

## **Hackathons as a method to foster collaboration between Secondary-Level-Schools and Universities**

### **1. Introduction**

Entrepreneurial education is seen as a motivational bridge to get youth excited about technology [4]. Currently, there are a few initial projects underway aimed at integrating entrepreneurship education with computational thinking. [2; 5; 9]. In secondary school education, there are so far only activities that promote either entrepreneurial or IT education with hackathons and coding events aimed at promoting problem-solving or computational thinking in a playful way based on learning through challenges. For example, CODEWEEK BW (<https://bw.codeweek.de/>) promotes coding without including the entrepreneurial perspective or LaunchX (<https://launchx.com/>) focuses on entrepreneurial aspects and not on coding.

### **2. Current research on entrepreneurship education and computational thinking**

Entrepreneurship, i.e., the application of entrepreneurial thinking and action, is understood as a set of principles, decision-making logics, and techniques that anyone or everyone can tap into to some degree [10]. Entrepreneurship is considered to be the creation of value, whether by starting an innovative organization or within an existing organization [13]. In response to the question of what and how effective schools can be in influencing startup propensity, Mittelstädt (2018) draws on the Theory of Planned Behavior (TPB). In relation to entrepreneurship, the TPB models that an entrepreneurial attitude (I can/will ...) is first established before entrepreneurial intentions (I plan ...) and then entrepreneurial actions (I am entrepreneurial ...) occur [12]. The entrepreneurial attitude is formed through self-efficacy and a sufficient level of knowledge, skills, and experience. Therefore, it is important to offer teaching-learning arrangements that address entrepreneurial tasks and encourage participants to overcome challenges. In the context of IT education, strategies and techniques from computer science can be summarized in the term "computational thinking". Computational Thinking is the thought process in formulating problems and solutions that can be expressed as algorithms [11]. Considering this, Computational thinking represents the identification of a problems and their solution as well as the associated cognitive process executed by humans to solve problems using computational concepts [18]. This problem-solving process requires knowledge of how concepts of computer science, computers and computer networks work and how the application of algorithms and data structures, and the implementation of simple executable programs can be carried out. The foregrounded problem and goal orientation focuses on (computer science) problem-solving skills [1: 27], can prepare learners for careers in the technical and digital fields, and at the same time address technical and STEM

competencies to enable young people to work with digital machines (AI systems, robots, or autonomous systems) in the future. Considering this, computational thinking is seen, among other things, as a driving force for the development of problem-solving skills; a suitable IT-based task can also promote self-efficacy in computer science [14].

### **3 Project description #EntreCoThink**

In order to sustainably anchor the project in schools, the project EntreCoThink develops, implements and evaluates hackathons with 7th to 10th grade secondary school students in STEM subjects. A hackathon combines the terms hacking and marathon. Hacking involves tinkering and being creative to develop innovative solutions in the IT field and build working prototypes in a short period of time. The hackathons are developed, piloted and conducted with school classes at the Karlsruhe University of Education. The hackathon starts with a call for challenges in the STEM field. Companies or civil society organizations (such as the city of Karlsruhe) in the region present a current problem to be solved in the area of Health Teck, Urban Tech, etc. Students are given the task to implement a technical solution based on the Agenda 2030 Sustainable Development Goals. A hackathon will be based on the design thinking process, which includes the phases 1) problem understanding and analysis, 2) elaboration of the wishes and needs of the target group, point of view definition, 3) idea development, concept design and mockup of the planned app, 4) design and programming of a prototype with the MIT App Inventor<sup>1</sup> and 5) testing of the prototype [7]. Finally, the groups pitch their ideas to a panel of judges.

### **4 Final consideration**

Karlsruhe University of Education aims at the Establishment of a service center for teachers. The goal of the service point is to enable teachers to implement hackathons themselves as multipliers at schools. The service center therefore aims to provide an all-round service. Teaching and learning materials are developed, evaluated and made available. For this purpose, a website will be developed where teaching-learning material will be available for teachers. In addition, an individual hardware support will be established. In addition, a material tinkering kit for hackathons for the conceptual, creative development of project ideas / mockups will be developed during the project and also made available to teachers. Another task of the service center is the proactive approach of schools to conduct hackathons and to advise and support teachers in the implementation. A network with regional partners is also to be established in order to bundle practical contacts for the Call for Challenges and to help schools with networking.

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***Миттельштедт Евальд, Вінке Клаудія. Хакатон як метод, що сприяє колаборації середньої школи з університетом.***

Орієнтація на підприємницьку діяльність формується завдяки самоефективності (впевненості у ефективності власних дій) та певному рівню знань, навичок та з набуттям необхідного досвіду. Автори дослідження вважають необхідним запропонувати учням вже на рівні середньої школи такі навчальні ситуації, які вимагали б від учнів виконання підприємницьких завдань та заохочували їх реагувати на виклики. Автори також стверджують, що важливі для підприємництва навички розвиваються за допомогою ІТ освіти та комп'ютерного мислення. Комп'ютерне мислення полягає у формулюванні проблеми та побудові рішень у формі алгоритмів. Розвиток комп'ютерного мислення готує студентів до роботи в сфері цифрових технологій, розвиває технічні та STEM компетенції, вчить молодь спілкуванню з машинами, водночас такий спосіб мислення є потужним драйвером для розвитку навичок розв'язування проблем (Problem-solving Skills), виконання завдань з ІТ також сприяє самоефективності.

Зазначені вище навички формуються в ході виконання учнями проєктів, так званих Хакатонів, що розробляються, випробовуються та проводяться фахівцями Педагогічного університету Карлсруе. Кожний хакатон починається з проблеми у сфері STEM, компанії або громадські об'єднання (наприклад, громада міста Карлсруе) пропонують проблему, що вимагає вирішення. Студенти мають реалізувати технічне рішення проблеми на основі Повістки 2030 та цілей сталого розвитку. Хакатон має пройти всі стадії процесу дизайн-мислення, та у фіналі групи мають презентувати свої ідеї перед колегією суддів.

Маючи успішний досвід створення та проведення хакатонів, Педагогічний університет Карлсруе має план створення сервісного центру для вчителів середніх шкіл з метою озброїти їх матеріалами для проведення хакатонів у школах.

**Ключові слова:** орієнтація на підприємництво, самоефективність, хакатон, комп'ютерне мислення, вирішення проблем.

***Mittelstädt Ewald, Wiepcke Claudia. Hackathons as a method to foster collaboration between Secondary-Level-Schools and Universities.***

The entrepreneurial attitude is formed through self-efficacy and a sufficient level of knowledge, skills, and experience. The authors of the paper find it important to offer secondary school students teaching-learning arrangements that address entrepreneurial tasks and encourage participants to overcome challenges. Some of the essential entrepreneurial skills are taught in the course of IT education, strategies and techniques of which are referred as "computational thinking". Computational Thinking (CT) is the thought process in formulating problems and solutions that can be expressed as algorithms. CT can prepare learners for careers in the technical and digital fields, and at the same time address technical and STEM competencies to enable young people to work with digital machines, it is seen, among other things, as a driving force for the development of problem-solving skills; a suitable IT-based task can also promote self-efficacy in computer science. The skills mentioned above can be fostered and developed through projects (hackathons) developed, piloted and conducted with school classes at the Karlsruhe University of Education. The hackathon starts with a call for challenges in the STEM field. Companies or civil society organizations (such as the city of Karlsruhe) in the region present a current problem to be solved in Health Tech, Urban Tech, etc. Students are given the task to implement a technical solution based on the Agenda 2030 Sustainable Development Goals. A hackathon will be based on the design thinking process. Finally, the groups pitch their ideas to a panel of judges. Having successful experience in designing and conducting hackathons, Karlsruhe University of Education aims at the establishment of a service center for teachers with the goal of enabling teachers to implement hackathons themselves as multipliers at schools.

**Key words:** entrepreneurial attitude, self-efficacy, hackathon, computational thinking, problem-solving.