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Use of Information and Communication Technologies in Primary Education – A Case Study of the Czech Republic

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Abstract

The aim of this research study is to explore the use of information and communication technologies (ICT) in classes at the first stage of primary schools, specifically in the Czech Republic. Firstly, the authors discuss the current state of this research issue, and secondly, they describe their own research which should clarify how, why and how often the teachers at the first stage of primary schools use ICT in their teaching. The findings indicate that although more than 50% of the teachers at primary schools use ICT in their teaching on a daily basis, they need further continuous methodological training which would contribute to their effective use of ICT in classrooms. The results also showed that the teachers who had participated in a methodological course on ICT use appeared to implement ICT in their classes more than those who had not attended such training. In addition, the results revealed that the use of ICT was not influenced by the length of the teaching practice and that the use of ICT still did not have any impact on the relationship between the teacher and his/her pupils and among pupils themselves. Nevertheless, the results suggest that there should be ample and continuous trainings which would ensure that teachers have relevant competences for using ICT in their classrooms.

Keywords: Education, Teachers, ICT, Primary schools, Case study

Introduction

At present, modern information and communication technologies (ICT) penetrate in all spheres of human activities, including education, in order to increase effectiveness and quality of teacher's work. In fact, ICT are now an inseparable part of children's lives. They consider them as natural as breathing (Prensky, 2004). Therefore, schools at all educational levels try to incorporate them in their curricula. Research connected with the use of ICT in education has already run for more than 40 years (cf. Baytak, Tarman, & Ayas, 2011; Brdicka, 2003; Collins, 1996; Domingo & Gargante, 2015; Murphy et al., 2003). Research evidence reveals that ICT have a positive impact on learning, especially in primary education (Badia et al., 2014; Inan & Lowther, 2010; or Van Braak et al., 2004).

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Frydrychova Klimova (2012) lists several benefits of the use of ICT on learning, which is also true for primary education:

- learning concentrates rather on the learner than a teacher;
- learning becomes more personalized;
- learning becomes on the one hand more independent, on the other more collaborative and interactive;
- learning can happen at any place and any time;
- learning is enriched with more up-to-date materials, which can be tailored according to students' immediate needs;
- thanks to multimedia activities, learning becomes more varied and dynamic;
- learning requires critical thinking;
- learning becomes more culture conscious.

The importance, efficacy and usefulness of ICT in primary education have been also reflected in many cross-national and national comparative research studies such as Computers in Education (COMPED, 1989-1992), Second Information Technology in Education Study (SITES, 2006), or Study of the Impact of Technology in Primary School (STEPS, 2007). The latest international research study conducted in the area of primary education was International Computer and Information Literacy Study **(**ICIL, 2013). In the Czech Republic, the most significant project in this field was the project on Information and Communication Technologies in Everyday Teacher's Work (Zounek & Sedova, 2009). The research project was performed only in one region of the Czech Republic and focused on the teacher's attitude towards technologies. The results of the project were as follows:

- teachers perceive ICT in their teaching as a good opportunity or as a recognized necessity;
- teachers used ICT in a traditional way, i.e., for testing and explanation of the study material;
- relationship between pupils and teachers still remain traditional in the new technological environment;
- teachers incorporate ICT into their teaching due to their popularity among pupils, not for the didactic purpose;
- teachers admit not having relevant ICT skills and an overview of materials and applications used in the teaching enhanced by ICT.

Research (Kiper & Tercan, 2012) also indicates that especially the present novice teachers, at primary schools are willing to use ICT in their teaching, however, they need a systematic methodological input on the use of ICT in primary education. In addition, most of the schools still have a lack of teachers who would possess superior user or administrator skills (Annual Report of the Czech School Inspection, 2011; 2012).

Thanks to the EU projects, basic and secondary schools are now relatively well equipped with modern ICT. This is also confirmed by annual reports of the Czech School Inspection (Annual Report of the Czech School Inspection, 2011) and European Schoolnet (Czech Republic Country Report on ICT in Education, 2011). ICT form an inseparable part of basic education, used as an instructional tool, s learning tool and as a school subject. The subject ICT is taught once a week for 45 minutes (1 lesson) at primary schools (RVPZV, 2007).

The purpose of this study is to explore teachers' attitude towards the use of ICT at the first stage of primary schools in the Czech Republic. Firstly, the authors discuss the current state of this research issue in the countries of the European Union and secondly, they describe their own research which should clarify how, why and how often the teachers at the first stage of primary schools use ICT in their teaching.

Research questions, hypotheses, phases and methods of the research

The aim of this research study was to find answers to the following three research questions:

1. Does the length of teaching practice of the teachers at the first stage of primary schools influence the frequency of the use of ICT in teaching?
2. Does further education of the teachers at the first stage of primary schools have an impact on the frequency of the use of ICT in teaching?
3. Do the relationships between the teacher and pupil and among pupils themselves change as a consequence of the use of ICT during lessons?

On the basis of the research questions stated above, the following two hypotheses were defined:

Hypothesis A: *Younger teachers (less experienced) use ICT more often than older teachers (with a longer teaching practice).*

Hypothesis B: *Teachers of the first stage of primary school who participated in an ICT training use ICT in teaching more than the teachers who did not participate in such a training.*

The research started in September of 2010 and finished at the end of the year 2015. Consult Fig. 1 below for the research timeline.

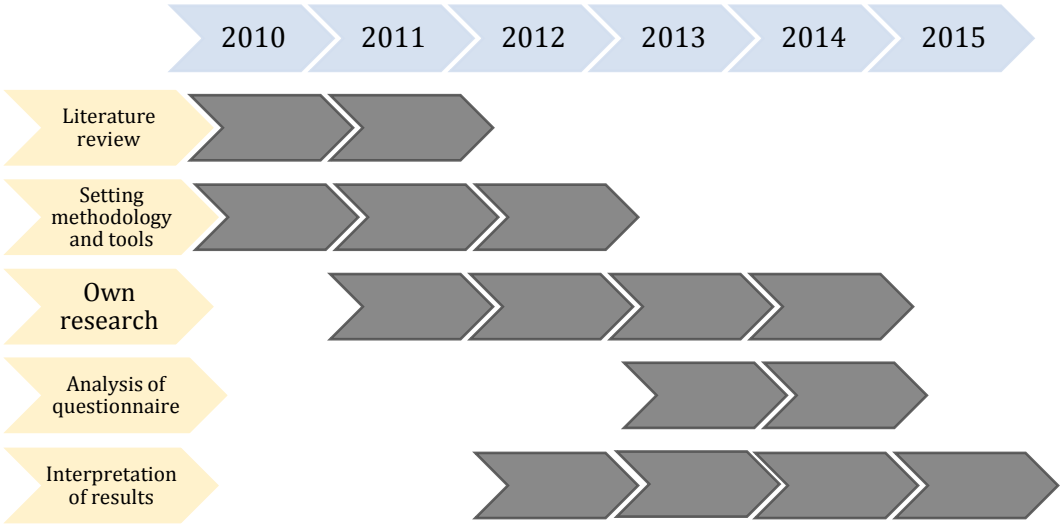

Figure 1. *Research timeline (authors' own processing)*

The research was performed in five phases, which are described together with the methods used for the analysis of the research issues.

Phase 1

Phase 1 involved a comparative analysis of the use of ICT in the subject *Man and His World* in the fourth and fifth grades of the basic school. The teachers of this subject at five basic schools in Hradec Kralove were interviewed and on the basis of these interviews, a pilot questionnaire was made.

Phase 2

The pilot questionnaire was finalized. This questionnaire was partially based on already validated and used questionnaire made by Zounek and Sedova (2009). The questionnaire as a research tool was statistically processed and its reliability was set at 0.71 (Cronbach Coefficient Alfa).

The pilot version of the questionnaire was distributed among randomly selected 15 part-time students (future teachers of the first stage of primary education, out of which 13 were females and 2 were males at the age of 25-51 with the teaching practice between 2 and 26 years) at the University of Hradec Kralove. The questionnaire consisted of 15 closed and 4 open questions. Smaller insufficiencies in the questionnaire were removed and the newly modified questionnaires could be distributed.

Phase 3

The questionnaire was distributed into 230 basic schools in the region of Hradec Kralove. Altogether 135 respondents returned the filled in questionnaire. 129 were females and 6 were males at the age of 26 – 60 years with the teaching practice between 3 months and 40 years.

The aim of the questionnaire was to discover:

- in what ways the teachers use ICT;
- how often they use ICT in their classes;
- how ICT are applied in classes;
- to what extent ICT influence teaching;
- to what extent ICT penetrate into the relationship between the teacher and pupil and among the pupils themselves;
- what factors influence the teachers of the first stage at primary schools to implement ICT into their teaching;
- what kind of training on ICT the teachers have already had;
- whether the age of the teacher influences his/her attitude towards ICT or not.

Phase 4

Phase 4 involved a standardized observation which was done with the help of interactive analysis based on the observation and evaluation of communication and interaction in the classroom. Out of 53 available observation systems, the authors selected Flanders system of interactive analysis (Flanders, 1970). Flanders set basic activities of a teacher and a pupil. These activities repeat during classes and their mutual proportion during classes characterizes this process. Svatos and Dolezalova (2011) expanded and slightly modified these categories. In addition, Manenova (2012) added one more category which describes a form of pedagogical interaction – a description of silence, chaos in the classroom. All these categories are defined below:

- T1 – Teacher accepts pupil's feelings, behavior, s/he tries to show empathy in a constructive way.
- T2 – Teacher evaluates pupils positively, s/he praises pupil's performance.

- T3 – Teacher uses, explains, develops or accepts pupil's ideas.
- T4 – Teacher asks pupils questions which are connected with the study material, working methods or organizational matters.
- T5 – Teacher informs, explains or states his/her opinions.
- T6 – Teacher gives instructions, orders.
- T7 – Teacher criticizes performance, answers or activities of pupils or their behavior.
- P1 – Pupil asks questions, s/he seeks support and help at his/her teacher.
- P2 – Pupil asks questions, s/he seeks support and help at his/her peers.
- P3 – Pupil informs, explains, states his/her opinions – under pressure or influence of his/her teacher.
- P4 – Pupil informs, explains, states his/her opinions – out of his/her own activity and motivation.
- P5 – Pupil directs, modifies activities of other pupil(s), provides help to other pupil(s).
- P6 – Goup work when pupils communicate with each other.
- P7 – All class discussion.
- P8 – Pupils work independently, without apparent interaction.
- O1 – Silence or chaos in the classroom, pauses (slurred communication).

Explanation: T – teacher, P – pupil, O - organization

These data were evaluated both in a quantitative and statistical way. A special program CodeNet developed in the Department of Pedagogy and Psychology of the Faculty of Education at the University of Hradec Kralove was used for the acquisition and quantitative processing of the data. The research ran from September of 2011 till January of 2012. The aim was to discover characteristics of four lessons with the use of interactive board.

Phase 5

Phase 5 included the evaluation of the results and their comparison with other research studies.

Results

Results of the questionnaire

The findings showed that 99% of the respondents actively used ICT in classes, mainly to stimulate pupils to learn, to test and evaluate pupils and to explain new subject matter. Almost three quarters (57%) of the respondents use ICT very often, 27% several times a week, 15% only several times a months and only 1% never uses ICT in classes. Furthermore, the findings also demonstrated that pupils considered the use of ICT in their classes as an inseparable, normal part of teaching to which they had already got used to.

The results of the questionnaire also revealed the fact that 90% of the respondents did not think that the use of ICT would cause a loss of personal, face-to-face contact between the teacher and his/her pupil or among the pupils themselves. 62% of the respondents also reported that they did not believe that the pupils would learn faster with the help of ICT and 51% did not consider their teaching more effective when using ICT.

As the findings indicate, the teachers most often exploit ICT for the following activities:

- 92% of the respondents use ICT to practice and revise the study material;
- 88% of the respondents use ICT to access pictures, music or demonstration of various phenomena;
- 66% of the respondents give pupils tasks through ICT;

- 65% of the respondents use ICT as a tool for the explanation of the new subject matter;
- 37% of the respondents use ICT to test pupils;
- 4% of the respondents let pupils study the new material with the help of ICT (e.g., with the help of computer tutorials, the Internet or a video film).

Table 1 below then illustrates the type of ICT the teachers use in their preparation for classes as well as during classes.

Table 1. *ICT used in the preparation for classes and during classes*

Interactive board	83 %
Internet	91 %
Data projector	43 %
CD player	84 %
Television	25 %
Video	41 %
MP3 player	14 %
Printer connected to the computer	64 %
Scanner	33 %
Video camera	9 %
Dictaphone	1 %
Computer	80 %
Tutorials and encyclopedias on CD or DVD	84 %
Digital camera	51 %
Programs for the preparation of presentations	64 %

In addition, 70% of the respondents stated that they considered ICT as a nice change in their teaching, 36% of the respondents as a necessity and 2% of the respondents as an unnecessary tool for their teaching.

The findings also showed that the teachers were mostly stimulated to use ICT by their family (50% of the respondents) or by the training paid by their employer (64% of the respondents). Only 7% of the respondents were motivated by their study at a university and 17% of the respondents attended the ICT course at their own expense. Moreover, almost 86 % of the respondents reported that they developed all teaching materials (presentation, text files) themselves. 89% of the teachers used the Internet to search for new materials. 90% of the teachers use materials bought by their school. Interestingly, 41 % of the teachers did not use the materials developed by their colleagues

95% of the teachers use ICT for communication with their colleagues, pupils and their parents. More than 60% of the respondents participated in some training on the use of ICT.

Results of the standardized observation

The findings of the standardized observation confirmed that the teachers actively used ICT in their teaching. As far as the interaction is concerned, the teachers mostly organize and direct, while pupils mostly state their own opinions; it is pupils' own activity and motivation – s/he raises his/her hand or freely enters discussion.

Statistical verification of the hypotheses

Hypothesis A

Null hypothesis: Age (length of teaching experience) does not influence the frequency of the use of ICT during classes.

Alternative hypothesis: The frequency of the use of ICT during classes depends on the length of teaching practice.

The research sample was formed by the inexperienced teachers (length of the practice – 1 year) and by the experienced teachers (length of the practice up to 40 years). The respondents were divided according to their teaching practice into five groups (Table 2).

Table 2. *Frequency of the use of ICT on the basis of the teachers' experience*

	Up to 6 years	6 – 12 years	13 -19 years	20 -27 years	over 27 years	total
Every lesson	5	4	11	9	3	32
Once a day	8	4	7	12	11	42
Three times a week	9	2	2	15	8	36
Less often	3	3	4	9	6	25
Total	**25**	**13**	**24**	**45**	**28**	**135**

Independence hypothesis was tested by chi-square distribution. Value 14.749 for the monitored data was determined. At the chosen significance level of 5%, the null hypothesis is not cast off, i.e., the frequency of the use of ICT in education does not depend on the length of teaching experience. Classic Pearson's correlation coefficient is observed for two variables value of R = -0.096, therefore slightly negative. This would mean that the lower length of teaching experience (which usually means a lower age teacher), the higher the frequency of the use of ICT. P-value for this test of the zero coefficients is 0.227, however, that the hypothesis that these two variables are independent cannot be dismissed.

When used, Agresti approach (Agresti, 2002) is M = 1.248. Monitored data includes 135 individuals, which is enough to use asymptotic distribution of this statistic. The calculated p-value equals to 0.264. At the 5% level the independence of the length of practice and frequency of the use of ICT by teachers are not rejected.

The findings thus show that the hypothesis has not been proved.

Hypothesis B

Null hypothesis: Participation in an ICT training does not have any impact on their use in teaching.

Alternative hypothesis: Frequency of the use of ICT in classes depends on the fact whether the teacher participated in the ICT training or not.

The respondents could choose from three areas of education in the field of ICT.

- SIPVZ (State Information Policy in Education) – Basic (B)
- SIPVZ – Basic (B) and Advanced (A)
- Other (most of the respondents had some sort of training with interactive board or methodological training in the field of ICT)

In the first phase the respondents were divided into two groups on the basis of their participation in an ICT course.

Table 3. *Frequency of the use of ICT depending on passing or not passing the ICT course*

	No course	Course	Total
Every lesson	4	27	31
Once a day	8	35	43
Three times a week	2	34	36
Less often	2	23	25
Total	**16**	**119**	**135**

Apart from the main hypothesis, the authors set three partial hypotheses:

B1) *Null hypothesis:* The teacher who participated in the basic training (SIPVZ – B), uses ICT as often as the teacher who did not participate in any training.

B2) *Null hypothesis:* The teacher who participated in the basic and advanced training (SIPVZ – B and A) uses ICT as often as the teacher who did not participate in any training.

B3) *Null hypothesis:* The teacher who participated in the basic and advanced training (SIPVZ – B and A) or in other training, uses ICT in classes as often as the teacher who participated in the basic training (SIPVZ – B).

All the hypotheses described above were processed in the same way as hypothesis A.

Tests of hypothesis B and all three partial hypotheses are presented in Table 4 below. The chosen significance level was 5%.

Table 4. *Hypothesis B and its tests*

	hypothesis B	hypothesis B1	hypothesis B2	hypothesis B3
Chi-square	3.631	3.449	1.443	10.425
p-value	0.304	0.327	0.695	**0.015**
Yarnold's criterium	fulfilled	fulfilled	fulfilled	fulfilled
Correlation coefficient R^2	-0.100	-0.214	-0.066	0.255
p-value	0.248	0.131	0.540	**0.005**
M^2 statistics	1.342	2.293	0.381	7.688
p-value	0.247	0.130	0.537	**0.006**
n	135	51	88	119

The main hypothesis about the frequency use of ICT in classes is not influenced by the participation in the ICT course cannot be rejected. However, the partial hypothesis B3 is right since applied tests rejected the null hypothesis. Therefore the teacher who participated in the basic training only uses ICT in his/her classes less often than the teacher who participated in other training.

Summary of the results

The research showed that more than a half of the respondents used ICT on a daily basis, mainly in the teaching of Czech language and mathematics. The most exploited ICT included the interactive board, the Internet and tutorials. The teachers perceived ICT as a nice change in their traditional classes and as an interesting activation and motivation for their pupils. Only 2% of the respondents considered ICT useless for their teaching. 36% of the respondents perceived ICT a necessity due to the present pressure on information literacy. 98% of the teachers evaluate the use of ICT in education positively. Therefore it is surprising that they did not think that ICT had a significant effect on the increase of the effectiveness of teaching. The survey also revealed that ICT would negatively influence their attitude to pupils or among pupils themselves. The results also showed no impact of the length of the teaching practice on the use of ICT in teaching. Nevertheless, those who attended the methodological course on ICT used ICT in their classes more often than those who participated only in the basic or advanced ICT training.

Discussion

The aim of this research study was to discover teacher's attitude towards the use of ICT at the first stage of primary schools. The authors researched several variables: age, the length of the teaching practice, and education in the field of ICT.

The questionnaire survey revealed that the teachers were positive about the use of ICT in their classrooms. They most often use the interactive boards, computers and CD players.

91% of the respondents use the Internet in their work. During the lesson they exploit ICT to broaden the knowledge and practise the study material (92% of the respondents), Zounek & Sedova (2009) in their study present that 41% of their respondents use ICT for testing, 38% as a background and complement and 24% of the respondents use ICT to explain the new study material. Similar results have been confirmed by Tezci (2009), who also argues that the teachers' use of ICT in classrooms is fairly limited. They mainly exploit the Internet, e-mails, word processing and educational CDs. Sanchiz Ruiz et al. (2011) say that the teacher should be able to use ICT especially in the following areas of education: web pages, emails, videoconferences, telephone, chats, news, cell phone messages, and software. In fact, it is a must since students who are now the so-called digital natives want to interact (communicate, share, exchange), create, meet, coordinate, evaluate, learn, search, analyse, report, socialize and evolve differently (Prensky, 2004).

The authors also compared the frequency of the use of ICT with the results of Zouenk & Sedova (2009). Consult Table 5 below:

Table 5. *Comparison of the findings of two research studies on the frequency of the use of ICT in teaching*

Frequency of the use of ICT	Authors' study	Zounek and Sedova (2009)
Every hour	24 %	0 %
Once a day	33 %	12 %
Three times a week	27 %	52 %
Three-four times a months	18 %	31 %
Never	1 %	5 %

The findings indicate that currently, the teachers use ICT more frequently than it used to be in 2009. In addition, in comparison with Zounek & Sedova (2009), the findings of this study also show that present primary schools are much better equipped with ICT thanks to the EU projects and therefore the frequency of the use of ICT can increase.

On the basis of the interviews, it can be said that the use of ICT has changed teacher's role as well. The teachers have become mediators, which means that they are a kind of organizers, moderators; they interfere into the interaction pupil – ICT if a pupil faces a problem and needs the teacher's help. Some teachers also think that they are more partners to their pupils since the use of ICT enables them to work together with their pupils and solve join problems or similar tasks.

The findings also revealed that the teachers did not consider that the use of ICT would have any impact on the relationship between the teacher and the pupil. However, they are a bit skeptical about the communication among the pupils themselves. They pointed out at the fact that ICT enabled children to play with their help, which does not make them move much and thus, it has an adverse impact on their health.

The questionnaire survey also showed that the most stimulating factor supporting the use of ICT in classes is the training paid by the employer, followed by colleagues and then own children. Table 6 below compares the authors' findings with the findings of Zounek & Sedova (2009).

Table 6. *Comparison of the stimulating factors influencing the frequency of the use of ICT in teaching*

Stimulating factor	Authors' study	Zounek and Sedova (2009)
Partner	14 %	22 %
Own children	28 %	33 %
Relatives	8 %	4 %

Table 6 (Cont.). *Comparison of the stimulating factors influencing the frequency of the use of ICT in teaching*

Stimulating factor	Authors' study	Zounek and Sedova (2009)
Friends	14 %	11 %
Colleagues	36 %	59 %
Training paid by the employer	64 %	56 %
University study	7 %	9 %
Pupils	4 %	4 %
Training at one's own expense	17 %	7 %
The person alone	17 %	40 %

Table 6 illustrates that the teachers more often take an advantage of a possibility of further education in the field of ICT although they have to pay for it themselves. The survey also confirmed that the teachers who participated in the ICT training use ICT in their teaching more than those who did not attend any course. This is also confirmed by Manenova (2012; 2009) that education in the field of ICT has an impact on the use of these technologies. In his research study Tezci (2009) claims that the more experience and knowledge of ICT the teachers have the more positive they are about their use in teaching.

Interestingly, there is a low percentage of the impact of the university study on the use of ICT in teaching. Therefore more research should be done on this issue. Do future teachers get acquainted with ICT as didactic tools during their university studies? Do they pass any course on the use of ICT in teaching during their university studies?

The statistical analysis also did not prove the impact between the age (the length of the teaching practice) and the frequency of the use of ICT. The same findings were also confirmed by Manenova (2009), Tezci (2009) or Umar and Yusoff (2014) who also found no correlation between the teachers' years of service/experience and the use of ICT. This can be connected with the fact that current novice teachers are much more digitally literate than it used to be 20 years ago. Nevertheless, even these novice teachers lack a systematic, continuous, methodological training which would contribute to the improvement of effective use of ICT in primary education. For example, the teachers should be advised on how to use ICT to promote autonomous learning as well as collaboration among their pupils. As Smeets (2005) claims, most teachers still do not make use of the potential of ICT to contribute to the power of learning environments. Computers are used mainly to complement rather than change the existing pedagogical practice. Ersay and Bozkurt (2015) suggest that teachers should reduce the prejudice about the use of ICT and utilize the processes that increase and facilitate the learning.

On the basis of these findings, the authors set the main pedagogical approaches to the use of ICT in primary education, which should be followed. These include a collaborative use of ICT (in pairs or small groups), but younger pupils may need some guidance in how to collaborate effectively and responsibly; a short but focused use of ICT in classrooms (three times a week); use of ICT as a supplement to traditional teaching; and support teachers in developing their use of digital technology to ensure it improves teaching and learning aims (cf. Higgings et al., 2012).

Conclusion

Both theoretical and practical findings indicate that the teachers at primary schools flexibly react to the present changes in education which are connected with the use of ICT in teaching. In fact, ICT have become an inseparable part of their everyday educational practice. They offer teachers a number of new didactic tools of high quality. Nevertheless, there should be more training on the effective use of ICT in primary education which would ensure that the teachers have relevant competences for using them in their

classrooms. In addition, there should be more encouragement and support to increase teachers' motivation to improve the level and quality of ICT in their teaching (Uluyol & Sahin, 2016) since it is the teacher who by his/her approach and professionality decides about the benefits and their impact on the quality of teaching. As Higgins et al. (2012) say, *it is the pedagogy of the application of ICT in the classroom which is important: the how rather than what*.

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Conflict of Interest

The authors declare that they have no conflict of interest.

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