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Transformation of teachers' beliefs about the use of digital tools in lessons that foster
creativity and critical thinking

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Research terminology and list of abbreviations

In this study, **digital tools** are understood to be a subgroup of digital technologies that are used in the learning process. In our case, we are talking about the usage of specialized digital services and platforms on various digital media (tablets, laptops or computers) in the classroom to implement an active learning strategy.

Active learning - strategies that allow students to participate in learning activities, take responsibility for their own learning, and establish connections between ideas through analysis, synthesis, and evaluation [Gogus, 2012].

Competence is the ability to fluently select and use the most appropriate knowledge, skills, attitudes and values here and now to solve problems, including in new situations [Dobryakova, Frumin, 2020].

Critical thinking is a way of thinking about any subject, content, or problem in which the thinker improves the quality of his or her own thinking, takes responsibility for the deduced structures, and uses intellectual standards [Paul, Elder, Bartell, 1997].

Creativity is the ability to create a new (unique, unexpected) product or solution suitable for the context of the task [Sternberg & Lubart, 1999 (quoted by Vincent-Lancrin et al., 2018)].

Teachers' beliefs are an associatively related set of features based on experience [Rubinstein, 1997]. Teachers' beliefs are a complex and sometimes contradictory set of opinions based on both professional and personal experience [Pajares, 1992].

Action research (AR) is a method of solving a real problem in a specific organization, implying the accumulation of information (about the context and the reality under study) [Coghlan, Brannick, 2005].

A lesson fostering critical thinking and creativity is a lesson in which the components of critical thinking and creativity are stated as expected educational outcomes with the usage active learning strategies [Vincent–Lancrin et al., 2019]

Student–centered teaching is an approach in which the focus of the learning process shifts from the teacher to the student in order to develop his/her learning autonomy [Jones, 2007].

Teacher–centered teaching is an approach based on the behaviorist theory of learning, in which the teacher defines the goals and means of learning without focusing on the student's goals.

Relevance of the study

Critical thinking and creativity play an important role in school education, allowing students develop the skills and competencies needed to successfully adapt to the modern world. The topic of developing critical thinking, creativity, as well as other key competencies, is firmly on the agenda of educational research [World Economic Forum, 2016; Vincent-Lancrin et al., 2019]. At the same time, there have been transformations of the Russian school federal state educational standards (FSES) in terms of expected meta-cognitive and personal results. The list of educational results in accordance with the Federal State Educational Standard includes, for example, include the ability to create, apply and transform signs and symbols, models and

schemes for solving educational and cognitive tasks; the ability to correlate actions with planned results, monitor activities in the process of achieving a result, determine ways of acting within the proposed conditions and requirements, adjust their actions in accordance with the changing situation [Avdeenko et al., 2018]. It is stated that the development of universal competencies should take place in all lessons and subjects at school. Critical thinking and creativity, as the educational outcomes, are becoming important fundamental principles that help students develop the skills necessary for a successful life in modern society [Vincent-Lancrin et al., 2019; World Economic Forum, 2022]. Digital technologies can contribute to the development of critical thinking and creativity in school [Uvarov, 2011; Wegerif, 2002]. Technologies create opportunities for more interactive and in-depth learning, as well as contribute to the development of skills necessary for the modern information society [Fraillon et al., 2020; Mochizuki et al., 2019].

Nevertheless, there is a gap between the stated educational results and the practice of teaching at school [Uvarov, 2022]. This is a serious problem that has a negative impact on the quality of education and student success and requires serious attention. There is an obvious discrepancy between what happens "behind closed doors" in classrooms, how teachers perceive the teaching and learning processes, and expectations of educational policymakers from planned and implemented reforms [Fullan, Hargreaves, 1992; Jackson, 2016].

Thus, the lack of changes in regular educational practice of teachers becomes a barrier to large-scale innovation [Cuban, 2003]. Based on this statement, the study addresses a number of important issues related to changes in professional perceptions and expectations of teachers at the individual level and the spread of innovations at the systemic level, which lies within the framework of teacher professional development [Balykbayev et al., 2022; Barinov et al., 2016]. The study suggests that the catalyst for changes in teachers' professional beliefs may be the transformation of their practice, the acquisition of new experience in the process of action research. The focus of the work is on teachers' beliefs about fostering of critical thinking and creativity of school students in the classroom using digital tools.

Contradictions and gaps in scientific knowledge

The practice of usage digital tools (hereinafter – DT) in classroom is way ahead of research. First, the research is quite localized. It often considers one or two tools for only one educational result (critical thinking or creativity), or for only some of their components (for example, using a specific digital service to create a "wordcloud" product for the development of creativity) [Malita, Martin, 2010; Piotrowski J., Meester L., 2018; Yeh et al., 2019].

Barriers related to technical equipment and learning ("first-order barriers") and those related to the internal resistance of teachers ("second-order barriers") when using digital tools are separately investigated [Rikala et al., 2015]. Secondly, studies about certain innovations often takes place in isolation from the observation of real teaching practice, which does not allow us to draw a reliable conclusion about any real implementation [Gil-Flores et al, 2017; Gikas, Grant, 2019; Lee, Chen, 2015].

Thus, there are several slightly overlapping fields in the area of interest to us: critical thinking and creativity, teachers' beliefs, and the use of digital tools in the classroom. All these fields are combined in the framework of solving the scientific problem of this study: the need to transform teachers' beliefs regarding the use of digital tools for the development of key competencies of students.

Theoretical and methodological foundations of the study

To describe the content of lessons from the point of view of the development of critical thinking and creativity, a model developed by the OECD will be used [Vincent-Lincrin et al., 2019]. It is based on a number of well-known models of creativity (E.P. Torrens, J. Guilford, B. Lucas, M. Csikszentmihalyi, A. Cropley) and critical thinking (B. Bloom, R. Marzano, P. Facione, R. Paul and L. Elder). The useful peculiarity of this model is that it is as close as possible to the school context, since it was used and partially confirmed by teachers (see Table 1).

The second model used describes the transformation of teachers' beliefs of possibilities of digital tools and real practice in the classroom [Donnelly et al., 2011].

The third model, which will complement the interpretation of the results obtained, is the Technology acceptance model (Davis, 1989). It suggests that aspects such as perceived usefulness and ease of use of digital tools contribute to their adoption and implementation into professional practice.

Table 1. The OECD project's Model of Critical and Creative Thinking [Vincent-Lincrin et al., 2019]

	Creativity (Coming up with ideas and solutions)	**Critical thinking (Questioning and evaluating ideas and solutions)**
Inquiring	Play with unusual and radical ideas	Challenge assumptions
Imagining	Generate ideas and make connections	Find several perspectives on the problem
Doing	Produce, perform or envision something personal	Propose own product/opinion justified on logical, ethical or aesthetic criteria
Reflecting	Appreciate the novelty of solution and/or possible consequences	Acknowledge uncertainty/limits of chosen solution/position

Scientific research apparatus

The **object** of the dissertation research is the teachers' beliefs towards the usage of digital tools during the activities that foster critical thinking and creativity.

The **subject** of the dissertation research is the change of teachers' beliefs in the process of action research during the implementation of digital tools during lessons that foster critical thinking and creativity.

The **purpose of the study** is to explore the possibilities of transforming teachers' beliefs about the use of digital tools in lessons that foster critical thinking and creativity.

Research questions

1. How are the teachers' beliefs about the possibilities of digital tools in lessons that foster critical thinking and creativity changing among teachers who carry out action research?

2. How do the beliefs about the lesson that foster critical thinking and creativity change among teachers who carry out action research (a lesson centered on the teacher, or a lesson centered on the student)?

3. How do the teachers' beliefs about creativity and critical thinking change?

Research hypotheses

1. Teachers' beliefs of the usefulness of digital tools change by acquiring personal experience of usage digital tools at the lessons that foster critical thinking and creativity.

2. Teachers, carrying out action research, change their beliefs about the lesson that foster critical thinking and creativity: from focusing on teacher to focusing on student.

3. Teachers change their beliefs about creativity and critical thinking as educational objectives.

Research objectives

1. Operationalize the concepts of "critical thinking", "creativity", "action research", "digital tools", "teachers' beliefs".

2. To identify didactic features, as well as organizational characteristics of the lesson that foster critical thinking and creativity.

3. To identify didactic features of using digital tools for lessons that foster critical thinking and creativity.

4. To identify teachers' beliefs about a lesson that foster critical thinking and creativity, and the possibility of using digital tools in such lessons (by entrance interviews)

5. Create a list of digital tools for use in lessons that foster critical thinking and creativity, and pass it on to teachers.

6. Form a group of teachers and conduct training on the development of lessons that foster critical thinking and creativity in the logic of action research.

7. Conduct semi-structured observations in lessons developed by teachers as part of action research to control intervention and analyze ways of usage of digital tools.

8. Identify changes in teachers' beliefs of the lesson that foster critical thinking and creativity, and the possibility of using digital tools in such lessons (by intermediate and final interviews).

Methodology

This study is considered as qualitative applied research. The design of the work is built in the logic of Action research (hereinafter – AR). The sample included 15 teachers (F=13) from primary and secondary schools, teaching different disciplines in schools in two regions: Moscow and the Moscow region. The training for teachers lasted six months and consisted of two three-day face-to-face seminars, which were also based on the logic of active learning, including reflection and comprehension of new experiences according to the Kolb cycle [Kolb, 2014]. After learning how to develop lessons that foster critical thinking and creativity, and use digital tools for active learning, teachers were asked to develop and conduct 8 lessons over six months as part of an individual action research. During that process, the participating teachers were interviewed and observed in the classroom. A thematic analysis of the interviews was conducted using open and axial coding.

In total, 15 case studies were collected – individual action research of 15 teachers who developed and conducted 8 lessons in their classrooms aimed at developing critical thinking and creativity using digital tools (like Tricider, Miro, Kahoot, Canva, Jamboard, Plickers, Nearpod, Mentimetr). Based on semi-structured observations in lessons, intermediate and final interviews, the following data were obtained, which were subsequently described and interpreted:

1) 15 entrance and 15 final interviews with teachers who conducted all 8 lessons;
2) 80 interim interviews on the practice of using new tools;
3) 80 semi-structured observations with an evaluation of lesson transformation, changes in teaching and usage of digital tools.

The intervention took place within the framework of the "Action research" approach [Lewin, 1947]. The method assumes, on the one hand, the solution of a real problem in a particular organization, on the other – a "way of accumulating information" (about the context and the reality under study) [Coghlan, Brannick, 2005. p. 9]. In this case, the teachers carried out their own action research designing and conducting lessons that fostered critical thinking and creativity by the usage of digital tools. The lessons were conducted in accordance with the educational program of a particular discipline, the author acted as an expert on the use of digital tools for active learning.

The results of the study

For a systematic presentation of the results concerning changes in teachers' beliefs during their own action research, the Don Kirkpatrick model for evaluating educational programs was used [Kirkpatrick & Kirkpatrick, 2006], adapted for the educational sphere [Stes et al., 2010; Saroyan, 2022]. Kirkpatrick's model structured the analysis of the results obtained. Other models described in the theoretical part of the summary are used for meaningful interpretation.

The model (table 2) describes four levels of learning outcomes (aspects of the adapted version of Stes at al., (2010) will be presented here and further).

Table 2. Results of the application of action research

Level of professional development	Description	Results
1. Teachers' reaction to the professional development program	Teachers' reaction to learning, structured in the form of practice-oriented individual action research under the guidance of a mentor.	The use of digital tools in the classroom for a long time with a mentorship contributed to their adoption by teachers.
2. Change of beliefs. Acquiring new skills and knowledge.		
2.1. Changes about teaching and learning		There is a change of teachers' beliefs from teacher-centered to more student-centered beliefs.
2.2. Change of the perception of digital tools	Understanding the role of DT at the lesson and the importance of it as a tool for learning.	Digital tools have become perceived by teachers as useful in a lesson where students are in an active position.
2.3. Increase in knowledge about the tools being studied		Teachers learned some technical features of the digital tools used.
2.4. The emergence of new skills		Teachers mastered the forms of group work.
3. Change of behavior Transferring skills to a work context	Applying new skills to their work context, changing practices.	Teachers used new digital tools that support active forms of student work (group work, projects, feedback collection, etc.) Teachers mastered new ways of organizing active learning in the classroom.
4. Change in organization		

4.1. Spreading the practice among colleagues		In two schools where teachers worked in teams, colleagues began to share their practices with other teachers on their own initiative or at the request of a principal.
4.2. Change among students		
4.2.1. Their perception of learning in general		Data not available
4.2.2. Changing students' learning strategies and behavior in the classroom	Students' reaction to assignments as one of the aspects of the learning strategy. Changing learning behavior in the classroom.	According to teachers' feedback and semi-structured observations by the author of the study, students' engagement has increased with the use of active forms of work. It was also relevant for those students who weren't active before. According to teachers, students liked digital tools.
4.2.3. Changing educational outcomes as a direct effect of teacher training.		Data not available

1. **Teachers' reaction** to the professional development program

The first level of results is a reaction of participants towards the professional development program. As mentioned above, this program was built in the form of a practice-oriented individual action research, under guidance of a mentor (the author of this study). In teacher interviews we can see an emphasis on action research.

All the teachers noted that it was important for them to connect the action research with their own practice. According to the teachers, it was the need to use digital tools in the classroom to solve specific learning tasks that made them stay till the end and finish the research. At the same time, some teachers indicated their own resistance at the beginning of the study. It should be noted that teachers emphasize the difference between this form of professional development from the common ones. The teacher's reaction to activities in the classroom is presented in more detail in the next section.

Teachers noted the need for reflection on the action taken during the discussion of the lesson with the author and the importance of expert support during the lesson planning process.

"I really liked the process about all the work around the lessons, even more than the lessons themselves. I felt like I am not alone sitting with my demons in the dark while planning the activities. When I can come to someone to tell them, and in the end it will turn out not just some kind of lesson, but also some element of understanding how other people look at it." (Biology teacher, basic and school, T1[1])

Thus, a technique of "thinking upon action" was implemented by the teacher. That is, building reflection on the basis of a specific action performed by him or her. It is important to note that reflection was structured in the logic of action research and included an analysis of the current situation and the development of further pedagogical actions.

2. Change of beliefs. Acquiring new knowledge and skills
2.1. Changing attitudes towards students' own teaching and learning activities

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[1] Here and further: the individual number assigned to each teacher during decryption and encoding

The next block is the participants' beliefs about teaching in general and the perception of the learning process at school – how they teach and how students learn. It can be said that this was the most important result for teachers, obtained by them in the course of their own action research.

We see that teachers who have conducted action research see the value of a lesson in what is commonly defined as student-centered teaching. In the intermediate and final interviews of teachers, it sounded like this:

"I finally realized that lessons should be interesting to students!" (English teacher, 8th grade, T7)

"I saw that if students were interested and understand the task, they generally worked without me, on their own" (English teacher, 7th grade, T8).

Quotes demonstrate the teacher's focus on the actions of students, their interest. Therefore, when coding, these quotations were attributed to the concept of student-centered teaching.
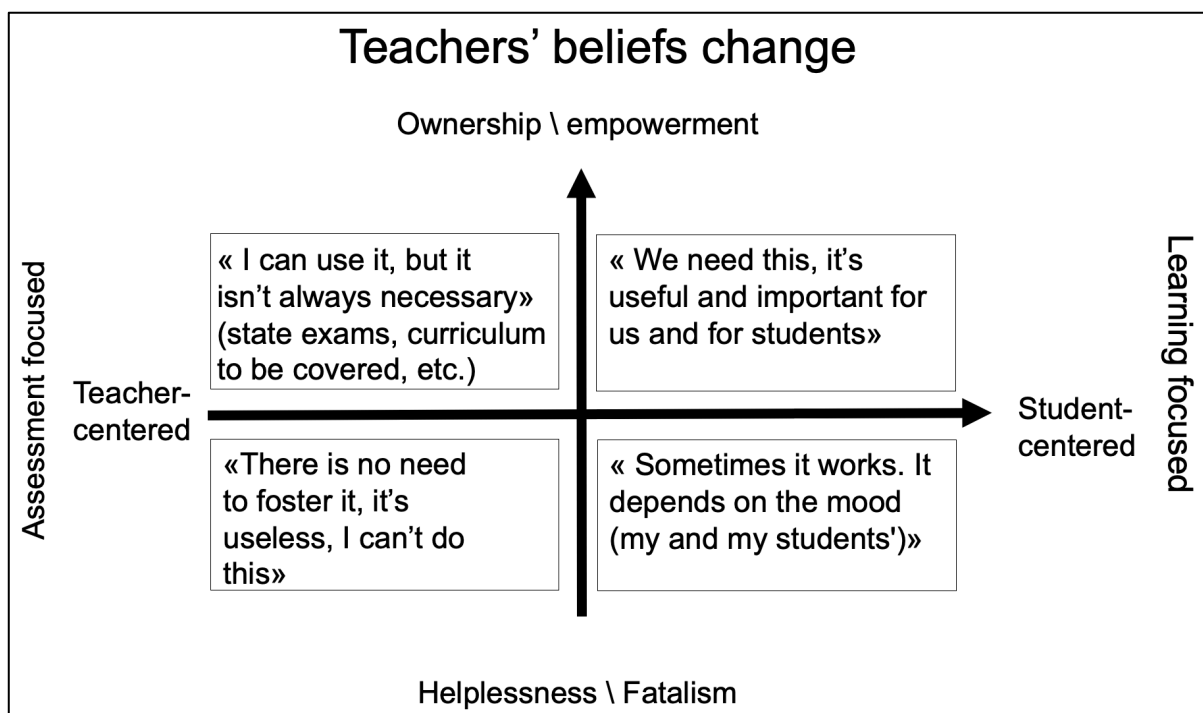
Let's note the nature of dynamics of teachers' beliefs. There are a number of changes in interim interviews: they were becoming more detailed, teachers discuss the individual characteristics of students and select tools in a targeted manner for them. It can be said that in the final interviews, codes related to the student-centered teaching became much richer (the quotes were longer and there were more of them).

2.2. Changing of the perceptions of digital tools

This point reveals the change in teachers' beliefs about digital tools in the process of their own actin research. We are talking about the role of DT in the lesson and their importance both in the teacher's activity (teaching) and in the educational activities of students (learning). Comparing the entrance and final interviews, we can note a very bright dynamic in most cases. In the entrance interview, teachers more often expressed a lack of understanding of why they need to use digital tools other than for slide presentations and showed rather an explicit denial of digital tools used by students. As a result of the study, teachers became more positive about the use of digital tools, as, according to them, they saw that DT involved students and at the same time worked for important educational results for teachers.

The D. Donnelly model, which was described above [Donnelly et al., 2011], was chosen as the main model for a meaningful analysis of changes in teachers' beliefs regarding digital tools. In the course of this study, the model was supplemented with quotes from teachers. Teachers have formulated four positions regarding the use of digital tools that fit into this model (Figure 1).

Figure 1. An adapted model of professional beliefs about digital tools

Teachers' beliefs change

Ownership \ empowerment

	Ownership \ empowerment	
Assessment focused / **Teacher-centered**	« I can use it, but it isn't always necessary» (state exams, curriculum to be covered, etc.)	« We need this, it's useful and important for us and for students»
	«There is no need to foster it, it's useless, I can't do this»	« Sometimes it works. It depends on the mood (my and my students')»

Helplessness \ Fatalism

Student-centered · Learning focused

Open coding has shown the following results:

1) The main changes did not concern beliefs about the competencies of critical thinking and creativity, but there is a shift in the paradigm of student-centered teaching.

2) Personal professional transformation was revealed with a strengthening of the teacher's agency, including a more conscious selection of specific digital tools for new pedagogical tasks.

3) Digital tools are perceived by teachers as something that increases the interest of students.

Below (table 3) is a comparison table of quotes from the entrance and final interviews about using mobile phones in the classroom of one participant.

Table 3. Dynamics of entrance and final interviews

Entrance interview	Final interview
"If you use your phone in class, it's so distracting! This is not a lesson anymore. No, definitely not in class, not in extracurricular either."	*"Now I have some kind of dual attitude to this. On the one hand, I see that children are interested that, indeed, we can get more information and work there. On the other hand, I still have "cats scratching", how it can be – mobile phones in the class. But the good news is that the children are not just staring there. During these lessons they were passionate about exactly the task that needed to be done." (primary school teacher, T12).*

An important point was that teachers accepted new technologies, by focusing on students' reaction, on changing of their behavior. The interest and involvement of students in the classwork was the main argument in favor of teacher change: adoption of new digital tools and ways of organizing the lesson.

"Today's lesson was really great. I really liked it. I think the topic was just very interesting - and it was interesting for students. [...] They did absolutely everything I planned. Even those students who usually don't work – they were involved in the discussion. I was just walking, watching, watching, and thinking "Wow"" (laughs) (English teacher, secondary school, T7)

Teachers say that the focus of the lesson is shifting from the actions of the teacher to the active forms of student work, describing the change in their role in the lesson. Teachers emphasize that they take the place of an observer in the lesson, giving students the opportunity to express themselves as much as possible.

"There were two lessons when students didn't want to finish the lesson. They were sayling like: "That's it, goodbye, teacher, we'll continue working on our own." From this reaction, you can probably tell that they liked the lesson and the tasks. It was interesting to watch." (English teacher, secondary school, T8).

At the same time, it is important to note the complexity of the changes taking place:

1) First of all, teachers begin to consider DT as a tool not only for themselves, but also for students. In the entrance interview, the informants mentioned DT only as a means for a teacher to present the material "for visualization", which does not imply any active behaviour of students. In the final interview, teachers said that digital services used specifically by students can stimulate critical thinking or provoke a necessary discussion.

2) In addition, new ways of working with DT change the nature of the lesson, provoke a transition from front-line learning to active forms of work.

3) The third important point is that working with digital tools becomes more conscious and meaningful for teachers. They begin to argue the choice of a particular tool in terms of learning objectives and student engagement. In the final interview, the teachers highlighted in sufficient detail such educational tasks: searching for information, creating their own products, analyzing information from open sources, collecting feedback, and involving students. Thus, digital tools began to be perceived as helping students solve learning tasks related to active cognitive work, and not only as a way to visualize information presented by the teacher.

It is worth paying attention to another aspect of the transformation of teachers' beliefs about digital tools. In some cases, we have seen a transition from complete denial of DT to their acceptance. By practicing the use of DT, teachers have found that they are able to master them, and the tools can be useful for solving certain tasks. In this case, these changes can be explained using the "Technology Acceptance Model" [Davis, 1989], where the main factors of digital technology adoption are described in the categories of " perceived usefulness" and "ease of use" of DT. This can be evidenced by the following quotes.

"With these digital tools lesson became more interesting and more diverse. And there is quite a lot of time left for other tasks. I would have spent at least twenty minutes on a test without using a digital service. And here everything is fast and good" (laughs). (primary school teacher, T12) ("usefulness").

"The QR-codes went well, and I liked them too. Before that I was just trying to figure out a way to send links right in the class. It is clear that it is unrealistic to print a piece of paper with links and hang it on the wall." (biology teacher, primary and high school, T1) ("ease of use").

2.3. Increase in knowledge about the tools being studied

In the learning process, teachers had to overcome some difficulties. But their own action research helped them to master new tools: teachers saw their usefulness and ease of use, which, according to the Technology acceptance model [Davis, 1989], serves as the basis for the adoption of new technologies.

To use digital tools in the classroom, teachers had to get acquainted with technical features of certain services. Despite the fact that the participants tried to work with the tools in face-to-face seminars, this caused problems for some teachers when creating their own lessons. Sometimes part of the time was spent searching for specific digital solutions that correspond to certain educational tasks. But the experience gained in action research allowed teachers to study and master a variety of digital tools.

2.4 The emergence of new skills

The most striking increase in new skills can be seen in how teachers began to introduce group forms of work in the classroom with the help of new tools.

Almost all teachers did not use group work on a regular basis or did not conduct it at all before the study began (which they admitted only in the final interview), although they had heard about its need. During the training seminars, an emphasis was put on group work as a practice that allows students to foster critical thinking and creativity (compare ideas, evaluate proposed solutions, choose a suitable hypothesis from the proposed ones, etc.). In the final interviews, teachers, summarizing the personal experience gained during the study, talked about the importance for them of the interest that students began to show in the classroom; about specific digital and paper tools and forms of work that allow this to be done.

Interviewer: Which of all the things that you have tried, will you probably use next?
Informant: Group work, that's for sure. The mind maps they drew in the group on the topic they had covered. And Plickers – guys really liked it (T13, primary school).

3. Changing of behavior (change of practice)

Since tracking changes in teachers' beliefs occurred during the process of action research, it is important to describe how teaching practice ("action") was transformed in the classroom in terms of using digital tools for active learning and fostering of critical thinking and creativity. First, let's describe what the lessons looked like in general, and then focus on changing the practice.

Description of the lessons developed
Teachers developed activities can be grouped in the following way:

1) The lesson contained only elements of a lesson that foster critical thinking and creativity.
In this case, the lesson proceeds in the usual way for the teacher and students, but, according to teachers, an "interactive element" is used, associated with forms of work aimed at developing critical thinking and creativity using digital tools. For example, it could be a group work that lasts 5-7 minutes or a short survey at the beginning or at the end of the lesson via a digital service. Then students returned to passive listening. In interviews, teachers, however, reported

that when developing the lesson, they tried to keep critical thinking and creativity as one of the results of the lesson, although "*it was difficult*" (T10, T14).

2) Designing a comprehensive lesson aimed at developing critical thinking and creativity.
All elements of the lesson are connected by a single plot and are aimed at fostering critical thinking and creativity. Teachers used forms of work that corresponded to the logic of active learning: mini-research or mini-projects that students performed in teams; concept mapping of the topic they passed; debates on environmental issues in biology class; parliamentary debates or drawing up a business plan in social studies class; developing excursions in primary social science class, etc.

3) Developing a single course.
The third option for developing 8 lessons involves designing a complete course or mini-module aimed at developing critical thinking and creativity within the subject and using digital tools for active learning. For example, a teacher suggested that students during 8 lessons develop their own blog project representing the Chinese language and culture (T2, Chinese, primary school). Each lesson was devoted to individual cultural aspects, linguistic units and features of texts in the mass media (the target audience of the blog, a content plan that included topics of accommodation, leisure, relocation, etc.). Each of the lessons was built in the logic of active learning using digital tools. At each lesson, the students had group work sheets structuring their activities, open tasks for working with the lexical material necessary to describe topics of the blog.

Change of practice

There were five trajectories of practice change within the framework of changing beliefs.
1. Moving from a "traditional" lesson to an active one without using digital tools (case T4). As part of the action research, the teacher did not use digital tools, as they did not solve current educational tasks.
2. Maintaining the format of a frontal lesson with individual student work, but using DT to collect feedback by the teacher. There were no changes in beliefs (case T13). Collecting feedback is an important change in practice, but in this case it was implemented for automated verification of tests.
3. Using digital tools in a new way: to solve learning tasks within the framework of active learning. (cases T10, T14, T8, T15, T6). The lessons before the action research included a large amount of DT (video, presentations, audio) used by the teacher. As part of the study, the DT began to be used by students, which implied, among other things, a change in educational tasks.
4. Moving from "traditional" lessons without digital tools to active ones using DT for tasks of this format (instead of frontal usage) (cases T9, T1, T2, T12, T7). A description of the specific DT is provided below.
5. The lesson before the study was already active for the student. Teachers have already demonstrated a commitment to a student-centered approach. There was a lot of group work in the classroom to conduct mini-studies or perform small project tasks with groups presenting their results to the whole class. Assignments for students often did not involve a single correct answer or could be solved in different ways. In the course of the action research, teachers put into practice digital tools necessary for solving educational tasks related to the fostering of critical thinking and creativity competencies. (cases T11, T3, T5).

What digital tools have been tested by teachers? During the interview, several groups of instruments were identified.

1) Using DT to form high-order skills (for example, critical thinking and creativity). These were services, for example, for working with arguments (Tricider), for creating collages based on the result of work (Canva), using an interactive time line (Timeline JS).

2) Collecting feedback. Teachers used services such as Nearpod, Plickers, and Mentimetr for instant feedback to students.

3) Access to information, the exploratory function of DT: using the Internet to search for ideas, sites with virtual tours of famous museums, Google Earth to assess the terrain, online translators, services for finding hotels to create a tour, image search for illustrations.

4) Exchange of ideas between students during the lesson: chats, Googledocs for working together on a document and commenting on other people's work, Jamboard and Miro for visualizing students' ideas during group work.

4. Change in organization. Changes at the school level
4.1. Spreading the practice among colleagues
In Kirkpatrick's model, the dissemination of practice among colleagues is stated as one of the learning outcomes. Initially, the action research was individual with the support of a mentor. The study involved three schools where several teachers were trained, but the lessons were designed individually. However, in the final interviews, teachers working at the same school said that they began to share the mastered tools with the rest of the team.

4.2. Changes among students
4.2.2. Changing learning strategies and behavior in the classroom
This section describes the reaction of students to the forms of work and tasks offered to them as part of their behavior in the lesson. As mentioned above, all lessons were discussed between the teacher and the mentor, including the activity of students and the teacher ("reflection upon action").

The students were involved in active forms of work in the lesson: they worked in groups, carried out mini-projects or mini-studies, independently searched for information in various sources, tested hypotheses, compared the results obtained by different groups. Often, the training tasks did not involve the only correct answer. According to teachers, students generally work more proactively in such lessons. At the same time, those students who, according to teachers, have not worked before and have poor grades in the subject were also actively engaged. During the lessons, such students went to the blackboard to be responsible for the entire team, distributed tasks within it, coordinated the work, looked for answers to the questions of the task, and offered many ideas for solving it. It is the interest and involvement of students that teachers record in interviews as one of the most important results of the conducted action research.

«Students who seemed weak in regular lessons behave differently in these lessons. One girl said to her group, "So we're working as a team now. You do this, and you do that. Let's go." And at this moment, she didn't think she was bad at speaking English, but she usually does: "I can't write at all, I don't know a single word," but here she started working». (English teacher, 7th grade, T8)

Let's focus on one more important observation. There were no recorded messages from teachers in the interview, allowing them to say that their ideas about critical thinking and creativity have changed. Teachers generally did not discuss the content of certain theoretical constructs or terms, whether they are «competencies», «critical thinking and creativity», or «educational outcomes». In the interview, the teachers discussed "their pedagogical reality", that is, the

actual practice: the forms of work in the classroom, the possibility of using tools, the behavior and reactions of students. The change of beliefs concerned precisely the field of their practical activity (teaching and learning).

Thesis statements
The following statements are put forward for defense:

1. Critical thinking and creativity are complex constructs that define the requirements for the structure and organization of the lesson, corresponding to active learning and student-centered learning approaches.
2. Digital tools can be used to organize active learning and fostering of critical thinking and creativity (self-search for information, create models, discuss hypotheses and solution strategies).
3. Teachers' beliefs about using digital tools to organize active learning, foster critical thinking and creativity change in the process of transforming practice when a teacher carries out action research. The main argument in favor of transformations for teachers is a change in the nature of students' activities and behavior in the classroom.
4. The changes relate to teachers' beliefs about the organization of the lesson, which foster critical thinking and creativity: the focus of the lesson on the student's activities increases. There is no transformation of teachers' beliefs about the content of the theoretical constructs "critical thinking" and "creativity".

The novelty of the conducted research
1. It is shown how teachers' beliefs about lessons that foster critical thinking and creativity change in the process of transforming their practice in the course of action research.
2. The transformation of teachers' beliefs about digital tools for active learning is also described for the first time.
3. The factors that are crucial for the transformation of teachers' beliefs about lessons that foster critical thinking and creativity are identified. This is a change in the nature of students' activities and behavior in the classroom: increased activity and interest in new forms of work.
4. It is established how teachers' focus of the educational process shifts from the teacher to the student. It happens when teachers master new digital tools (new ways of using them) in lessons that foster critical thinking and creativity during action research
5. It is shown that when mastering new digital tools (new ways of using them) in lessons that foster critical thinking and creativity, active learning increases.

Theoretical significance
1. This work makes a theoretical contribution to the sciences of education from the point of view of studying teachers' beliefs. It is shown that teachers' beliefs are a complex construct that reflects different aspects of teaching and changes in the process of teacher activity. Changes occur when teachers take a research position that is reflective of their own practice. First of all, it is not the beliefs about theoretical constructs (such as "critical thinking" and "creativity", "educational results") that are changing, but the beliefs about the organization of the lesson, the activities of the teacher and students.
2. The study contributes to the description of teachers' beliefs about their own practice and describes ways to transform them. The study showed that the condition for the transformation of teachers' beliefs is a change in their practice. In particular, the development of new forms of application of digital tools, with constant reflection on their own activities. This allows us to change the logic of the organization of professional development of teachers, to shift the focus from theoretical to practical training. This approach fits into the discussion of adult learning

theory (androgogy), requiring a focus on the practice-oriented nature of teachers' professional development. The results emphasize the importance of the teacher's research position in relation to pedagogical practice. This includes the teacher's ability to conduct a purposeful reflection on his\her own activities, request feedback from students and analyze the information received to transform teaching.

Practical significance

The results of the study can serve as a basis:

1. To develop a professional development program for teachers in the field of lesson design that foster critical thinking and creativity, including the use of digital tools in such lessons.

2. To prepare methodological recommendations for the development of professional development programs for teachers based on the principle of action research.

3. The prepared list of digital tools can be mastered by teachers and successfully used in lessons both as a means to promote the fostering of critical thinking and creativity, and to support the active nature of learning.

4. The materials (lessons) developed by teachers during the research can significantly expand the bank of activities aimed at fostering of critical thinking and creativity, as well as be used in the development of subject programs and courses.

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