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The formation of entrepreneurial thinking in future educators in the context of their continuous professional development

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Abstract

This article explores entrepreneurial thinking as a key area of continuous professional development for teachers. Both concepts are linked by the need for self-actualization and the shared goal of adapting to challenges in education and enhancing its competitiveness. As teaching becomes more complex due to evolving educational trends, the integration of entrepreneurial thinking is essential. The study aims to identify pedagogical tools that foster the joint development of entrepreneurial and professional competencies in future teachers within a university environment. Methods such as self-actualization diagnostics, formative learning, and observation were used to improve the content of the elective course "Entrepreneurship in Education" and its support program. The resulting tools are interdisciplinary and enhance innovation, proactivity, reflexivity, and creativity. They also promote metacognitive abilities that help future teachers broaden their professional roles and attract new resources. The findings contribute to the development of entrepreneurial pedagogy, addressing a gap in current professional training. They also have practical implications for shaping the philosophy and policies of entrepreneurial universities, strengthening their academic autonomy and role in regional socio-economic development.

Keywords: Continuous professional development, Entrepreneurial thinking support program, Entrepreneurial thinking, Future teachers, Personal self-actualization.

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1. Introduction

Entrepreneurial thinking, in a society of global problems and local solutions, has become an integral part of professional pedagogical competence, as it is characterized by opportunity recognition, risk-taking, and proactive initiative [1] as well as the ability to «think, act, and make decisions across a wide range of situations and contexts» [2]. This type of thinking contributes to the development not only of professional skills but also of essential life competencies.

In the context of our concept of Continuous Professional Development (CPD) for future and early-career teachers entrepreneurial thinking stimulates metacognition - and vice versa - since «metacognition represents a special capacity for engaging in the entrepreneurial process» [3]. This makes it a powerful factor for adapting to the variability, complexity, and diversity of pedagogical activity. The meta-learning approach we propose connects students' and early-career teachers' analyses of their own academic and professional deficits with strategies for self-development, thereby improving the quality of both their learning and professional practices. We suggest that purposeful development of entrepreneurial thinking skills, within the structure of professional pedagogical competence, will expand opportunities for professional growth.

At the same time, there is a contradiction in pedagogical theory and practice: while entrepreneurial thinking positively influences professional development, there is a lack of structured approaches for integrating it into the training of future teachers in higher education institutions.

To address this contradiction, we pose the following research questions:

RQ 1. What should be the content of a course on entrepreneurial thinking in order to synchronize it with the professional development of future teachers?

RQ 2. What teaching methods should be used in such a course within the context of teacher training to meet the goals and objectives of CPD?

We define CPD as «the readiness and ability to form and implement personal, social, and organizational goals and values aimed at a smooth entry into the profession and the expansion of the professional pedagogical profile» [4].

The aim related to these research questions is to identify pedagogical mechanisms for integrating the content and methodology of entrepreneurial education into the professional development of future teachers.

The logic of this study is clarified by the following hypothesis: if entrepreneurial thinking is developed within the structure of professional pedagogical competence, it will stimulate CPD in future teachers, because expanding the boundaries of knowledge through the creation of innovative entrepreneurial ideas, combined with an interdisciplinary approach in translating ideas into entrepreneurial actions, fosters meta-abilities to act in accordance with those ideas.

Let us now review the current state of the field.

Researchers Sastre, et al. [5] argue that technologies and the digitalization of the market world have led to the development of the concept of entrepreneurial thinking [5]. On the other hand, contrasting views exist: «Data collected from various sources such as Scopus and Web of Knowledge, using the keyword 'entrepreneurial thinking', show that there is a limited number of studies on entrepreneurial thinking and its significance» [1]. These authors further visualize the focus of existing literature and note: «The diagram clearly shows that most of the existing research has focused on general entrepreneurship rather than specifically on entrepreneurial thinking» [1]. We also take into account the cautionary stance of Kuratko, et al. [6] who highlight the fragmented conceptualization of entrepreneurial thinking and the lack of comprehensive theories connecting entrepreneurial thinking with corresponding behavior [6].

In Canada, a unique course titled "Entrepreneurial Thinking", which teaches leadership skills, has been offered since 2014. Its updated version is now available as an open educational resource. Of interest to us is the course's focus on developing core entrepreneurial thinking skills as outlined by Peschl, et al. [7] and Peschl, et al. [8]: problem-solving, tolerance for ambiguity, resilience after failure, empathy, creativity with limited resources, responsiveness to critical feedback, and teamwork. The course is aimed at undergraduate students majoring in business, management, and law. However, these same skills are highly relevant in the context of Kazakhstan's reformed education system. Developing these skills requires further investigation into how teachers' thinking in terms of opportunity identification, risk management, and effective decision-making influences their entrepreneurial intentions [9]. In this context, the study by is particularly interesting. It identifies entrepreneurial traits such as locus of control, achievement motivation, risk-taking, inventiveness, self-efficacy, and tolerance for uncertainty as motivators for entrepreneurial intentions, while entrepreneurial thinking is seen as the catalyst that transforms these traits into intentions.

Shiri, et al. [10] in studying the specifics of the development of entrepreneurial thinking among university students in Iran, identified the influence of latent variables such as entrepreneurial environment support, educational content and methods, and the mediating role of entrepreneurial inspiration. Similar studies were conducted at universities in Spain and Puerto Rico, where researchers found that the formation of an entrepreneurial culture among students contributes to the development of leadership skills and the creation of an innovative environment [11]. At the National University of Mongolia, a study involving 337 undergraduate students from the School of Business emphasized the importance of developing entrepreneurial passion and enhancing entrepreneurial self-efficacy to strengthen students' entrepreneurial motivation. At the National University Toribio Rodríguez de Mendoza de Amazonas, the development of students' entrepreneurial competencies significantly impacted their innovative thinking and behavior. A survey of 395 university students in China showed the influence of entrepreneurship courses on learning outcomes and students' self-efficacy.

These findings are of particular significance for Kazakhstan, given the rapid development of the private education sector and the trend toward commercialization under the influence of the global economy. One of the current trends in higher education is the "triple helix" model - the interaction of universities, businesses, and the government [12]. For instance, a Kazakhstani case study [13] substantiates indicators of entrepreneurial culture within the university

environment, including value orientations, pro-business thinking, entrepreneurial proactivity, activeness, and maturity. However, entrepreneurial culture is preceded by entrepreneurial thinking, the formation of which requires dedicated study. The need for such research is confirmed by an emerging trend: «The internationalization of universities worldwide prioritizes two essential missions of higher education institutions — entrepreneurial education and intercultural entrepreneurial education» [14].

We consider entrepreneurial thinking to be part of the professional competence framework for teachers because the targeted educational outcomes aim not only to enhance the potential for successful entrepreneurial endeavors but also to foster a culture of innovation, adaptability, and strategic problem-solving across various contexts [15].

In this regard, the development of teacher training programs based on entrepreneurial skills in STEM (Science, Technology, Engineering, and Mathematics) education appears particularly promising [16-18]. The demand for a professional development program for gifted teachers, developed by Turkish researchers [19] is explained by its integration of entrepreneurial skills with lesson design, self-efficacy, and computational thinking [19]. The strategic orientation of entrepreneurial skills toward CPD for teachers necessitates the application of meta- and interdisciplinary approaches, which are highly relevant in the context of Kazakhstan's updated school curriculum.

Turkish researchers Durnali, et al. [20] through a survey of 412 pre-service teachers, established that creative thinking played a significant role in the relationship between emotional intelligence and entrepreneurship [20]. We regard this conclusion as a valuable contribution toward shaping a holistic image of the teacher and the comprehensive application of CPD resources. Karen van Dam et al. (Netherlands) identified the core competencies of teachers' entrepreneurial behavior: entrepreneurial knowledge, career adaptability, professional self-efficacy, creative thinking, networking skills, and teamwork abilities [21]. We have incorporated these competencies into the design of our formative learning approach, recognizing their potential for advancing CPD. After all, «education for entrepreneurship... responds to the natural human drive for growth, contributing to the development and improvement of both the individual and society» [22].

Despite the broad scope of research and the diversity of concepts related to entrepreneurial thinking, there remains a gap concerning pedagogical intervention in this phenomenon's influence on the CPD of future teachers. We have integrated this phenomenon into the structure of professional competence of teachers operating in today's educational market. The identified gap in the development of entrepreneurial culture among student youth is addressed in a dissertation study [23] in which the authors of this article participated as the developer, consultant, and reviewer.

This article explores a new direction for addressing that gap - namely, the content and methodology for developing entrepreneurial thinking in future teachers.

2. Materials and Methods

The method of categorical and terminological analysis of literature was used to refine the concept of entrepreneurial thinking, defining it as a way of thinking, reasoning, and acting that determines stable and successful behavior within systems of social and productive relations. It includes the potential to create competitive intellectual or tangible products as outcomes of constructively transforming obstacles into growth points and development zones. Based on theoretical and empirical analysis, entrepreneurial thinking in teachers is specified as the readiness and ability to generate innovative entrepreneurial ideas and transform them into practical actions, combining the resources of both pedagogical and entrepreneurial activities.

Entrepreneurial thinking is considered a component of the professional competence of a teacher, the relevance of which stems from market expectations of proactivity, agency, and leadership from teachers in advancing educational and entrepreneurial initiatives. The development of entrepreneurial thinking in future teachers is more successful when integrated with CPD processes, as both phenomena push learners beyond traditional disciplinary boundaries.

The integrating factor is self-actualization - a foundational and simultaneously instrumental quality of the future teacher. Under its influence, entrepreneurial thinking, in the form of entrepreneurial skills, is transformed into entrepreneurial behavior.

We associate self-actualization with the confidence of future teachers in their ability to carry out entrepreneurial actions to achieve the goals of educational entrepreneurship and to broaden their CPD profile.

Indicators of personal self-actualization in future teachers — along with additional indicators across 11 scales - were diagnosed before and after the formative training using the SAT (Self-Actualization Test) methodology [24].

The use of this methodology is justified by the fact that the level of self-actualization is one of the significant indicators of entrepreneurial thinking. The value scale is also considered a core indicator of self-actualization, as it reflects an individual's ability to share values typical of a self-actualizing personality, including in the context of CPD.

The research base was the multidisciplinary Yessenov University (Caspian University of Technologies and Engineering named after Sh. Yessenov).

The target sample included 3rd-year students from the following educational programs: 6B01101 – Pedagogy and Psychology; 6B01301 – Pedagogy and Methods of Primary Education; 6B01401 – Physical Education and Sports. In both the control and experimental groups of each program, there were 30 participants - a total of 180 students.

The representativeness of the non-probability sampling is due to the participants' categorization as future teachers, and the sufficient diversity of this population (three teacher training areas), their informed, voluntary, and motivated participation, and 100% coverage of all 3rd-year academic groups. These students had already developed informed opinions on the significance of CPD and educational entrepreneurship in the teaching profession due to the policies of the entrepreneurial university [13] and were accessible for experimental influence.

An elective course, developed by the authors, titled "Entrepreneurship in Education", was implemented into the learning process of the experimental groups and piloted during the second semester of the 2024–2025 academic year.
Expected outcomes of the course - students will develop:

- Understanding of the essence of educational and entrepreneurial activity, its types, forms, and successful international practices, the application of which broadens the range of CPD strategies.
- Understanding and application of the basics of educational startup creation and management, supporting CPD through the development of innovative design thinking.
- Skills to generate a bank of educational-entrepreneurial ideas, create business plans, forecast risks, and design implementation strategies - aligning with CPD objectives for organizing new forms of activity.
- Application of strategies for self-realization in entrepreneurial behavior, including volitional self-regulation, proactivity, agency, creativity, emotional intelligence, and leadership - fostering internal CPD resources.
- Motivation for and confidence in educational entrepreneurship, along with nonlinear reflection skills — reinforcing the meaning and values of CPD.

Lecture and Practicum Topics of the Elective Course:
1. Entrepreneurship as a socio-economic phenomenon in complex societies and the global world
2. Entrepreneurial activity: methodology and ethics
3. Entrepreneurship in education: characteristics, directions, and technologies
4. Educational innovation projects: cases and lifehacks
5. Private education in Kazakhstan and globally: challenges, expectations, and trends
6. Entrepreneurship in supplementary education: ecosystem for talent development
7. Educational startup: key features
8. Business planning and marketing analysis
9. Legal and ethical foundations of educational entrepreneurship
10. Design thinking and teacher creativity in educational entrepreneurship
11. Personal traits of the teacher-entrepreneur
12. Indicators of entrepreneurial success for teachers
13. Leadership and team management in educational entrepreneurship
14. Partnership marketing and the art of negotiation
15. Educational entrepreneurship as a direction for professional teacher development

The implementation of the proposed course was accompanied by in-class work using interactive teaching methods.

- Lecture formats included foresight sessions, flipped learning, gamification, instructional-guidance sessions, inquiry-based learning, collaborative lectures with stakeholders, Synectics-style lectures, problem-based learning, and lectures with planned errors;
- Practical sessions featured: Case Studies, debates, iscussion and strategic sessions,TED Talks, Simulation games with modeling of psycho-pedagogical conditions; business simulation games; case-seminars, practicum on project and startup development, extended-dialogue seminars, storytelling, thematic investigations, trainings, workshops.

Course participation also involved students maintaining an Entrepreneurial Journal [25] which included: Part 1. Reflective Journal – submitted biweekly throughout the course; Part 2. Midterm Meta-Reflection Report – a reflective essay titled: «What contributes to my success in developing entrepreneurial thinking? »; Part 3. Final Meta-Reflection Report – an argumentative reflective letter titled: «Has entrepreneurial thinking become a strategy for my CPD?».

The conceptual foundation of the research is that developing entrepreneurial thinking in future teachers to expand their professional profile (and thus within the framework of CPD) requires an integration of in-class and extracurricular activities within the educational environment. In this regard, we have developed and implemented a Program to Support Entrepreneurial Thinking (over the course of two semesters in the 2024–2025 academic year). The program is presented in Table 1.

Table 1.
Program for Developing Students' Entrepreneurial Culture.

Stages	Components of Entrepreneurial Culture			
	Value-motivational	**Cognitive**	**Emotional-volitional**	**Behavioral**
1	**2**	**3**	**4**	**5**
1. Awareness	Goals			
	Develop positive motivation toward entrepreneurship; motivation for success.	Acquire foundational knowledge in entrepreneurship; develop creativity.	Develop reflection skills for emotional states and volitional qualities.	Develop adaptability
	Forms and methods of work			
	Motivational training	Role-playing game «I as an entrepreneur»; Participation in university entrepreneurship support events.	Self-analysis of volitional traits.	Adaptation training
2. Comprehension	Goals			
	Develop motives for self-actualization; form terminal and instrumental values of entrepreneurial activity.	Study disciplines aimed at mastering entrepreneurial knowledge and skills. Develop legal awareness; gain ability to analyze and reflect on one's own actions.	Develop stress resilience.	Enhance goal-setting, teamwork skills.
	Forms and methods of work			
	Self-development program for entrepreneurial skills and CPD.	Entrepreneurship club; exposure to leading global education business practices.	Stress-resilience training.	Goal-setting training. Group projects. Team-building training.
3. Implementation	Goals			
	Development of professional motivation and career orientation; motivation for entrepreneurship in the field of education.	Development of professional motivation and career orientation; motivation for entrepreneurship in the field of education	Development of professional motivation and career orientation; motivation for entrepreneurship in the field of education	Development of leadership skills and the individual's adaptive potential
	Forms and methods of work			
	Group coaching: “My Future Professional Career” Learning management and marketing basics.	Training seminar: “Protecting Intellectual Property Rights”	Training on emotional-volitional self-regulation. Project or startup development.	Master class: “Success Strategies” Encounter-group training.

2. Results

Let us now move to the results of the diagnostics of self-actualization indicators, which characterize the strength of the individual’s orientation toward developing internal resources within the activity of entrepreneurial thinking as a new vector of CPD.

Table 2 and Figure 1 present the self-actualization indicators of the participants prior to the formative training.

Table 2.
Indicators of self-actualization according to the SAT methodology (in average scores) and significance indicators of differences based on the Mann–Whitney U-test.

Groups	**Scales**										
	Time Orientation	**Values**	**View of Human Nature**	**Need for Cognition**	**Creativity**	**Autonomy**	**Spontaneity**	**Self-understanding**	**Self-sympathy**	**Sociability**	**Flexibility in Communication**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
EG (Experimental Group)	8.1	9.4	6.8	8.0	8.7	7.1	7.7	7.7	6.8	9.6	8.4
CG (Control Group)	8.3	9.2	6.6	8.5	8.2	7.5	6.9	7.1	6.4	9.0	7.9
Mann–Whitney U-test	0.017 $p \geq 0.05$	0.017 $p \geq 0.05$	0.017 $p \geq 0.05$	0.020 $p \geq 0.05$	0.020 $p \geq 0.05$	0.019 $p \geq 0.05$	0.017 $p \geq 0.05$	0.020 $p \geq 0.05$	0.019 $p \geq 0.05$	0.020 $p \geq 0.05$	0.020 $p \geq 0.05$
Significance of Difference	Differences are not significant										

Table 3.
Self-actualization indicators according to the SAT methodology based on the results of the formative experiment.

Groups	**Stage of the experiment**	**Scales**										
		Time Orientation	**Values**	**View of Human Nature**	**Need for Cognition**	**Creativity**	**Autonomy**	**Spontaneity**	**Self-understanding**	**Self-sympathy**	**Sociability**	**Flexibility in Communication**
EG	Stat..	8.1	9.4	6.8	8.0	8.7	7.1	7.7	7.7	6.8	9.6	8,4
	Form.	9.5	9.5	8.9	9.4	9.0	8.5	8.0	9.3	9.0	9.6	9,0
Mann–Whitney U-test		0,010*; $p \leq 0,05$	0.017 $p \geq 0.05$	0.000*; $p \leq 0.05$	0.010*; $p \leq 0.05$	0.020 $p \geq 0.05$	0.000*; $p \leq 0.05$	0.020 $p \geq 0.05$	0.000*; $p \leq 0.05$	0.000*; $p \leq 0.05$	0.018 $p \geq 0.05$	0.020 $p \geq 0.05$
CG	Stat.	8.3	9.2	6.6	8.5	8.2	7.5	6.9	7.1	6.4	9.0	7,9
	Form.	8.3	9.0	7.0	8.8	8.5	8.0	7.5	7.5	6.9	9.2	8,2
Mann–Whitney U-test		1.000; $p \geq 0.05$	0.018 $p \geq 0.05$	0.020 $p \geq 0.05$	0.019 $p \geq 0.05$	0.019 $p \geq 0.05$	0.020 $p \geq 0.05$	0.021 $p \geq 0.05$	0.020 $p \geq 0.05$	0.019 $p \geq 0.05$	0.018 $p \geq 0.05$	0.019 $p \geq 0.05$

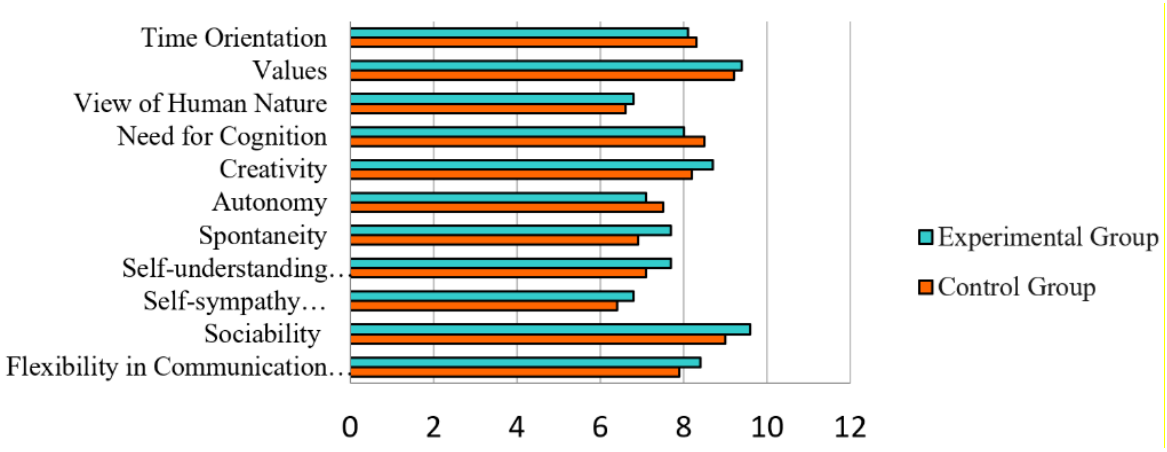

Figure 1.
Indicators of Self-Actualization of the Future Educator's Personality.

The analysis of the experimental group's data showed that within the self-actualization system, the highest scores were on the scales of Sociability – 9.6; Values – 9.4; and Creativity – 8.7. It is important to note that these indicators reflect the students' entrepreneurial potential. Slightly lower scores were observed on the scales of «View of Human Nature» – 6.8; «Self-sympathy» – 6.8; and «Autonomy» – 7.1. No statistically significant differences were found between the experimental and control groups.

After the formative training, the experimental group exhibited positive shifts in several components of self-actualization. According to the Mann–Whitney U-test, statistically significant differences were found in the following indicators: Time Orientation, View of Human Nature, Need for Cognition, Self-understanding, Self-sympathy. Other indicators did not show statistically significant changes. In the control group, the changes were statistically insignificant.

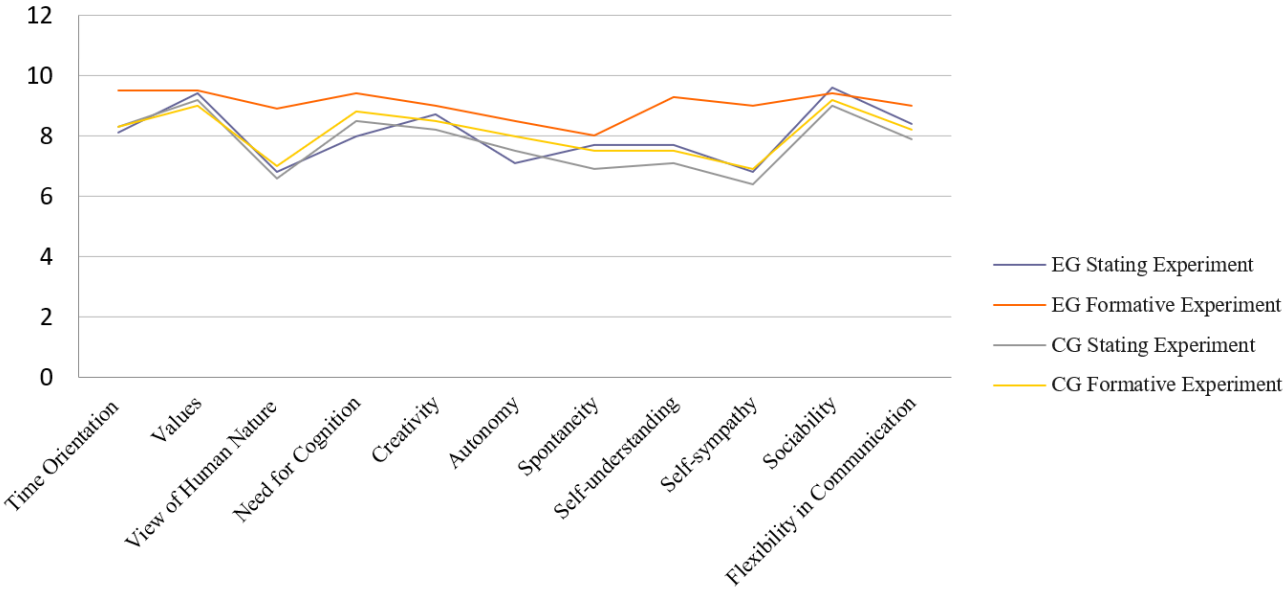

Figure 2.
Self-Actualization Indicators of Participants in the Experimental and Control Groups Based on the Results of Formative Training.

3. Discussion

In addressing Research Questions 1 and 2, we rely on the perspective of Finnish researchers, who argue that the true potential of entrepreneurship education lies not in teaching business fundamentals, but in promoting entrepreneurial thinking and enhancing students' ability to recognize and seize opportunities in various contexts [26]. This framing underscores the relevance of entrepreneurship education to CPD.

The elective course "Entrepreneurship in Education" and the Entrepreneurial Thinking Support Program are seen as timely responses to the growing complexity and diversity of expectations in pedagogical work, and they reflect the evolving needs of teacher training. A survey of 96 students from Abai Kazakh National Pedagogical University - all future primary school teachers - identified key manifestations of entrepreneurial competence: innovation promotion, risk management skills, self-confidence, emotional intelligence [27].

Observations made during the formative training period highlight the importance of fostering entrepreneurial intention - defined as a conscious mindset that channels personal attention, experience, and motivation toward planned entrepreneurial behavior, including initiating new ventures [28].

The effectiveness of this pedagogical intervention, through both the elective course and the support program, is primarily attributed to a holistic approach to entrepreneurship education and CPD. These resources positioned educational entrepreneurship as a practical toolkit for developing proactivity, agency, and leadership in future teachers, grounded in self-actualization as a core instrumental quality. Students demonstrated genuine interest in mastering interdisciplinary tools, a process facilitated by fostering a positive mindset. In creating a supportive environment, we drew upon the research of Shuwei, et al. [9] who emphasized: Success-oriented learning environments, constructive feedback, belief in self-efficacy, encouragement of individual growth, alongside the development of self-regulation, problem-solving, teamwork, and time management skills.

A problem-oriented approach (creating a collaborative problem-solving environment where students become active participants in their own learning [29]), along with research-based and activity-based approaches, interactive teaching methods, and organizational forms of both in-class and extracurricular engagement (such as virtual practicums, video conferences, and virtual consultations), helped shape future educators' understanding not only of the current demands of the education market. From the perspective of educational entrepreneurship, students modeled new opportunities for professional activity, the promotion of innovations and initiatives for the education of tomorrow. They did so by integrating resources from pedagogical thinking, strategic management, and foresight thinking. Thus, the course content and its teaching methodology made it possible to integrate innovative self-actualization, entrepreneurial self-actualization, and entrepreneurial knowledge, aligning with the «Theory of Planned Behavior» [30]].

The model of mediated moderation, where entrepreneurial self-actualization and the entrepreneurial university environment act as mediators [31] explains the necessity of strengthening the instrumental and applied orientation of formative education. Central to this are ecosystems of student-led projects and startups, cultivated through both the elective course and the Entrepreneurial Thinking Support Program.

We applied the principles of the "Lean Startup Method" Liu, et al. [32] encouraging students to move beyond the classroom and engage directly with external stakeholders, iteratively developing their minimum viable product (MVP) into a viable solution. One such method was the Elevator Pitch, titled "Key Startup Information", delivered in 60–90 seconds (as opposed to the conventional 30–60 seconds). Students presented their ideas to educational leaders, business representatives, and professional communities. The core elements of an effective pitch included: unique problem-solving ideas, attractive competencies, clear competitive advantages. Following the pitch sessions, stakeholders self-organized into interest-based micro-teams guided by the principle of «who engaged whom with which idea» to develop collaborative engagement plans.

The process of creating educational projects and startups fostered creative, entrepreneurial, and reflective thinking skills among future teachers. The effectiveness of their synergistic development is supported by the findings of Varlık, et al. [33] who identified positive and statistically significant correlations among these variables. Our observations confirm that active student participation in startup development reinforces the CPD educational ecosystem, where: entrepreneurial thinking fosters innovation; creative and innovative thinking aids in ideation and application; reflective thinking enables the evaluation and enhancement of implementation processes. Enterprising teachers are those who design new programs and technologies tailored to the diverse needs of learners [34] thereby enriching their innovative experience. CPD that integrates creativity, reflection, entrepreneurship, and innovation remains open-ended and inherently supports career and educational advancement.

A special emphasis was placed on the personal and professional qualities of the instructors delivering the elective course and those facilitating the Entrepreneurial Thinking Support Program. In our case, these were course teachers characterized by innovative pedagogical thinking, personalized teaching styles, and a research-based approach to pedagogical practice. It is essential to consider the findings of Paula, et al. [35] who underscore the transformational role of teachers as role models in entrepreneurship education. Their study proposes a scale of key attributes that future entrepreneurship teachers should embody personal attributes (values and traits reflective of life choices and interpersonal depth), professional characteristics (competencies needed to responsibly and effectively integrate entrepreneurship in the classroom), pedagogical skills (methods and teaching strategies specific to entrepreneurial learning). Such a holistic view of the instructor's role highlights an increasing responsibility not only of learners but also of teachers in shaping their own continuous professional development through entrepreneurship education.

4. Conclusion

The study provided answers to the research questions posed.

RQ 1. The content of the elective course on developing entrepreneurial thinking in future teachers reflects the university's policy to align with the economic and social development of the region, respond to system-wide changes in education, and contribute to enhanced graduate employability and career profiling. Mastering this course within the ecosystem of an entrepreneurial university leads to long-term outcomes for the CPD of graduates in the field of "Pedagogical Sciences". The course is globally oriented toward cultivating entrepreneurial thinking as metacognitive skills, enabling the management of analytical, critical, creative, adaptive, and strategic thinking processes, thus ensuring the sustainability of CPD. The course integrates subject-specific, pedagogical, and professional (entrepreneurial) knowledge, skills, and competencies based on metacognition and meta-learning, as explored in our previous study.

RQ 2. Entrepreneurial thinking development should not be limited to specialized courses. In order to achieve broader impact on teachers' CPD, it must become an integral component of lifelong teacher education, embedded within academic programs. The methodology of the course itself reflects the integration of Education for Sustainable Development and Entrepreneurship Education, applying problem-based, research-oriented, and experiential learning through an interdisciplinary approach, facilitating the creation of personal learning experiences. Active and interactive methods from innovative pedagogy (which provide the foundation for self-actualization) and entrepreneurial pedagogy (which offer tools for fostering innovation and creativity) are combined with meta-learning strategies. It is precisely multi-dimensional meta-learning that shapes entrepreneurial thinking, extending beyond business creation to include the ability to navigate uncertainty, adapt to change, and devise innovative solutions across various professional and personal contexts [36].

The answers to the research questions support the hypothesis: Entrepreneurial thinking in future teachers can be naturally embedded in CPD. The entrepreneurial mindset of a teacher - with its global goal of progressive problem-solving - aligns with the evolving nature of the teaching profession in a complex world, offering effective tools for CPD activities.

The findings of this study may be used in the development of teacher education programs and teacher professional development courses, the design of entrepreneurial university ecosystems; the creation of analytical frameworks to assess teacher professional competence.

This study, however, is not without limitations. First, it focused solely on self-actualization as a foundational-instrumental quality of the future teacher, whereas the integrative structure of entrepreneurial thinking encompasses a wider range of personality traits, competencies, and skills. Nevertheless, the use of self-actualization as a diagnostic construct enabled a focus on the motives and prerequisites for self-development, understood as internal CPD resources. Second, the study explored only the positive outcomes of entrepreneurial thinking, whereas its potential downsides, particularly those related to the content and structure of entrepreneurship education, warrant closer examination. The narrow focus on pedagogical intervention via a single elective and support program highlights the gradual and sequential development of entrepreneurship policy in teacher education without overburdening academic programs.

These limitations underscore the need for future studies employing robust qualitative and quantitative methodologies to further investigate the mechanisms through which educational entrepreneurship theory and practice impact teachers' career-educational growth, as well as the quality of innovation, reform, and initiative implementation in education.

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