



SEINÄJOEN AMMATTIKORKEAKOULU  
SEINÄJOKI UNIVERSITY OF APPLIED SCIENCES

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# Novice Programming Students' Reflections on Study Motivation during COVID-19 Pandemic

Meija Lohiniva

*School of Business and Culture  
Seinäjoki University of Applied Sciences  
Seinäjoki, Finland  
meija.lohiniva@seamk.fi*

Ville Isomöttönen

*Faculty of Information Technology  
University of Jyväskylä  
Jyväskylä, Finland  
ville.isomottonen@jyu.fi*

**Abstract**—In this Research Full Paper, the aim was to explore students' perceptions of their study motivation during COVID-19 pandemic. The goal was to dig into this current topic when it is still fresh. This type of event could be recurring in time and it may also be related to more permanent changes in education. The context of the study was an introductory programming course run in synchronous hybrid mode during COVID-19 pandemic. This was a qualitative study where students were interviewed about study motivation, effects of the pandemic, and differences between studying before and during the pandemic. Data collected was analyzed using data-driven theory-based content analysis. Students found it important to have a sense of belonging to the course, peers, and teacher to stay motivated. Hybrid mode was seen to be problematic in terms of communication, collaboration, and connectedness. Pandemic caused time allocation issues, challenges in collaboration due to safety measures, and a general worry. It seemed imperative for students' self-efficacy to know other students had similar challenges, too. Some students formed micro-communities which proved to be a great form of collaboration, especially during a time when the number of close connections was limited. Educators should put effort into giving feedback, help, and encouragement to students, especially in difficult subjects during challenging times. Somewhat comforting is, that if a student's motivation is strong enough, not even a pandemic can affect that.

**Index Terms**—motivation, CS1, pandemic, synchronous hybrid learning

## I. INTRODUCTION

Educators all over the world faced a massive new challenge, as COVID-19 pandemic forced universities to close the doors of their campuses early 2020. Educators had to make an emergency shift to full online mode overnight. Transferring from classrooms to online mode was not the only thing the pandemic changed: it also brought a lot of worry and strict preventive measures. Learning to program is known to be difficult and to overcome the challenges, students need to be motivated [1]–[6]. Tinto [6] describes three aspects of motivation institutions can influence to be self-efficacy, sense of belonging, and perception of curriculum. This current study concentrates on the first two since the hypothesis is that these might have been influenced by the pandemic, and also because the participants are Open UAS students, not degree students. The target of this study was to explore how the pandemic affected students' study motivation. Students were also asked to compare their experiences to a course they took before the

pandemic. The pandemic being such a recent incident, there is not much research regarding this as of yet and it is an interesting and important phenomenon to study. Challenges in CS1 courses is not a new phenomenon and there is a number of research articles to be found concerning this. The role of motivation in programming studies [1]–[5] and suggested solutions, such as collaborative learning [7], [8] have also been researched. The research gap this current study aimed to fill was the effects of the pandemic on students' study motivation. The main contribution of this work was to provide insights into students' perceptions of their motivation during difficult times such as the pandemic and increase knowledge on the subject. Practical contributions were suggestions on what educators can do to fortify motivation, during challenging times in particular.

## II. RELATED WORK

### A. Motivation

To learn to program, the student must adopt a whole new language and mindset. They need to practice and apply, mere memorization does not suffice. These are some of the reasons depicted to explain the challenges. [1] [4] Furthermore, skills in problem-solving and logical reasoning are often not on a sufficient level [4]. Tek, Benli, and Deveci [1] conducted a study related to self-efficacy, or programming-efficacy in the case of programming, by utilizing self-efficacy scales. Their study indicates self-efficacy, in correlation with a mindset about programming, to have a big role in explaining the struggle with CS1 courses [1]. Motivation the students have for studying can be intrinsic, like the will to learn, or extrinsic such as hopes related to income or occupation [6]. According to Gomes and Mendes [4], only a few students have enough intrinsic motivation to learn to program. Many factors can affect students' study motivation, both in and outside school. For instance, teachers and their methods of choice can make a difference in motivation. Tinto [6] describes self-efficacy, sense of belonging, and perception of curriculum to be some of the most important factors in study motivation that institutions can influence. Self-efficacy can be defined as a person's belief in his capabilities to succeed in a particular task or situation [9]. Sense of belonging, on the other hand, denotes student's perception of belonging in their study [6].

It is important to keep in mind, Bandura [9] reminds, that self-efficacy is learned, not inherited and that it varies in different situations. Some of the things possibly having an impact on self-efficacy are the teacher, programming itself, and peers. For this reason, it is something the teacher should pay attention to. People with a weak sense of self-efficacy often underachieve, whereas people with a strong sense of self-efficacy tend to have more persistence and perform better even in challenging situations [3]. Gorson and O'Rourke [2] studied self-efficacy based on the effect of typical moments in programming such as syntax errors, task taking more time to complete than expected, or having to start over, that might prompt negative self-assessment. This was found to lower student's self-efficacy and the suggested solution for this was interventions to make students' expectations more accurately reflect the reality of programming. A study by Lishinski, Yadav, Good, and Enbody [5] indicates self-efficacy to be the most important predictor of a student's performance. Furthermore, their study shows the things affecting self-efficacy are metacognitive strategies and goal orientation. They see self-efficacy and performance to be a loop where self-efficacy improves performance and then performance improves self-efficacy and so forth. In their paper they suggest self-efficacy interventions to support students' performance.

Gomes and Mendes [4] published a paper on teachers' views about introductory programming courses and motivation. They concluded aspect having the biggest effect on students' study motivation to be a close and comfortable student-teacher relationship. Teacher influence is mentioned in other studies, too [6]. Teacher's feedback and encouragement can have a significant positive effect. Collaborative methods have often been suggested as a means to enhance student motivation through active engagement. Yadav, Mayfield, Moudgalya, Kussmaul, and Hu [7] recently published a paper about collaborative methods, self-efficacy, and motivation in CS1. They studied the phenomena from student's perceptions and their learning outcomes. According to their paper, the students perceived collaboration to have affected their learning, but the outcomes indicated that self-efficacy is the one single factor that has the greatest impact on students' learning. Furthermore, Corney, Teague, and Thomas [10] explored the means of collaborative methods to enhance student engagement and performance. They also found them beneficial. One popular approach to add collaboration and engagement in teaching is gamification as suggested by Knutas, Ikonen, Nikula, and Porras [8]. In their study, they saw an increase in online collaboration and peer support, when applying gamification.

### *B. Hybrid Learning*

Hybrid learning, also known as blended, mixed-method, or b-learning is a method of teaching that combines onsite and online teaching. Synchronous hybrid mode refers to a mode of hybrid learning, where both, onsite and online learners, are participating simultaneously. The idea of hybrid mode is to give flexibility for students and enable participation in teaching for students, who are not capable of coming to on-

site classes. With the pandemic, the need for hybrid mode was expanded. In their article, Wang, Quek, and Hu [11] noted challenges in hybrid mode related to the instructor. Balancing to give equal presence to both online and onsite students is challenging. For online students, the situation was seen to be problematic in terms of communication and observing classroom events, and for classroom students, the issues were related to engagement, especially when working with their online peers. For everybody, getting used to the new environment was also laborious. Motivation in synchronous hybrid mode was studied in a study by Butz, Stupnisky, Peterson, and Majerus [12]. They compared the experiences of students participating remotely and onsite. They found slight differences in three aspects between the two student groups: need satisfaction, motivation, and perceived success. Their conclusion was, that hybrid mode is not as problematic as previously assumed and the only major fallback is on feelings of relatedness. They see this as due to online learners having less social interaction with their peers and for this, they suggest educators encourage communication. On the contrary, another similar study by Olelewe, Agomuo, and Obichukwu [13] studied programming students in an asynchronous hybrid learning setting. They found online learning forcing students to take a more active role, and thus enhance their engagement and academic achievement. A similar finding is visible in Means, Toyama, Murphy, and Baki [14]: hybrid learners' performance was higher than that of their fully online and onsite counterparts. The last one was a general meta-analysis not restricted to higher education programming courses.

### *C. Studying during Pandemic*

Although COVID-19 pandemic being such a recent incident, Neuwirth, Jović and Mukherji [15] already published some guidelines for distance and hybrid teaching during and post-pandemic. They see collaboration between students and faculties as essential in accommodating a successful environment for studying. They emphasize the importance of mentoring, consultation, and continuous feedback. Furthermore, a virtual classroom etiquette is suggested, where students are encouraged to have their cameras on, use tools such as raising a hand and chat, unmuting microphones when not speaking, and asking and answering questions in synchronous lectures. Baloran [16] and Savitsky, Findling, Erel, and Hendel [17] both studied students' anxiety and coping strategies during the pandemic. Baloran's [16] study states that the pandemic caused concerns amongst students, and students were hesitant toward online-blended learning. Based on his findings, he suggests higher education develop plans concerning future pandemics in regards to supporting students' mental health and pedagogical delivery paradigm. Savitsky et al. [17] studied nurses and amongst them, anxiety levels were even higher. Their suggestions include the following: educators should invest in a stable educational framework and encouragement and support. Chang, Yuan, and Wang [18] also studied students' mental health status during the pandemic. They found out that anxiety and depression level of student varies based on

student's residential area (rural/suburbs), major (medical/non-medical), gender, age, drinking habits, and tone of information (negative/positive) received concerning the pandemic. The current study builds on Tinto's conceptualization of study motivation and focuses on study motivation during COVID-19 pandemic. This pandemic was the first to influence education to this extent, but most probably not the last. For this reason, there is not much research on this field yet, but it is an important phenomenon to study.

### III. THE STUDY

#### A. Study context

Context for this study was an introductory programming course at Seinäjoki University of Applied Sciences. The learning objective of the course was to learn basic concepts and structures of programming. The course was part of a study unit offered at Open University of Applied Sciences (OpenUAS) studies in the Fall semester of 2020. Due to the outbreak of COVID-19 pandemic Spring semester 2020, universities had to transfer to full online mode. By the time of the studied course, the pandemic situation had calmed down to the extent, that restricted contact sessions were feasible. This enabled the course to be run in a synchronous hybrid mode, giving the students the option to choose, whether they wanted, or were able to participate in the classes remotely, or in the classroom. All classes were held in a classroom and streamed to enable simultaneous remote participation. The main pedagogical approach of the course was traditional teacher-led where each class consisted of an introduction to the topic and practical programming assignments. Questions and comments from the distance learners were audible to the students in the classroom, and those of students in the classroom were repeated by the teacher to the distance learners. Onsite students were able to see their online peers when they had their cameras on, but the online students only saw the teacher and her screen. Other means of communication offered by the course were Microsoft Teams chat during the sessions and a discussion forum in Moodle learning management system. No synchronous hybrid mode-specific environment was used.

#### B. Method

This study was qualitative research in which the data collection method was semi-structured interviews and the content analysis was data-driven qualitative content analysis. Content analysis was chosen as an analysis method because the study aimed to understand and interpret the meaning of data collected and according to Hsieh and Shannon [19] content analysis is a good tool for that. The directed approach was used, where Tinto's [6] conceptualization of motivation was used in the creation of the interview guide and in the initial steps of the analysis process. In this sense, the method was mainly data-driven but additionally having theory-based characteristics.

#### C. Participants and data collection

There were 36 students who started the course and of those, 11 completed the course successfully. The dropout rate is high, and the assumption is, that three aspects influenced this. Firstly, these students were open UAS students, which means they often study just for fun and tend to drop out easily. Secondly, COVID-19 pandemic subverted many people's lives, causing them to give up all things not mandatory. Thirdly, introductory programming courses are known to have high dropout rates, due to the fact of programming being a challenging subject to learn. After the course, all students, regardless of whether they completed the course or not, were asked to partake in the study as an interviewee. A total of 11 students agreed to be interviewed. Of these 11 students, seven participated in the classes mostly in person and four remotely. All of them had little to no experience with programming. The age group of the participants ranged from 21 to over 50. Interviews took place in October-November 2020. Interviews were conducted individually either in person, by videoconference, or by phone call. Interviews were semi-structured (SSI). SSI was selected as a data collection method because the aim was to get to know each individual's independent thoughts on the matter. Prior to interviews, an interview guide was created listing the topics to be discussed in the interviews. The main topics for discussions were study mode (in-person/remotely), studying programming, motivation, sense of belonging, self-efficacy, comparison to pre-pandemic studying, and the effects of the pandemic in studies. Questions were open-ended and no self-efficacy scales or other such instruments were used. Sense of belonging and self-efficacy were taken from Tinto's [6] conceptualization of study motivation. The interviews were recorded and later transcribed. In the results section of this paper, the participants are referred to as P1-P11.

#### D. Analysis procedure

The first step in the content analysis process is to code text data and sort the informational content of the interview transcripts into categories [19]. Initially, the main low-level categories were thought to be based on Tinto's [6] conceptualization of motivation; self-efficacy, sense of belonging, and others. As the analysis proceeded and peer checks were carried out, it became evident that a more suitable way to categorize content, in this case, was to divide it based on the stakeholders on the motivation rather than the factors of motivation Tinto [6] presented. In this sense, the analysis approach was transformed from theory-based towards a data-driven categorization method. The main categories thus identified are listed in table I with examples of keywords used for each category. Categories are *teacher*, *self*, *peers*, *distance learning*, *pandemic*, and *assignments*. These categories would later be inspected based on the factors in Tinto's [6] model.

#### E. Considerations on trustworthiness

In semi-structured interviews, according to Newcomer, Harry, and Wholey [20], a lot of weight on the success of the study depends on the skills of the interviewer. The interviewer

TABLE I  
CATEGORIES

Theme	Definition	Illustrative Quotes
Teacher	Participant indicates teacher affected their study motivation	"teacher played a big role"
Self	Participant indicates they themselves affected their own study motivation	"I have set my target level"
Peer	Participant indicates peers affected their study motivation	"to see your peers struggle"
Distance Learning	Participant indicates distance learning affected their study motivation	"it's easier to ask questions in the classroom"
Pandemic	Participant indicates the pandemic affected their study motivation	"due to corona"
Assignments	Participant indicates assignments affected their study motivation	"once you got a difficult task done"

in this study was not very experienced but, on the other hand, the interviewer knew the subject area well and was familiar to the interviewees, which might have made the interviewees more comfortable sharing their insights. The other thing to take into consideration is that 36 students started the course, but only 11 of them agreed to be interviewed. This leaves some room for thought, whether students with specific insights were more inclined to partake, and had there been different aspects brought up by the students, who decided not to participate. Furthermore, of the 11 interviewees, seven participated mostly in person and four mainly remotely. This might lead the results to be biased to the in-classroom point-of-view. Peer checks were conducted in the analysis phase to add to the trustworthiness. Adjustments were made based on these checks, for instance, the analysis approach was adjusted from theory-based to one resembling a data-directed approach.

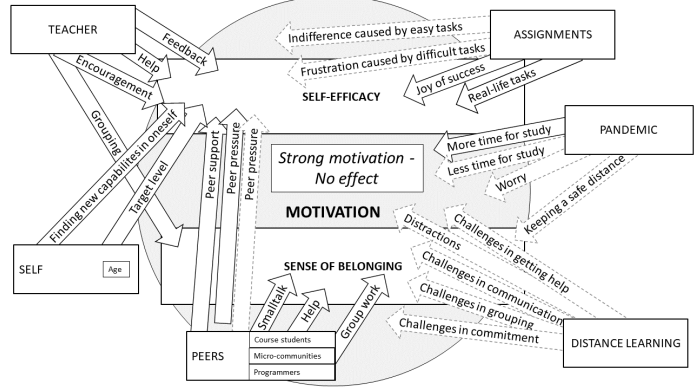


Fig. 1. How different influencers affected study motivation. The solid outline indicates a positive impact and the dashed outline a negative one.

TABLE II  
NUMBER OF STUDENTS MENTIONING SPECIFIC FACTOR

Factor	No. Students
Teacher: Feedback	2
Teacher: Help	3
Teacher: Encouragement	3
Teacher: Grouping	2
Self: Finding new capabilities in oneself	1
Self: Target level	1
Peer: Peer support	6
Peer: Peer pressure (positive)	1
Peer: Peer pressure (negative)	1
Peer: Smalltalk	4
Peer: Help	1
Peer: Group work	3
Distance learning: Challenges in getting help	5
Distance learning: Distractions	8
Distance learning: Challenges in communication	8
Distance learning: Challenges in grouping	5
Distance learning: Challenges in commitment	7
Pandemic: More time for study	1
Pandemic: Less time for study	5
Pandemic: Worry	1
Pandemic: Keeping a safe distance	2
Assignment: Indifference caused by easy tasks	1
Assignment: Frustration caused by difficult tasks	6
Assignment: Joy of success	3
Assignment: Real-life tasks	3

#### IV. RESULTS

In this section, the results of the analysis are described. Results are divided into subsections, based on the categorization shown in table I. Figure 1 summarises the different factors students named to have influenced their study motivation. These factors are *teacher*, *self*, *peers*, *distance learning*, *pandemic*, and *assignments*. Students did not always use these exact terms, but example keywords referring to these are described in table I. A specific area of self, that came up was *age*, which is visible in the figure. As well, in the figure, there are three sections in peers, which demonstrate the three layers of peers described by one interviewee. The arrows with solid outlines represent positive influence and the dashed outlines negative influence. Self-efficacy and sense of belonging are two of the main factors in study motivation in Tinto's [6] conceptualization. These two aspects were included in the interview guide, and for that reason are under special attention in this study. There is also, an area inside motivation that no arrows are pointing to, which illustrates the case of motivation being so strong, that nothing can make a difference. Table II lists the number of students mentioning a specific factor.

All interviewees were highly motivated to begin with, and they enjoyed learning programming, despite finding it demanding. The initial reasons participants wanted to study programming varied from a possible change of career to studying just for the fun of it. For some of the students, this changed during the course and for others, it stayed the same.

##### A. Teacher Influence

As can be seen in figure 1, the aspects named in interviews related to teacher's influence on students' study motivation were *feedback*, *help*, *encouragement*, and *grouping*. Feedback, help, and encouragement were said to have a great impact on students' self-efficacy.

1) *Feedback*: Students stated receiving feedback to be important, when studying something completely new, such as programming, where one might not be able to tell, at first, whether they are going in the right direction with their solutions.

P4: "Of course it's nice to get positive feedback... it's like... had there not been any, if you didn't get any feedback, you would've missed it."

2) *Help*: Students described the availability of help as assuring. The importance of help being available was highlighted in remote study mode.

P11: "It was very positive and surprising that there was personal help [from the teacher] available when needed when studying remotely."

3) *Encouragement*: Encouragement was mentioned to be one of the important aspects of teacher influence for motivation. The need for encouragement came up in several interviews and was deemed to be particularly important in programming, a subject the students found arduous.

P1: "In a challenging subject as this, the role of the teacher is really big, like, that you get a feeling that the teacher really wants that I, too, will learn and it isn't indifferent to her."

4) *Grouping*: Most students stated that students' sense of belonging could have been enforced by the teacher by organizing some grouping exercises. This course was an open UAS course for adult learners, and for this reason, there were not as many grouping activities on the agenda as might have been beneficial.

## B. Self Influence

Self influence refers to interviewees indicating factors on their study motivation caused by themselves. In the interviews, there were two factors brought up in this category, *target level* and *finding new capabilities in oneself*. Age and generation of students were mentioned in interviews as having both negative and positive influences. For self-efficacy, age and life experience were seen to have a positive influence. Prior experience with frustration and fallbacks was considered a good aid to overcome challenges. The trust in oneself's general self-efficacy was said to be stronger than that of participants' younger selves.

P3: "I have been wondering, had I been in a similar situation when I was younger and experiencing such frustration... I don't know whether I had managed as well."

Also the joy of success was anticipated to be stronger at a late age. On the other hand, this generation was seen as having a hard time learning to communicate in the virtual world.

1) *Target Level*: One participant described her strong self-efficacy to have had a great impact on her study motivation. She further explained, that to have a strong self-efficacy, she had to put it into perspective with her target level. With a realistic, reachable target, it is easier to stay motivated. According to her, life experience is a valuable help in this.

P3: "I don't feel that I'm particularly gifted in this, but I put it into perspective in relation to my own target level... at this stage of life, I no longer think, that I have to be extremely good in this, but I have had so many different target levels for learning throughout my life, that I have a strong feeling, that I can reach a level in this, that satisfies myself."

2) *Finding New Capabilities in Oneself*: One student mentioned how her self-efficacy changed drastically during the course from previously seeing herself incapable of learning to program to actually start to pursue a career in programming.

P2: "I have always thought that I don't want to do anything like this and I don't want to be an engineer or I'm not interested in these sorts of things, and then I found that side of myself where I'm like, wait a minute, I've been sitting at this computer for four hours trying to figure this out and I don't want to stop."

## C. Peer Influence

According to respondents, peers had a great impact on study motivation. Factors listed included *peer support*, *peer pressure*, *smalltalk*, *help*, and *group work*. One student saw three different layers of peers related to programming: *course students*, *micro-communities*, and *programmers*. These can be seen as subsections of peer influence in figure 1.

1) *Peer Support*: Peer support was seen as a way to relate to other students' experiences with learning to program. Especially important it was, for a lot of students, to realize they were not the only ones struggling.

P1: "[My motivation was strengthened by the impression that] other students in the group were also struggling with the same newbie issues."

This was not limited only to the peers in the same group, but also knowing it to be a general challenge made it easier for students to cope with the hard work.

P2: "But the knowledge helped when [teacher] said that this [challenges in learning to program] is a global issue."

Peer support was seen to be transmitted by facial expressions and informal oral communication, which are not very well passed on from the classroom to the virtual world.

2) *Peer Pressure*: Peer pressure manifested itself when the students saw their peers being able to learn studied subjects and that realization made them feel that if others can learn this, they will be able to learn it, too. This was described to be more perceivable in a classroom.

P1: "When studying in a classroom, you can feel the peer pressure when you see others doing and learning so I have to learn and do, too."

One interviewee also saw a possibility of peer pressure to have a negative influence in a scenario in which other students were more skilled in the studied subject.

P1: "Had I noticed, for instance, that the group was full of young people who had known how to do

everything straight away, and also their questions in the class would've been way over my head and I wouldn't have had any idea, what they are talking about... like they were speaking a foreign language... then that would've been depressing."

3) *Collaboration with Peers*: Collaboration with peers in means of *smalltalk*, *help*, and *group work* were mentioned. All in all, the conclusion of one of the students was that studying alone would just not work.

P7: "Nothing would come out of this on my own."

Only one of the interviewees said he did not long for collaboration with their peers.

P6: "In the end, it [sense of belonging] didn't affect it [study motivation], I am, in everything, a person who likes to work alone."

4) *Micro-communities*: Micro-communities are not a factor influencing students' motivation but a subset of peers and in this sense different from peer support, peer pressure, and collaboration. Students referred to micro-communities as student groups, that worked together based on their own initiative. These micro-communities were formed amongst students who knew each other beforehand, in some cases even enrolling in the course together. Students described micro-communities to have increased their study motivation by providing peer support, and somebody to work with and talk to about the subject.

P4: "For us, this pair work has worked very well, it might have been... had I worked on my own that I would've tired, so I would say this micro-community has been great."

Students in micro-communities were less active in seeking collaboration with students outside their micro-community.

P4: "I didn't feel the need [to collaborate with students outside the micro-community] which is because we can complement each other.. we were like a micro-community"

Members of micro-communities knew each other well and spent time together in their free time outside the course work, which helped with organizing time for collaboration. Also with the pandemic, when you have to limit the number of contacts, the micro-communities were still able to work together in person. Some micro-community members also had a healthy competition that made the members more motivated to learn.

5) *Different Layers of Peers*: One student identified three layers of peers she had for her programming studies. The first one being the fellow students on the course. With this layer, she found the sense of belonging to be rather shallow. The second layer was her own micro-community, where she felt a very strong sense of belonging. The third layer named, was the universal group of people who understand programming lingo, to which she wanted to belong to.

#### D. Assignment Influence

In many interviews, the aspects related to assignments came up. Students named the following assignment-related

factors having strengthened their study motivation: *Indifference caused by easy tasks*, *Joy of success*, *frustration caused by difficult tasks*, and *real-life tasks*. Based on the student's comments, it seems imperative to have the assignment degree of difficulty be at a fitting level for the students.

1) *Indifference Caused by Easy Tasks*: If the assignments are too easy, the students do not find them very motivating.

P4: "A lot of times I've had to search additional info and I think it's kind of built-in here... I haven't found it a bad thing, on the contrary, if the assignments were just you code, like just labor without the feeling of searching and comprehending... it is... motivation would be lowered."

2) *Joy of Success*: The more demanding assignments seemed to enforce students' self-efficacy.

P4: "The joy of success at this age when you realize that ok, this works, I got it to work, is so rewarding that it makes you work hard for a long time."

3) *Frustration Caused by Challenging Tasks*: On the other hand, if the assignment is too difficult, it might weaken student's self-efficacy.

P7: "... when there's been a difficult task and I've been like I don't understand this on any level, of course, it makes me feel like am I stupid."

A strong self-efficacy was seen to have helped overcome frustration caused by difficult tasks.

P3: "I feel that it [self-efficacy] has an impact [on motivation] and that, when you're accustomed to thinking, that I can learn things then even though something is difficult and you get frustrated, you just push through."

4) *Real-Life Tasks*: Some of the students found real-life assignments to work on and that had a major positive influence on their study motivation.

P4: "When we found these.. all these assignments within our own business more or less, it has given us so much."

In general, assignments being concrete was found motivating.

P3: "It has been great that the assignment was so concrete, it sure motivates."

#### E. Distance Learning Influence

Most of the interviewees who had been studying remotely were forced to do so due to technical or health-related reasons. Some of them found distance learning to have a negative impact on their study motivation. The factors of distance learning influence on the study motivation were *challenges in communication*, *challenges in getting help*, *distractions*, *challenges in grouping*, and *challenges with commitment*. One interviewee pointed out that it does not matter so much, whether teaching is in a classroom or remote, as long as it is live, as opposed to recorded. The influence of distance learning on motivation was seen to be stronger if the motivation was not very high to begin with.

P1: "If one is at all so and so [with the motivation] then it [being in the classroom] has an impact."

1) *Challenges in Communication*: Students found it easier to ask questions in the classroom. The issues mentioned in asking questions remotely were in regards of how to format questions and the general hesitance of turning the microphone on in a conference call. This was anticipated to be a generation-related issue, depicting the younger generations to be more comfortable with remote communication.

P3: "When in the same room, it is, at least for me, easier to open my mouth."

Some students suggested the tools used (discussion forum in Moodle, chat in Teams) were perhaps not the best of tools to encourage communication.

P2: "Now in this other course, we have a Slack channel, and when I posted there saying the train left and I'm running to catch up, a lot of people commented straight away."

2) *Challenges in Getting Help*: To get help with problems was reckoned to be more convenient in the classroom. The remote learners had a higher threshold for asking for help for their code issues by sharing their code, than the learners in the classroom who could just ask the teacher to stop by at their desks to help with the issues. Programming was seen as a subject that in particular benefits from in-classroom sessions. One student who had doubts about the need for in-person sessions came to realize the opposite.

P3: "I have been weighing [the need for in-person sessions] now that I've been trying to learn to program, would it be better to have for example six hours of contact sessions.. perhaps so."

3) *Distractions*: One of the challenges students mentioned in distance learning was the number of distractions and difficulties in keeping concentrated.

P10: "When you come to the school, you study harder. When you're home there are always other things to do, and then you might lose your interest [in studying]."

4) *Challenges in Grouping*: Grouping in this context encompasses activities and situations that lead to the evolution of team spirit to improve collaboration and communication by accommodating a safe environment. Students described grouping to be more difficult in distance mode. Peer support and the will to help others in the virtual world were seen as lower than in the classroom.

P4: "The fact that you don't know... that I can't even connect the name with the face and who is who, and who are these people... so I couldn't be bothered helping others with their problems."

One student mentioned finding same spirited friends for support in strenuous situations to be easier in the classroom. This was mentioned to be especially important in a difficult subject as programming. Informal messages such as facial expressions are one mean of offering peer support. With these,

the remote mode of study lacked compared to the in-class mode. Furthermore, remote learning does not accommodate well for informal small talk.

P8: "It would've been a bit different, had there been people around, and then you would've chitchatted and so on... it doesn't feel right to interrupt [from distance]"

5) *Challenges in Commitment*: Some students also said, that seeing the teacher in person makes students more committed to studying and thus less prone to drop out.

P1: "I dare say, had I not seen the teacher in person in the first class, when there were the times of frustration... what if I just give up."

Seeing the teacher via videoconference was said to not have the same effect, at least not to the same extent.

P6: "We had this other course and didn't have any in-classroom teaching, it was lacking, it would've been nicer to at least see the teacher, well he had the video on, but anyway, that we would've met in real life and so on so... perhaps for that course's motivation, it had an impact."

The student's commitment to studying was seen to be weaker in distance learning.

P6: "I've liked both [in-classroom and distance] a lot but I'd rather be in the classroom. It feels more like a commitment."

## F. Pandemic Influence

Pandemic was also seen as a factor in students' study motivation. The pandemic-related influence was said to be caused by *less time for studying, more time for studying, worry, and keeping a safe distance*.

1) *Less Time for Studying*: Programming was seen as a very time-consuming skill to learn by many participants. The lack of time and the amount of time needed for learning to program was the single most mentioned aspect when discussing challenges in the studies. Most of the students said they would have wanted to spend more time studying than they were able to. For some students, the amount of time needed to learn to program came as a surprise whereas some of them knew it beforehand but still were unable to allocate a sufficient amount of time for it. For some of the students, the pandemic had caused so much work that they did not have as much time for the studies as they had hoped and planned for.

2) *More Time for Studying*: On the other hand, for one student, the pandemic had accommodated more time for studying, since all recreational events had been canceled.

P2: "Probably this [pandemic] has made it easier because my calendar is empty, there is nothing on the weekends, I haven't been going anywhere so I've been spending all my time studying."

3) *Worry*: One student mentioned worrying about the pandemic having had an impact on her studies.

P1: "I can tell that... kind of my threshold for losing my nerve has been lowered [due to the pandemic] and thus with difficult tasks I tend to give up easier."



4) *Keeping a Safe Distance*: Keeping a safe distance was mentioned as having interfered with the sense of belonging and thus, study motivation.

P6: "There was some [sense of belonging] but I would've liked more, but there was a little bit, maybe it was the corona, the fact that you had to keep a safe distance."

One of the interviewees said he had such high motivation that not even a worldwide pandemic, could have wavered that.

P9: "For the first time my motivation was 100% so nothing had an impact on that."

## V. DISCUSSION

The results indicate support from the teacher and peers, be it their micro-community or the whole class, was important for all interviewees. The feeling of support being available was complicated when studying remotely, which is in line with the study by Butz et al. [12] in which relatedness was discovered as the biggest challenge in a hybrid mode. The need for support was said to be emphasized in distance learning mode and with a difficult subject like programming. The key observation was that the students studying in micro-communities were committed to studying and performed well. It is worth investigating how educators could encourage micro-communities. As Tinto [6] stated, it does not matter that much to which group the student has the sense of belonging, as long as they do.

Sense of belonging is often encouraged by informal messages in classrooms and they are not easily transformed into virtual classrooms. This is something educators should pay attention to when situations such as pandemics compel transition from classrooms to virtual ones. The student-teacher relationship was described to be the most influential factor in the study by Gomes and Mendes [4]. This was also brought up in the interviews. It was important for the students to meet the teacher face-to-face to feel more connected to the studies and thus enhance retention. This supports the idea of having at least the introductory session of a course in a classroom.

Self-efficacy had a big impact on study motivation as was assumed based on the prior research [1], [2]. For strong self-efficacy, the aforementioned encouragement from the teacher and support from peers seemed to be important. Additionally, interviewees brought up age and generation-related aspects, noting that previous experience helps to deal with frustration and drawbacks and to set realistic goals. Given that the study population consisted of adult learners, educators should not forget to emphasize encouragement with challenging subjects in such a context.

As Wang et al. [11] state, synchronous hybrid teaching is strenuous for the teacher when she has to balance between the students in the classroom and online. In the present setting, the communication between online and onsite learners might have felt more natural, had there been a good quality stream from the classroom students toward the online students. Conference microphones would have been needed to capture

such conversation. Agreed by both teacher and students, the important thing that calls for a change was the classroom participants' attitude towards distance learning and especially communication in the virtual world. An assumption among the interviewees was that their generation is less eager for communication online compared with later generations.

The pandemic brought changes in classroom teaching, too. The participants had to wear masks and keep a safe distance. Facial expressions are not as well visible from behind the mask and keeping a safe distance was mentioned to have harmed students' sense of belonging. The present research setting clearly conveys that it is harder to help and do group work when students cannot work closely together or touch the same devices without disinfecting.

## VI. CONCLUSION

Taking a qualitative interview study approach, novice programming students' reflections on study motivation during the COVID-19 pandemic were explored. The main contribution of this work is to increase knowledge on the phenomenon and discuss actions educators can take to prevent pandemics from harming students' study motivation. The results indicate that the pandemic influenced the students' study motivation. The pandemic caused worries, time allocation challenges, and difficulties in communication, collaboration, and commitment. These impacts were not restricted to a specific study mode but were experienced by both online and onsite learners. On the other hand, if a student's motivation was strong enough, even the pandemic could not damage that.

It is acknowledged that the motivational factors described in this study are reflections of a small group of students on one specific course. We will most probably see pandemics in the future, and this is an area that needs further research. It is worth studying what happens if the situation prolongs and in such cases how to support students and encourage communication and collaboration. In our follow-up research, these aspects that arguably influence study motivation will be studied also outside the time of the pandemic. The present results encourage such research.

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