CAN HACKATHONS CONTRIBUTE TO THE DEVELOPMENT OF ENTREPRENEURSHIP AMONG STUDENTS AT ALL? CASE STUDY OF AN EDUCATIONAL HEALTHCARE HACKATHON

Anastasiia Grigoreva, Almazov National Medical Research Centre

ABSTRACT

Hackathons started as software events nowadays are applied in many different branches and industries. Educational hackathons are held in schools, Higher Education Institutions, nonprofit organizations as an innovative problem- and action-based pedagogical method that prepare students for future carrier in innovative sphere. Focusing on learning outcomes, most educational hackathons are isolated from innovation process: developing the entrepreneurship among students is not the primary considered goal of educational hackathons. Despite several researches highlight that hackathons offer the possibility to faster development of new ideas or to transfer ideas from product development into a prototype, they also agree that transfer hackathon outcomes into marketable products cannot be done by hackathons. Other researches investigate connections between participation in hackathon and start-ups founding. The goal of our research is to evaluate the potential of educational hackathons in terms of developing entrepreneurship among students and to find factors that will improve entrepreneurial outcomes of educational hackathons. The paper reports a case study of educational healthcare hackathon hold by a non-profit organization for HEIs students in April 2023 in Saint Petersburg, Russia. As organizers, we present hackathon process description, target audience and lessons learned based on participant observation and their feedback. Case study results confirm that the outcomes of educational hackathons lie beyond learning outcomes and under certain conditions can become a driver for the development of technological entrepreneurship among students. We propose a set of recommendations based on which hackathons can be integrated in innovation hub activities or university startup studios as a continuous process of innovation creation. Applying this set of recommendations will improve the effectiveness of the educational hackathons results in the context of the development of student entrepreneurship, which will favorably affect the increase in the number of high-tech startups.

Keywords: Educational Hackathon, Healthcare Hackathon, Student's Entrepreneurship, Startups, University-led Business, University Startup Studios.

INTRODUCTION

Educational hackathon is an innovative pedagogical method aimed at creating an environment for collaborative and competitive problem-based learning, allowing participants collaborate in cross-functional teams with experts, coaches and community partners but also compete with other teams (Kohne & Wehmeier, 2020; Suominen et al., 2018). The main distinctive feature of the educational hackathon is its focus on educational objectives, particularly it aims at the developing of scientific, technical, creative, entrepreneurial and managerial skills of involved students. An educational hackathon typically does not pay great

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importance to the proposed prototypes and does not aim to commercialize them in the future. Educational hackathons are usually organized by Higher Educational Institutions (HEIs) for their students and involve industry representatives to state practical problem for students and support them during the event. The educational hackathons outcomes provide benefits for all stakeholders involved: participants can extend their knowledge, learn new skills and are given the opportunity to promote their ideas. HEIs benefit from university-industry collaboration, can develop students critical thinking skills and prepare their career readiness. On the other side, industry representatives get new ideas or prototypes to their problems, can recruit the best students after observing them in teamwork. Based on such diverse benefits, educational hackathons have started to be applied at HEIs in different, also non-technical and computer science, areas (Silver et al., 2016; Mehta et al., 2022).

Exploring the hackathon phenomenon, researcher notes its positive impact on the creation of new ideas: "*bringing together a broad spectrum of intelligent people with diverse backgrounds can result in problem-solving solutions that would never have occurred through any one group in isolation*". While some researchers claim Kohne & Wehmeier (2020), that hackathons exclusively offer the possibility to quickly develop new ideas or to promptly transfer ideas from product development into a prototype, other agree that the transfer into marketable products and the testing on the market are out of scope (Medina Angarita & Nolte, 2020), meanwhile, other authors confirm connection between hackathons and foundation / development of startups (Cobham et al., 2017; Nolte, 2019). So, current understanding emphasizes the effectiveness of hackathon as a tool to create new ideas aimed at solving some practical problems, but generally hackathons themselves are not about making ideas coming into practice (Duhring, 2014; Walker & Ko, 2016). The gap between creating ideas during hackathons and making them alive is more relevant for educational hackathons where students have little experience in startup foundation and the goals of educational hackathons lay in the educational area, although student ideas can be precious for industries. After the educational hackathon has finished, participated teams of students often remain without any support to work further on their ideas. Moreover, students' entrepreneurial skills are not enough to work on a startup project further, or they are completely absent and this lead to the fact that many students ideas proposed during the event do not find their further development and implementation. In addition, even sponsors or industry representatives take part in hackathon events, their assistance considered to be given to winners that limited potential hackathons positive outcomes.

Our research questions are:

RQ$_1$: *What potential have educational hackathons on the development student's entrepreneurship?*

RQ$_2$: *How should educational hackathon be organized in order to accelerate the development student's entrepreneurship?*

This paper presents case study results of educational healthcare hackathon under title «Design thinking in patient-centered medicine» that we carried out in April 2023 by Medical cluster founded by five HEIs and Almazov National Medical Research Centre in Saint Petersburg, Russia (http://hackathon-transmed.tilda.ws/). The present study describes a hackathon, where multidisciplinary teams of students were exposed to patient-centric context and appropriate design thinking tools to generate and chose the best ideas. Case study results confirm that the outcomes of educational hackathons lie beyond learning outcomes but also in entrepreneurship development. We propose a set of recommendations based on which educational hackathons can be integrated in innovation hub activities and\or university startup

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studios as a continuous process of innovation creation. Applying this set of recommendations will improve the effectiveness of the educational hackathons in terms of involving students in entrepreneurship.

The remainder of this paper is structured as follows. In the following section 2 we briefly consider the hackathon phenomena in its variety and share our classification for hackathons. This is followed by our interpretation of existing researches evaluating connections between hackathons and startups foundation. We then summarize our case study of hackathon in section 3, which we have organized to observe participants. We then discuss our understanding of the role of the educational hackathon and its impact on involving students in technological entrepreneurship. Finally, we conclude with our set of recommendations to involve educational hackathons in innovation hub context and\or university startup studios, including the importance of further comprehensive support of hackathons teams.

LITERATURE REVIEW

Hackathon is an interdisciplinary and competitive team event aimed at accelerating innovations by bringing together a diverse group of interdisciplinary professionals from different industries who will work collaboratively in time fixed period of time (day/weekend) and learn from each other, focusing on a specific problem, developing a solution using design thinking techniques and pitching the solution to organizers and sponsors (Kohne & Wehmeier, 2020), (DePasse et al., 2014). At the end of the competition, the best solutions presented are awarded. Hackathon events often provide cash prizes to may help seed development, and some even offer accelerator/incubator programs to propel their concept forward (Kohne & Wehmeier, 2020).

Hackathons initially were organized for IT specialists as a programming competition between several teams proposing a solution based on applications of IT. Started as software events, hackathons now are applied in many areas (Mehta et al., 2022; Walker & Ko, 2016; Garcia et al., 2020). Below we provide a brief overview of the variety of their forms.

Educational hackathons considered to be an innovative pedagogical method for teaching innovation in HEIs (Suominen et al., 2018). While traditional conferences focus more on transferring knowledge, hackathons are more about collaboratively generating solutions (Garcia et al., 2020). As a competitive event and pedagogical method, educational hackathons have many advantages, such as to bridge the gap between the educational context and working life, prepare students to work with real business problems, improve students soft-skills. Attending hackathon events allows students to get the innovation capabilities they are required upon their graduation. Including hackathons in the course study extend the individual learning with collaborative group-based and networked learning in a multidisciplinary environment (Duhring, 2014). Educational hackathons has been presented in the educational domain of future engineers (Mehta et al., 2022). Some authors highlight educational purposes of hackathons for engaging non-computer science students in coding tasks (Bonilla et al., 2019).

Another art of hackathons presented at HEIs science centers are science hackathons. Science hackathons help young researches to find a multidisciplinary team for developing interdisciplinary research, networking Ghouila et al. (2018) or to do part of the research on the event, for example literature review (Schoeb et al., 2020). Groen & Calderhead (2015) claim that science hackathons are important especially for academics in the early stage of their career, as they offer opportunities to build collaborations and write research proposals.

Hackathons are also applied internal to companies. Company-Internal hackathons (corporate hackathons) encourage new product innovation by their staff. Company hackathons

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help to find a new solution to the problem in short time, improve horizontal communication in the company, increase staff loyalty (Lodato & DiSalvo, 2016). For some staff hackathon is an opportunity to bring their ideas to life and advance their careers, aside from positive effects on their networks and skill development (Nolte et al., 2018). Experience of conducting corporate hackathon shows that hackathons outcomes may get continuous on practice that is logical as results focus on a company context and participants and organizers continued to stay in contact in the working environment.

Hackathons are organized in varying forms. Both online and offline formats of hackathons are met in practice. Hackathons can be local within one corporation or HEI, region or international (Kohne & Wehmeier, 2020). For local hackathons offline format is common, for international – online. The majority of hackathons are technically oriented: they focus on a specific programming language, media artifact, or platform, such as a JavaScript hackathon or a visualization hackathon or a mobile hackathon. Other events, however, are organized around social themes and conditions (Lodato & DiSalvo, 2016). In all hackathon types, participants form teams and engage in intense collaboration within cross-functional (multidisciplinary) teams over a defined period of time, competing with other teams working on the problem. Three main features of any hackathon can be highlighted:

- collaboration within a team,
- competition between teams,
- Project- and problem-oriented work.

The summary and our classification of hackathons art are presented in Table 1.

Table 1
VARIETY OF HACKATHONS

Criteria	Hackaton-types	Example
format	-offline -online - hybrid	DevelopWeek 2023 Hackathon is held in-person and online. (https://www.developerweek.com/global/)
coverage	- local - region - national - multinational	HackZurich (as is told by organizers) is the largest hackathon in Europe. Every year appx. 600 international applicants from 85 countries. (https://hackzurich.com/)
length	- half a day - whole day - weekend - long-term	HackMIT is a weekend-long (36h) hackathon that hosts thousands of students from different countries. (https://hackmit.org/#tracks)
target audience of participants	- stuff of a company - students - researches - innovators, entrepreneurs	Facebook has run over 50 hackathons, and they form an integral part of company culture.
stakeholder initiator	- industry company - HEI - incubator - government	BioEconomy Business Accelerator BioPaavo and Kasvu Open, in cooperation with Gasum Ltd., hold a hackathon that aimed to find solutions and partners to utilize the biogenic CO2 stream from upgraded biogas. (https://www.jamk.fi/en/project/biopaavo/biopaavo-hackathon)
outcomes	- technical focused (application, software) - problem focused	Eduhack is an Erasmus Plus project where professionals from Estonia, Spain, Ireland and Turkey met to discuss the challenges, which local education system faced and organized hackathons to co-create the best solutions to solve the challenges. (https://hackingeducation.eu/).
field	- IT	Ilorin Innovation Hub hold E-Government Hackathon.

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	- health - transport - ecology - government - etc.	(https://ilorininnovationhub.com/programs/e-government-hackathon/)
team	- newly formed on hackathon - newly formed before hackathon and special for the hackathon - existing communities	Yale CBIT Healthcare Hackathon do not allow to participate solo. It is possible to find other members to work with at the hackathon (https://yalehackhealth.org/).

While there is a large body of research around hackathons, investigating types of hackathon and describing how hackathon was organized and what outcomes gained individual participant, teams or organizers, some researches focus on the connection between hackathon participations and their inventions to work on the project ideas further and found startup. Below we give the review on this research topic.

In papers Poncette, et al., (2020); Cobham et al., (2017); Nolte (2019) researches confirm, that hackathons also have multiple outcomes including the sparking of new businesses and entrepreneurial activity. Cobham et al. (2017) describe a three-day hackathon-inspired event, organized by University of Lincoln and give recommendations how hackathon process should be organized in order to create sustainable student entrepreneurial activity (Cobham et al., 2017). Focusing on the process of hackathon event itself, Cobham et al. (2017) pay no attention on the follow – up phase of hackathon what in our opinion, that is in line with other researches Nolte et al. (2018); Dehli (2016); Guerrero et al. (2016); Olson et al. (2017), is critical important in order to bring project ideas into life. Some studies Nolte (2019); Olson et al. (2017); Nolte et al. (2020) present the quantitative assessment on how many project teams continue activities after the end of the hackathon. Based on quantitative studies of continuation across hackathons in a variety of domains, Nolte et al. (2020) says that after a week only 17% of the projects carry on their work and distinguishes long-term continuation and short-term continuation. Acquiring funding or create a startup is positively associated with longer-term continuation activity, while technical continuation intentions such as finishing the technical development of a team's project or adding new features is not connected to continuation activity. Olson et al. (2017) in their case study found that 30% of teams continued work after hackathons in medical area. Such a big rate was possible with the support of the organizers: the healthcare hackathon model included preceding priming activities and targeted post-event support. Supporting measures included award programs for early stage ideas, an online community, in-person and virtual accelerators and physical workspaces.

It is important to highlight that hackathon for professionals differ from educational ones, where students have little experience in business. On one hand, existing studies of the practical outcomes of hackathons confirm the hypothesis that hackathons can result in starting innovative businesses and participants who are interested in participation in hackathon may have entrepreneur potential (Nolte, 2019), on the other hand, how it is sustainable in the student's environment remains an open question. Nevertheless, detailed exploration of how educational hackathons should be supported in order to boost development of sustainable high-tech entrepreneurship among students is missing.

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METHOD AND CASE DESCRIPTION

In order to contribute to understanding how educational hackathon hold on HEI can contribute to student's entrepreneurship development and which support is needed to improve possible practical results of educational hackathon, as a hackathon organizer in this section we present the results on our case study. The regional youth educational hackathon "*Design thinking in patient-centered medicine*" was organized by managing company of The Medical Research and Educational Cluster "*Translational Medicine*" (http://hub.almazovcentre.ru/). We chose a case study approach to study the educational hackathon and its entrepreneur potential. Our results were generated from the observation of the process of hackathon from organizer's point of view, facilitators' feedback after each day of the event, and the student reports on their experiences from the hackathon.

The Medical Research and Educational Cluster "*Translational Medicine*" was established in 2015 by decision of the Scientific Council of the Ministry of Health of the Russian Federation. Today, the cluster unites 26 participants: research centers, universities, pharmaceutical companies, manufacturers of medical devices and one development institute. The founders are five HEIs of St. Petersburg, Russia and Almazov National Medical Research Centre (Almazov Centre), who are members of the Management Board of the cluster.

Autonomous non-profit organization Management Company "*Innovations and Digital Technologies in Healthcare*" is a project office of the Cluster "*Translational Medicine*". As a non-profit organization, the cluster management company participated in 2022 in the competition for grants for the implementation of social projects and became the winner with the youth educational hackathon "*Design thinking in patient-centered medicine*". Three months have passed since the announcement of the winners of the grant competition and the holding of the hackathon.

Among the socially significant tasks of holding a hackathon, the following ones were identified: a current lack of personnel with creativity and design thinking skills to develop innovative digital medicine solutions, narrow specialization and difficulties in interaction within cross-functional teams (communication difficulties): for example, not all physicians have a comprehensive understanding of IT in medicine. On the other hand, for IT professionals is difficult to understand the requirements of medical professionals. The task was outlined to solve these problems at the level of education at the HEIs.

The hackathon took place in offline format in Almazov Centre in April 2023 and lasts 2 days, the days were thematically independent. Hackathon was advertised through academic email lists, as well as website and social media postings. All were focused on students receiving education in the field of medicine, biotechnology, IT, mathematics and medical instrumentation in St. Petersburg and the Leningrad region.

The first day of the hackathon was dedicated to patient centricity and included the following questions for future work on the hackathon:

1. *How to demonstrate a high level of professionalism and competence of medical personnel?*
2. *How to ensure the high quality of diagnostic procedures in the eyes of patients?*
3. *How to ensure the quality and availability of patient information?*

The second day was about digital healthcare solutions and it focused on difficulties of doctors:

1. *How to ensure prompt monitoring of the dynamics of the patients' condition?*
2. *How to provide doctors with access to cutting-edge knowledge in their field?*
3. *How to provide medical staff with reliable information about the medical history of incoming patients?*

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As we can see from the list of the questions, the tasks of the hackathon were chosen to be medically and practical oriented. On the one hand, they were state by health care professionals, on the other hand, they were as broad as possible to include students from non-medical areas. For the first day we invited three patients with bad recent experience and for the second day we invited three doctors for interviews.

Registration of participants took place before the start of the event in online format. Offline registration started on the same day as the hackathon. The event started at 10:00, 21 and 22 April 2023 and finished at 19:00.

The hackathon was conducted according to the following plan:

1. Opening by the organizer of the event and the moderator. The moderator was a certified facilitator, Maxim Loginov, expert in Design Thinking (https://highadvance.org/our-team/maksim-loginov/). Then he led the entire hackathon and taught the participants into the methodology of design thinking.
2. The random division of participants into multidisciplinary teams depending on personal choice of the topic. Totally three topics were available for elaboration each day.
3. Team building in every team.
4. Interviewing patients and physicians in order to collect information based on real stories with problem context.
5. Creating an empathy map based on the conducted research.
6. Lunch break (buffet).
7. Identification of the stages associated with the topic.
8. Creating and generating ideas to solve problems faced by the patient or physician.
9. Highlighting ideas that may be implemented using a Venn diagram.
10. Creating two flip charts.
11. Ideas that need to be implemented.
12. Ideas for the implementation of which verification is necessary.
13. Presentation of ideas and evaluation by judges in poster section.
14. Selection of the winner and awarding.
15. Completion. Summing up the results of the event by the moderator and organizer.

The hackathon was supported by 28 experts in the following roles:

- hackathon moderator – 1 person
- speaker domain expert – 2 persons
- team facilitator – 10 persons
- respondent doctor – 3 persons
- respondent patients – 3 persons
- media volunteers – 3 persons
- organizer team – 3 persons
- jury – 3 persons

The plan clearly laid out by the organizers was observed in the structure and time. Medical content of tasks, support of patient and physicians were covered by Almazov Center stuff, moderator Maxim Loginov was an experienced business coach accredited in design thinking methodology, facilitators were chosen the people with educational, business and coach backgrounds, jury were formed by Almazov center management and ITMO university (one of the founders of the Cluster) to provide different expertise. The multidisciplinary jury consisted of three members, including a physician with a marketing background, an intellectual property expert in medicine and one scientist of Security of medical solutions and IoT.

There was no requirement to come to the event with existing teams or find it before the event. All teams were formed at the event. There was no need to study or work on the project in advance. The outcome of the hackathon was the ideas presented in poster session. Solutions in the context of the hackathon meant a complex of measures that address a problem in order to solve or improve it.

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A case study approach was chosen to conduct research into the outcomes of the hackathon. We conducted interviews and survey questionnaires to gather data from the participants in roles students, moderator, facilitators involved in the hackathon process, and from university staff accompanying representatives of participating universities. The data gathered includes both quantitative and qualitative results to evaluate the effectiveness of the hackathon. We asked participants of hackathon about their experience in participation in hackathon events or similar marathons direct in message while confirming their participation, participants were asked to fill forms with personal date, including name, specialty of study, age on the hackathon. After hackathon event we asked every participant about anonyms feedback using the google forms.

Hackathon process

144 students attended the event from a range of subject disciplines: general medicine, pediatrics, dentistry, biotechnical systems and technologies, bioengineering, software engineering, neurotechnology, technosphere safety, applied informatics in design, and enterprise architecture. Totally students from 10 universities and 1 secondary school took part in the hackathon Table 2. 9 universities in St. Petersburg and one student from a university of another city in Russia, who later entered the medical intern at the Almazov Center. On the first day, 71 people took part in the hackathon, forming 9 teams of 7-9 people. On the second day of the hackathon, there were 65 participants, 9 teams of 6-9 people. We invited all HEIs, which were the members of the Cluster and all HEIs of Saint-Petersburg, who train future doctors to ensure the interdisciplinary and enough future doctors in hackathon.

Table 2
HEIS ATTENDED THE HACKATHON

HEI	Number of hackathon participants	Cluster member	Centralized participation in the hackathon
Almazov Center	5	yes	no
Medical Academy	18	no	yes
St. Petersburg Medical and Social Institute	9	no	yes
Politech Petra	28	yes	no
GUAP	2	yes	yes
PromTechDesign	22	no	yes
Pediatric Medical University	1	no	no
ETU "*LETI*"	31	yes	no
ITMO	8	yes	yes
Smolensk State Medical University	1	no	no
Secondary school 617	11	no	yes
	136		

Interest in the hackathon was high due to the broad advertising campaign, but selection procedures were not provided, so the organizer had to introduce a restriction for a part of students as it was not possible to place them all indoors: non-medical students of two HEIs could only take part in one of the days. The days were thematically and logically interdependent of

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each other. The restrictions were not applied to students of medical specialties to ensure their enough quantity. As a result, almost one-quarter of the total number of all participants were medicine related. Inviting students from a wide range of disciplines ensured by broad set of participant skills and encouraged the formation of multidisciplinary teams Figure 1, moreover, the educational nature of the hackathon set a goal to make students able to communicate in a multidisciplinary environment to better prepare them for future careers.

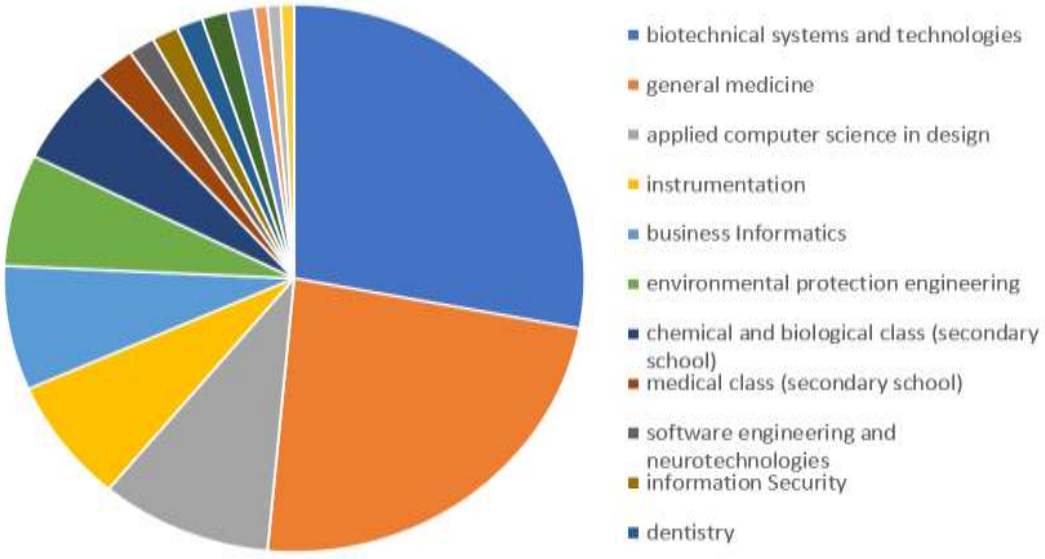

FIGURE 1
MAIN SUBJECT OF PARTICIPANTS ATTENDED THE HACKATHON

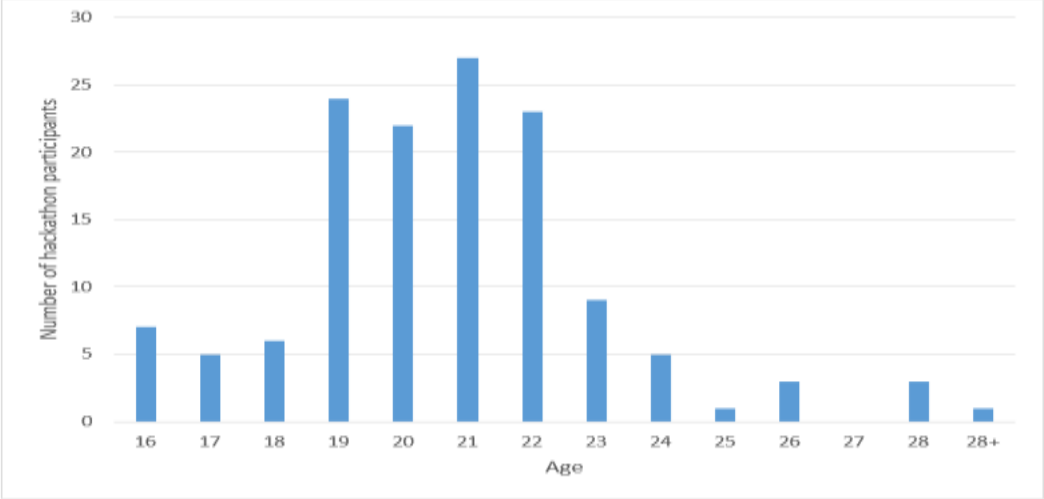

FIGURE 2
AGE OF PARTICIPANTS ATTENDED THE HACKATHON

Despite the large-scale distribution of letters of invitation among the specialized medical and technical HEIs of St. Petersburg, not everyone showed interest in the event, which, nevertheless, did not prevent us from exceeding the declared by the Foundation indicators in terms of the number of hackathon participants. Among those who showed interest in the event were HEIs that often use the hackathon format and their students are familiar with it and

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regularly attend such events (3 HEIs), as well as universities that wanted their students to attend a new, unfamiliar, format (4 HEIs). Another motivation was the strengthening of university partnerships and the creation of a fertile soil for future partnership (2HEIs). 2 medical HEIs wanted to present their medical institution on the event organized with the highest support of Almazov Center–competitor in medical education. One participant has a goal to get acquainted with the Almazov Center as he was planning to apply to this HEI. An unexpected interest in the hackathon was shown by the management of the secondary school. Participating pupils were satisfied with the event, and asked to allow them to participate in the second day on their own initiative.

We proceeded from the fact that participation in the hackathon was the first for many students (73 % of respondent said that this hackathon was the first one for them), the majority of participants (appr. 70 %) were in the age between 19-22 years old Figure 2. Moreover, medical hackathons have not been held in St. Petersburg before and the existence of established interdisciplinary teams we likely to disappear. Therefore, it was decided to form teams on the spot. Despite the fact that in one medical HEI there was a scientific and educational club of students of various medical specializations, it did not included any engineers or IT, so accepting an established medical team to participate in the hackathon would not allow realizing truly multidisciplinary.

A part of students' non-medical subject reflected that because of the medical orientation of the hackathon they feared that they would feel uncomfortable in the new topic, but in real they found the event very positive. Many students appreciate the main moderator as well as the team facilitators who assisted them during the course of the event. One team of students asked organizer after the event how and where they can work further with their idea, to whom they can present their idea.

Throughout the hackathon students discussed issues of solving problems related to patient-centricity and physician-centricity and consider ideas of implementing information systems, applications, various technologies, as well as artificial intelligence. Despite the fact that most of the participants were not primarily related to the medical area (only 24% students are future physicians), a large number of ideas were proposed that were highly appreciated by the jury. At the same time, the hackathon showed potential for further work on the ideas, participants who caught fire with their ideas turned to the organizer for further support measures and were ready to work on their ideas further.

DISCUSSION

Hackathon is an innovative pedagogical method that supports traditional classrooms at HEIs. Hackathons can be effectively applied to the curriculum of students to prepare them for their future working lives. The outcomes of an educational hackathon lie beyond educational perspectives. The experience of organizing the educational medical hackathon "*Design-thinking in person-centered medicine*" showed the desire of participants to continue working on their ideas in order to bring them to life. But the initial goals and duration of the educational hackathon, as well as the lack of further support, don't allow students to achieve their entrepreneurial ambitions if they don't continue to search for opportunities to ensure the progress of their ideas on their own. Answering our research questions, we can state as following.

Hackathons organized by HEIs have great potential for developing entrepreneurship among students, but they should be organized in the right way.

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Students want to work further on their projects if they have a good understanding of the domain, and their teams consist of students they know. In this regard, the most active participants of our hackathon were from one medical academy of Saint-Petersburg, all were members of the science and technology club and were motivated by their own desire to participate, to strive, and to win. A small private medical educational institution sent its students to get acquainted with the experience of a leading federal medical science center (Almazov Center) implementing research, treatment, and education programs. The greatest motivation and involvement were met among those students, who were directly related to medicine and participated not individually but with the understanding that they presented their HEI and different scientific schools. Students of leading technical universities, who were familiar with this format of events and had experience participating in such events within the walls of their own university, also showed great involvement. Other students have attended the event because their participation was centrally organized by the departments of the universities, which pursued the goal of strengthening inter-university cooperation and exchange. The least involvement was among students referred to participate by universities but far from the medical domain (enterprise architecture, industrial design). The latter, however, successfully coped with the tasks and evaluated the experience of participation positively.

Ideas and teams of educational hackathon should get further support to bring their ideas to life. For some students (36%), primal educational results, for example, learning something new and sharing network are not so important as they get passion to make their ideas come alive but struggle with a lack of business experience. In order to improve the entrepreneurial potential of educational hackathon we recommend the following factors:

Team relationships: It is necessary to conduct trainings on team building and team facilitation not only directly at the hackathon, but also before and after it. This requires a developed entrepreneurial and technological infrastructure: libraries, co-working spaces, research laboratories, testing sites, as well as training and acceleration events.

Financing: Students must see before themselves clear and realistic opportunities to obtain financial resources to put their ideas into practice. These can be both accelerator programs for a specific grant competition, and hackathons within university startup studios that distribute the investment budget for promising projects.

Access to the professional community: The professional community should be open and accessible, include various competencies: experienced startups, representatives of investment funds, project and product managers and R&D experts.

It can be assumed that the survival of hackathon project ideas depends on the city where the event is held: where the community and infrastructure are more developed and last longer, the percentage of transformation from a prototype to a business is higher. The problem of involving students from remote regions with less developed infrastructure in technological entrepreneurship is becoming vital. Some of these tasks can be solved through the introduction of a digital platform.

CONCLUSION

Our study has several strengths. We had a deep understanding of the hackathon process. As organizers we had the opportunity to see not only what was on the surface but also what was behind the scenes of the event. After each day of the hackathon, we shared our observations in an open, non-coercive manner among the facilitators, the main moderator of the event. We were able to see a significant (34.1%) response rate for an email-solicited internet-based survey. This

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response rate itself suggests a high level of continuing engagement of the hackathon participants. We have seen first-hand feedback from the participants, including some negative points. About 15% of the participants did not agree that there were three thematic tracks at the hackathon every day and that there was only one winning team.

Our study is not without limitations: one hackathon in the medical field was analyzed and our initial tasks as the organizer did not include further support of the project teams, and moreover, the ideas of the hackathon were initially announced as stimulating scientific and creative activity for students, not entrepreneurship. Further research into the hackathon phenomenon in the context of student entrepreneurship should take place on the basis of start-up studios and innovation hubs, whose activities are designed to involve students in high-tech entrepreneurship.

Our study confirms that the implementation of educational hackathons is an effective and innovative pedagogical method, which is in line with other studies. At the same time, we set another vector of hackathons at HEIs – as a tool for the development of youth entrepreneurship.

Educational hackathons can become an effective tool for generating student business ideas, and in the context of the established student entrepreneurship support ecosystem, they can become an integral element in the development of student entrepreneurship if students will get further support with finance, experts and accelerating programs.

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