

Practices That Change Teachers' Beliefs: Use of ICT for the Development of Critical and Creative Thinking at School

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This article examines the change in teachers' beliefs regarding new educational outcomes and new forms of using digital tools. For six months, 18 teachers developed and conducted lessons that form students' critical and creative thinking. At the same time, ICT tools were used not only by the teacher, but, most importantly, by students themselves. The intervention took place within the framework of the 'action research' approach, where the author acted as an organizer and a facilitator of the process. All teachers received preliminary training and were involved in the action research. As a result, it was revealed that the change of beliefs occurs during the transformation of practice, considering the fact that teachers were in exploratory, reflexive position regarding their own activities. That is, the condition for changing teachers' perceptions was a continuous personal experience of using, testing new tools in a professional context and reflecting on new practices.

Keywords: teachers' beliefs, action research, critical thinking and creativity, ICT.

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Практики, меняющие представления учителей: ИКТ на уроках, формирующих критическое и креативное мышление

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Рассматривается смена представлений учителей относительно новых образовательных результатов и новых форм использования цифровых инструментов. 18 учителей в течение полугода разрабатывали и проводили уроки, формирующие у учащихся критическое и креативное мышление. При этом ИКТ-инструменты использовались не только учителем, но, главное, самостоятельно учащимися. Интервенция проходила в рамках подхода «исследование действием». Автор выступал в качестве организатора и фасилитатора процесса, учителя прошли предварительное обучение и были вовлечены в исследование действием. В результате было выявлено, что смена представлений происходит в ходе трансформации преподавания, при том, что учителя занимают исследовательскую, рефлексивную позицию относительно собственной деятельности. Утверждается, что условием изменения представлений учителей стало появление продолжительного личного опыта использования, апробации в профессиональном контексте новых инструментов и рефлексии новой практики.

Ключевые слова: представления учителей, исследование действием, критическое мышление и креативность, цифровые технологии.

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Introduction

The topic of critical thinking, creativity and other core competencies become a regular one in educational research as well as the possibilities which are offered to teachers and students using ICT tools [7; 24; 19]. This article highlights the usage of

the classroom ICT tools aimed at development of critical and creative thinking competences [17].

The article is devoted to teachers' views on possibilities for developing critical and creative thinking at subject-specific lessons, and the role of ICT tools in this pro-

cess. This research raises several issues related to the spreading of system-level innovation and changing of professional beliefs on individual level [5; 9].

The purpose of the study is to answer a question how teacher's beliefs towards fostering creativity and critical thinking with the use ICT change in process of modifying the pedagogical practice.

A hypothesis of the current research is that classroom practice might be a catalyst for a teachers' beliefs transformation.

The choice of school lessons as a space for fostering critical and creative thinking based on the L. S. Vygotsky's view about social nature of thinking, higher order thinking skills and similar conceptions in foreign research. They are connected as one receives information, new arguments and new questions in discussion and while obtaining feedback. In class, we can create an environment that contributes to information exchange and feedback, which provides support for an individual initiative and fostering critical and creative thinking [13].

The constructs of critical thinking and creativity, the characteristic of the lesson, tasks of the lesson and environment in this research are based on the report of the Organization for Economic Cooperation and Development (OECD) "Fostering Students' Creativity and Critical Thinking: What it Means in School". The model describes creativity as the capacity to find and create new ideas and decisions, and critical thinking as the capacity to ask a valid question, analyze, argue and evaluate ideas and decisions. Both of these competences are divided into four characteristics or the students' actions: research, imagination, action and evaluation. The OECD model is based on many well-known models of creativity (E.P. Torrance, J. Guilford, B. Lucas, M. Csikszentmihalyi, A. Cropley) and critical thinking (B. Bloom, R. Marzano, P. Facione, R. Paul and L. Elder). One of the features of the model is that it is de-

signed specifically for the school context as teachers used and clarified it while having such lessons.

Fostering and assessing critical thinking and creativity require renewal of activities and methods of organizing them. However, the main problem for teachers remains the shortage of tools, which can provide such a transformation of the lesson. Digital technologies might become the core tools [6].

It's important that digital technologies in this research are considered from two sides.

Firstly, as a digital device, which physically appears in class, or hardware (e.g. PCs or tablets). Secondly, there are services, websites, platforms, apps — all the resources that can be used having the access to hardware ("multi-modal resources") [17].

The usage of portable digital devices by students (tablets or laptops) enables them to look for, gather and classify the information (as a component of critical thinking) and suggest, test a hypothesis, or present a result in an unusual format as a means of self-expression (this is the component of creativity) [10; 17].

Another research key construct is teacher's beliefs. On the one hand, beliefs are fragmentary (collected from different sources in pieces), on the other hand, they are unstable and not constant. Beliefs are based on self-esteem, experience, and judgements. The research shows that teacher's beliefs are a highly complicated and controversial set of opinions based on both professional and personal experience [16].

A link between teacher's beliefs and their practice of using ICT at lesson and fostering critical and creative thinking determine the research framework and main hypothesis [10; 16]. That is, that teacher's beliefs might change while they are gaining new pedagogical experience.

A number of studies demonstrate that new experience with digital technologies

can contribute to changing teacher's position to more student-centered, which is close to a constructivist approach [23]. In public schools both in Russia and abroad, negative teachers' attitude to portable device usage in class is quite common [14]. Students' mobile devices (phones, tablets, laptops) are considered as a barrier rather than learning tool.

This research uses the Donnelly's model to analyse professional teachers' beliefs [12]. It includes two main vectors: an orientation toward the teacher or a student, and agency, or independence and responsibility for using new tools. It is expected that there are different teachers' belief trajectories of change during their implementation of a new practice and different starting points from which the change begins. The model is described in Figure 1 with extra quotes from interviews with teachers due to this research.

Research Methods

The intervention was done using "Participatory action research" method as a part of "action research" [15]. Action research is a reflective practice. It claims the ability of each one to be a part of the research process and be an active participant. This research aims at changing the participant's practice research [15]. Actors question their practice constantly, while reflection helps them plan ahead. Participants (teachers and students) were actively involved being open for feedback and lesson refinement. The author had a role of an organizer and process' facilitator, while teachers changed their pedagogical practice using the action research. Therefore, we could observe how teachers' beliefs were changing in practice [18].

It must be noted that action research is a form of professional development, which includes reflective research-based activities. This form of learning is designed specifically for teachers as it is close to

their practical mindset [1]. The practician's knowledge is directly related to action that is why it can be presented verbally, while reflecting upon action [20]. Therefore, the chosen research method perfectly fits professional development because of its practical activities. Thus, it is considered also as a suitable pre-service training due "to the importance of fostering reflection and decision-making in this type of education" [4].

The sample consists of in-service teachers from elementary, middle, and high schools of various disciplines from two regions: Moscow and Moscow Region. Participants were asked to give eight lessons, which foster critical thinking and creativity using ICT tools (student's mobile phones). Teachers designed their own activities, and they could also use the exemplary ones. Before that, all participants had training on foster critical thinking and creativity (2C) [3]. A set of ICT tools (apps, web-sites or the way of working with students' mobile phones) was recommended for every lesson. Examples of activities were designed and tested within the OECD project "Fostering Students' Creativity and Critical Thinking: What it Means in School" [13]. These activities imply problem-based method, during which students work in groups and then present and compare the results.

Teachers could use any digital services, which seemed applicable for the activities. Apart from typical searching the Internet, such services were introduced: Tricider, Mentimetr, Kahoot, Nearpod, Timeline, Plickers, Canva. They were used by students on their PC's, laptops, or mobile phones during the activities.

This research included interviews with teachers and lesson observations. The interview was semi-structured and included several topics: what is creativity and critical thinking; is it possible to develop them at subject-specific lessons and how to do

it, if possible. Also, the interviews covered the usage of ICT in class and teachers' personal and professional attitude towards mobile phones. During the observations it was important if students used ICT and what for; what type of activities teachers were using, how students were reacting to the activities, whether they had any problems during the lesson. Before each 1—2 lessons, the teachers and the interviewer discussed the type of activities that would follow, the usage of ICT there, the steps of the lesson, and where 2C might be applicable. After the lesson the participants and the interviewer discussed the teachers' experience of the activity, of using a certain ICT-service, or any problems with it, and what to change for the next time. Thus, these interviews helped teachers to reflect on their experience, which is a vital part of action research method as it makes teachers become researchers in their own classrooms.

In this research we used an axial and open coding type through a thematic analysis. Preliminary axes were connected to the research question: the perception of critical thinking and creativity; the capacity to foster them, and teachers' attitude towards

ICT using in educational cases. We discuss open coded in this research further.

This research contains 18 cases. The data consists of structured observations and interviews with a teacher before and after all the lessons and between them. Thus, there are:

1. 38 pre- and post-interviews with teachers who gave 8 lessons;
2. 80 interviews before and after the lessons about the usage of new tools;
3. 100 structured observations, which were used to evaluate lessons' transformation, changes in teaching or instruments' usage.

Results

We chose Donnelly's model as a core one for describing teachers' beliefs transformation [12]. It was enriched by teachers' quotes during this research. As we can see, teachers formulated four positions concerning the usage of ICT tools.

A part of the results didn't match the teachers' beliefs model and a primary hypothesis; therefore, an open coding was used. For example, instead of creativity and critical thinking as the main axes other topics as the major for teachers were found.

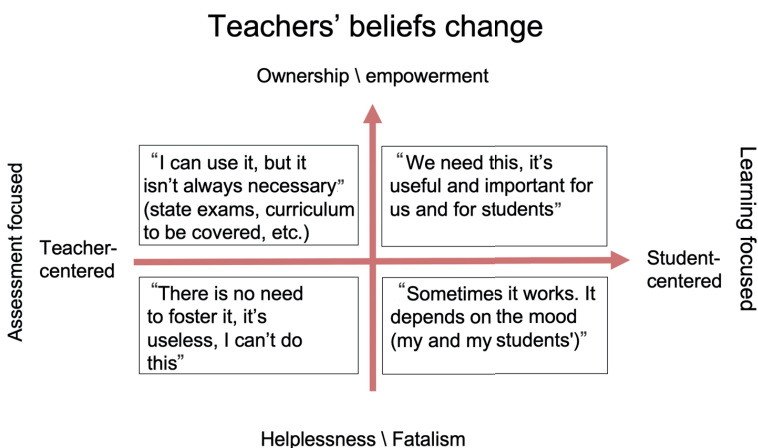


Fig. 1. Adapted model of professional beliefs

These are 1) shifting (more) towards the student-centered pedagogy and 2) teachers' agency, through which they can choose ICT tools for pedagogical goals. Teachers considered ICT as a tool to increase the students' involvement. Also, ICT is seen for them as a tool to obtain feedback.

Below, the model is illustrated with the examples of the interviews. All quotes were coded, and ID was assigned to every participant. During citing this ID is placed at the end of the quote. As an example, we quote a teacher who is talking about his/her attitude towards the usage of mobile phones during the lesson at the beginning of the research.

"If students can use mobile phones during the lesson it's too distracting! **There is no any lesson at all!** We can use mobile phones during neither lessons nor extra-curricular activities".

And that is the teacher's answer on the outcome of this research:

"Now I have mixed feelings about it. On the one hand, I can see the students' interest and that's really enable us to gain more information to work on. On the other hand, I am still heavy-hearted because of the usage of mobile phones in class. But it's really important that **students not just attend classes**. They are involved in the activity". (W2R2-T12¹).

More to the point, teachers accepted new tools guided by the students' reactions and behaviour change. The students' involvement into the classwork became a reason for a lesson change. That is the acceptance of new tools and method of organization of the lesson.

"They really liked [to use a service], and they asked me about it everyday after that. I said: "Hey, hold on, we can't use it daily. Maybe we can do it in a day?" And they said: "Alright". So, we came to an agreement". (W2R2-T9)

"It was really important for me, when students said that they liked going to school. "Now I want to attend classes", they say. It was music to my ears. It was not in vain. We had to use it long ago". (W2R2-T12)

"Today's lesson was really good. I liked it a lot. I think, the topic was quite interesting — and it was interesting for students as well. [...] Everybody worked hard with no exceptions. Even usually inactive students were involved in the discussion. I just walked through the class, monitored and observed them. I thought: 'Wow, it's so cool'" (laughs). (W2R1- T13)

Teachers described that the focus of the lesson shifts from the teacher's action to active the classwork form. Their role in a class has changed too due to the new tools. Teachers point out to their observer's role while giving a chance to students to prove themselves independently.

"And in 4C lessons they are divided into two groups and that's it, they started working. Of course, I organized the whole work at first, but the rest of the time I just monitor". (W2R2-T4)

"I remember two lessons when they didn't want to finish the work. They said: "That's all, goodbye, Teacher, you can go, we will finish the work by ourselves". I think that such a reaction is a good sign that they liked it. It was a real joy to watch". (W2R1-T4).

Discussion

Job-embedded professional development became popular in the nineties. The most significant factor in this format is a relevant context for each teacher's professional goals and activities [21]. This research might become an argument for usage of this method. A teachers' involvement in researching and reflecting upon

¹ Hereinafter: ID, which is assigned to each teacher for coding and decoding.

their own activities can become a base for a more effective professional growth, which includes continuous change of practice and feedback on this practice. This method makes a school a self-training organisation where a teacher can share his/her experience systematically [20].

This research has some limitations. Teachers' incoherence in opinions and actions can be an obstacle to full participation in the research. It takes a lot of time to fully obtain any new practice, and it also depends on the primary level of using any ICT tools. The lack of these competences in the beginning could be a problem, which teachers could not solve and thus could "stuck" in their progress or leave the training in the middle of the research. Moreover, we should keep in mind that positive results might be seen for those teachers, who were already interested in this type of professional development. They agreed to the research initially as they could be already more student-oriented than those who declined [8].

It should be noted that several issues, which are connected with the topic of teachers' beliefs transformation, but were not the focus of our attention and thus should be developed further. First and foremost, can we say that the change in practice lead to different educational outcomes? The outcomes could be considered as both subject competences and critical and creative thinking. To answer this question, an experimental methodology would suffice. Such a research might be focused on the results of the organisation analysis and students' learning activity within a specific pedagogical context. This methodology also can be based on video analysis of teachers' practices, for example within the scope of researching corpora TALIS [22].

Conclusion

According to the research, we can assume how teachers' beliefs change. Teach-

ers' beliefs can change during the ICT tools implementation in their practice if a teacher has a research interest, or a reflective position. Thus, if a teacher has an experience in ICT tools usage and reflection about new practice than his/her beliefs are more probable to change [21].

Teachers master new methods and classwork organisation forms in a lesson. At the same time, teachers connect critical and creative thinking to a specific classwork form instead of pedagogical or psychological conceptions that might seem more abstract to participants [2]. In final interview, most of the teachers described "2C" competences via group work or specific activities, or technics (e.g. mind maps), which they could acquire during the research. However, they didn't define the concept of "2C" explicitly though the whole training process was dedicated to that.

For teachers, the argument in favour of fostering "2C" competences and the implementation of ICT tools became interesting to students in new classwork forms. ICT had the value for teachers when they started using it and saw students' involvement, positive feedback, and interest. Also, teachers accept ICT tools by perceiving its ease-of-use and usefulness to practice it for clearly stated pedagogical goals. This conclusion confirms current ICT implementation models, such as "Technology acceptance model" [11].

Such conclusions allow us to make a few remarks about teachers' professional development. There are two types of professional development for in-service teachers: traditional training and on-the-job training. Traditional training includes field seminars, lectures, conferences, and they have limited effects, as such a training leads only to incremental changes (not fundamental) or to "horizontal" (not "vertical") changes. It can be done technically, or superficially without any practice change [8; 9].

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