hours, you know, so that would be my biggest dissatisfaction with online courses."* (Participant 2)

*"the instructors had like other like videos of other teachers doing the content. And it was like old video. And that's when I realized that the instructors weren't actually making videos of themselves making the content, they were actually there was, I guess some like a master copy and then they were giving. The like, you know, the all the instructors of that specific course, the videos for it and all the information that they needed to give us."* (Participant 3)

**Discussion and Conclusions**

This study aimed at understanding the influence of interpersonal interactions (interactions with course content, interactions with peers, and interactions with instructor) on undergraduate engineering students' engagement in online engineering courses. Four online undergraduate engineering students were recruited to participate in the interviews. The data showed that student-to-content interactions, student-to-student interactions, and student-to-instructor interactions

enhanced students' engagement in the online courses, feelings of belongingness and connectedness to the larger community, student satisfaction, etc.

In this study, as the focus was on understanding the impact of interpersonal interactions on student engagement, we would like to explain how students defined engagement in the first place. Engagement is letting students have course experiences that help them learn the course content without difficulty, having peers to share knowledge and learn from by communicating with each other, and having instructors reachable to get their questions answered.

Firstly, student-to-content interactions and engagement showed varying results from participant interviews. Three students mentioned that the course content positively affected their engagement in the online course. On the other hand, one student believed the course content did not affect their engagement, but it was a crucial part of the course. These results partially agree with the existing literature. For example, the student-to-content interactions have been shown to positively impact engagement in online courses [21]. These student-to-content interactions create engagement by reducing feelings of boredom and creating enjoyment in the course.

Secondly, student-to-student interactions showed that it promoted engagement in the online course and created a sense of belonging. The students believed interactions with their peers helped them engage in the course material. It is important to note that several students mentioned how working with their peers helped create community and sense of belongingness. These results directly correlated to many research studies available. When students are allowed to collaborate and communicate with their peers, students have a higher engagement in the course [29]. Similarly, students feel a sense of belonging and a part of the community when given worthwhile and trusting relationships with peers [30].

Thirdly, student-to-instructor interactions also promote engagement in online courses and create a sense of belonging. Three of the students had instructors that helped create engagement in the online courses. However, one student mentioned interactions with their instructors did not necessarily influence their engagement in the online course. They believed instructors who were present and active in their courses created engagement in the course. These results are consistent with studies already published. Studies show that student-to-instructor interaction has a significant impact on students' learning and engagement [31]. Similarly, studies also show that student-to-instructor interactions help the student create a sense of belongingness in the online courses [32].

**Limitations, Implications, and Future Work**

Similar to other research studies, this study also comes with limitations. The sample recruited for this study includes participants from one university at undergraduate level and is not representative of the broader online engineering programs/community. Additionally, the undergraduate students recruited were from only three engineering majors: information technology, software engineering, and graphic information technology, which does not reflect the experiences of all engineering majors.

The findings from this study are timely and relevant as ABET is increasingly accrediting online engineering programs in the United States. The study's findings imply that institutions trying to increase the persistence of their students in online undergraduate engineering programs and other online programs need to consider the importance of interpersonal interactions in online learning environments. By purposefully providing opportunities for students to engage with the course

material, other students, and the instructor, course instructors who possess design flexibility can significantly alter the way that students learn in online courses.

Potential future directions include recruiting research participants (undergraduate and graduate students) from different engineering majors and institutions across the United States. Additionally, collecting data would be important to further understand the nuanced experiences of the non-traditional students in the online programs and find what aspects of these interactions specifically influence/hinder their motivation, participation, learning, engagement, and persistence decisions in online courses.

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**Appendix A: Interview Questions**

1. What are the different types of interactions that you have experienced in your course X?
    a. Interactions with the content
    b. Interactions with the peers
    c. Interactions with the instructor
2. What is your opinion about these interactions? Do they positively/negatively influence your involvement in your courses?
3. As a part of your course X, what type of interactions were you required to do with your course learning management system?
    a. Can you provide specific examples? (Can you please walk me through a scenario of an interaction that you have had with the content of course X for my better understanding?)
    b. Can you elaborate more on that?
4. What is your opinion on those interactions? How do you perceive them?
    a. What aspects of those interactions were helpful academically (engagement, feeling of belongingness, learning experiences, motivation, persistence, etc.)?
    b. What aspects of those interactions could have been better designed or provided with for better learning experiences or opportunities?
5. During your enrollment in the course X, what type of interactions with your peers, were you expected to have?
    a. Can you provide specific examples? (Can you please walk me through an interaction that you might have had with a peer in course X?)
    b. Can you elaborate more on that?
6. What is your opinion on those interactions? How do you perceive them?
    a. What aspects of those interactions were helpful academically?
    b. What aspects of those interactions could have been better designed or provided with for better learning experiences or opportunities?
7. In your course X, what type of interactions did you have with your course instructor?
    a. Can you provide specific examples? (Can you please walk me through an interaction that you might have had with your course X instructor?)

    b. Can you elaborate more on that?
8. What is your opinion on those interactions? How do you perceive them?
    a. What aspects of those interactions were helpful academically?
    b. What aspects of those interactions could have been better designed or provided with for better learning experiences or opportunities?
9. Honestly, how do you think a course would look like without interactions with course learning management systems, peers, and instructor? Can you please share your thoughts on that?