DIGITAL ENTREPRENEURSHIP COMPETENCIES AMONG STUDENTS: METHODOLOGICAL ASPECTS OF THE MATURITY LEVEL AND DEVELOPMENT PROGRAM MAKING

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ABSTRACT

The article highlights the methodological aspects of determining the maturity level of digital entrepreneurship competencies among students. The authors offer an approach to developing digital entrepreneurship competencies model in the form of an ordered list of four groups: entrepreneurial competencies; digital competencies; communication, interpersonal and intercultural interaction; self-development and security competencies. The authors have tested the method on a focus group of students of Nur-Sultan universities. The authors have developed a matrix of digital entrepreneurship competencies ranking, which allows the prioritization of the competencies to develop according to the criteria of importance and problematicity. The authors have determined criteria for the selection of student training methods (number of students, practice orientation, the level of expertise of trainees, the level of learning motivation and cognitive activity, the pace of academic work, material difficulty level), and has summed up the most common methods on highlighted criteria. The authors have formed the scheme of development for the student development program as a set of training methods focused on overcoming the revealed gaps of competencies. The authors have offered an algorithm of a training method selection on the basis of delivering desired results with the maximum possible coverage of trainees and the training material difficulty level.

Keywords: Digital Entrepreneurship, Competencies, Entrepreneurship Competencies, Digital Competencies, Competency Gaps, Labor Market, Higher Education, Student Training Program.

JEL Classifications: A2, J2, M1

INTRODUCTION

Entrepreneurship is the driving force of both the economy and society. Entrepreneurship training contributes to the formation of entrepreneurial thinking within society, as well as the emergence of new entities and more efficient use of creative potential, existing knowledge and skills. Penetration of digital technology into human life is a feature of modern society. This is explained by the progress in information technology, telecommunications. Economy's digital development issues are accompanied by increased entrepreneurial activity, an increase in the quantity and quality of digital competencies, which relates to higher education.

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In this situation, higher education's key task is to develop digital entrepreneurship competencies among students, seeing that any field of education regardless of direction and practical significance is basically the formation of a system of professional competencies. In the modern digital world, the more competencies of digital entrepreneurship a person possesses, the more likely it is for this person to cope with the business challenges that he faces. Accordingly, the lack of certain digital entrepreneurship competencies reduces this person's effectiveness in business activities on a background of the economy's further digitalization.

A competency-based approach in higher education helps develop student's professional competencies, including those of digital entrepreneurship. In this context, the need to assess the development (maturity) level of students' digital entrepreneurship competencies, that is, assess their readiness and capability for digital entrepreneurship, is particularly relevant. Despite a wide discussion of the competency-based approach issues in higher education (Adelaja & Minai, 2018; Aurik & Astri, 2018; Baubonienė et al., 2018; Bordean & Sonea, 2018; Kurmanov et al, 2015; Kurmanov et al., 2016; Naushad, 2018; Papagiannis, 2018), the question of the assessment methodology is still open.

LITERATURE REVIEW

The post-industrial stage of development characterized by creation of new information and communication technologies, demands significant sociocultural changes. According to many researchers (Clark, 1998; Klofsten, 2000; Etzkowitz, 2002; Audretsch et al., 2006; Mueller, 2006; Fayolle & Redford, 2014; Centobelli et al., 2019), the performer should be replaced by creators competent not only in a particular field, but also skilled in many areas including the digital entrepreneurship competencies. In modern society, the university gets the *"third mission"* of training experts capable of independent search for knowledge, its analysis, generalization, design. Also, this third mission is being transformed under the influence of external calls and contributes to the development of digital entrepreneurial competencies among students.

The World Bank's World Development Report: Digital Dividends (World Bank, 2016) groups all types of skills in demand in the modern economy into three groups: cognitive, social and behavioral, technical.

Top 10 key skills that, according to the World Economic Forum analysts, are necessary for successful work in the conditions of the fourth industrial revolution (Gray, 2016) are as follows: comprehensive approach to problems, critical thinking, creativity, people management, ability to work with people, coordination skills, interactions, emotional intelligence, judgment and speed of decision-making, client focus (Service Orientation), ability to coordinate and negotiate, cognitive flexibility. It is noted that in five years, more than a third of the skills (35%) considered important in the modern workforce are subject to change.

The DigComp digital competency model (Carretero et al., 2017) offers five areas of competence: Information and Data Literacy Competence, Communication and Collaboration Competence, Digital Content Creation Competence, Safety Competence, Problem Solving. The model highlights a total of 21 competencies. The advantage of this model is in the availability of detailed rating scales for 8 EQF qualification levels. The model also establishes the following levels of competencies development: Foundation corresponding to levels 1 and 2; Intermediate that is levels 3 and 4; Advanced for levels 5 and 6; Highly Specialized which are levels 7 and 8.

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The New Foundational Skills of the Digital Economy model developed by Burning Glass (Markow et al., 2018) consists of four blocks, within which the corresponding lists of fundamental skills are determined: Human Skills; Domain Knowledge; Digital Building Block Skills; Business Enabler Skills. This model highlights the levels of competencies development as well: Baseline Competencies, Core Competencies, Distinguishing Competencies.

Thus, the composition of the digital entrepreneurship competencies that a university graduate should possess is quite extensive and diverse (Baidi & Suyatno, 2018; Bhat & Singh, 2018; Buchnik et al., 2018; Kurmanov et al., 2019; Minai et al., 2018; Pudjiarti, 2018). An attempt to develop all competencies at the same time shall most likely lead to a dissipation of resources and a large "work in progress" with low results. An effective (balanced by resources and results) personnel development program needs addressing three key issues:

- What to teach? First of all, one needs to list priorities for the development of digital entrepreneurship competencies.
- Whom to teach? Then assess the digital entrepreneurship competencies.
- How to teach? Once done with the second question, choose the most appropriate training methods and draw up a program for developing the digital entrepreneurship competencies.

METHODS

Before proceeding to the assessment of digital entrepreneurship competencies maturity level, it should be noted that there are certain differences in the terminology used. The article does not set the task of conducting a detailed terminological analysis. In this regard the following definitions will be taken as a basis: Competencies are the personnel characteristics necessary for successful activities: a combination of knowledge, skills, abilities, efforts and behavior stereotypes (Kurmanov et al., 2013). Digital entrepreneurship is broadly defined as creating new ventures and transforming existing businesses by developing novel digital technologies and / or novel usage of such technologies (European Commission, 2015).

We have developed the methodology for assessing the maturity level of competencies in the framework of the scientific study *"Modern mechanisms of innovation management in the development of entrepreneurship of the Republic of Kazakhstan"* (Kirdasinova & Kurmanov, 2019). As an information base for the study, we used the questionnaire materials collected among university students in the city of Nur-Sultan. We have interviewed a total of 247 students of economic specialties. We feel important to note that the questionnaire of respondents includes two blocks. The first one accumulates questions aimed at identifying the parametric characteristics of the respondents, such as: gender, age, academic performance, work experience, achievements and distinctions, additional professional skills and competencies. The second block is a questionnaire designed for students to self-assess the maturity level of their digital entrepreneurship competence (Table 1).

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Table 1
QUESTIONNAIRE FORM DESIGNED TO ASSESS THE LEVEL OF IMPORTANCE AND MATURITY OF DIGITAL ENTREPRENEURSHIP COMPETENCIES

No	Competence	Competency importance (ranked 0 to 10)	Competence maturity scoring (ranked 0 to 10)				
			Beginner	Pre-Intermediate	Intermediate	Upper Intermediate	Advanced
1	Dealing with ambiguity						
2	Task assignment						

The presented methodology can rightfully be positioned as an instant diagnostic of the key digital entrepreneurship competencies maturity level. The important stages of the methodology are as follows: the division of competencies into groups (according to the uniformity of content); the formation of expert groups, which include employer representatives; allocation in each group of the most important competencies; development of a questionnaire; survey of respondents; processing of survey statistics; analysis of the results; justification of managerial influences. The format of the questionnaire proposed by the authors includes the following parameters:

- A list of key competencies of digital entrepreneurship substantiated by experts.
- A ten-point scale for respondents to assess their importance.
- A ten-level scale for students to self-assess the maturity level of digital entrepreneurship competencies (ranking: 1: initial level; 2: below average; 3: average level; 4: above average; 5: advanced level) (Table 2).

To identify the level of digital entrepreneurship competencies, respondents were offered a special rating scale (Table 2).

Table 2
THE SCALE OF COMPETENCY MATURITY LEVEL ASSESSMENT

Level	Maturity level scoring	Substantial characteristics
Beginner	0 to 2.0	Competence is undeveloped. You have the potential and abilities to develop competence in the future
Pre-Intermediate	2.1 to 4.0	Competence is not fully developed (developed poorly). You possess limited knowledge necessary for this competence
Intermediate	4.1 to 6.5	Competence is sufficiently developed. You possess the sufficient knowledge and can deal with simple tasks related to this competence
Upper Intermediate	6.6 to 8.5	Competence is well developed. You possess the sufficient knowledge and skills. You successfully deal with complex tasks in a real-case scenario
Advanced	8.6 to 10.0	Competence is fully developed. Not only you possess all the necessary knowledge and skills, but also studied additional materials. You successfully deal with complex tasks. You are able to make a decision in a crisis situation and are ready to bear responsibility for it

We would like to note that the questionnaire materials serve as an informational basis for building the profile of the digital entrepreneurship competencies maturity and the program for their development. It is no secret that the personnel management of entities pays particular attention to this aspect: a comparison of the competence development level conditioned by a

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particular job and the competence development level of the employee performing this work allows us to conclude that one or another person is suitable for this work or the need to bring them in line with each other.

Building the profile of the digital entrepreneurship competencies maturity of economic specialty graduates needs identifying of 4 competency groups: entrepreneurial; digital; communication, interpersonal and intercultural interaction; self-development and security competencies.

Methodology for assessing the digital entrepreneurship competencies maturity includes the following steps:

1. Clarification of the list of competencies being analysed.
2. Conducting a survey: filling out a questionnaire in accordance with the offered manual.
3. Processing of survey data: calculation on each analyzed importance parameter of a rating (average score).
4. Graphical presentation of the study results in the information field of four quadrants formed by the following axes: Y-axis: the range of changes in the importance rating identified by the results of the survey statistics; X-axis: the range of changes in the competence development level. Construction of a graphic model is as follows. First, a line parallel to the X-axis is drawn through the middle of the importance rating range.

This divides the information field into two zones: the upper one of relatively high importance and the lower one of relatively low importance. Then, through the middle of the competency development level range, a line is drawn parallel to the Y-axis. This delimits the information field into two parts: the right one with a relatively high development level and the left one with a relatively low development level. As a result, four quadrants are formed, each of which is characterized by two main parameters (competency development level and importance rating) and one derivative (problematicity level).

RESULTS AND DISCUSSION

In the process of analyzing the results we have calculated the average importance value and the development level of digital entrepreneurship competencies. We feel important to note that all competencies within the group are equivalent. While processing the focus group results, we have obtained the data now presented in Table 3.

With the Table 3 data, we conclude that the most developed competencies in the focus group are as follows: communication competencies, interpersonal and intercultural interaction; self-development and security competencies. Least developed are the digital competencies. The most important competencies for students are entrepreneurial ones.

The next step in the methodology is a graphical representation of the results obtained (Figure 1).

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Table 3
DISTRIBUTION OF THE AVERAGE IMPORTANCE VALUE AND THE DEVELOPMENT LEVEL OF DIGITAL ENTREPRENEURSHIP COMPETENCIES AMONG RESPONDENTS

No	Competence groups	Development degree	Importance degree
Entrepreneurship competencies–in red color			
1	Dealing with ambiguity	1,7	8,8
2	Task assignment	5,8	6,9
3	Team building	3,5	7,2
4	Motivation and development of others	4,1	5,4
5	Delegation	2,1	7,1
6	Resource management	2,2	9,3
7	Organization of own activities	3,9	9,3
8	Responsibility, risk taking	2,2	9,5
9	Initiativity	3,2	8,8
10	Persistence in achieving goals	4,9	8,5
11	Task implementation monitoring	1,8	8,1
Digital competencies–in blue color			
12	Information literacy	5,2	8,8
13	Programming	0,6	3,4
14	Production systems design	0,4	2,8
15	Application development	0,4	3,7
16	Copyright and licenses	1,2	2,5
17	Information management	2,1	4,7
Communication, interpersonal and intercultural interaction–in orange color			
18	Teamwork	5,3	7,4
19	Writing and speaking skills	6,9	8,2
20	Presentation skills	5,8	7,9
21	Openness	7,8	9,2
22	Client focus	5,1	9,2
23	Stress management	5,3	6,6
24	Cross-functional and cross-disciplinary interaction	6,4	5,3
25	Foreign languages and cultures	2,8	8,3
26	Ethics	7,1	7,6
Self-development and security competencies–in green color			
27	Self-awareness	5,2	3,7
28	Perception of criticism and feedback	6,1	6,2
29	Learning ability	6,7	9
30	Creativity including the ability to see opportunities	7,2	9,5
31	Critical thinking	6,2	9,5
32	Privacy and discretion	8,7	3,7
33	Environmental protection	8,5	2,8
34	Health and wellness	8,7	6,5

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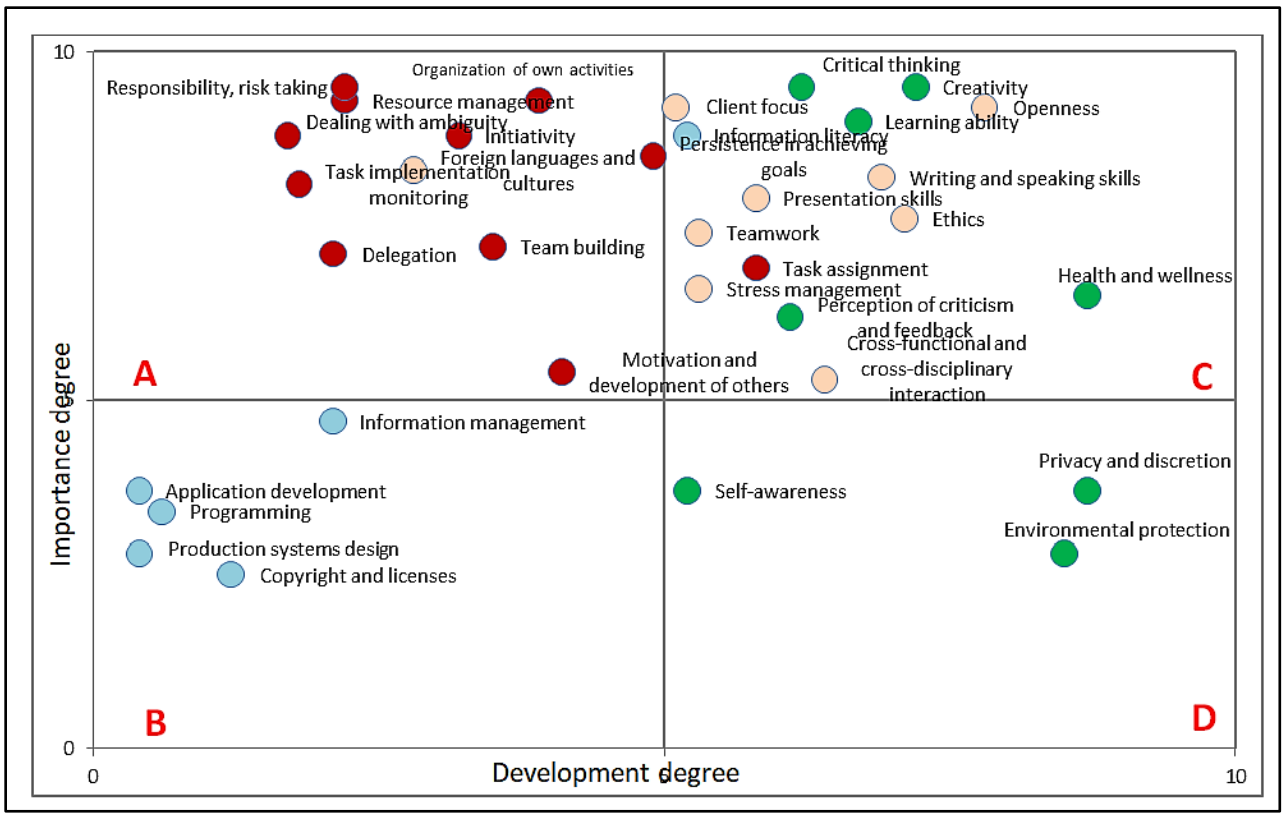

FIGURE 1
A MATRIX FOR ASSESSING THE IMPORTANCE AND DEVELOPMENT LEVEL OF STUDENTS' COMPETENCIES IN DIGITAL ENTREPRENEURSHIP

The matrix clearly shows that digital competencies have fallen into the «lagging behind» category, while the development degree of entrepreneurial competence among students is not properly developed.

To identify the maturity level of digital entrepreneurship competencies on a relative scale, that is, by belonging to quadrants, we propose using the following scheme:

- Square «A» area is a relatively satisfactory level.
- Square «B» area is a relatively problematic level.
- Square «C» area is a relatively safe level.
- Square «D» area is a relatively normal level.

Furthermore, making recommendations requires selecting the most appropriate method of developing digital entrepreneurship competencies among students. Table 4 lists the criteria for selecting a teaching method, while Table 5 shows the characteristics of various teaching methods according to the competencies development degree and the highlighted criteria.

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Table 4
THE CRITERIA FOR THE SELECTION OF TEACHING METHODS

	Criteria	Assessment		
		1	2	3
A	Student number	Massive	Group	Individual
B	Practicality	Theoretical	Mixed	Practical
C	The level of students' preparedness (knowledge of the entrepreneurship and computer science basics)	High	Average	Low
D	Learning motivation	High	Average	Low
E	Cognitive activity	High	Average	Low
F	The pace of academic work	High	Average	Low
G	Material difficulty level	High	Average	Low

Subsequently, by expert means, we have identified the most suitable methods for teaching students, depending on the maturity level of their digital entrepreneurship competencies (Table 5).

Table 5
DESCRIPTION OF TEACHING METHODS

No	Teaching method	The values of teaching method selection criteria	Selection of a teaching method depending on the maturity level of digital entrepreneurship competence			
			«A» square area	«B» square area	«C» square area	«D» square area
1	Visualization lecture	A.1; B.1; C.3; D.3; E.3; F.3; G.3	∨ ∨ ∨	∨ ∨ ∨		
2	Problem lecture	A.1; B.2; C.2; D.2; E.2; F.2; G.2	∨ ∨ ∨			
3	Discussion lecture	A.2; B.2; C.3; D.3; E.3; F.3; G.3		∨ ∨ ∨		
4	Mini project method	A.2; B.3; C.3; D.2; E.2; F.2; G.2	∨ ∨ ∨			
5	Training elements	A.2; B.3; C.2; D.2; E.2; F.2; G.2	∨ ∨ ∨			
6	Brainstorm	A.2; B.3; C.1; D.2; E.2; F.2; G.2				∨ ∨ ∨
7	Business and role-playing games	A.2; B.3; C.2; D.1; E.1; F.2; G.2	∨ ∨ ∨			
8	Group hands-on session	A.2; B.3; C.1; D.2; E.2; F.2; G.2			∨ ∨ ∨	
9	Thematic workshop	A.2; B.3; C.3; D.3; E.3; F.3; G.3		∨ ∨ ∨		
10	Group learning in achievement teams	A.2; B.3; C.1; D.1; E.1; F.1; G.1			∨ ∨ ∨	
11	Cooperative learning method	A.3; B.2; C.1; D.2; E.2; F.2; G.2				∨ ∨ ∨
12	Case method	A.2; B.3; C.1; D.1; E.1; F.1; G.1			∨ ∨ ∨	
13	E-learning	A.3; B.3; C.1; D.1; E.1; F.1; G.1			∨ ∨ ∨	

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14	Benchmarking	A.2; B.3; C.3; D.1; E.1; F.1; G.2	∨ ∨ ∨			
15	Action training	A.2; B.3; C.3; D.3; E.3; F.3; G.2		∨ ∨ ∨		
16	Computer simulation	A.3; B.3; C.3; D.3; E.3; F.3; G.2		∨ ∨ ∨		
17	Behavioral modeling	A.3; B.3; C.1; D.2; E.3; F.3; G.2	∨ ∨ ∨			
18	Basket method	A.3; B.3; C.1; D.3; E.2; F.2; G.3				∨ ∨ ∨
19	Responsibility delegation method	A.3; B.3; C.1; D.1; E.1; F.1; G.2			∨ ∨ ∨	
20	Critical thinking method	A.3; B.3; C.2; D.3; E.3; F.3; G.2		∨ ∨ ∨		∨ ∨ ∨

The results on the development of digital entrepreneurship competences provided by this research are in line with the emerging third mission of universities related to the process of knowledge transfer as related to the process of knowledge transfer as a driving force facilitating innovation and affecting innovation, social and economic development in addition to the two traditional missions focusing on research and teaching (Etzkowitz, 2002; Audretsch et al., 2006; Mueller, 2006; Fayolle & Redford, 2014; Centobelli et al., 2019). More in details, the literature has coined the term entrepreneurial university to identify "a social system" that "actively seeks to innovate in how it goes about its business, to work out a substantial shift in organisational character so as to arrive at a more promising posture for the future" (Clark, 1998). According to this definition, universities are becoming "stand-up" social systems in which digital entrepreneurship can be considered both as a process and an outcome (Klofsten, 2000).

We believe that the entrepreneurial function of universities is associated with the commercialization of the results of its scientific research, that is, with the implementation of the *"third mission"*. An entrepreneurial culture, management, and marketing should play a significant role in the activities of an entrepreneurial university. A university that shows entrepreneurial activity should train competitive experts with creative entrepreneurial thinking capable of implementing innovative projects in the digital-economy context.

RECOMMENDATIONS

Data obtained has allowed us to formulate recommendations on the selection of the most appropriate methods for the development of digital entrepreneurship competencies among students in each area of the assessment matrix, that is, to draw up a competency development program.

The «A» square area: Developing the digital entrepreneurship competencies in this area requires using the following classroom and non-classroom teaching methods: visualization lecture, problem lecture, mini project method, training elements, business and role-playing games, benchmarking, behavioral modeling.

The «B» square area: Methods the most suitable for the development of digital entrepreneurship competencies in this area are as follows: visualization lecture, discussion lecture, thematic workshop, action training, computer simulation, critical thinking method.

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The «C» square area: group hands-on session, group learning in achievement teams, case method, e-learning, responsibility delegation method.

The «D» square area: brainstorm, cooperative learning method, basket method, critical thinking method.

CONCLUSION

The most obvious and well-reasoned form of presenting the competence model of digital entrepreneurship is a hierarchically ordered list of different groups of «hard» (related to information technology and entrepreneurship) and «soft» (related to cognitive and socio-behavioral characteristics) skills and their subsequent refinement.

The application of the proposed methodology allows not only assessing the maturity level and importance of digital entrepreneurship competencies. It also helps to assess the quality of the educational program and, if necessary, adjust curricula. In addition, this competency maturity profile is easy to compile for each individual student and to include in his/her portfolio. This approach will not only provide the student with a competitive advantage in the labor market, but will also help him use his own potential most effectively.

A tool for building digital entrepreneurship competencies is the development program. The logical sequence of program development stages includes the following: assessing the gap in terms of digital maturity (determining the transformation direction), listing competencies relevant for overcoming (what to teach?), determining the needs for developing digital entrepreneurship competencies (whom to teach?), and selecting training methods (how to teach?).

In resource-constrained environment, it is necessary to list priorities for the development of competencies based on an assessment of their importance from the standpoint of influence on the achievement of organizational goals and problematicity determined by the size of the gap between the required and current levels. Due to the presence of a diverse arsenal of teaching methods, we are to choose one that provides the necessary results with the maximum possible coverage of students and the level of training material complexity.

ACKNOWLEDGMENT

We would like to thank the reviewers for their useful comments and suggestions.

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Citation Information: Kurmanov, N., Aliyeva, Z., Kabdullina, G., & Mutaliyeva, L. (2020). Digital entrepreneurship competencies among students: Methodological aspects of the maturity level and development program making. *Journal of Entrepreneurship Education, 23*(2).