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Systematic training of future teachers for developing critical thinking of schools pupils in Kazakhstan

Gulmira Myrzatayeva^{1*}, Negmatzhan Almetov¹ and Nagima Tazhmukhanova²

Abstract: The article focusses on the problem of professional competencies formation of students-prospective teachers in relation to the development of critical thinking of school pupils. Based on the theoretical analysis of relevant psychological and pedagogical literature and on problem analysis, three possible approaches for training future teachers to achieve professional competencies which demonstrate their readiness to develop critical thinking of schoolchildren. The study was conducted in 2020–2021 academic year. Using the Watson–Glaser Test, levels of development of critical thinking of the third-year students-future teachers of English language are determined. With the testing method, level of mastery by students of theoretical foundations and approaches to the development of critical thinking are studied. Methods of control tasks describing pedagogical situations which allowed to determine students' skills in using methods and techniques of CT development of pupils. The effectiveness of three possible approaches to the development of professional competencies related to critical thinking instruction are measured and compared. It is concluded that the most effective approach is through systematic integration of tasks of developing students-future teachers' own capacity for critical thinking with formation of their readiness and competencies for professional pedagogical activities to develop critical thinking of school pupils.

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1. Introduction

Critical thinking (CT) has become one of the aims to be achieved in study subjects in various educational contexts all over the world. Some authors and philosophers consider critical thinking as set of skills, while others as worldview and personal dispositions. A number of scientists refer critical thinking to universal skills independent from subject area (Gadzella & Baloğlu, 2003), while others claim that CT has subject orientation and depends on depth of knowledge and understanding of this or that discipline (McPeck, 1990; Willingham, 2008).

Employers worldwide refer critical thinking to “soft/transferable” or “human” skills, listed in top-10 most demanded skills. So, in WEF Report 2020, critical thinking and analysis are in the top 5 skills for 2025 out of 15 skills (Forum, 2020). Association of Higher Education Career Services in their Report of graduate Survey note results of employer survey on their preference of graduates’ global skills among which “analytical thinking” has shown in the first place on priority out of 12 skills (Graduate Market Survey AHECS, 2020). As it is known, analysis is one of the subskills of critical thinking (Halpern, 2014; R. H. Ennis, 1993). In this regard, the question arises how to form critical thinking skills of future graduates? “The Economist added that to be effective, employability skills must be integrated into every subject area so that the skill development becomes inseparable from knowledge sharing because soft skills cannot be taught in an isolation” (Fajaryati & Akhyar, 2020, p.8).

There are hundreds of publications on the importance of critical thinking, on the ways and strategies for its development among various groups of students, but only a limited number of studies focus on special training and training of teachers so that they can teach students/pupils critical thinking.

It is clear that it is first and foremost necessary to train university teachers and teachers for the integrated development of critical thinking within their taught subjects. For example, Barry L. Boyd and others noting that CT is a cornerstone of learning outcomes emphasizes that “Further focus must be given to faculty development” (Boyd et al., 2017, p.1). A similar opinion about the key role of a teacher in the development of critical thinking of school pupils is shared by a number of authors (Piedade et al., 2020; Uribe-Enciso et al., 2017). It is logical that a teacher called to effectively teach students critical thinking, first of all, themselves should have such skills. Thus, in recent research, E. Janssen and T. Mainhard noted that “teachers first need to possess CT skills themselves, so that they can provide explicit instruction and integrate CT in their lessons” (Janssen et al., 2019, p.9). It should be noted that the task of developing students’ critical thinking was set in strategic documents of education development in Kazakhstan, namely “State program of the development of education and science of the Republic of Kazakhstan for 2016–2019” (Decree of the President of the Republic of Kazakhstan, 2016), which laid the basis of transition of Kazakhstan schools to updated content of education. More recently, in the 2021–2022 academic year, the discipline “Critical Thinking” was introduced in general secondary schools in the 7th grade in Kazakhstan, as part of the variation course on “Global competencies” (undefined). These novations caused the necessity of preparing future teachers for CT instruction at schools. However, there is a lack of common understanding of how students-future teachers should be trained within higher educational institutions for being ready to develop critical thinking of school pupils.

This study aims to determine empirically more effective approaches in preparing and training prospective teachers in universities for their future CT instruction at school.

2. Literature review

2.1. Defining critical thinking

First mentioning about critical thinking in scientific literature is referred to John Dewey (Dewey, 1910), who paid special attention to reflection, though didn't introduce the term "critical thinking". Later, similar vision was developed by Richard Paul. Paul describes critical thinking as goal-oriented thinking about one's own thinking: it is "the art of analyzing and evaluating thinking with a view to improving it" (Paul, 1995, p. 2). Subsequently, Paul together with Linda Elder distinguish eight elements of critical thinking: purpose, question at issue, information, interpretation and inference, concepts, assumptions, implications and consequences and point of view (Paul & Elder, 2006).

Michael Scriven and Richard Paul offered the following definition of critical thinking: "Critical thinking is the intellectually disciplined process of actively and skillfully *conceptualizing, applying, analyzing, synthesizing, and/or evaluating* information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (The Foundation for Critical thinking, 1987).

One of the collective definitions of critical thinking was given by 46 experts in the so-called "The Delphi Report", where six subskills comprising the basis of CT were distinguished: interpretation, analysis, evaluation, inference, explanation and self-regulation (Facione, 1990).

2.2. Critical thinking and Bloom's taxonomy

Some authors differentiate lower and higher-order thinking skills of critical thinking that are related to Bloom's taxonomy (Bloom, 1956). For example, a conceptual framework of critical thinking was adopted from Bloom's taxonomy in a study (Zapalska et al., 2018), where the model guides students' work via six stages of critical thinking: stage 1: Remembering; stage 2: Understanding; stage 3: Applying; stage 4: Analyzing; stage 5: Evaluating; and stage 6: Creating. The authors present examples of critical thinking assignments or projects that were progressively used from freshman to senior level claiming that higher levels of cognitive thinking are achieved sequentially by students. In another study, Sönmez points to the fact that the six cognitive categories of the revised taxonomy "were efficient in creating the learning process" in terms of its structure (Sönmez, 2019). The Bologna Declaration and its subsequent adoption across the European Higher Education Area (EHEA) have emphasised the documentation of learning outcomes and given further relevance to the legacy of Bloom.

2.3. Teaching critical thinking

We assume that critical thinking is a learning skill (Critical Thinking and Learning - Edited by & Mason, 2009; Halpern, 2014; R. H. Ennis, 1993) that can be developed under certain pedagogical influences. The effectiveness of CT training largely depends on teachers. In this regard, relevant training of teachers is needed to cultivate CT skills. In a well-known report, R. Aram and J. Roksa emphasized that teachers need adequate training to be "effective instructors" (Arum & Roksa, 2011).

R. Ennis (1989) defined four instructional approaches: a general approach where critical thinking is taught as a separate course; an infusion approach where explicit critical thinking instruction is infused throughout the content of each course; an immersion approach where students are expected to think critically about the content but the skills are not explicitly taught; and a mixed approach that combines the general and infusion approaches or the general and immersion approaches.

Over the past decade, many educational systems are moving towards student-centered learning and focusing on learning thinking skills, where a teacher plays an important but not central role. Thus, the application of a contextual pedagogical approach and dialogic discourse in classes stimulates critical and creative thinking of students (Curtis et al., 2020).

K. Chadwick proposes a conceptual model of a teacher's role in teaching thinking skills in five aspects: mastery strategies, metacognitive strategies, structure and logic, dispositions, intellectual standards and problem-solving skills comparing it with common problems that teachers face in practice (Chadwick, 2011). As noted by some authors, it is highly important for teachers to arrange favorable environment for developing critical thinking in everyday practice, also by being a facilitator (Clark, 2019). Authors of another study find significant influence of problem-based learning on students' critical thinking skills ($p=0.010$) (Amin et al., 2020). When it comes to particular techniques of critical thinking development stimulation heuristic conversations, discussions, case analysis, project work, creating mind-maps, writing essays and short written assignments, analysis of problem situations are noted as useful in teaching English (Starichkova et al., 2021). Special attention is suggested to give to questioning techniques and apply more higher-order level questions for students' critical thinking (Mustika et al., 2020).

Thus, the analysis of the literature on the topic shows that most authors agree that adequate training of teachers should take place for them to be able to teach critical thinking. However, only a limited number of studies are devoted to ways of training future teachers for teaching CT and they differ in strategies, approaches and methods.

3. Methodology

3.1. Sampling

The study involved 108 third-year students of one of the large universities in the south of Kazakhstan, future teachers of a foreign language at the ages from 19 to 23 years. All students were studying in the third year of one and the same study programme ("Training of teachers of foreign languages") and had one and the same courses before pedagogical experiment.

Initial information about the entire pool was taken from the English Department in the institution where the study was conducted. In fact, all students studying on their third year of study program "Training of teachers of foreign languages" were included (there were only some drop-outs in the test days because of absence of students due to illness), so in total 108 students took part. Sampling was carried out with the help of random sampling method. Total sampling comprised of 108 students of study program "Training of teachers of foreign languages", by means of random sampling, was divided into three groups: control (from 36 people) and two experimental groups (32 and 40 students). No intervention factors were introduced in the control group, while in the first and second experimental group there were two different intervention factors.

The accuracy of the data obtained was assured by prior consultation and detailed instruction of two teachers of the Department, who conducted tests and interviews. They were consulted on how to explain assignment for students, timing matters, avoiding cheating and gathering answer sheets. In addition, there was invisible remote-online observation for procedure on behalf of the researcher team. All the answers were fixed in Excel file and calculated automatically.

3.2. Timing

The research was conducted during one academic year (2020–2021), that is students were starting their third year of study at the beginning of the experiment and finished it at the end of the experiment. All the measurements were taken twice: at the beginning of the academic year—before introducing of further described experimental interventions and at the end of the academic year, when necessary experimental measures were finished.

Ethical issues: All the participants involved in the research completed informed consent forms, where they were informed about the purpose of the study and that it was anonymous and confidential.

3.3. Research methods

In this study, we used a combination of the standardized Watson-Glaser Critical Thinking Appraisal Test (WGCTA-5 Factor Model), specially developed questionnaire of prospective teacher-students for assessing their knowledge and readiness to apply methods of CT development in their pedagogic activity, and the observation of student practice in schools, regarding the effectiveness of their use of certain CT development methods. The WGCTA-5 Factor Model is comprised of 80 items, divided into five subscales (Watson & Glaser, 2002). The “Inference” subscale discriminates among the degrees of truth and falsity of inferences drawn from given data. The “Recognition of Assumptions” subscale recognizes unrelated assumptions on pre-suppositions in given statements. The “Deduction” subscale determines whether certain conclusions necessarily follow from information given in statements or premises. The “Interpretation” subscale weighs evidence and determines if generalizations based on given data are warranted. The “Evaluation of Arguments” subscale evaluates between arguments that are strong and relevant and those that are weak or irrelevant to particular questions. All subscale scores were summed up to get the total CT score. Taking into account that English is not a native language of respondents, though their major, some key vocabulary with definitions or translations were given at the end of answer sheets. Also, an additional 10 minutes were given to respondents, taking into consideration that some words could be unfamiliar to them.

A set of data were obtained before and after the experiment, and pre-post measurements were undergone effect size calculation using the method by Morris (2008).

All applied methods were aimed to answer questions: what approach is more effective for prospective teachers to be ready for CT instruction—immersion approach only, explicit training of students’ own CT skills only, or systematic approach.

3.4. Intervention factors

The essence of the experiment is that in the control group, critical thinking was taught exclusively by traditional (used in the organisation) methods. That is, critical thinking of future teachers was formed by the content of study programs only (similar to immersion approach). Thus, no changes were applied in the control group in the way they were trained to be future teachers.

In the first experimental group, a new intervention factor was introduced—approaches and methods for developing critical thinking of students that have not yet been used in the practice of training future teachers in Kazakhstan. Unlike the existing traditional practice, focused pedagogical work was organized to develop critical thinking of students. An elective course “Fundamentals of Critical Thinking” was introduced into the study program, that is students’ critical thinking skills were explicitly taught and trained during that course. Moreover, some other disciplines of the curricula were expected to develop CT through their content.

Two intervention factors were introduced in the second experimental group: 1) focused pedagogical work to develop of students-future teachers own critical thinking; 2) organization of the educational process in the university for the development of professional and pedagogical competencies of students—future teachers for the formation of critical thinking of school pupils.

3.5. Measures taken in the first experimental group

Taking into account existing shortcomings of the practice of developing critical thinking of students of pedagogical specialties and their professional readiness for developing critical thinking of school pupils, the following innovations have been introduced into the work with the first experimental group:

A special seminar was held with university teachers of psychology, pedagogy and methods of teaching a foreign language on the topic “Technologies for developing critical thinking of students”;

- development of lectures and seminars, a package of tasks, didactic and handout materials on the use of technologies for the development of critical thinking of students—future teachers of a foreign language were presented;

- developing critical thinking of students is raised to category of priority tasks of teaching general pedagogical and special courses. Regular discussions were held with teachers and discussions of their focused pedagogical activities to develop critical thinking of students. The necessary advice was provided to teachers;

- introduced an elective course for students “Fundamentals of Critical Thinking,” the purpose of which is to theoretically and practically prepare students for interactive engagement with teachers in the processes of developing critical thinking, for conscious and active work on mastering methods and techniques of critical thinking;

At the same time, in the first experimental group, experimental intervention to develop critical thinking of students was limited only to measures to develop critical thinking of students themselves. Special pedagogical measures aimed at the formation and development of their professional readiness for the development of critical thinking of school pupils were not applied.

3.6. Measures taken in the second experimental group

In the second experimental group, unlike the first experimental group, the following was used as an intervention factor: (1) targeted activities to develop critical thinking of students; 2) formation and development of professional competencies of students—future teachers of a foreign language in the aspect of the development of critical thinking of school pupils.

In this context, in the second experimental group we implemented *the following organizational and pedagogical measures*:

- training of teachers of general professional and special departments participating in the experiment on a special seminar on the topic “Formation of professional readiness of future teachers to develop critical thinking of students.” This special seminar includes two modules: 1-module - “Technologies for the development of critical thinking of students,” 2-module - “Preparation of students for the development of critical thinking of pupils of general secondary educational organizations.” So, within the framework of this special seminar, two didactic tasks were solved: development of critical thinking and the formation of students’ readiness for pedagogical activities in the direction of developing critical thinking of pupils;

- content of basic and elective courses of the group of study programs “Training foreign language teachers” was enriched with theoretical materials and educational tasks for the development of critical thinking of students;

- elective course “Fundamentals and technologies for the development of critical thinking of students” was introduced. Under term “*technology*”, in this context, we imply *pedagogical technologies* consisting of techniques, methods, means and tools used to achieve learning goals. The course consists of two modules. 1-module: “Theories and concepts of critical thinking,” 2-module: “Technologies for the formation of critical thinking in school pupils”;

- in the educational process, the proportion of purposeful and systematic forms and methods of work on the development of critical thinking of students was increased;

- into programmes of continuous pedagogical practice were included individual creative tasks and group projects to study the best practices of foreign language teachers in developing students' critical thinking; preparing methodological developments on the use of technologies and methods for the development of critical thinking of school pupils; monitoring the development of critical thinking of school pupils and psychological and pedagogical diagnostics of its impact.

4. Results

4.1. State of affairs in all three groups before introducing intervention measures

An analysis of study program of the group of specialties "Training of foreign language teachers" implemented in practice of the university shows that:

- tasks of developing critical thinking are mainly solved not through the content of study programs, but mainly through the procedural component of the pedagogical process (during studying curricula disciplines, by using forms, methods and techniques of organizing educational activities that contribute to the mastery of critical thinking techniques—analysis, synthesis, comparison, evaluation, etc.);
- the topic of critical thinking is not covered in the main content of study programs or course syllabi, but only their practical component: tasks for the independent work of students, partly the performance of course and thesis work. So, students master methods and techniques of critical thinking by performing tasks for independent work, coursework and thesis, and individual tasks for the period of pedagogical practice. The "theoretical part" of the development of critical thinking is actually absent. Students do not understand the basics of critical thinking, so they begin to perform practical tasks without proper theoretical understanding. Often, critical thinking methods are mastered "in fact," sometimes by trial- and -error methods;
- Critical thinking issues, mainly related to methods and techniques are partially addressed in courses "Pedagogical Psychology," "General Pedagogy," "Didactics," "Methodology for Teaching a Foreign Language." However, the efforts of teachers and students to develop critical thinking in the teaching of these courses cannot be considered goal-oriented and systematic.
- there are no special separate courses aimed at developing future foreign language teachers' own critical thinking;
- Little is affected by another, not less important component of teaching future teachers critical thinking—the formation of their professional and pedagogical readiness for the development of critical thinking of pupils in a general secondary school.

Thus, in the Control group formation and development of critical thinking of students was carried out according to the customary methods used at the university.

Diagnosis of the level of development of critical thinking of students according to the methodology of WGCTA showed the following quantitative results (see Table 1).

As can be seen from Table 1, at the beginning of the experiment, the level of development of critical thinking in all samples is approximately the same. In general, students with low level of

Table 1. Level of development of critical thinking of students at the beginning of the experiment

Sampling	Number of samples (people)	Mean	Standard deviation
Control group	36	49.89	3.89
1st experimental group	32	49.97	6,16
2nd experimental group	40	50.57	3,56

critical thinking are predominant. If, to consider by sub-tests, lowest scores were gained in “Making inferences”, the highest fell on “Recognizing of assumptions” section in all three groups.

Average low results in general allow to conclude that despite the fact that critical thinking of students is listed on the list of universal competencies of future teachers formally, there were no system of pedagogical measures and actions aimed at its development in study programs.

An important condition for the development of critical thinking of future teachers and their professional readiness to form critical thinking of pupils is students’ knowledge of its theoretical foundations and approaches. From this point of view, we studied the level of students’ knowledge of the theoretical foundations and approaches of developing critical thinking using specially developed tests (Table 2). In this case, the levels are determined according to the Bloom methodology (taxonomy).

An analysis of students’ proficiency of the theoretical foundations and approaches of developing critical thinking at the beginning of the experiment (Table 2) shows that most students of all samples have knowledge of the foundations of critical thinking at the level of knowledge and understanding, partly of application. The number of students who demonstrated formation of theoretical knowledge of the foundations of critical thinking at the level of analysis, synthesis and application makes up a small part of them. Only a few students showed the level of “evaluation” of mastering the basics of critical thinking. From this, we can deduce that during the formation of competencies of critical thinking of future teachers due attention is not paid to their knowledge of theoretical foundations and approaches to the development of critical thinking. This situation affects both the effectiveness of development of critical thinking of students themselves, but also their professional readiness to form critical thinking of pupils of general secondary educational organizations.

We have studied the skills of students in the use of pedagogical technologies (methods and techniques) for the formation and development of critical thinking of school pupils with the help of control tasks describing the pedagogical situations of the development of critical thinking of school pupils. Results were rated on a 10-point scale (Table 3).

The data of Table 3 show that the average score in the groups according to the indicator “Understanding pedagogical situation described in the task and the formulation of the problem” in the control group is 6.4 and in the first and second experimental groups, 6.2 and 6.3, respectively. Most students understand pedagogical situations described in the tasks and highlight the problem. Meanwhile, quantitative results on the following indicators show that students have poorly formed skills that really demonstrate their readiness to use technologies to form critical thinking of trainees of general secondary educational organizations. For example, the indicator “ability to formalize methodically competently pedagogical actions to solve the problem of forming critical thinking of pupils” in three groups is in the range of 4.0 and 4.2. From this, we can conclude that students—future teachers of a foreign language have middle and low levels of skills of using methods and techniques to form and develop critical thinking of school pupils. We see a reason for this state in the lack of systematic and focused work on the development of critical thinking of students and their readiness for pedagogical work on the development of critical thinking of school pupils.

At the educational intervention stage of the pedagogical experiment in the control group, the development of critical thinking of students and the formation of professional competencies of their readiness for the development of critical thinking of school pupils were carried out according to the traditional method, i.e. with no interventions implemented.

The first experimental group used systematic pedagogical measures aimed at developing critical thinking of students (enriching the content of basic and elective courses with an orientation on the task of developing critical thinking of students, introducing an elective course “Fundamentals of Critical Thinking” aimed at improving their own CT skills).

Table 2. Level of students' knowledge of theoretical foundations and approaches of critical thinking development at the beginning of the experiment							
Sampling	Number of samples (people)	Levels of proficiency of theoretical foundations and approaches for the development of critical thinking of students					
		Knowledge	Understanding	Application	Analysis	Synthesis	Evaluation
Control group	36	10	10	9	3	2	2
1st experimental group	32	9	9	7	4	2	1
2nd experimental group	40	14	13	7	3	1	2

Table 3. Students' skill proficiency in using technologies of formation and development of critical thinking of school pupils

Parameter	Sampling and average scores		
	Control group	1st experimental group	2nd experimental group
Understanding pedagogical situation described in the task and the wording of a problem	6.4	6.2	6.3
Ability to make a solution algorithm of a pedagogical problem	5.1	4.9	4.7
Justification of the choice of strategies and methods for the formation of critical thinking in school pupils and their relevant combination	4.8	4.6	4.5
The ability to formalize methodically competently pedagogical actions to solve the problem of forming critical thinking of pupils	4.2	4.4	4.0
Variability and creativity of proposed options and solutions	3.2	2.9	2.8
Overall Mean for 5 parameters	4.75	4.6	4.46

In the second experimental group, formation of students' competencies of critical thinking was focused on solving two interrelated problems—absorption by students of scientific foundations for development of critical thinking of students, development of competencies for the use of technologies and approaches for development of critical thinking in future professional and pedagogical activities with pupils.

At the end of the experiment, we diagnosed overall readiness of future foreign language teachers to form and develop critical thinking of school pupils according to the abovementioned three parameters: the level of development of critical thinking of students (their dynamics by comparing the results at the beginning and end of the experiment); students' knowledge of theoretical foundations and approaches of critical thinking; students' pedagogical skills development level in using methods and techniques of instructing and developing critical thinking. In this case, the same methods of investigating these parameters were used, which were noted above.

Comparative data of the level of development of critical thinking of students at the beginning and at the end of the experiment are presented in Tables 4 and 5 (see Table 4, 5).

More demonstrably, these data can be seen in Figure 1.

As we see from Tables 4 and 5 though the results of students in Post test were still not so high, there was a good improvement in the first experimental group and significant in the second experimental group, while the control group had a low increase.

Comparative data of students' mastering of theoretical foundations and approaches of critical thinking development at the beginning of the experiment are presented in Table 6 (see Table 6).

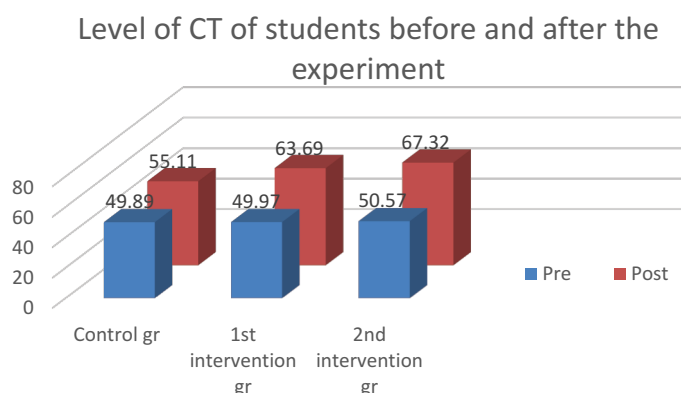
Table 4. Level of critical thinking of students of the first and Control group at the beginning and at the end of the experiment and its effect size

	1st intervention group		Control group	
	Pre	Post	Pre	Post
Mean	49.97	63.69	49.89	55.11
Standard deviation	6.16	4.62	3.89	3.59
Number of sample	32	32	36	36
Effect size d_{ppc2} (by Morris)	1.653			

Table 5. Level of critical thinking of students of the second and Control group at the beginning and at the end of the experiment and its effect size

	2nd intervention group		Control group	
	Pre	Post	Pre	Post
Mean	50.57	67.32	49.89	55.11
Standard deviation	3.56	4.76	3.89	3.59
Number of sample	40	40	36	36
Effect size d_{ppc2} (by Morris)	2.89			

Figure 1. Level of critical thinking of students of the second and Control group at the beginning and at the end of the experiment.



The data of Table 6 show that by the end of the experiment, the control group showed insignificant dynamics in the level of student knowledge of the theoretical foundations and approaches for the development of critical thinking. In the first experimental group, there is a decrease in the number of students who showed student knowledge of the theoretical foundations and approaches for developing critical thinking at the level of “knowledge” and “understanding” and “application,” and vice versa, an increase in the number of students with the levels of “analysis,” “synthesis” and “evaluation.” At the same time, students with the level of “analysis” reached the largest peak in these groups.

Meanwhile, in the second experimental group, there is also an increase in the number of students with knowledge of theoretical foundations and approaches for the development of critical thinking at the levels of “analysis,” “synthesis” and “assessment,” and significantly higher than in the first experimental group.

The level of students’ skills in the use of technologies for the formation and development of critical thinking of school pupils is determined by us, as at the beginning of the experiment, with

Table 6. The level of students' mastering of theoretical foundations knowledge and approaches of critical thinking at the beginning and at the end of the experiment														
Sampling	N people	Level of students' mastering of theoretical foundations and approaches of critical thinking												
		Knowledge		Understanding		Application		Analysis		Synthesis		Evaluation		
		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	
Control group	36	10	5	10	9	9	11	3	5	2	3	2	1	
1st group	32	9	1	9	4	7	3	4	12	2	9	1	3	
2nd group	40	14	-	13	2	7	3	3	16	1	12	2	7	

the help of control tasks describing pedagogical situations of the development of critical thinking of school pupils. Comparative data are shown in Table 7 (Table 7) and diagram (Figure 2)

Judging by the data of Table 7, in the control groups, there is only a slight dynamic in the proficiency of students' skills in the use of pedagogical technologies for the formation and development of critical thinking of school pupils. In the first and second experimental groups, there is an increase in all indicators. At the same time, we observe a noticeable increase in the indicators of the formation of students' skills in the use of technologies for the formation and development of critical thinking of school pupils in the second experimental group, in which, in addition to targeted pedagogical measures for the development of critical thinking of students themselves, approaches and methods for the formation of professional competencies of students for their readiness to develop critical thinking of school pupils were used. Calculated effect size shows that the interventions in the second group had 4 times higher effect than in the first group.

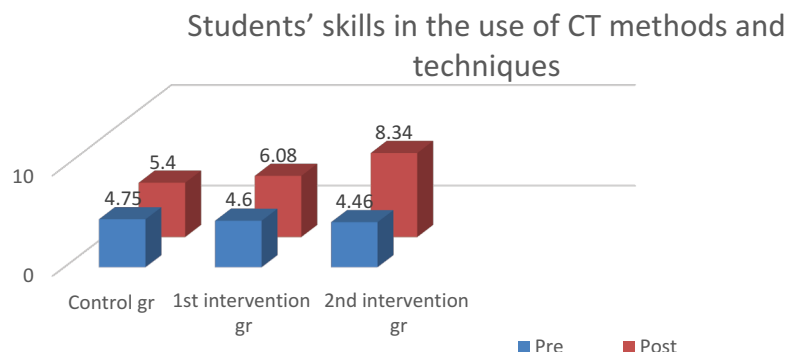
5. Discussions

We have used several indicators and measurements to estimate overall readiness of prospective teachers' professional competencies for developing critical thinking of school pupils:

Table 7. Level of students' skills in the use of technologies (methods and techniques) for the formation and development of critical thinking of school pupils

Parameter	Sampling and average scores					
	Control group		1st experimental group		2nd experimental group	
	Pre	Post	Pre	Post	Pre	Post
Understanding pedagogical situation described in the task and the wording of a problem	6.4	6.9	6.2	7.3	6.3	9.2
Ability to make a solution algorithm of a pedagogical problem	5.1	6.8	4.9	5.9	4.7	8.9
Justification of the choice of strategies and methods for the formation of critical thinking in school pupils and their relevant combination	4.8	5.2	4.6	6.9	4.5	8.3
The ability to formalize methodically competently pedagogical actions to solve the problem of forming critical thinking of pupils	4.2	4.4	4.4	6.1	4.0	8.1
Variability and creativity of proposed options and solutions	3.2	3.7	2.9	4.2	2.8	7.2
Overall Mean	4.75	5.4	4.6	6.08	4.46	8.34
Standard deviation	1.02	0.92	0.98	0.82	0.76	0.72
Effect size by Morris			0.819		3.538	

Figure 2. Level of students' skills in the use of technologies (methods and techniques) for developing critical thinking of school pupils.



- the level of development of critical thinking of students (their dynamics by comparing the results at the beginning and at the end of experiment);
- students' knowledge of theoretical foundations and approaches for the development of critical thinking;
- development of students' skills in the use of technologies for the formation and development of critical thinking of school pupils.

The level of critical thinking of students determined with the help of WGCTA in its Five-Factor Model version allowed us to measure CT of all students in all three groups, which was equally low at the beginning of the experiment. As we found in a number of other studies using WGCTA "Making inferences" subscales were the lowest, such as: M. Grosser and Nel Mirna's study (Grosser & Nel, 2013), study by B. Gadzella and M. Baloğlu (Gadzella & Baloğlu, 2003).

We studied student proficiency in theoretical fundamentals and approaches for developing critical thinking through developed control tests whose response options corresponded to three possible levels of their formation: weak, medium and low. The level of theoretical readiness at the end of the experiment remained weak in the control group while significantly improved in two other groups.

Students' skills in the use of technologies for the formation and development of critical thinking of students are determined by control tasks that describe pedagogical situations of the process of the formation and development of critical thinking of pupils. Students had to formulate pedagogical tasks and offer options for solving them. For example, the control tasks describe the situation with students mastering actions of analyzing and evaluating texts in English of 0.5–1 pages during a lesson. A student carefully reads the text and identifies a problem that would be formulated as a pedagogical task that arose for a teacher. Then, student must offer options for solving this problem using studied forms, means, methods and methodological techniques for developing critical thinking. It is worth to note that students in the second intervention group with more targeted preparation on methods and techniques of CT noted that they become more attentive to professional self-reflection with the help of self-reflection sheets with questions. As one of the students said during her practice "The most challenging but making me think critically towards my own pedagogical proficiency were questions "Has anything went wrong during the lesson? If yes, why? What would you do differently?"

The measured level of CT in pre- and post-tests and its effect size are compatible with other similar studies. For example, in the meta-analysis, Abrami (Abrami et al., 2008) found some positive changes in CT in groups using a pedagogical intervention on its development, with large variation in effect sizes according to the type of intervention and the degree of its implementation. In another review study, R. Huber and N. Kuncel question the results of training CT students in colleges on the feasibility of evaluating universal subject-independent tests (Huber & Kuncel, 2016).

As for targeted training of future teachers for CT teaching, the research results show that more comprehensive and systematic character of preparation tends to have positive output. In this regard, we agree with Ab Kadir (Ab Kadir, 2017), who stressed the necessity of systematic development of teachers' knowledge in CT teaching.

Some limitations:

We see two main limitations in the present study. In the framework of the current study, we used one year between pre- and post-measurements described in this article, students-future teachers were on their final fourth year of study and had some school practice by the moment of post-tests. However, it would be worth for future research to observe trained students' real performance at school as teachers developing CT in their everyday pedagogical activity. Another limitation is connected with cultural differences. There are authors who argue that the results of standardized CT measurements do not always represent the objective level of CT, since they do not take into account the cultural characteristics of students: "Students as critical thinkers differ on the basis of educational and cultural background" (Liyanage et al., 2021, p.2)

6. Conclusion

The conducted research demonstrated the impact of three approaches of training students of pedagogical specialties on their professional readiness to develop critical thinking of pupils of general secondary educational organizations.

First, during traditional approach used at the university, study programs of pedagogical specialties are focused on learning outcome, which consists in the formation of critical thinking among students as universal professional competence. This problem was solved partially within the framework of the theoretical cycle of curricula implicitly through psychological and pedagogical disciplines, in the educational process using active and interactive forms and methods. However, it is episodic and fragmented in its nature. Students do not receive systematic ideas about critical thinking, about approaches and technologies for its formation. The work on the formation of students' readiness for the development of critical thinking of school pupils is also decided as peripheral to other tasks of professional and pedagogical and methodological training of future teachers. According to the research results, students of the control group demonstrated poor abilities to develop CT skill of pupils. Thus, this approach cannot be described as effective.

Second, provided that the formation and development of critical thinking of students-prospective teachers is highlighted as a special task for the training of future teachers, and at the same time, new elective courses on the basics of critical thinking are introduced, and in the educational process at the university approaches and technologies for its development among students are systematically used, the impact of the development of critical thinking on the formation of professional competence of future teachers reaches a higher level. A specialist with developed critical thinking is formed. Students' developed critical thinking determines the formation of a higher level of their professional and pedagogical thinking. However, such an approach does not yet sufficiently ensure future teacher competencies to develop CT skills of school pupils.

Tests and observation results revealed that a student with even a relatively high level of critical thinking reaches a sufficient level of professional competence to develop critical thinking of pupils only if he/she has a high motivation to master the future profession, shows a high interest and desire for professional development.

Third, provided that the task of developing students' own critical thinking (future teachers) is systematically integrated into study process together with students' mastery of knowledge of critical thinking theory and training in practical using of methods and techniques for CT development prospective teachers demonstrate the highest level of readiness for critical thinking instruction at school. By developing their own thinking, knowledge and ability to apply methods and

techniques of developing critical thinking of pupils, a future teacher can be more prepared for successful pedagogical activity at school.

On the basis of interpretation of the obtained data, and observation of intervention measures implementation in experimental groups we have identified possible difficulties and risks of using approaches to development of critical thinking of future teachers:

-formation and development of critical thinking of students turns out to be an “auxiliary” to the priorities of professional and pedagogical education in Kazakhstan;

-even students with a developed level of critical thinking may lack motivation for professional training;

- poor training of HEI teachers in development of critical thinking of students and their readiness for pedagogical activities to develop critical thinking of school pupils;

A further research in this area would be providing more long-term data on systematic training of teachers for CT development of pupils with analysis of possible drawbacks in the “system”.

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