Software Startup Formation in an Experiential-Based Course - An Empirical Investigation of Students' Motivations

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Cico, O., Duc, A. N., & Jaccheri, L. (2020). Software Startup Formation in an Experiential-Based Course-An Empirical Investigation of Students' Motivations. I *2020 IEEE Global Engineering Education Conference (EDUCON)* (s. 1278-1285). IEEE. https://doi.org/10.1109/EDUCON45650.2020.9125274

Software Startup Formation in an Experiential-Based Course – An Empirical Investigation of Students' Motivations

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***Abstract*— We added a Bootcamp external activity to our experiential-based course for first-year master students of Norwegian University of Science and Technology. Students engaged with realistic challenges from stakeholders while participating in the Bootcamp. We aimed to evaluate this year's student motivation in startup formation. We followed a mixed-methods approach combining data from a questionnaire and interviews. From the questionnaire, we found that the motivations regarding dimensions, such as startup formation increases, and the involvement of existing team members slightly decreased after Bootcamp. The interviews show that involving others—not only the existing team members—and having better funding opportunities are deemed crucial in future startup formations. The involvement in the startup formation of the existing stakeholders is still at a marginal level. The overall outcomes of the study help educators and researchers make educated decisions in relation to introducing startup formation within intensive software engineering experiential-based courses.**

Keywords*— Bootcamp, startup formation, experiential course, empirical software engineering

I. Introduction

Combining inter- and multidisciplinary teams for realistic product creation in an academic setting has been reported in many previous studies [1-3]. Agile and Lean Startup practices are also part of this process. A startup is recognized as a special condition for developing software products, in which the influence of business and team dimensions are more significant than those in traditional environments [4-6]. Software startup engineering (SSE) practices and their evolution cycle are well-explored in the literature [4]. Software-intensive courses with a focus on minimum viable product (MVP) creation are commonplace [7-10]; however, to the best of our knowledge, there has been no prior investigation of student motivations that could lead them to pursue startup formation based on realistic MVPs developed during an experiential-based course. After organizing a three-day Bootcamp activity incorporated into our course, we decided to investigate the perception of student motivation in creating Software Startups. To this end, we asked the following research question (RQ):

RQ: *How does a Bootcamp activity affect students' motivation in creating Software Startups in an experiential-based course?*

To answer the **RQ**, we followed a mixed-methods approach combining data from quantitative and qualitative questionnaires and interviews, respectively. The questionnaire contained 21 samples and interviews, with four different samples randomly selected from four different groups. Specifically, 21 students responded to the questionnaire once before Bootcamp Day 1 and again after Day 2. A sample of four students randomly selected from different groups were involved in the interviews. We performed a statistical analysis of the questionnaire answers and thematic coding of the qualitative data gathered during the interviews.

After analyzing the data, we found that overall motivations regarding startup formation and the involvement of other team members—not only those in the course—in a future startup increased after close collaboration with the stakeholders and the development of the MVP during the Bootcamp; however, stakeholders are mainly considered potential customers rather than being part of the core startup team.

The remainder of the paper is structured as follows. Section II presents related work. Section III describes the course and Bootcamp setting. The study's design and methodology are discussed in Section IV. Section V presents the obtained results as well as key findings. Section VI discusses the findings, lessons learned, their threat to validity, and ethics connected with the study. Finally, Section VII provides conclusions for this study and future research opportunities.

II. Related Work

Kolb has introduced experiential-based learning as a tool for students to utilize their background competencies to develop their skills [11]. Since then, numerous research efforts have been made during the past fifteen years in introducing experiential-based learning within a higher education setting.

A. External stakeholder-based courses

Jaccheri and Sindre [7] have identified the benefits of using multi- and interdisciplinary approaches in experiential-based learning courses combining Software Engineering (SE) with art. The authors have used action research by gradually improving the course. One suggestion for future work mentioned in their study is to establish more performance-oriented tests (e.g., an experimental pretest-posttest design). In our research, the pretest-posttest investigation relying on a questionnaire is part of the mixed-methods approach applied; however, in our study, an introduction of industry-related external activities was included in the course.

Pappas et al. [8] have suggested initial steps for experimenting with experiential learning with information and communication technology (ICT) tools to provide students with the needed competencies and experiences to solve societal challenges. The authors used a collaborative platform to expose students to real societal problems through ICT and

SE practices. To evaluate their findings, the authors have conducted a qualitative survey with students, which followed the experiential learning cycle. Further recommendations were made to perform a mixed-methods investigation (both qualitative and quantitative), as in this study, to evaluate the students' experiences during the course. Similar to our study, the authors have introduced external activities to the course.

João and João [9] have made a similar effort to foster entrepreneurship in engineering education. The authors conducted a survey with students from two master's courses of the same engineering school. The authors identified three main motivations that would prompt students to start a business, which are related to the satisfaction of market needs, the creation of jobs, and the resolution of social problems. A lack of assistance in assessing business viability alongside risks is regarded as the most relevant obstacle for the students. Their study is limited to a quantitative data evaluation gathered from a small sample size. The authors recommend that similar, more comprehensive studies be performed in different countries.

Martínez and Xavier [10] report the student experience and lessons learned from utilizing the challenge-based learning approach. The active participation of stakeholders and student-based startup formation are reported as core activities during their three-week intensive course based on the innovation journey cycle adopted from Energy for Smart Cities 2015-2016. The work is still in progress but reports positive outcomes related to students' academic (master thesis generation), career (internships and job proposals), and entrepreneurship opportunities.

B. Bootcamp-based courses

Sidhu et al. [12] have conducted a 4-day intensive Bootcamp class experience on innovation and entrepreneurship. They focus on student mindset towards innovation and startup formation and the Bootcamp activity is reported as the treatment used to affect this mindset. The authors use the concept from the Berkley Innovation Index open project. They further claim that their results are intended to measure whether entrepreneurial behaviors can be learned. The study is mainly based on pre- and post-test values gathered before and after the Bootcamp activity.

Similarly, Hickey and Salas [13] describe an extensive experience in introducing Bootcamp activities as a new model for learning web/mobile development and software entrepreneurship. Their longitudinal study is mainly focused on activities similar to those in incubators/accelerators boosted by further academic content.

III. Course And Bootcamp Settings

A. The Course

Experts in Teamwork (EiT) [14] is an MSc degree course based on the experiential learning approach [11]. In the course, students are expected to collaboratively identify and to propose specific innovative solutions that can be identified using SE to achieve the desired Sustainable Development Goals as defined by the United Nations (UN) [15].

The course includes resources, e.g., compendium and exercises related to team dynamics, provided by learning assistants and course leaders. The course-specific learning objectives are:

- Students are able to apply what they learned about inter-personal skills previously to jointly work in both the problem and solution domains.
- Students are able to apply a fundamental group theory to solve their specific collaborative situations.
- Students are able to reflect on their teamwork and to analyze the way that the group communicates, plans, makes decisions, accomplishes tasks, handles disagreements, and relates to professional, social, and personal challenges.
- Students are able to conduct retrospective reflections at both the individual and team levels.
- Students are able to take initiatives (actions) that encourage cooperation, and they can contribute to changing patterns of interaction to create more productive, constructive, and social collaboration in a group.

1) The teams. Teams are commonly composed of students with different study backgrounds, including the SE area. The main characteristic is the multi- and interdisciplinary composition of each team. Each team makes an effort to develop an innovative idea. Team composition is decided by the village leader before the start of the course, taking into account discipline and gender balance. Diversity contributes to the skillset and background experience of the team to develop relevant, innovative solutions. The team size varies from five to seven students at most. Self-structuring is common, and a balanced environment for making decisions assists in team sustainability. Furthermore, each team is required to apply a group process theory [16] when coping with challenges and improving team dynamics.

2) Course enrollment. The course website [17] is publicly available and announced to students from different faculty departments in the university X. The recruitment occurs from the 1st to the 31st of October 2018. After recruitment is finalized, a total of 21 students participate in the course. Table 1 reports the course demographics regarding students' ages, genders, and academic backgrounds.

3) The student evaluation. In addition to the project report of the team, each student must submit an individual process report. The final deadline for the submission of the reports is one week after the last course day. The course description and the assessment criteria provide the formal framework for the report, where the process and project reports account for 50% of the final grade each. The team receives a unique common grade.

B. The Bootcamp

1) The event. The Bootcamp is comprised of three day-long events organized during the semester. It motivates students to develop relevant solutions and business concepts through Minimum Viable Product (MVP) prototypes, which can be field-tested during and after the course in realistic scenarios.

The learning assistants and course leaders provide support through state-of-the-art innovation tools and methods; these tools are developed by Innovation Norway and assist students

in setting ambitious goals for developing their future startups. Students undergo several phases:

- **Day 1:** Utilize practical exercises related to thinking analogously, brainstorming, idea selection, and solution proposal.
- **Day 2:** Focus on idea development through lean methodology, prototyping, and business models.
- **Day 3:** Learn how to pitch ideas, think internationally, and create useful SE products or services to address societal challenges based on UN Goals [15].

The Bootcamp-specific learning objectives are:

(1) Students are able to create useful SE products that address realistic societal problems.

(2) Students are able to foster innovative and lean thinking.

(3) Students are able to develop project management skills based on Lean and Agile methodologies.

(4) Students learn how to present and pitch their products.

(5) Students can develop their communication and negotiation skills.

2) The external stakeholders. The external stakeholders are part of different sectors. Their role is to present a framework of practical social problems that can be addressed through SE practices. Their participation in the Bootcamp is key to the fostering of innovative ideas. We cover three crucial sectors (academia, government, and industry) when choosing stakeholders' backgrounds based on the triple helix model of innovation [18]. In this case, the Commune of Trondheim represented the governmental body, Capeesh Startup company represented the industry, and students and instructors involved in the course represented academia.

IV. SURVEY

We used a mixed-methods approach based on Borrego et al. [19], triangulating both data and methods during our investigation to offset weaknesses in answering the **RQ**. The investigation involved approximately equal numbers of quantitative and qualitative questions to help corroborate the findings.

First, we guided our investigation based on the **RQ**. The survey involves questions regarding the Bootcamp external activities that have a direct effect on the students' motivation to pursue startup formation. Second, we categorized our research into two essential phases:

- **Phase 1** - focused on research design and preliminary investigation (quantitative approach - questionnaires).
- **Phase 2** - consisted of full data collection and data analysis (qualitative approach - interviews).

A. Survey Design

During **Phase 1**, we asked students to answer the same questionnaire once before the initial Bootcamp presentation (Day 1) and again after the MVP prototyping was developed (Day 2). This way, the group under investigation (EiT students received the same treatment at different points in time.

TABLE I. QUESTIONNAIRE INSTRUMENT

	Value (1-5)
Motivation in startup formation	
Motivation in involving your team members in startup formation	

TABLE II. INTERVIEW QUESTIONS

Interview part	**Question**
Part 1 – Background Questions	1. What is your team composition? 2. What is your project about? 3. What are your key motivations for participating in the Bootcamp?
Part 2 – Specific Questions	1. What motivates you to create a startup after the Bootcamp? 2. Would you involve your team members in startup formation during or after the Bootcamp? Can you explain your answer?

The calendar time difference between the two questionnaires is approximately 40 days. To minimize bias, the respondents did not have the answers from the first survey available during the second one.

We grouped the dimensions considered for this study into **(1)** startup formation and **(2)** team members involvement in startup formation **motivations**. Students rated the key dimensions reported in Table 2 with a Likert five-point scale (from 1 to 5), which served as the main survey instrument.

During **Phase 2**, we interviewed the students at the end of Bootcamp (after Day 3). Interview questions are presented in Table 3. We split the interview questions into two essential parts. Part 1 focused on the background understanding of the team composition, the project themes, and motivations for participating in the Bootcamp activity. Part 2 of the interview represented the core of our investigation aligning with our two dimensions under investigation. The data gathered during the second phase both aligns with and complements the data obtained during the first phase, thus assisting in answering the **RQ** accurately.

B. Data Collection

We conducted the study during the spring semester of 2019, where each of the four teams involving 21 students (approximately five team members per team) chose to develop a project within the EiT experiential-based course addressing different UN goals [15]. It was observed that all the projects were different but of similar complexity. All teams developed a mobile app solution as an MVP. More precisely:

- **Halloo-CapX** is a language app used for people to meet. The principal function of the app is to connect two participants with different nationalities and different native languages. With the aid of the app, participants will be able to learn a new language and to meet in person. This app is designed as a multi-player game, and its uniqueness is that both players must collaborate in completing games to obtain coupon prizes (food, coffee, museum, cinema, etc.). The prizes are to enjoy together and to move from a chat conversation to face-to-face meetings. These games must be played in groups, not individually; in this way, the connection between participants will increase each time they play and win games as a team. The project aims to address the UN Goal number 10 in *"Reducing inequality"*.

- **Sanku-Lions** addresses the issue of malnutrition in Tanzania as UN Goal 2 for Zero Hunger. Sanku-Lions developed a mobile app interface for the mill operators dedicated to providing nutrients to populations in rural areas of Africa.
- **B-Social** develops an app for social services available to international students in Trondheim. The project was created to help promote the social services that are available for internationals in Trondheim from the municipality and other organizations. The end goal was to help expats, refugees, and students succeed at living and thriving abroad through the use of a survey and an app. The survey that the team created was used to assess how various internationals socially feel about living in Trondheim. Do they feel a part of Trondheim society? Do they have access to and knowledge about the social benefits available to them? The team has developed an app to go hand in hand with the survey. The app aims to have a precise place for the survey, results, and community forum that internationals can use in Trondheim. The project aims to address UN Goal 8 by defining citizens' needs for better economic growth.
- **Daps** develops an app to reduce the carbon print by collecting and reusing expired food in supermarkets. Expired food items from supermarkets are collected by volunteers, brought to a central storeroom at NTNU where the items are sorted, and then redistributed to students and other interested customers. This process is supported by an app in which the current stock of the storeroom is displayed, and interactions with the customers can occur. An environmental lifecycle assessment was then performed to analyze how much the environmental impact of food waste could be reduced through this project. It was found that 529.8 tons of CO2 emissions could be saved by carrying out this project. The resulting project thereby contributes to UN Goal 13 by reducing Trondheim's Carbon Footprint.

1) Phase 1 - Questionnaires. We presented the students with the questionnaire on the first day of Bootcamp. Students were asked to anonymously complete the online questions focused on the dimensions in Table 2. After Bootcamp Day 2, we again asked the students to complete the same questionnaire, this time reflecting on learning outcomes.

2) Phase 2 - Student interviews. We performed the students' semi-structured interviews after Bootcamp was completed and before the course ended. We interviewed a total of four students from four different groups selected based on random sampling from each group. Beforehand, we carefully formulated the questions into a template prepared by two of the authors (Table 3). Early preparation allowed for focusing the interview questions in connection with the RQ.

C. Data Analysis

1) Quantitative analysis. Because we did not know what to expect from the investigation, we decided to consider the same group and to analyze the mean and variance of the obtained answers before and after Bootcamp.

We could not hypothesize about these values because our small sample would not derive any significance from a statistical analysis [20]. Thus, we decided to deepen our understanding while aggregating the second part of the investigation to provide importance to our results in this preliminary phase.

Nonetheless, performing a questionnaire investigation dedicated to the Bootcamp activities allowed for gathering and analyzing relevant data for the next step.

2) Qualitative analysis. After carefully collecting the data to obtain significant evidence that would help us answer the RQ, we then applied a thematic analysis approach [21], which consisted of identifying recurring patterns and themes within the interview data. The steps we followed to conduct the systematic analysis consisted of:

(1) **Reading the transcripts.** This step initially involved quick browsing and the correction of the automatically transcribed data from the audio recordings. We made quick notes about first impressions. Later, we reviewed the transcribed data more carefully by judiciously reading line by line.

(2) **Coding.** During this step, we focused on choosing and labeling relevant words, phrases, or sentences and even larger text fragments or sections. The labels revealed more about perceptions related to Bootcamp activities. We primarily looked for repetitive and unexpected answers compared to previous theories. We attempted to code as much as possible regarding the technical, soft, and project management dimensions. To mitigate bias, the two authors worked separately during this coding process.

(3) **Creating themes.** After gathering all the codes, we decided on the most relevant ones and created different categories, which are also defined as themes. Many initial systems from the previous step were either dropped or merged to form new ones.

(4) **Labeling and connecting themes.** During this step, we decided on which themes were more relevant and defined appropriate names for each of them. Furthermore, we also attempted to identify relationships among the themes.

(5) **Drawing the results summary.** After deciding on the theme's importance and hierarchy, we generated a summary of the results. We aggregated the thematic analysis of semi-structured interviews with students into one diagram.

To fulfill the five steps, we used NVivo 12 [22] as a thematic coding tool. The quantitative data gathered allowed for acquiring an initial impression of the dimensions' perceived challenges.

To fully understand the startup motivation mindset, we used the second phase of the investigation. The thematic analysis results consisted of different themes that reflected the actual perceptions of the investigated dimensions from the participants in the study.

V. RESULTS

To address the RQ, the findings of the impact of Bootcamp on student motivations related to startup formation *and* team members' involvement in startup formation are discussed from both quantitative and qualitative perspectives.

A. Quantitative Results

During the quantitative phase of the investigation, we calculated the mean and variance for the chosen dimensions, as shown in Figure 1. Based on the Likert five-point scale, the values (y-axis) vary from one to five for each dimension (x-axis) before and after Bootcamp Days 1 and 2, respectively.

The following results were obtained after students' close collaboration with external stakeholders and MVP development:

- The median value ***M*** of student motivation in startup formation increased from 2 to 3.
- The first quartile $\boldsymbol{Q_1}$ increased from 1 to 2, and similarly, the third quartile $\boldsymbol{Q_{3\ 1}}$ increased with a variation from 3 to 4.
- There was no variation of the ***Min*** and ***Max***, retaining the values of 1 and 5, respectively.

Values for the involvement of existing team members vary as follows after students' close collaboration with their team members:

- The median value ***M*** of student motivation in involving existing team members decreased from 4 to 3.
- The first quartile $\boldsymbol{Q_1}$ and third quartile $\boldsymbol{Q_3}$ retained the same values of 3 and 5, respectively.
- The min value ***Min*** decreased from 2 to 1, but there was no variation of the ***Max*** value 5.

Overall, the median value ***M*** of involving existing team members in startup formation is higher than the median value of startup formation motivation. The decrease in the former and the increase in the latter indicates that the Bootcamp positively motivated students towards startup formation, but the students might not necessarily want to collaborate with the existing team members.

The increase in the quartiles $\boldsymbol{Q_1}$ and $\boldsymbol{Q_3}$ related to startup formation motivations further confirms the Bootcamp's positive effect; however, the lack of variation of these two values in involving the existing team members indicates that the perception is not entirely negative.

The ***Min*** value again decreased, indicating that there might be an overall uncertainty regarding the extent to which the existing team members are relevant to the team. Startup formation does not reflect any variation at the extreme values, indicating that some of the students may retain their original mindset, either fully convinced or totally not interested in startup formation.

B. Qualitative Results

In the second part of the investigation, we performed a thematic analysis of the student perceptions regarding startup formation. As shown in Figure 2, the two main themes Startup Formation and Team Member Involvement are connected themes such as startup formation motivations and involving existing team members.

1) Startup formation motivations. The students' reports during the interviews showed that the main startup formation motivations vary from brand establishment, working for themselves rather than others, and contributing to social change by ICT means. One student expressed:

> *"…If I wanted to make my effort in society, then the best option for me is to establish my own startup. And, uh, anything to help me to establish my own brand and work on the idea I have and release it to the world or give it to society. And I prefer to work for myself than other companies …"*

There were also cases of reports that although some students did not have an entrepreneur mindset or preferred to work for large organizations, relying on fixed job security, they still showed optimism related to the possibility of making an impact on society through startup formation. Stakeholders play a key role in the process. One interview included the following student reflection when asked about the possibility of startup formation:

> *"…For me, it's all different because of my background* ***[European Studies]****. I'm definitely not the type of person who wants to be an entrepreneur. I prefer working for a big organization. But, I think it's* ***[startup formation]*** *really inspiring to contribute to social change. That's what I like about it..." and "…she* ***[The stakeholder]*** *really helped to bring out, like, the entrepreneurial side of the project…"*

The main perception about funding is that it can be an important incentive in future startup formation as one of the students stated during the interview:

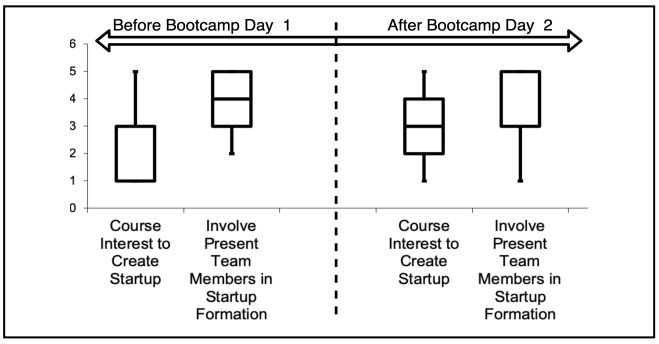

Figure 1. Students' motivations in startup formation.

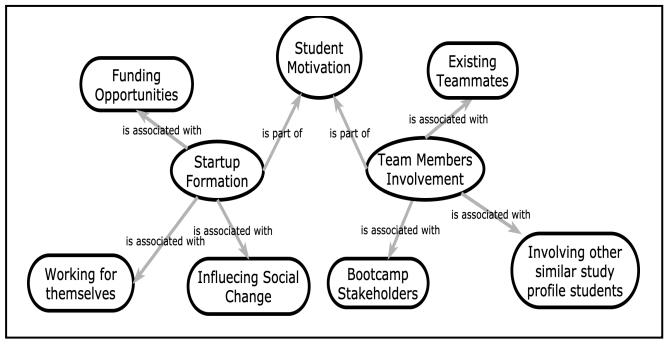

Figure 2. Students' interview theme analysis.

"… I think it is really, really important to foster the belief that you can get funding for your idea and grow it forward into a startup, or we can sell our product to one of the stakeholders…"

Furthermore, another student observed that funding the project and having opportunities at hand in Norway is an important motivation in startup formation. The student also mentioned that tight collaboration with the external stakeholder helped the team in exploring funding opportunities:

"…Yes. Knowing that there is an external factor ***[Funding]*** *out there in Norway specifically, but also it was really helpful to have our stakeholders come back during the Bootcamp because she* ***[The stakeholder]*** *gave us tips on how we could get funding and in what direction to go..."*

Yet another student discussed available funding opportunities as well as expectations:

"…So, I think it's good to know that there are funding options available, and it kind of gives a boost that maybe you should think about. But, I think there should be an easier forum or maybe a more guided forum as to how to get funding..."

Another student stated the importance of funding helping in idea development:

"…I think it's really important to be aware of the funding opportunities that we do have because there are a lot of them, especially around the University area. So, for everyone to have heard of that and to see those ideas I think is really, really important to foster the belief that you can get funding for your idea and grow it forward...."

2) Involve existing team members in startup formation. The involvement of other team members in startup formation is observed in three different contexts: (1) involvement of existing team members, (2) other team members not part of the course, and (3) Bootcamp stakeholders. One of the interviews relates to point (1) and (2) reports as follows:

"…Yeah. Team members are fine. Yes, I would involve the present ones as well as others in the future …"

Another student discussed the involvement of existing team members as a great opportunity. In this case, the student already had previous experiences in social entrepreneurship:

"…certain members of our team I really, really like, and I admire a lot of the things that are the qualities that they have. So, if I were to create a new team, I think that I've gained collaborators that come from other backgrounds compared to the ones ***[Collaborators]*** *that I have from before …So, the fact that some of them come from completely different disciplines than the one I am from would be useful if I were to start a startup again…"*

Another student expressed that although he has learned a lot from his existing team members, he prefers working with other students specifically from his department to pursue the idea of startup formation:

"…Yes, I have thought about receiving help from some student at our department, but, uh, maybe not my teammates here, but I have learned from my current team members about improving my teamwork skills…"

Stakeholders are in most cases viewed as potential future customers to spark the startup formation. One interview report emphasizes the following:

"…for our project specifically, we have decided to focus more on selling our product to one of the stakeholders..."

C. Findings

The quantitative findings related to an increased student motivation in startup formation (cf. Section V.A) are aligned with reports from student interviews in Section V.B.

Indeed, students are highly motivated to embark on startup formation after close collaboration with the stakeholders during Bootcamp. Many have their own entrepreneur mindset and view startup formation as an opportunity. There are other students who do not fully comply with the idea but appreciate the long-term value of startup formation regarding societal change. The students seemed to be well-aware that the funding opportunities and the collaboration with external stakeholders definitively helped them in exploring similar opportunities.

The students also realized the value of working in a multidisciplinary group; however, their perceptions pivoted in the involvement of the existing team members in their future startup initiatives (cf. Section V.A). As discussed in Section V.B, the reasons vary from personal expectations not matching those of other team members, unwillingness to pursue the MVP development further, and the desire to work with other different study profiles not present in the existing teams. Regardless of the reasons for continuing with existing or choosing new team members, the argument related to the value of a multidisciplinary team in future startup formation seemed to be strongly embraced by all participants.

We were unable to fully match the stakeholders with students in the process of a future startup formation. Challenges arise in this context because connecting those who are less experienced (students) with those who are more experienced (stakeholders) leads to a misbalance of the team in a startup context.

VI. Discussions

The two phases of the study allowed us answering the posed **RQ**. Although we did not validate any hypothesis, during phase 1, due to the small sample size and data not being normally distributed, we obtained meaningful results from the qualitative data gathered in phase 2. We identified the reasons behind the increase in startup formation motivations and variations in the involvement of existing team members, other team members, and existing stakeholders.

These findings allow us engaging in a non-sterile discussion about students having the willingness to foster innovative ideas by means of a startup formation within experiential-based courses; however, the startup formation expectation is unevenly met from the multidisciplinary

course teachers, who mainly prefer focusing on the learning outcomes of the course. Thus, the introduction of external activities involving external stakeholders (such as Bootcamp) is a vital driver for students' motivations in startup formation.

Nevertheless, we are aware that we need to have a better model or framework for student-stakeholder collaboration in startup formation so that the former does not view the latter as a mere customer or simply a resource to exploit but as a future partner.

Key findings:

1. *Students have an increased motivation towards startup formation after a close collaboration with external stakeholders and having developed their first MVP.*
2. *Funding opportunities are deemed crucial in helping students foster the idea of startup formation.*
3. *Involvement of existing team members is perceived as positive in most cases, but students do not exclude the possibility to collaborate with other future team members.*
4. *Collaboration with stakeholders is still marginal, and the main role based on students' reports that the stakeholders might cover is that of a potential customer.*

A. Threats to Validity

Based on recommendations from Maxwell [18], we report the following validity threats of this study:

(1) **Content validity:** We have chosen to analyze dimensions that are widely accepted by the research community in SE literature. We also take into consideration studies overlapping with SE practices, which rely on an experiential-based learning approach.

(2) **Criterion validity:** Two previous studies [6,9], cf. Section 2, achieved similar results as our findings but relied on quantitative methods. Thus, we can claim we use an instrument aligned with previous research while gathering more detailed insights.

(3) **Descriptive validity:** Although we have attempted to gather as much information as possible, we admit that some aspects might not have been able to be recorded. To mitigate this threat to validity, we have used audio to verify the descriptive data retrospectively and have stored the remainder of the data electronically.

(4) **Interpretation validity:** We have carefully kept track of the written perspective of the individuals being researched. This way, we are ensured that their unique perspective is taken into account rather than imposing meaning from our point of view. Open-ended questions have been used to allow the participant to elaborate on answers.

(5) **Researcher bias:** We were careful not to put any bias on gender, culture, or academic background. The only bias could be primarily related to being constrained in interviewing at least some SE students; however, it did not affect the study because SE was the primary focus. The questions asked were the same for all students.

(6) **Construct validity:** The sample is small, and we need further experimentation to fully assess the construct validity of the quantitative data, but as of now, the results obtained are fairly consistent with the qualitative data.

B. Ethics

To conduct our study following data privacy protection guidelines, we used the EU General Data Protection Regulation (GDPR) rules to conform to the country where the study was conducted [23].

We presented the samples with an inquiry about participating in our research project. Participation was voluntary. We explained—especially to the students—that there were no negative consequences if he/she chose not to participate or later decided to withdraw. More concretely, the questionnaires were kept anonymous, and no personal data was stored. Interviewers gave consent through an informative letter. In the letter, we provided information to participants regarding the purpose of the project and what was involved in relation to the interviewee's participation. Once a proper explanation was provided, the participants signed the consent form before the interview began.

VII. Conclusion And Future Work

We designed EiT to allow students to interact with external stakeholders by introducing Bootcamp activities. We aimed to evaluate whether students realized the relevance of this activity in motivating them to create startups. To answer this question, we conducted an embedded study based on a mixed-methods approach. We administered a questionnaire at the beginning of and during Bootcamp after developing the first project MVP. Furthermore, we conducted semi-structured interviews, taking samples from student groups and stakeholders.

We initially found an increase in motivation for startup formation and a variation of the mean and variance in the involvement of existing team members in a future startup. To further elaborate the initial findings with respect to answering the research question, we performed a thematic analysis of the students' interviews. Indeed, we found that students had higher motivation levels in startup formation after closely collaborating with external stakeholders during Bootcamp. Motivating factors mentioned relate to entrepreneurial mindset, impacting social change, and funding opportunities. Nevertheless, students not only have interest in involving the existing team members in a future startup but also others, such as students from their similar disciplines. The stakeholders are primarily viewed as potential customers rather than part of the team.

After analyzing the quantitative and qualitative data gathered, it was found that students have an overall positive perception of startup formation opportunities during the course. Students were willing to collaborate with existing team members in the future, but they might also prefer to work with others with similar study profiles to theirs. The students valued team diversity.

The involvement of external stakeholders in startup formation is still not mature, and there is a need for a proper model or framework to facilitate the student-stakeholder collaboration.

As future work, we intend to evaluate the potential of developing realistic products based on startup formation within the course. Some open questions remain such as: How can we further involve the stakeholders, and what are their motivations and challenges to actively collaborate with students in startup formation? Which of the three entities—academia, industry, and government—should be involved in these collaborations? We intend to propose a model or framework facilitating funding opportunities and the student-stakeholder collaborations.

ACKNOWLEDGMENT

This work was funded by the Norwegian Research Council under the project IPIT (Project Number: 274816) and the Centre for Excellent IT Education, Excited.

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