# Future Proof: Hackathons as Occasions to Experience Entrepreneurial Thinking


**Sabrina C. Eimler and Carolin Straßmann**

**Abstract** The pandemic has opened up room for a creative reinvention of traditional teaching and learning formats making entrepreneurial skills, as, e.g., described in the EntreComp framework, a more pronounced part of the curriculum. As part of the course "Positive Computing and Diversity in Human Computer Interaction," which is offered to students of different study programs within the computer science department, a (coding-free) two-day online hackathon was organized as an occasion to experience and strengthen entrepreneurial skills. Two major goals were pursued with the work documented in this chapter: (a) providing students with an intense, challenging hands-on experience of different facets of their own entrepreneurial potential, and (b) describing example hackathon events regarding the content, technical and organizational structure as recommendation for practitioners. Consequently, besides outlining a pilot hackathon, the chapter describes essential elements of the course, in which the hackathon was embedded, and content as well as didactic orchestration of both, the course and the hackathon. Evaluation data from two hackathon rounds are presented and taken up in a discussion and reflection.

**Keywords** Hackathon · 21st century skills · EntreComp · Higher education · Sustainable development goals · SDGs · Online learning · Innovation · Diversity

S. C. Eimler (✉)
Institute of Computer Science, Hochschule Ruhr West University of Applied Sciences Bottrop, Bottrop, Germany
e-mail: sabrina.eimler@hs-ruhrwest.de

C. Straßmann
Institute of Computer Science, Ruhr West University of Applied Sciences Bottrop, Bottrop, Germany
e-mail: carolin.strassmann@hs-ruhrwest.de



J. H. Block et al. (eds.), *Progress in Entrepreneurship Education and Training*, FGF Studies in Small Business and Entrepreneurship,
https://doi.org/10.1007/978-3-031-28559-2_27

## 1 Introduction

University education in STEM fields, such as computer science, still often follows traditional formats and practices. Regularly it does not cover or foster important entrepreneurial skills like those comprehensively described in the EntreComp framework (European Commission, 2018), a European framework aiming to foster understanding and spread of entrepreneurship among citizens and organizations. EntreComp harmonizes different concepts of entrepreneurship and describes three competence areas (ideas and opportunities, resources, into action) with 15 entrepreneurial competences, attitudes or knowledge domains (learning through experience, working with others, creativity, vision, coping with uncertainty/risk, self-awareness, self-efficacy, etc.).

More familiar in the teaching context, though also often not considered, is the concept of twenty-first-century skills (World Economic Forum, 2016). Looked at more closely, this skill set has a lot of overlaps with skills discussed as important in entrepreneurship. Apart from basic economic skills, training creativity, familiarity with future trends, diversity and intercultural sensitivity, pitching, rooting one's ideas in science, (virtual) group collaboration, and working under pressure or identifying where a group has gaps in knowledge and needs expert advice are important skills to be trained in a sustainable education concept, laying foundations also for the creation of innovation and building a lasting business.

The pandemic has opened up room to challenge traditional ways of teaching and paved the way for totally new and different forms of digitally supported learning experience able to address the abovementioned topics and skills. The dynamic and rapidly changing circumstances have also created room for experiments and "outside the box" learning and teaching experience that are now on the test bench for a long-term implementation in curricula. We believe that (coding-free) hackathons are a way to allow students to discover and experience facets of an entrepreneurial mindset and activate essential elements of their twenty-first-century skill set.

Often hackathons are organized by companies as extracurricular activities in the "war for talents." They are especially used to train specific skills, like programming skills (Awuni Kolog et al., 2016). However, due to the challenge-based learning approach of hackathons (Gama et al., 2018), they are an ideal occasion at which students can enrich their soft skills (e.g., thinking collaboratively or creativity; (Awuni Kolog et al., 2016)). Gama et al. (Gama et al., 2018) showed that hackathons are a valid teaching method in which time constraints as a structuring element can help students in idea generation, sorting, and prioritizing as well as with timely solution development.

The findings of Gama et al. (Gama et al., 2018) also emphasize the role of the teachers involved and the conceptual setup of the hackathon. In order to train skills and mindset, it is important to give students (or hackathon participants, respectively) enough freedom with regard to methods and approaches applied in their collaborative work. The challenge is to be present as a teaching person and assist whenever help is needed while letting the groups gain their own experiences. In this chapter we aim to show a best practice example of how students can experience multiple facets

of skills that are described in the EntreComp (European Commission, Joint Research Centre, et al., 2018) and twenty-first-century skill sets (World Economic Forum, 2016), meeting the sweet spot of making them use, experience, and develop their competence, providing assistance and challenging them.

The chapter covers insights from two rounds of an 8-week course each concluding with a two-day high-density hackathon. Besides the description and evaluation of a pilot hackathon as an initial inspiration, the chapter covers the framing course and the hackathon providing insights into content, concept, and didactics, digital tools, and an analysis of data collected from students reflecting on the experience as well as lessons learned for future implementations.

## 2 Pilot: #Semesterhack

Due to the pandemic, learning formats needed to be substantially changed and, more than ever, became socially relevant. As a mere switching of lectures, projects, and seminars from face-to-face to online formats was not considered productive, we decided to try a new way of teaching students and, in line with an entrepreneurial mindset of the teachers' side, to explore this new space of opportunities. An online course was set up, covering future trends (e.g., diversity, AI, positive computing, social robotics) inspired by, e.g., the Future of Jobs Report released by the World Economic Forum, using a mixture of synchronous (workshops, online lectures, expert inputs) and asynchronous formats (videotaped talks, TED talks, quizzes, reading material) as a preparation to take part in the hackathon. With the #Semesterhack, the Hochschulforum Digitalisierung, the German Academic Exchange Service, and the AI Campus called for a joint event in which solutions for studying and teaching in the digital summer semester were to be found in 36 hours. A solution was to be designed able to create mutual awareness among teachers and learners and promote the feeling of being competent, autonomous, and related (as predictors of well-being) in order to guarantee a successful semester for everyone. Students worked in three groups presenting different solutions: (1) The Awareness Aquarium represents participants of a learning environment as fish equipped with several awareness features covering personal traits but also technical details about participants. (2) InTREEgration uses a forest to create awareness. Students are growing from small plants to knowledgeable trees with information boards in the trunk, providing personal and status information. Teachers are forest animals. (3) The Awareness Classroom is dedicated to live reactions, i.e., (mostly) emotional reactions to the current content of an event. Clapping, hearts, sad, or happy emojis fly across the screen (which is meanwhile standard, but was not at that time). Feedback collected from the participants ($N = 13$) in an online survey showed a positive evaluation regarding the overall experience ($M = 4.38$, $SD = 0.06$; max. 5, assessed using a Kunin scale with five faces from frowning to smiling), flow (Rheinberg et al., 2003) as a measure to assess the balance between a person's competence and the feeling of being challenged ($M = 3.81$, $SD = 0.44$; 17 items; also see Sect. 6), and factors like collaboration (e.g., "I liked working in my group,"

**Table 1** Evaluation of the pilot hackathon [13 statements, 1 = not agree at all, 5 = fully agree]

| Statements about | M | SD |
|---|---|---|
| The challenge [3 items] | 3.92 | 0.84 |
| The groups [3 items] | 4.51 | 0.44 |
| Support by teachers/group [2 items] | 4.71 | 0.45 |
| Recommending hackathon participation [2 items] | 4.27 | 0.70 |
| Self-efficacy [3 items] | 4.03 | 0.74 |

"Communication in my group was good"), support (e.g., "Support by the coaches was helpful"), self-efficacy (e.g., "I had the impression to have essentially contributed to the success"), and course recommendation (e.g., "I would recommend participating in a hackathon like this") (see Table 1).

Open field comments supported the quantitative data: People enjoyed the hackathon and liked the challenge, and they reported technical problems were hindering and considered brainstorming online difficult, felt time pressure, were satisfied with the support by the teachers and reflected on team conflicts and communication.

Experience and solutions of this pilot inspired the implementation of a hackathon in the next round with some changes made content-wise and with regard to the diversity of challenges. The final concept is covered in the following sections.

## 3 Course Organization and Content

The course as such is part of the mandatory curriculum of the study program Human-Machine Interaction at an advanced level. Students from other programs in the department (e.g., eCommerce, Applied Informatics, and Business Informatics), from masters studies or research interns as well as students from the Babes-Bolyai University in Cluj-Napoca, Romania, enrolled voluntarily. Course material is accessible via Moodle and comprises several thematic sections with individual learning goals and suggestions how to go through the material collection. Besides using a variety of different material (videos, research paper with guiding questions, group activities, research posters, etc.), each of the sections contains a multiple-choice self-test. Consultation hours are combined with workshops and are used to bring the students together, give the chance to ask questions, and commonly reflect with varying reflection tasks on the content. To receive credits, participants take a Moodle quiz with questions drawn from the self-test question pool (graded), take part in the hackathon (not graded), participate in the pitch (not graded), and hand in a more elaborate documentation of the idea (graded). On the content level, the course covered the following topics inspired by the UN Sustainable Development Goals (United Nation, 2022), the Future of Jobs Report (World Economic Forum, 2020), or the Essential Eight Report (PWC, 2020): (a) gender and diversity including concepts like stereotypes, the diversity wheel, and Hofstede's cultural dimensions;

(b) positive computing as a human-centered and well-being-oriented paradigm in technology development; (c) virtual and augmented reality as tools for teaching, sensitization, future work environments, and research; (d) design and perception of social robots as assertive interaction partners; and (e) AI and circular economy and trending fields needing a high level of awareness.

## 4 Future Society Hack: Didactic Structure, Schedule, Content, and Communication Channel

Closing the course, the *Future Society Hack* took place after 7 weeks. Students were to apply the acquired knowledge and therefore asked to familiarize themselves with all course material in advance. Solutions should draw from and combine at least two thematic areas. While no programming was necessary, a prototypical demonstration of a digital solution leading to a well-being- and flourishing-oriented future society was required. The didactic structure of the course, but especially the hackathon, should train the students entrepreneurial mindset and twenty-first-century skills such as group collaboration, communication, intercultural and gender sensitivity, creativity, and endurance, but also risk-taking, working under pressure, etc.

## 5 Challenges

Challenges should represent real and relevant questions and covered a thematic variety based on project calls by the Federal Ministry of Education and Research that were shortened and adapted. (i) Innovative Women in Focus: Women are still underrepresented in central and high-profile functions as well as media coverage referring to innovation and science, although they have been essential in innovation and groundbreaking research findings. This lack of visibility must be structurally anchored through innovative approaches and strategies so that it can develop comprehensive and sustainable effectiveness. (ii) Science for All Citizen-Oriented Science: The aim of this challenge is to get the public more interested in science and to strengthen citizens' scientific literacy. This makes developments in research more transparent and accessible. In doing so, it is particularly important to reach target groups that have had little or no access to science. This requires innovative and participatory approaches that optimally address the needs of different target groups. (iii) Innovative Technologies for Live-worthy Surroundings and Quality of Life: The challenge aims to design livable spaces—smart, sustainable, and innovative—in order to create a better quality of life in urban and rural areas. Concepts are to be developed for physical and virtual assistance systems for private and public spaces, from interactive systems for everyday school and work life. Interactive technologies can make local life more comfortable, safer, more sustainable, and more independent—whether in the neighborhood, in the city, in suburban regions, or in the countryside.

## 5.1 Didactic Structure and Procedure

The hackathon was held in May 2021 and lasted 35 hours. For the organization of the hackathon event, a Webex channel was set up containing a main channel for general communication among all participants, a channel for the coaches, and channels for each of the teams. *Day 1* started with a joint kickoff with all participants in which the overall goal, rules, challenges, and schedule were presented in a 15-minute keynote. Afterwards, participants were activated by a check-in session using a Miro board (interactive digital pinboard; see Fig. 1) and asked to note down fears and expectations on sticky notes. The moderators commented on the notes to reduce the students' worries and spread a joint vision of the hackathon's procedure.

Moreover, students indicated their level of topic expertise and prior experiences with hackathons. This short check-in enhanced the overall open and benevolent atmosphere, since students were asked from the beginning to share their thoughts and feelings. After the check-in phase, the brainstorming and group finding phase began. This was also done on the Miro board (see Fig. 1) in combinations with group calls in Webex. The teaching team supported and moderated the process. All students were asked to collect their ideas, thoughts, and potential solutions on the board. For the challenge-related discussions, Webex group calls were used, where people brainstorm and discuss together different focuses and solutions within one of the three challenges. In the beginning, students could switch between all challenges and discuss their ideas for multiple challenges. Over time, the ideas became more specific and about two to four solution ideas per challenge emerged. With the help of the moderators, students discussed advantages and disadvantages of the solutions and the group finding process started. At this point, students were asked to decide which challenge they finally join. Within the challenges, the students then jointly

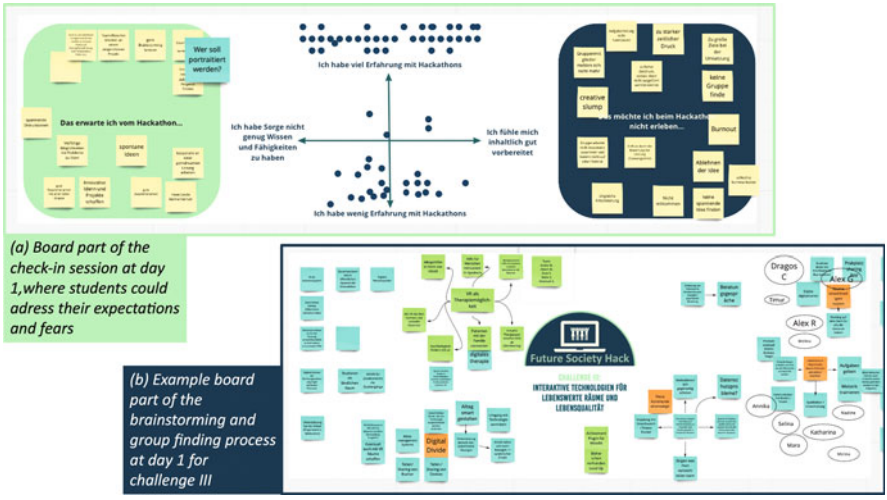


**Fig. 1** Example of the used Miro board for check-in (**a**) and brainstorming (**b**) session

decided which of the solution ideas they would like to follow. The following seven groups consisting of about six students were built: challenge I (1 group), challenge II (3 groups), challenge III (3 groups) (for results, see Sect. 6). The whole brainstorming and group finding process took about one and a half hours. After that, the final groups started to develop their solution on their own. However, they had the opportunity to receive expert advice from the teaching persons on (a) content-based topics (e.g., AI, social robotics, VR) and (b) prototyping- and pitch-oriented topics (e.g., How to design a pitch deck? or How to develop a clickable prototype? or feedback on graphic design). In order to receive this feedback, the groups actively had to sign up for coaching sessions. We used Google Docs (www.google.com/docs) to coordinate the appointments with the coaches. Here, the coaches offered different time slots (presented in a simple table) and the sub-teams could choose slots by noting their names in the table. The coach then—at the chosen slot—joined the group call of the sub-team and gave the needed expert advice. This trains them to assess when and for what they need help and distinguish which skills and competences are already available in the group (since the groups were interdisciplinary and intercultural). At the end of day 1, a summarizing get-together has been offered to reflect on the first day, the students' experiences, and to give the feeling of shared detachment ("individual's sense of being away from the work situation"; Etzion et al., 1998, p. 579) of work. Nevertheless, the students were free to extend their work after the reflection get-together.

*Day 2* started at 9 am with a joint check-in meeting (about 15 min), where the teaching persons again scheduled the day, gave general hints for the pitches in the evening, and spread a sense of unity. After that, students were free to work together in their groups and had the same opportunity to receive expert advice. At the end of the day (5 pm), the solution pitches took place, where all groups presented their final results within 3 min. For the pitch session further external judges joined, to enhance the official and meaningful atmosphere and honor the time that the students spend on their solutions. After each pitch, a short discussion, where all students, teaching persons, and judges could ask questions, was held. This was especially important for the groups to receive final feedback before they handed in the final course results. The whole atmosphere at the pitching session was meant to be benevolent and all teachers expressed their gratitude and pride about the students' work. At this point, no assessment or rating have been communicated, to keep the students motivated and leave a positive experience of the hackathon behind.

## *5.2 Challenge Solutions and Hackathon Winners*

The judges evaluated (without grading) all pitches. In sum, they were enthusiastic about the maturity of the prototypes, since some groups already had created ready-to-use clickable prototypes with high-level details. Three winners were selected in a democratic process, where each judge listed their favorite and the teams that have been mentioned the most were selected to be the winners. All winners received a

certificate and a cup branded with the hackathon name as a price to honor the good and creative ideas. Winners were the following solutions, each described by a tweet written by the teams themselves (as part of the solution documentation):

The situation in the old people's home has never been as lonely as it is today. That's why we need to act – now! InnoHeim – the innovative solution with smart technologies and robots that revolutionize the home for the elderly and promote inclusion #inclusion #innovation.

Edutainment with a clear mission: Virtual Escape Room creates awareness for female entrepreneurs in a playful way and helps people interested in starting a business to network. #whowasthefounder #thefutureisfemale #womenintech #femaleentrepreneurship.

A smart city, has smart citizens, so start sharing. Lend your parking space when you're not using it, and in return you'll get a new one that fits your needs. This is where you stop standing in traffic and start moving! #smarttrafficlight #sharingeconomy.

## 6 Evaluation of Hackathon Experience

In order to get deeper insights into participants' perspective, an evaluation was setup with SoSci Survey, a free online survey tool. The landing page would explain that the evaluation intends to capture participants' course experience and how they felt about the hackathon, their group, and the project results. Subsequently, they were guided through questions about demographics (gender, study program, challenge number); overall experience of participants; statements measuring their flow; statements assessing aspects concerning their work in groups, support, etc. (Table 2); and statements about entrepreneurial skill training (Table 3) and prioritizing the top three of skills that have been trained. The questionnaire closed with an open field asking for positive/negative feedback, ideas, and recommendations for further hackathons. Besides the demographics (which used checkboxes), the overall evaluation (which used frowning to smiling faces), and the prioritizing task (which used drag and drop options), all statements in the questionnaire were to be answered using 5-point Likert scales in which a smaller number indicated a low level of agreement or relevance (e.g., not at all, does not apply, do not agree at all).

**Table 2** Evaluation of the future society hackathon [13 statements, 1 = not agree at all, 5 = fully agree]

| Statements about | M | SD |
|---|---|---|
| The challenge [3 items] | 3.85 | 0.80 |
| The groups [3 items] | 4.59 | 0.45 |
| Support by teachers/group [2 items] | 4.20 | 0.50 |
| Recommending hackathon participation [2 items] | 4.04 | 0.96 |
| Self-efficacy [3 items] | 4.26 | 0.42 |

**Table 3** Self-assessment of skills trained by taking part in the hackathon [13 items, 1 = not at all, 5 = very much]

| Skills | M | SD |
|---|---|---|
| Critical thinking/problem solving | 4.05 | 0.79 |
| Creativity | 4.00 | 0.87 |
| Communication | 4.36 | 0.66 |
| Collaboration/cooperation | 4.64 | 0.58 |
| Curiosity | 3.45 | 0.91 |
| Initiative | 4.18 | 0.73 |
| Endurance | 4.32 | 0.84 |
| Adaptability | 4.05 | 0.90 |
| Leadership | 3.59 | 0.85 |
| Social and cultural awareness | 3.68 | 1.04 |
| Well-being-oriented technology development | 4.09 | 0.97 |
| Gender and diversity awareness | 3.43 | 1.12 |
| Risk-taking/courage | 3.14 | 0.89 |

From all course participants ($N = 60$), 22 provided feedback ($m = 10, f = 10$, 2 no answer). The majority ($N = 16$) was enrolled in the study program Human-Machine Interaction. The overall experience that was assessed using a Kunin scale (1 = frowning face, 5 = smiling face) was positive ($M = 4.32$, $SD = 0.72$). Flow (i.e., feelings of joy, task concentration, obliviousness, and competence) was measured with 17 statements adapted from (World Economic Forum, 2020) (e.g., I was fully concentrated, I was absorbed in my task) and resulted in a high mean value ($M = 4.53$, $SD = 3.72$). Self-constructed statements were implemented to assess the evaluation of the challenge, working in groups, if people would participate again and recommend participation, if they felt supported and about the level of self-efficacy they felt (see Table 2). Since it was of interest in how far participants felt that the hackathon trained specific skills, participants were asked to indicate how intense the hackathon trained each of a list of skills and traits relevant in entrepreneurial thinking.

Taking a closer look at the twenty-first-century skills literature and literature on entrepreneurial mindset and skills, there is a high congruence between the skill sets (apart from the hard financial and legal skills on the entrepreneurial competence side). Creativity, endurance, communication, and leadership skills, as well as interpersonal awareness (social, cultural, and diversity awareness), curiosity, and ideation, are prominent elements of both concepts. Consequently, a self-constructed list of concepts was used, including personal skills, on the one hand, and aspects, e.g., well-being-oriented technology development and gender and diversity awareness, referring more to aspects that have been explicitly part of the teaching agenda on the content level.

Results are displayed in Table 3. Subsequently asked for a prioritization of a list of three of the aforementioned skills, participants chose the following: communication (10 indications), collaboration/cooperation (10 indications), and endurance (10 indications) where each named among the 3 most fields that people perceived

a learning gain by participating in the hackathon. Also important were problem-solving (9) and creativity (7). Initiative was mentioned four times, risk-taking twice, and the rest three times. Leadership and curiosity were mentioned once among the top 3. Nine participants left comments in the open fields with mostly positive comments on the experience as a whole while reflecting upon problems and challenges related to time pressure and creative processes under the given circumstances, chances to train existing skills and develop new ones, group communication, and scheduling. Suggestions included to involve more participants from other study programs, to provide a fixed and specifically prepared challenges beforehand and a schedule for both days.

## 7 Discussion and Lessons Learned

Embedded into an interdisciplinary curricular course offer that was transformed into a purely online version due to the pandemic, the chapter described the content as well as the implementation and evaluation of a two-day hackathon as a refined concept of an earlier pilot. The intense engagement in the challenge over 2 days appears to be a successful format to inspire students breaking with routines and expose them to new, uncontrollable situations while accompanying them in this new and state of insecurity with support offers. Challenge solutions and pitches varied in diversity and maturity. The participants reported to have trained important skills of an entrepreneurial mindset and are motivated to participate again as well as to recommend participation in the format to others. Both hackathons were evaluated positively, generally, but also with regard to the group and the level of self-efficacy experiences, support, and challenges to be solved. However, it needs to be mentioned that most of the participants knew each other before that hackathon, which might have made the online interaction more easy than that with strangers.

From a teacher's perspective, a number of lessons learned and recommendations can be outlined: The format requires a *high level of manpower* and a lot of experience, courage, and spontaneous responsiveness on the part of the teachers. The online-only situation allows a tailored personnel deployment, on-demand and without wasting time. It is possible to allow participants', e.g., with child supervision tasks, participation, which would be more complicated in an on-campus face-to-face situation. However, the housing situation needs to allow concentrated work, which cannot be ensured in every case. The *technical infrastructure is crucial* and has to work well. All participants need to be equipped with good devices and strong connections—otherwise, this turns out as hindering factors of the digital-only course. Students and teachers (as well as coaches that might contribute to the hackathons with their expertise) need a *high level of digital skills* in order to also spontaneously find alternative solutions if the infrastructure does not work as expected. Students (at least some of the group) have to be *familiar with prototyping tools, video/audio cutting,* etc. beforehand and have access to them if the requirement is to illustrate the idea using some creative media. If they are not experienced enough, this will distort them from working on their solution as such.

It is advisable to counteract the feeling of being overwhelmed or exhausted with *motivating intervention*. A longer duration is not advisable. A longer duration can promote exhaustion and people falling out of the flow. It would also demand more from teachers and coaches as guides on the students' side. The course can be seen as a *short but intense, positive experience* and may have a lasting effect on, for example, self-efficacy. A good combination of previous knowledge and new challenges must be ensured without creating pressure in order to enable a state of flow. Do not attach any grading to the hackathon itself and to the pitch at the end to motivate and encourage positively. *Give feedback and give them time to further elaborate* on their idea after the hackathon.

*Pitch trainings* and material on pitch composition are helpful to make expectations clearer regarding the maturity status the idea is required to have. The desire for the challenges to be published in advance that was mentioned in the evaluation is understandable, but contradicts the concept—it is not desirable that some might deal with finding a solution long in advance and others join in only afterwards; everyone has to start with what they bring to the table and contribute, based on the possibilities within the group, to the best result.

The two iterations have shown that there is a lot of potential for further research about hackathons as part of university curricular in a national or cross-national, interdisciplinary context: The success factors of creating an atmosphere that is both challenging and supporting and that makes use of individual competences still remain an open research question, especially when it comes to digital collaboration and distributed learning environments. It must be elaborated how many people can actually be looked after in such a format. In the next run, students will be more mixed with a stronger intercultural influence through the participation of a higher number of people from the Romanian university. Also, other than in the previous run, the majority of people will not or seldom have met each other in person before, due to the pandemic which might represent an obstacle in interpersonal communication standards and trust. Both circumstances, combined with a tight schedule, will show how diversity and a relative anonymity influence self-reported satisfaction, skills acquisition, and challenge solutions. In further iterations it is also to be considered how certain skills that are perceived to rather be in the background, e.g., courage and risk-taking, can receive a more pronounced role. It should also be considered which other skills of the entrepreneurial mindset are still missing from the list—how they can be trained and whether this can be meaningfully integrated in connection with the module. Against the background of a comparably small number of female founders, gender differences in communication and working style and preferences will also be a topic of analysis.

To conclude, based on the challenge solutions, pitches, and subjective evaluations of the participants, a two-day (coding-free) hackathon can be beneficially used to train entrepreneurial skills without addressing them actively in the course content. Using the active, open, and intense working situation of a hackathon and enrich it with the possibility of receiving expert advice can train participants' soft skills like risk-taking, curiosity, and self-regulated activity that is needed to be an entrepreneurial pioneer.

**Acknowledgement** The authors would like to thank Uwe Handmann, Alexander Arntz, Chiara Kloos, Mira Kisser, Paul Szabo-Müller, Nico Zengeler, André Helgert, Veronica Schwarze, Stephanie Schumacher, and the HRWStartUps-Team for contributing to the hackathon and/or providing feedback on the manuscript.

## References

Awuni Kolog, E., Sutinen, E., & Nygren, E. (2016). Hackathon for learning digital theology in computer science. *International Journal of Modern Education and Computer Science, 8*(6), 1–12. https://doi.org/10.5815/ijmecs.2016.06.01

Etzion, D., Eden, D., & Lapidot, Y. (1998). Relief from job stressors and burnout: Reserve service as a respite. *Journal of Applied Psychology, 83*(4), 577.

European Commission. (2018, ed.). *EntreComp into action: Get inspired, make it happen*. Publications Office. https://data.europa.eu/doi/10.2760/574864

Gama, K., Alencar, B., Calegario, F., Neves, A., & Alessio, P. (2018). A hackathon methodology for undergraduate course projects. In *2018 IEEE Frontiers in Education Conference (FIE)* (pp. 1–9). https://doi.org/10.1109/fie.2018.8659264

PWC. (2020, ed.). *Eight emerging technologies and six convergence themes you need to know about*. www.pwc.com/us/en/techeffect/emerging-tech/essential-eight-technologies.html

Rheinberg, F., Vollmeyer, R., & Engeser, S. (2003). Die Erfassung des Flow-Erlebens [The assessment of flow experience]. In J. Stiensmeier-Pelster & F. Rheinberg (Eds.), *Diagnostik von Selbstkonzept, Lernmotivation und Selbstregulation [Diagnosis of motivation and selfconcept]* (pp. 261–279). Hogrefe.

United Nation. (2022, ed.). *Sustainability development goals*. sdgs.un.org/goals

World Economic Forum. (2016, ed.). *New vision for education: Fostering social and emotional learning through technology*. https://www.weforum.org/reports/new-vision-for-education-fostering-social-and-emotional-learning-through-technology

World Economic Forum. (2020, ed.). *The future of jobs report 2020*. www3.weforum.org/docs/WEFFutureofJobs2020.pdf

**Prof. Dr. Sabrina C. Eimler** is an expert in Human Factors and Gender Studies from the Hochschule Ruhr West University of Applied Sciences (HRW). She uses innovative teaching methods to inspire creativity and entrepreneurial thinking (e.g., hackathons, virtual reality) and sees inclusion and (digital) well-being as key factors for innovation. She also teaches in the Innopreneurship program at the University of Duisburg-Essen (UDE) and is an active start-up coach and jury member of several competitions.

**Dr. Carolin Straßmann** is a postdoctoral lecturer at the University of Applied Sciences Ruhr West (HRW) in the field of human-technology interaction and social robots. She has a fascination for innovative teaching methods and develops new tools to improve online teaching (Project: VGather2Learn). She also teaches in the Innopreneurship program at the University of Duisburg-Essen (UDE) and gives classes about positive and digital leadership.