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## Article

# Digitalization in entrepreneurship education and its effect on entrepreneurial capacity building

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## MANAGEMENT | RESEARCH ARTICLE

# Digitalization in entrepreneurship education and its effect on entrepreneurial capacity building

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**Abstract:** Entrepreneurship education, the process of knowledge, skill, competency, and attitude development, aims to maximize the effectiveness of the entrepreneurial capacity building. The pandemic boosted the digital transformation of higher education and brought the online incubation platform NETMIB to life. This paper introduces this unique platform solution and utilizes online opportunities for skill and attitude assessment. An online survey-based research method was applied, and an online Entrepreneurial Orientation (EO) Index was developed as a valid scale for measuring entrepreneurial attitudes in online incubation programs. Based on the findings, student idea owners in the online incubation process have a significantly higher propensity to engage in business activities and a stronger desire for independence and achievement. The findings of this paper can contribute to the targeting and development of educational interventions in the incubation programs, and the online EO Index can be a useful tool among the performance measures of various incubation programs.

**Summary:** Entrepreneurship education, the process of knowledge, skill, competency, and attitude development, aims to maximize the effectiveness of the entrepreneurial capacity building. The pandemic boosted the digital transformation of higher education and brought the online incubation platform NETMIB (*Network of multidisciplinary ideation and business model generation*) to life. This paper introduces this unique platform solution of online incubation and utilizes online opportunities for skill and attitude assessment. Since education aims to influence entrepreneurial capacity, measured by attitudes, the paper develops a self-

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assessment tool for online entrepreneurship education. Hypothesizes that there are significant differences in the attitudes of the members according to their role in the online incubation process. An online survey-based research method was used, and an entrepreneurial attitude construct was created concerning the member's desire for innovation, personal control, achievement, and self-esteem. Based on the findings, student idea owners in the online incubation process have a significantly higher propensity to engage in business activities and a stronger desire for independence and achievement. The findings of this paper contribute to the targeting and development of educational interventions in incubation programs, and the online Entrepreneurial Orientation Index can be a useful tool among the performance measures of various incubation programs.

**Subjects:** Consumer Behaviour; Services Marketing; Service Industries

**Keywords:** entrepreneurial attitudes; entrepreneurship education; entrepreneurial capacity building; digitalization; online education

**JEL classification:** I23; L26

## 1. Introduction

Among the key topics of higher education institution (HEI) research, researchers pay much attention to the third role of the universities. By highlighting the importance of the third role, they often discuss topics like university-industry relations, the entrepreneurial activity of academic entrepreneurs (Aldridge & Audretsch, 2011; Holley & Watson, 2017), and after all, the economic impact of the universities. The growing interest in the third role also draws attention to entrepreneurship education. Regarding the entrepreneurial activities of universities, the curricular and extra-curricular educational interventions became the main drivers of the third role. Atmono et al. (2023) find that curricular and extra-curricular activities positively impacted entrepreneurial self-efficacy and intentions. Nguyen and Nguyen (2023) argue that entrepreneurship education enhances the entrepreneurial capacity of students and helps form and develop entrepreneurial intentions. The universities' educational interventions help spread entrepreneurial thinking; thus, they contribute to entrepreneurial capacity building in the economy.

As a consequence of the COVID-19 outbreak digitalization of entrepreneurship education has been accelerated. Many universities and colleges have had to shift their focus to digital engagement, with online learning platforms becoming the primary mode of instruction (Crawford et al., 2020). This transformation to online teaching has been crucial in overcoming the COVID-19 disruption and ensuring that students can continue their education while staying safe. However, it has also highlighted the importance of HEIs being prepared to deal with crises and adapt to new challenges that may arise in the future (Fadhel et al., 2022). The digital transformation has impacted everyone, and students and faculty in HEIs have been particularly affected (Elsalem et al. 2020). While they may be familiar with technology, the sudden shift to online learning has still significantly impacted their lives. The pandemic has highlighted the need for teachers and HEIs to have the necessary capabilities and resources to navigate and adapt to digital technologies (Fadhel et al., 2022). On the other hand, the pandemic has also presented opportunities for innovation and improvement in the service sector, including education (Agostino et al. 2020). Digital technologies, platform solutions, and their application in higher education, especially in the ideation and incubation process, were evident, available, and attainable solutions in the times of online education.

In this paper, the conceptual model of the educational intervention of the NETMIB online incubation platform will be introduced while assessing the attitude of its members towards

entrepreneurial activities. Our hypothesis posits that there are significant differences in the attitudes of the members considering their roles in the incubation process. To verify this hypothesis, four entrepreneurial attitudes will be measured that reflect the members' mindset regarding entrepreneurship. An entrepreneurial attitude assessing survey method was used that included questions concerning the members' attitudes toward innovation, personal control, achievement, and self-esteem. Four constructs were created and validated from these questions, with Cronbach's alpha test and explanatory factor analysis. Finally, an aggregated measure of entrepreneurial attitudes was developed from the four constructs, named NETMIB Entrepreneurial Orientation Index, and the index was compared to the entrepreneurial intentions of the participants.

The empirical results provide a clear picture of the attitudes of the participants of the online incubation process and contribute to the development of the measurement systems of an online incubation program. The originality of this work lies in studying the attitude profiles of the different actors in the online incubation process.

This paper is structured as follows. First, the online entrepreneurship education platform is introduced then the conceptual model of entrepreneurial capacity building is presented in relation to the available relevant literature. Next, the development and validation of the attitude constructs are described, which is followed by the review of the Entrepreneurial Orientation Index. Throughout the paper, the attitude profiles of the platform members will be analyzed and discussed, concentrating on the role of digital education in forming them.

### **1.1. NETMIB, the online incubation platform**

The NETMIB incubation platform is a multidisciplinary and multicultural environment, consists of incubation programs from universities of different countries, and provides an online environment, which can foster the new venture creation of individuals. The main objective of the online platform is to facilitate efficient cooperation between the public-private-governmental sphere of the economy to enable socio-economic growth via the development of entrepreneurial skills and the capacity of university students. This general objective involves improving the quality and relevance of the online teaching methodology at the participating Higher Education Institutions (HEIs) to develop the entrepreneurial capacity of university students. While digitally developing entrepreneurial capacity, NETMIB also aims to answer current socio-economic problems by generating relevant business ideas on the part of university students. This action-learning approach can further strengthen the functioning of the Triple Helix model at the participating HEIs (Etzkowitz, 2003). With the opportunities arising from the digital solution of the platform, by internationally interconnecting the participating HEIs' ideation and business model generation practices in the framework of the NETMIB, significant intercultural, cross-industrial, and multidisciplinary benefits can arise on the parts of all participants. The NETMIB platform also intends to establish a transnational entrepreneurship ecosystem that can support the development of entrepreneurial skills of participating persons (students, faculty members, business professionals, public servants,... etc.) while creating innovative solutions to solve regional, national, or international socio-economic problems.

For the European Union to be successful in implementing and expanding open innovation as one of the main drivers of its socio-economic growth, Higher Education Institutions (HEIs) must be able to produce independent, creative, entrepreneurial individuals who understand inter- and multidisciplinary challenges of the socio-economic environment and as a result, can contribute to open innovation. HEIs also have to develop action learning methods that bring the social/economic problems into the classroom along with the relevant stakeholders to facilitate co-learning and co-creation between students, professors, and the stakeholders (businesses, policymakers, society) with a particular problem. While the COVID-19 pandemic brought this process from the classrooms to the online world, the efficiency of these interactions has grown enormously. Students and academics not only have to learn, perform research, and co-create with business as well as with

government and society in accordance with the open university concept and the Triple Helix model.<sup>1</sup>, but they must deal with this task in a digital form.

The online platform has its competence portfolio, which is the member sphere of the platform, where registered users showcase their competencies after choosing their role in the incubation process of ideas and problems. The roles are student developers, student idea owners, internal mentors, and external mentors. Student developers work on other members' ideas and problems to bring them from a challenge-based idea category through the online validation process to a potential product and service development phase. Student developers, like student idea owners, are university students from the participating HEIs, who take an online course where the NETMIB platform is applied as an action learning method. According to the NETMIB member testimonials, idea owner students are interested in their idea's viability, if the idea is worth building a business on it, or basically, they are interested in how to become an entrepreneur. The teamwork-based teaching method of the platform via chat, chatbots, and built-in video-meeting opportunities happens in the so-called incubator rooms, where validation-seeking teams consisting of student developers and one or more idea owners go through the online, 10-step incubation process virtually guided by an internal mentor. Internal mentors are professors from the participating HEIs, with particular expertise in incubation, idea development, business development, or the disciplines connected to validation. External mentors are registered experts from the market with various competence backgrounds; usually, they are alumni of the HEIs, who can be connected to answer industry-specific questions for validation, access to networks and connections, etc.

## 2. Literature review

Practice-oriented and experimental teaching methods have become increasingly important in higher education, providing students with hands-on experience and practical skills to apply in real-world situations (Lei et al., 2021). These methods often involve project-based learning, internships, and other forms of experiential learning that can enhance student engagement and motivation. By incorporating these methods into their curricula, HEIs can better prepare students for the demands of the workforce (Ceyhun & Uygun, 2022). As Kashif et al. (2020) state, the COVID-19 pandemic did not cause the change to digital channels; it has undeniably accelerated the transition, as most people now have a digital ecosystem as part of their everyday lives. The pandemic has also accelerated the digital transformation of education, as universities and colleges have had to adapt quickly to remote teaching and learning.

Online platforms for lectures, assignments, and exams have become the norm, and digital tools like video conferencing, collaborative software, and learning management systems have become essential. The pandemic has highlighted the importance of digital readiness and has pushed HEIs to invest in technology and training to support their students and faculty better. With the rise of the digital economy, it is essential for HEIs to prepare their students for the demands of entrepreneurship in this field (Ratten & Usmanij, 2021). This can involve providing students with a strong digital literacy and technology foundation and offering courses and programs focusing on innovation, creativity, and business acumen (Haleem et al., 2022). Additionally, HEIs can foster entrepreneurship by creating partnerships with businesses and startups, providing incubation and mentorship programs, and encouraging students to participate in entrepreneurship competitions and hackathons. Extra-curricular activities can be a powerful way for HEIs to foster entrepreneurship and provide students with opportunities to develop their skills and interests outside the classroom. Activities such as entrepreneurship clubs, pitch competitions, and networking events can help students connect with like-minded peers and gain exposure to entrepreneurship (Sousa et al., 2019). These activities can also provide students with valuable skills such as leadership, communication, and teamwork, which are essential for success in entrepreneurship.

The COVID-19 pandemic also challenged entrepreneurs and influenced entrepreneurial intentions. Asad and Kashif (2021) point out that entrepreneurs faced uncertainty and huge losses, but with innovative and opportunity-seeking attitudes, they managed to survive the COVID-19 crisis.

Sulaiman et al. (2020) highlight the challenges of employment concerning productivity, health, and safety. Studying the banking sector, Ashfaq and Tariq (2021) discuss that the COVID-19 pandemic accelerated the digital transition and to overcome the challenges institutions need agility, flexibility, and the ability to eliminate their internal inconsistencies. Arve et al. (2023) argue that during the COVID-19 pandemic, 63% of prospective entrepreneurs postponed their project. Low opportunity cost and self-interest drove the entrepreneurial intentions in this period.

According to Levenburg and Schwarz (2008), factors that can drive the intention of individuals to engage in entrepreneurial activity include environmental factors, personality traits, and attitudes of the individuals. In the case of environmental factors, different systemic and framework conditions can be found, which can foster productive entrepreneurship, also known as the elements of an entrepreneurial ecosystem (Isenberg, 2010; Stam & Spiegel, 2017). The elements of an entrepreneurial ecosystem include formal institutions, culture, physical infrastructure, and demand among the framework conditions. Besides these, networks, leadership, finance, knowledge, talents, and intermediaries can also influence the entrepreneurial intentions of individuals as systemic conditions (Stam, 2015). Spiegel (2015) characterized these conditions as social, cultural, and material attributes.

Among personal traits, openness to experience and conscientiousness can play a crucial role. Still, emotional stability, the need for achievement, and tolerance for ambiguity can also influence entrepreneurial intentions (Zhao et al., 2010). From an educational point of view, personal traits do not vary over time; they cannot be changed with educational interventions (Rauch & Frese, 2007; Zhao et al., 2010).

The entrepreneurial competencies of individuals can be improved. The entrepreneurial competencies include entrepreneurial knowledge, skills, and entrepreneurial attitudes. Skills like opportunity recognition, the evaluation of business opportunities, networking, and communication, are crucial elements of entrepreneurial competencies. Still, they lead to the intention to become an entrepreneur only if the level of self-efficacy is high enough. Individuals must believe they can succeed (Rideout & Gray, 2013). We can also influence the attitudes of individuals concerning business activities (Ajzen & Fishbein, 1977; Robinson et al., 1991). Thus, educational interventions have to focus on activities that can influence the entrepreneurial knowledge, skills, and attitudes of individuals (Harris et al., 2007; Packham et al., 2010).

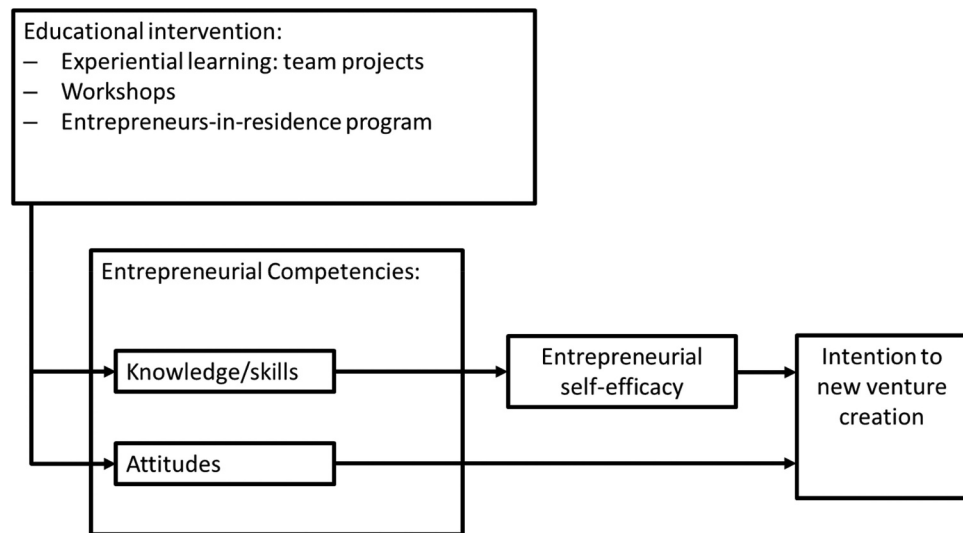
In the theory of planned behavior, Schifter and Ajzen (1985) argue that intention depends on attitudes, subjective norms, and perceived control. Attitudes measure the importance given to the beliefs about the behavior. Subjective norms are influential factors from reference groups such as family, friends, and work colleagues. Finally, perceived control is the belief about how much control we have over influential factors. Therefore, this theory considers intention as the best predictor of action. The theory of planned behavior was often validated in entrepreneurship research studying the relationship between attitudes and intentions in the case of students (Krueger et al., 2000; Sampedro et al., 2014; Souitaris et al., 2007). Thus, we should also find a positive relationship between entrepreneurial attitudes and entrepreneurial intentions in the case of our students.

As the third role of the universities highlights the entrepreneurial capacity building in the economy, considering the influential factors of the individual venture creation, universities can construct a conceptual model of educational interventions, which enables them to reach that goal. In the case of the NETMIB online incubation platform, the conceptual model of Izquierdo (2008) is considered a benchmark. The platform and the incubation programs of the participating universities can provide the needed systemic and framework conditions. The incubation programs of the member universities can develop educational interventions that can improve the members' knowledge and skills and influence their attitudes. As Figure 1 shows, universities can incorporate various educational interventions in their incubation programs. They can develop ventures from business ideas as team projects. They can organize workshops, which can provide entrepreneurial



**Figure 1. The conceptual model of entrepreneurial capacity building via the NETMIB online incubation platform.**

Note: Source: Adapted from Izquierdo (2008)



knowledge to the members. They can also invite entrepreneurs who can share their experiences with the participants of the incubation programs.

Figure 1 introduces the desired impact of these interventions. The educational interventions improve the entrepreneurial knowledge of the members, and if the individual possesses an appropriate level of self-efficacy, these together can create the intention of new venture creation. Although, it has to be emphasized that entrepreneurial knowledge is only one part of entrepreneurial competencies. The educational interventions also have to influence the attitudes of the members to affect their desire to become entrepreneurs.

Among the drivers of the desire to become an entrepreneur, we can mention risk-taking and innovativeness as the most cited attitudes (Levenburg & Schwarz, 2008). However, other studies indicate creativity, proactivity, alertness, emotional intelligence, personal control, achievement, and self-esteem as factors that can influence the mindset of individuals toward entrepreneurship (Robinson et al., 1991; Zampetakis et al., 2009). In this study, four of these attitudes were chosen to get a more unobstructed view of the mindset of the members of the NETMIB online incubation platform towards entrepreneurship.

## 2.1. Research method

In our research, we applied an online survey-based research method as a built-in platform application. In the fall and spring semesters of the 2020/2021 academic year, all the platform members who registered to the NETMIB online incubation platform were surveyed. The incubation platform was launched in the previous fall semester, and at the point of the research, 291 members of five university-based incubation programs from five countries provided their answers. In addition, there were participants from Botswana, the US, and Hungary. The users, whether involved via a course (student idea owners, student developers, internal mentors) or recruited from the university-based entrepreneurship ecosystem (external mentors) by the platform operators, filled out the questionnaire as part of their registration process. The survey initially consisted of 21 items based on the entrepreneurial attitude survey of Robinson et al. (1991) which was validated on a similar-sized sample. In the previous literature, Harris et al. (2007) and Gibson et al. (2011) found evidence that specific attitudes could influence the propensity of individuals to engage in business activities. Since our research aims to analyze the relationship between entrepreneurial attitudes and entrepreneurial intentions in the case of our online incubation program, we examined four entrepreneurial attitudes in our survey and selected the most relevant items to develop our entrepreneurial attitude constructs according to the method of Bolton and Lane (2012).



**Table 1. The selected entrepreneurial attitudes**

Attitudes	Definition
Innovation	<b>a desire</b> for creativity and experimentation through the introduction of new products and services
Achievement	<b>a desire</b> to achieve specific results in business.
Personal control	<b>a desire</b> to have personal control over business activities
Self-esteem	a strong sense of self-worth

Note: Source: based on Robinson et al. (1991)

Table 1 shows that the four attitudes include innovation, achievement, personal control, and self-esteem. These attitudes are measured with items strongly connected to the business activities of individuals. (See the whole survey in [Appendix A.](#)) The definitions in Table 1. state that the attitudes express desires towards business activities that can characterize the mindset of an individual concerning entrepreneurial thinking.

From the 21 items, four constructs have been developed that measure the four attitudes of the platform members by selecting the most relevant items. The items were matched up according to Cronbach's alpha value of the different constructs. The value of Cronbach's alpha above 0.7 indicates that the internal consistency of the construct is adequate. In this case, the items included in the constructs measure the same latent variable. After the validation of the constructs, the values of the constructs were calculated as the average of the selected items. The validity of the selected items was checked with the explanatory factor analysis. With the help of the explanatory factor analysis, it could be examined whether independent factors can significantly explain the variation of the selected items. As can be seen in Appendix B.2, according to the Kaiser-Meyer-Olkin (KMO) test, the determinant of the correlation matrix and Barlett's test, the correlation matrix of the selected items, is not an identity matrix so the factor analysis could be performed.

The main research question was: Are there significant differences in the attitudes of the different actors according to their online roles in the incubation process? As Table 2. shows, six hypotheses were formulated about the attitude characteristics of actors. In order to verify these hypotheses, different non-parametric tests have been applied to analyze the attitude differences between the groups.

**Table 2. The hypotheses of the study**

H1	<b>The members of the NETMIB platform have significantly lower self-esteem compared to other constructs at the moment when they apply to the incubation programs and register to the platform.</b>
H2	The student idea owners have a higher propensity to engage in business activities.
H3	The external mentors have a substantially stronger desire for innovation compared to the other actors of the incubation process.
H4	Student idea owners see entrepreneurship as a way to become independent in life.
H5	Student idea owners strongly believe that they can succeed with their business idea.
H6	Student developers believe the least that they can succeed in business activities

Note: Source: own construction of the authors

**Table 3. The procedure of the index creation**

1.	Outlier detection via the interquartile distance method
2.	Item value normalization to the interval between 0 and 1
3.	Equalization of the item value averages to be able to take all the motivating factors the same way into account.
4.	Calculation of the four sub-indices, as an average of the normalized items.
5.	Application of the penalty for the bottleneck method to modify the value of the sub-indices. <i>(Reason: if the respondents perceive themselves weaker concerning an attitude, it will also influence their overall willingness to engage in business activities.)</i>
6.	Identification of the Entrepreneurial Orientation Index as the average of the modified sub-indices. <i>(Winsorization of the sub-index values at the 95<sup>th</sup> and the 5<sup>th</sup> percentile was applied, so that no one can have extremely low or extremely high values relative to the others.)</i>

Source: own construction based on Szerb et al. (2012).

After exploring the actors' attitude patterns in the online incubation process, the research focused on the measurement opportunities of the overall willingness to engage in business activities. An index was created and tested among the online platform users. The method of Szerb et al. (2012) has been applied to build up a robust aggregated index from the items. As Table 3. shows, this method relies on the penalty for the bottleneck approach, which allows aggregating the information content of the four constructs. The equalization of the averages and the normalization measures the constructs on the same scale. The penalty for the bottleneck method makes the four sub-indices interconnected. Using this method, the values of the entrepreneurial orientation index can vary between 0 and 1 without ever reaching the upper and lower bound.

### 3. Results and discussion

The created constructs of the chosen entrepreneurial attitudes were validated with the help of Cronbach's alpha measure. Table 4. shows 11 items of the final entrepreneurial attitude constructs stemming from the 21 entrepreneurial attitude survey question match-up. These four constructs explain the attitudes of the members of the online incubation platform. Table 4. also presents a valid Cronbach's alpha value of the constructs (all above 0.7).

After the validation of the constructs, the explanatory factor analysis was performed. According to the analysis, two independent factors can explain approximately 59% of the variation of the selected items (See Appendix B.3), which can be considered a sufficient explanatory power (Bolton & Lane, 2012). Table 5. shows the factor loadings of the rotated factors (varimax method). It can be seen that the first factor consists of the questions, which are the building blocks of innovation, personal control, and achievement constructs. The factor is named entrepreneurial mindset since it suggests that the respondent has the desire to achieve something new and unique independently. The second factor is self-esteem, which measures whether the respondents feel comfortable in business situations.

Next, the values of the validated constructs were calculated as the average of the incorporated items, and the values of the online Entrepreneurial Orientation (EO) Index and its sub-indices were calculated following the previously introduced procedure of index creation (Table 3). Figure 2 shows the correlation structure of the index (See also Appendix B.1). The correlation between the sub-indices

**Table 4. Entrepreneurial attitude question-construct match up and their validation**

<b>Innovation</b>	
Q1	I often approach business tasks in unique ways.
Q2	I enjoy being the catalyst for change in business affairs.
Q3	I enjoy being able to use old business concepts in new ways.
Cronbach,, s alpha	0.736
<b>Personal Control</b>	
Q4	I create the business opportunities I take advantage of.
Q5	I feel very good because I am ultimately responsible for my own business success.
Q6	I get excited creating my own business opportunities.
Cronbach,, s alpha	0.76
<b>Achievement</b>	
Q7	I get a sense of accomplishment from the pursuit of my business opportunities.
Q8	I get my biggest thrills when my work is among the best there is.
Q9	I often sacrifice personal comfort in order to take advantage of business opportunities.
Cronbach,, s alpha	0.753
<b>Self-esteem</b>	
Q10	I feel very self-conscious when making business proposals.
Q11	I feel self-conscious when I am with very successful business people.
Cronbach,, s alpha	0.831

Source: own construction of the authors

is significant, and the EO index correlates with the sub-indices, which indicates that the sub-indices measure the same phenomenon.

Table 6. presents the descriptive statistics of the four entrepreneurial attitude constructs and the online EO Index. As the skewness and kurtosis show, the distribution of the constructs cannot be characterized as normal distributions. The descriptive statistics of the index are provided as a benchmark to interpret the values of the online Entrepreneurial Orientation index. The value of the index was defined on the (0,1) interval since the winsorization process does not allow the index value to reach its upper and lower bound. The value closer to one means a higher willingness of the individual to engage in business activities. The median of the index is 0.674, and the mean is 0.676, which suggests that more extreme values can be found on the right side of the distribution. 75 % of the participants have an index value higher than 0.568, and 25% have an index value higher than 0.783.

In line with our conceptual model of entrepreneurial capacity building, the link between the online EO Index and the entrepreneurial intentions of the participants was investigated. According to the theory of planned behavior introduced in the literature review, we have to find a positive relationship between the EO index and the entrepreneurial intentions of the students. The conducted survey contained the question of whether the registered members plan to become an entrepreneur or not (For the exact question, see [Appendix A](#)). Two hundred of the 291 participants provided an answer to that question, and 80% of the participants stated that they are planning to become an entrepreneur in the future.

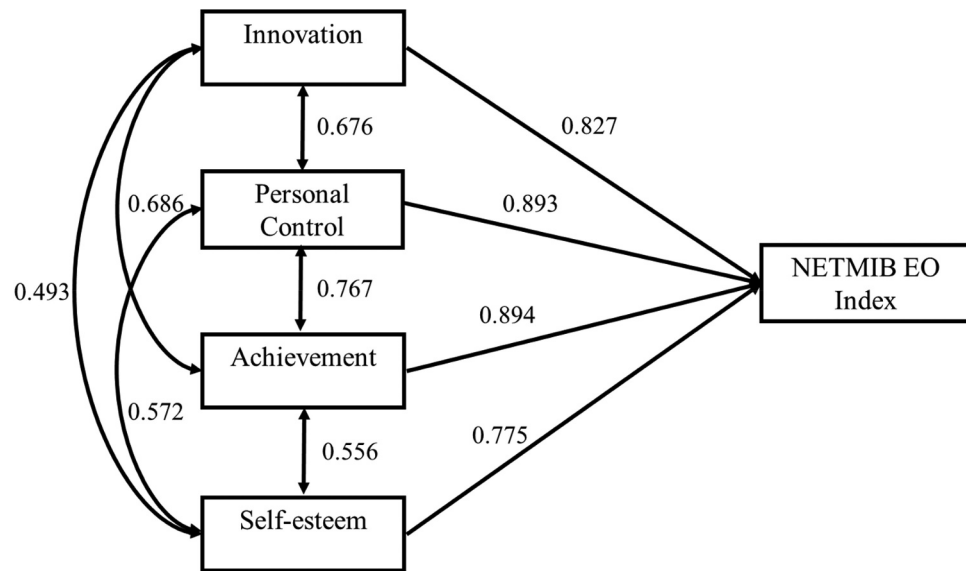
The established conceptual model argues that the higher the value of the constructed online entrepreneurial orientation index, the higher the propensity to become an entrepreneur. Since, in this case, the question related to entrepreneurial intention was the dependent variable, which is a binary variable, the relationship between the EO index and the entrepreneurial intention was

Table 5. The results of the explanatory factor analysis											
	Innovation			Personal Control			Achievement			Self-esteem	
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Factors	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11
Factor1	0.758	0.740	0.589	0.622	0.719	0.724	0.789	0.634	0.686		
	Entrepreneurial mindset										
Factor2										0.876	0.916
										Self-esteem	

Source: own construction of the authors

**Figure 2. The correlation structure of the NETMIB EO Index.**

Note: Source: own construction



**Table 6. Descriptive statistics of the attitude constructs**

Descriptives	Innovation	Personal Control	Achievement	Self-esteem	EO Index
Number of observations	291	291	291	291	291
25th percentile	6.000	6.333	6.333	5.000	0.568
Mean	7.148	7.456	7.590	6.500	0.676
Median	7.333	7.667	7.667	6.500	0.674
75th percentile	8.333	8.667	9.000	8.000	0.783
Std. Deviation	1.653	1.728	1.711	2.240	0.152
Skewness	-0.558	-0.643	-0.712	-0.385	0.029
Kurtosis	0.715	0.599	0.761	-0.412	2.348

Source: own construction of the authors

**Table 7. Results of the binary logistic regression model**

Variables	ln(Odds)	Exp(ln(Odds))
EO Index	6.251*** (1.420)	518.539
Constant	-2.704***(.904)	.067

Note: The test is significant at the \*\*\*0.01,\*\*0.05,\*0.1 level, respectively

Source: own construction of the authors

tested using binary logistic regression. The binary logistic regression estimates the probability of an event happening. In this case, the event is becoming an entrepreneur.

In our logistic regression model, the entrepreneurial intention was the dependent variable, while we included the online EO index as an independent variable. Table 7 shows the result of the binary logistic regression model. The stars denote the significance of the Wald tests, and the standard errors are presented in parentheses. It can be seen that the index has a significant positive effect on entrepreneurial intention ( $p < 0.01$ ), which supports our assumptions about the link between entrepreneurial attitudes and entrepreneurial intentions.

Table 7 also shows that a higher EO index increases the chance that a person has entrepreneurial intentions in the future. The odds of becoming an entrepreneur are 518 times higher for someone with a high EO index. The model has a Nagelkerke  $R^2$  of 17.4%. The Hosmer and Lemeshow goodness-of-fit test resulted in a 0.391 p-value, indicating that the used model fits the data well. According to the contingency table of the model, overall, the predictions are correct 80% of the time. The area under the curve is 0.743 and significant at the 1% level (See Appendix B.5 for further details).

The differences were investigated across the entrepreneurial attitude constructs and the roles in the incubation process to validate our hypotheses. Table 8. shows the Hodges-Lehmann median differences across the entrepreneurial attitude constructs. The HL estimator calculates the median of all possible differences between the two groups. The stars denote the significance of the related samples Wilcoxon sign rank tests at the 1%, 5%, and 10% levels, respectively, and the statistics of the tests are presented in parentheses. The table shows that self-esteem has significantly lower values than the other constructs, which implies that the online incubation platform members desire to accomplish something new and unique independently. However, they do not believe in their success when registering on the platform. This result suggests that program designers should also include the development of participants' self-esteem in their educational interventions. According to this, the H1 hypothesis can be accepted. The members of the online incubation platform have significantly lower self-esteem than other constructs when they apply to the incubation programs and register to the platform.

To answer the main research question of the paper, the attitude differences between the various roles were studied. Table 9. shows the Hodges-Lehmann median differences across the different roles in the incubation process. In addition, the groups were compared with the Wilcoxon—Mann-Whitney two-sample rank-sum test. The stars denote the significance of the tests, and the test statistics are presented in parentheses. Central tendencies across the different roles are presented in Appendix B.4.

Analyzing the median differences of the online EO Index, the median willingness to engage in business activities is similar in the case of the external mentors and the student idea owners. The estimated difference (HL $\Delta$ ) is 0.021 between the two groups, which is not significant. The student developers have a significantly lower propensity than the entrepreneurial attitude of the student idea owners. (HL $\Delta$ =−0.060, sig. at 1% level) Furthermore, the case is similar concerning the internal mentors (HL $\Delta$ =−0.114, sig. at 1% level). There is no significant difference between the internal mentors and student developers in the case of the online EO Index.

These attitude differences are easy to interpret after looking into the nature of the different roles in the online incubation process. The internal mentors and the student developers have a supportive role during the incubation process; their willingness and devotion are not expected and are not required to be high. Conversely, those who develop their ideas in the incubation programs want to create more. They want to leave an impact. These data provided adequate

**Table 8. Median differences across the entrepreneurial attitude constructs**

Constructs	Median differences	Lower bound (95%)	Upper bound (95%)
Innovation-Self-esteem	0.583***(21041.0)	0.250	0.833
Personal control-Self-esteem	0.833***(26328.5)	0.583	1.167
Achievement-Self-esteem	1.083***(25185.5)	0.750	1.333

Note: The test is significant at the \*\*\*0.01,\*\*0.05,\*0.1 level, respectively

Source: own construction of the authors

**Table 9. Median differences across the different roles**

<b>Roles</b>	<b>Innovation</b>	<b>Personal control</b>	<b>Achievement</b>	<b>Self-esteem</b>	<b>EO Index</b>
Internal mentor-Student Idea Owner	0.333 (1376.0)	-1.333*** (787.0)	-1.000** (853.5)	-2.0*** (719.5)	-0.114*** (775.5)
Student developer-Student Idea Owner	-0.333* (6849.0)	-0.667*** (6328.5)	-0.667** (6373.0)	-0.5* (6808.0)	-0.060*** (6149.0)
Student developer-Internal mentor	0.667** (2414.5)	-0.667* (1511.0)	-0.333 (1705.0)	-1.5*** (1253.0)	-0.047 (1574.5)
External Mentor (expert)-Student Idea Owner	1.333** (728.5)	0.333 (559.5)	0.000 (504.5)	-0.5 (417.0)	0.021 (545.5)
External Mentor (expert)-Internal mentor	1.333* (176.0)	1.667* (171.5)	1.333* (177.0)	1.0 (159.0)	0.136 (168.0)
External Mentor (expert)-Student developer	1.667*** (1160.5)	1.000 (977.0)	0.667 (954.0)	0.0 (738.0)	0.077 (961.0)

Note: The test is significant at the \*\*\*0.01,\*\*0.05,\*0.1 level, respectively

Source: own construction of the authors

*confirmation for the H2 hypothesis. The student idea owners have a higher propensity to engage in business activities.*

After that, the research focus turned to the innovation construct. The external mentors have a significantly stronger desire for innovation compared to the student developers (HLΔ = 1.667, sig. at 1% level), student idea owners (HLΔ = 1.333, sig. at 5% level), and internal mentors (HLΔ = 1.333, sig. at 10% level). The result suggests that the external mentors join the platform and support the members with their expertise to work on new and creative ideas, which they can forge into new products and services. Thus, it can be concluded that developing new products and services can motivate experts to join the platform. *These results allow us to provide some evidence related to the H3 hypothesis. The external mentors have a stronger desire for innovation than the other actors in the incubation process.*

In the case of personal control, negative differences can be found between internal mentors and student idea owners (HLΔ = -1.333, sig. at 1% level) and between student developers and student idea owners (HLΔ = -0.667, sig. at 1% level). In conclusion, it can be stated that the desire for independence is a strong motive for engaging in business activities in the case of the student idea owners. At the same time, it is something like a must in the case of supportive roles. *Regarding these results, the H4 hypothesis of the research can be confirmed. Student idea owners see entrepreneurship as a way to become independent in life.*

The achievement construct shows a negative difference between internal mentors and student idea owners (HLΔ = -1.000, sig. at 5% level) and between student developers and student idea owners (HLΔ = -0.667, sig. at 5% level). On the other hand, there are no significant differences between external mentors and student idea owners and internal mentors and student developers. In the case of the personal control and achievement construct, the differences refer to the overall differences between the actor with supporting roles in the incubation process and actors with their business ideas. *Thus, these results also support the H4 hypothesis.*



In the case of the self-esteem construct, a negative difference can be observed between internal mentors and student idea owners ( $H\Delta = -2.0$ , sig. at 1% level), between student developers and student idea owners ( $H\Delta = -0.5$ , sig. at 10% level). Furthermore, a negative difference exists between an internal mentor and a student developer ( $H\Delta = -1.5$ , sig. at 1% level). However, there are no significant differences between external mentors and the other actors. These results highlight that the student idea owners strongly believe that they can succeed with their idea, and among internal members of the incubation process, student developers believe the least that they can succeed in business activities. *Concerning these results, the H5 and H6 hypotheses can be confirmed: Student idea owners strongly believe they can succeed with their business idea. On the other hand, student developers believe the least that they can succeed in business activities.*

To summarize our findings concerning the attitude differences, we argue that the devotion is higher for participants who develop their own idea in the online programs. This phenomenon is observable in the case of personal control, achievement, and the self-esteem construct also. In conclusion, those who apply for the incubation program with their own idea have a stronger desire for independence and to achieve something in business. In addition, they believe more that they can succeed with their idea. The external mentors have a higher desire for innovation compared to the other groups, while student developers believe the least that they can succeed in business activities.

#### 4. Conclusion

The study aimed to examine the impact of the NETMIB online incubation platform on the entrepreneurial attitude of its registered members. The establishment of incubation programs can be beneficial in fostering stronger interactions between universities and industry. By offering opportunities for students and professors to apply their skills in real-world settings, these programs can help to build self-esteem and cultivate an entrepreneurial culture among participants. Furthermore, the international scope of incubation programs, in general, and in the case of NETMIB especially, can provide valuable opportunities for technology transfers and cross-cultural experiences, collaboration, and networking with industry experts and potential investors from different continents and cultures.

Whether online or in-person, incubation programs can provide a supportive and collaborative environment where participants can develop their ideas and bring them to the market. This can be particularly valuable for those needing more resources or experience to launch a business on their own. Overall, establishing the NETMIB incubation program can help bridge the gap between academia and industry, fostering innovation and economic growth while providing valuable learning experiences for participants.

Taking advantage of the measurement opportunities arising from the digitalization of entrepreneurship education, an online survey-based method was applied to assess the attitudes and willingness of participants of our online incubation program via a built-in platform application. By introducing the conceptual model of the online platform's entrepreneurial capacity building, our research discussed that educational interventions of the online incubation programs, in general, have the responsibility to provide entrepreneurial knowledge and to influence the attitudes of the participants towards entrepreneurship. If the self-efficacy of the members is high enough, the educational intervention can lead to the intention to become an entrepreneur.

This research aimed to investigate whether there are differences in the attitudes of the members of an online incubation platform based on their roles in the incubation process. We used an online survey-based method and created entrepreneurial attitude constructs related to innovation, personal control, achievement, and self-esteem. Our research found that members of the online incubation platform had significantly lower self-esteem than the other constructs at the time of their registration to the platform. This could suggest that members who join the platform may lack confidence in their abilities, impacting their participation and success in the incubation process. Additionally, the study found that student idea owners in the incubation process had a significantly higher propensity to

engage in business activities than those who participated as internal mentors or student developers in the program. This finding suggests that students with business ideas may have more motivation and drive to pursue entrepreneurial activities than others. Therefore, universities need to contribute to enhance the confidence and skills of individuals by expanding and broadening the scope of incubation programs and raising awareness of the entrepreneurial process and entrepreneurship in general. As a real implication of these findings, the University of Pécs has extended the program to all ten faculties, enabling multidisciplinary ideation and entrepreneurial teams.

The study also found that student idea owners had a stronger desire for independence and achievement and strongly believed they could succeed with their business idea. This finding highlights the importance of self-belief and motivation in entrepreneurial success. In our incubation program, everyone has to challenge themselves to be an idea owner. Therefore, in the first phase of our process, we introduced an ideation exercise in which each participant has to come up with their own ideas. Enabling the members to validate the viability of their ideas increases the effectiveness of the whole process, which could be measured in the future by the index presented in this research.

Overall, the study provides insights into the attitudes of members of an online incubation platform and how they differ according to the different roles in the incubation process. As mentioned above, the findings proved helpful in improving online incubation programs in general, particularly in the case of the University of Pécs with its NETMIB platform and incubation program. At the same time, our findings are also valuable in providing targeted support to members of the incubation programs with different attitudes and motivations.

After validating the constructs, the online Entrepreneurial Orientation Index has been developed as a valid scale for measuring entrepreneurial attitudes. The validation of the index was followed by a binary logistic regression analysis focusing on the prediction of the event of one becoming an entrepreneur. The online EO Index proved to be a significant explanatory variable of the probability of becoming an entrepreneur. Thus, it supports the assumptions of the established conceptual model that entrepreneurial attitudes are strongly connected to entrepreneurial intentions in the future. The findings can contribute to developing online educational interventions in incubation programs. The online Entrepreneurial Orientation Index can be a valuable tool among the performance measures of in-person or online incubation programs.

Among the limitations of this research, it must be stated that the EO index score measures the entrepreneurial attitudes of the students at the beginning of the educational intervention. There was no assessment of the entrepreneurial attitudes at the end of each semester/ideation/incubation phase.

The developed EO index can be used to compare the effectiveness of different educational programs and identify areas for improvement. For example, educators could use the index to assess the effectiveness of online programs versus in-person programs in fostering entrepreneurial orientation. In addition, the index identifies specific strengths and weaknesses of the participants, allowing educators to provide targeted support and feedback. Overall, the development of the NETMIB EO index has the potential to be a valuable tool in promoting and enhancing entrepreneurial orientation in students and in identifying best practices in entrepreneurship education.

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#### Note

1. Source: Overview of the webpage <https://netmib.pte.hu/content/overview>.

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## Appendix A

Indicate how much you agree or disagree with each statement by choosing a number between “1,, to indicate you “Strongly Disagree,, with the statement and “10,, to say you “Strongly Agree,, with the statement. A “5,, indicates you only slightly disagree, while a “6,, shows only slight agreement. Work as quickly as you can and indicate your first thought about the issue.

Q1 I often approach business tasks in unique ways.

Q2 I enjoy being the catalyst for change in business affairs.

Q3 I enjoy being able to use old business concepts in new ways.

Q4 I create the business opportunities I take advantage of.

Q5 I feel very good because I am ultimately responsible for my own business success.

Q6 I get excited creating my own business opportunities.

Q7 I get a sense of accomplishment from the pursuit of my business opportunities.

Q8 I get my biggest thrills when my work is among the best there is.

Q9 I often sacrifice personal comfort in order to take advantage of business opportunities.

Q10 I feel very self-conscious when making business proposals.

Q11 I feel self-conscious when I am with very successful business people.

Entrepreneurial intention (Yes/No):

Q12 Do you plan to become an entrepreneur?

## Appendix B

### 1. The correlation matrix of the NETMIB entrepreneurial orientation index and the four sub-indices

Correlations		Innovation	Personal Control	Achievement	Self-Esteem	EOINDEX
Innovation	Pearson Correlation	1	0.676**	0.686**	0.493**	0.827**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000
	N	291	291	291	291	291
Personal Control	Pearson Correlation	0.676**	1	0.767**	0.572**	0.893**
	Sig. (2-tailed)	0.000		0.000	0.000	0.000
	N	291	291	291	291	291
Achievement	Pearson Correlation	0.686**	0.767**	1	0.556**	0.894**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000
	N	291	291	291	291	291
Self-Esteem	Pearson Correlation	0.493**	0.572**	0.556**	1	0.775**
	Sig. (2-tailed)	0.000	0.000	0.000		0.000
	N	291	291	291	291	291
EOINDEX	Pearson Correlation	0.827**	0.893**	0.894**	0.775**	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	N	291	291	291	291	291

\*\* Correlation is significant at the 0.01 level (2-tailed).

### 2. KMO and Bartlett, s Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.866
Bartlett, s Test of Sphericity	Approx. Chi-Square	1375.487
	df	55
	Sig.	0.000***
Determinant		0.008

\*\*\* The test is significant at the 0.01 level

### 3. Variance explained by the factor analysis

Factors	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	5.019	45.631	45.631
2	1.427	12.969	58.600

### 4. Central tendencies of the constructs according to the different roles

		Achievement	Innovation	Personal control	Self-esteem	EO
<b>External Mentor (expert)</b>	Mean	8.067	8.333	8.033	6.150	0.717
	Median	<b>8.667</b>	<b>9.000</b>	<b>8.833</b>	<b>6.250</b>	<b>0.778</b>
	N	10	10	10	10	10
	Std.Dev.	1.404	1.833	1.915	2.550	0.174
<b>Internal mentor</b>	Mean	7.173	7.560	6.840	5.160	0.620
	Median	<b>7.333</b>	<b>7.667</b>	<b>6.667</b>	<b>5.000</b>	<b>0.591</b>
	N	25	25	25	25	25
	Std.Dev.	1.218	1.452	1.421	2.235	0.136
<b>Student developer</b>	Mean	7.411	6.961	7.297	6.468	0.660
	Median	<b>7.333</b>	<b>7.000</b>	<b>7.333</b>	<b>6.500</b>	<b>0.659</b>
	N	155	155	155	155	155
	Std.Dev.	1.727	1.567	1.699	2.158	0.148
<b>Student Idea Owner</b>	Mean	7.921	7.215	7.795	6.916	0.710
	Median	<b>8.333</b>	<b>7.333</b>	<b>8.000</b>	<b>7.500</b>	<b>0.731</b>
	N	101	101	101	101	101
	Std.Dev.	1.772	1.759	1.764	2.228	0.154



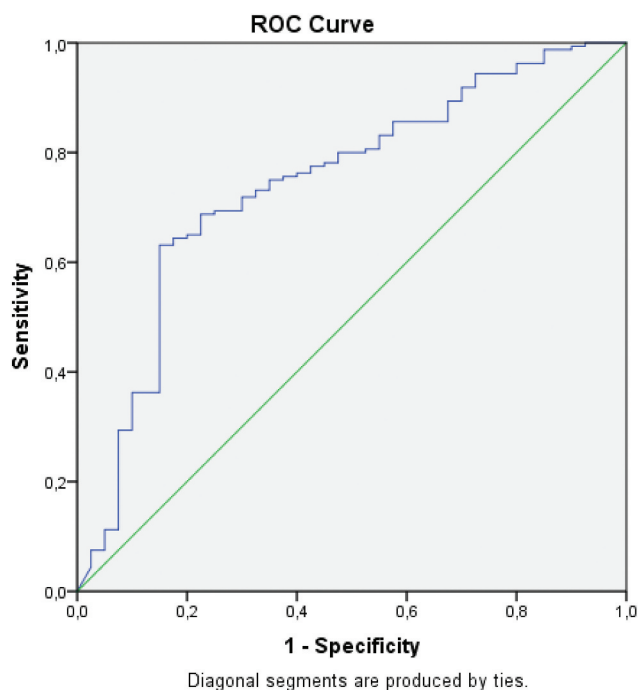
## 5. Logistic regression results

Omnibus Tests of Model Coefficients				
		Chi-square	df	Sig.
Step 1	Step	23.294	1	0.000
	Block	23.294	1	0.000
	Model	23.294	1	0.000

Model Summary			
Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	176.867 <sup>a</sup>	0.110	0.174

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than,001.

Hosmer and Lemeshow Test			
Step	Chi-square	df	Sig.
1	8.444	8	0.391



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**Area Under the Curve**

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Test Result Variable(s): Predicted probability

Area	Std. Error <sup>a</sup>	Asymptotic sig. <sup>b</sup>	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
0.743	0.045	0.000	0.654	0.831

The test result variable(s): Predicted probability has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the non-parametric assumption

b. Null hypothesis: true area = 0.5

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