Collecting and Using Data to Develop Digital Learning Culture at School

Heikki Sairanen, Mikko Vuorinen, Jarmo Viteli
University of Tampere, Finland

The use of ICT in schools is varied and can change quickly. In this paper, we present a new way of measuring and doing research on ICT in schools that combines ICT research with ICT development in a mutually beneficial way. We have developed a web service that helps schools in their own ICT development. The tool called Opeka has been widely adopted and now produces new information regularly. The information works on three levels: First, it gives immediate feedback to the teacher about their use of ICT in education. Second, it provides the principals and school communities information on how their school is doing in the use of ICT and provides comparative information. And third, it is useful for developers, decision makers and politicians on town, province or nation level. The tool can become an integral part of the development cycle of any municipality or school.

The Opeka service can also be seen as a help in finding and identifying the problems in ICT use of schools in the same way that learning analytics do but with a focus on teaching instead of learning. The system could even be seen as nudge analytics, where the idea is to create analytics that can nudge the users in a good direction, in our case to nudge teachers to use ICT in their teaching.

In this paper we focus on some basic questions and answer them with the data gathered by the system. We also give an overview of the system.

As data we use information gathered in the web service from autumn 2012 until spring 2013. The questionnaire has been answered by over 2500 teachers (n=over 2500) in that time period.

Keywords: learning analytics, ICT in schools, web service, ICT development, ICT practices, teaching analytics

Introduction

In this paper we analyze the ICT educational needs of Finnish teachers and also take a look at the challenges facing new teachers in Finnish schools.

This work is built around the Opeka system. Opeka is a questionnaire system that dynamically builds reports for individual schools and municipalities. We focus on three questions that are examples of what the data collected in Opeka can do.

Our questions are the following:

1. How do young teachers differ in their use of ICT from other teachers?

2. What kind of ICT training do young teachers want?

3. What kind of ICT training do young teachers especially want?

We answer these questions with the data collected from May 2012 to May 2013, but in certain questions we rely on only a part of the data set, because the questionnaire has been changed during the time period.

Overview of Opeka

To understand and develop the ICT ecosystems of Finnish schools, we have constructed a web-service that offers schools and municipalities a way of conducting a survey of their own school. The school or municipality receives a dynamically generated report on their own usage compared to other respondents. (Sairanen & Vuorinen, 2012)

We have named this service Opeka and it has been created and is maintained at the Tampere Research Center for Information and Media (TRIM) at the University of Tampere. The service has been collecting data from May 2012 and has thus run for almost a year. From the beginning of the project to 24th of April 2013, 3526 respondents have taken the survey.

During this time the research team has improved the survey in the spirit of continual development and has been able to improve the usability and utility of the system. The changes include changes to user interface and also changes to content of the questionnaires.

Creating and executing ICT development in schools is not an easy task. Often an individual teacher cannot see the full picture of the whole organization or even the perspective of their colleagues. The Opeka service allows self-reflection in Kolb's (1984) learning cycle. Figure 1 describes its adaptation for Opeka.

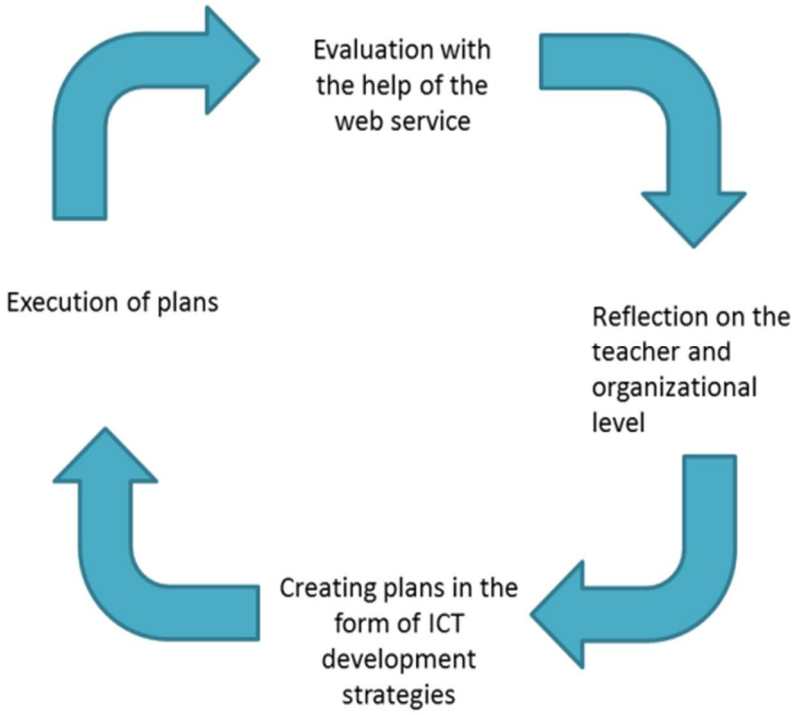

Figure 1 A model of improving the ICT use when using Opeka based on Kolb's (1984) learning cycle

As can be seen from the chart, the model of improving the ICT use with Opeka is rather general so it can be adapted to many different organizational strategies found in schools and municipalities.

The data collection of Opeka works through online questionnaires. All the responses from the questionnaires are collected to a single dataset. The system aggregates, filters and analyzes the data and provides comprehensive reports for schools and administration automatically and in real time. Also the effort of filling in the questionnaire is rewarded with a personal report that contains personalized aggregations and analyses of the whole dataset available.

The functionalities of Opeka can be divided into three different segments based on the users' point of view: respondent, manager and administrator functionalities.

Respondents authenticate themself to the site with their e-mail address and password. After the authentication they can fill in the background information and questionnaires, and view a personalized report page including comparisons to other respondents. The primary purpose of the respondent aspect is to collect structured and quantitative data. Currently Opeka includes three questionnaires: digital environment, devices and software and ICT skills. These questionnaires are aimed at teachers. In the next step of developing the system, there will be a questionnaire for students.

Manager, i.e. school rector, ICT development team, municipality or other administration personnel, uses Opeka to view reports of their province. Reports include graphs, visualizations and analyzes of the data. They also include links to associated reports (e.g. schools in the municipality) that the manager can share to concerned parties. Opeka reports are structured hierarchically according to respondents' background information: municipality report contains all the data collected from respondents that have selected the particular municipality as their primary place of work; school report contains the data with the particular municipality and school; office report contains data with the particular municipality, school and office. In addition, region report contains data from a group of municipalities and area report contains data from a group of schools.

The content of each report is similar in every type of report. The data is always shown in comparison to corresponding data in upper levels in the report hierarchy. That is, in office report you can compare data with the whole school, the area, the municipality, the region or all the available data. These comparisons are shown in all charts and can be used as a compare group in statistical analysis.

Administrator shares the links to the top-level managers (for regional and municipality reports) and uses the administrator tools to maintain the system and keep it up-to-date. Opeka has an administration toolbar containing report administration tools, tag administration tools and questions administration tools.

Theoretically the Opeka system is built around the idea of a learning technology ecosystem and utilizes the theoretical foundation of the ecosystem metaphor as introduced by Zhao and Frank (Zhao & Frank, 2003). The ecosystem metaphor is a holistic approach that highlights the components, their relationships as well as the environmental borders (Ficheman & Lopes, 2009).

Thus far, Opeka has been used to produce results about the basic usage of ICT in Finnish schools (Sairanen et al, 2013a) and also tentative attempts to see what kind of software and devices produce more usage in schools (Sairanen et al, 2013b).

Methodology

Differences between less experienced and more experienced teachers

We evaluate the questions based on the data collected by the Opeka system. To evaluate our research questions, we will analyze the data collected by using tools built in Opeka. These include basic statistical analysis methods.

To analyze how young teachers differ from more experienced colleagues, we first define a less experienced teacher as having 0 to 5 years of work experience. This information is collected by asking the users how many years of working experience they have.

We also use sum variables, which have been built into the system, to give overviews about certain aspects of ICT usage. To construct these, we create numeric scales for the answer alternatives and then sum these together as sum variables. We have constructed five sum variables that asses many aspects of ICT use in general. One of these is ICT Skills which is further divided into more detailed competences like ‘Digital content and learning environments’ and ‘Information security’.

We calculate means for each level and competence and then, compare the results of the less experienced to that of the more experienced group. In this way we can see how the groups differ in their ICT use.

Training needs of less experienced teachers

The survey includes some sections that are about a specific area of ICT competence. All these sections have a simple yes/no question in the following form ”I am interested in training about subject X”. Here X is the area of expertise. These results have been calculated for the less experienced group.

Also the questionnaire includes a *tag question* about other fields that may interest the user. By a *tag question* we mean a question where the user can type their own answer or select from answers that the previous users have used. The answers available are the most selected ones. Also when writing

an answer, the user is offered answers that partially match while the user is typing. This means that different users see slightly different answers and we have to be careful in our interpretations. We will also count these questions for the less experienced group.

Training needs of young teachers compared to older

We will also do a comparison between teachers that have 0-5 years of work experience and other teachers. We will create numeric scales for the questions and calculate means of each group. We will also do some simple analyzes of the statistical significance of the difference of these means.

Respondents

The respondents that have answered the questionnaire since the larger update in March 2013 number 949 (n=949). This number includes only the teachers in K-12 level education, and other levels are filtered out.

Undeclared	8
Subject teacher	379
Vice-headteacher	3
special education teacher	116
Pre-school teacher	10
Elementary school teacher (grades 1,2)	151
Elementary school teacher (grades 3,4)	121
Elementary school teacher (grades 5,6)	112
Immigrant teacher	4
Study guidance teacher	17
Headteacher	28

The backgrounds of the respondents vary. Most of our respondents are elementary school teachers (grades 1-6) and some are of higher levels. They come from different towns and cities. The sample is not as unbiased because the spread of Opeka's use has not been randomized. On the other hand we can get a 'deeper' sample as our samples often include a large portion of each individual school. To overcome these problems, we will mostly concentrate on the differences between teachers in our sample, as it is unlikely that there would be a large bias based on teaching experience.

Results

Differences between less experienced and more experienced teachers

We first compute the sum variables for each group. These can be seen in Figure 2. The less experienced teachers have higher ICT skills ($p < 0{,}001$) and also a better attitude regarding ICT ($p < 0{,}001$). However, there is no statistically relevant difference in the usage of ICT in teaching. This result seems at first quite surprising and the difference cannot be explained on the level of sum variables.

In technological readiness, ICT policy and procedures there is no difference. This is only natural as these variables have more to do with the environment in the school than with the preferences and habits of a single teacher.

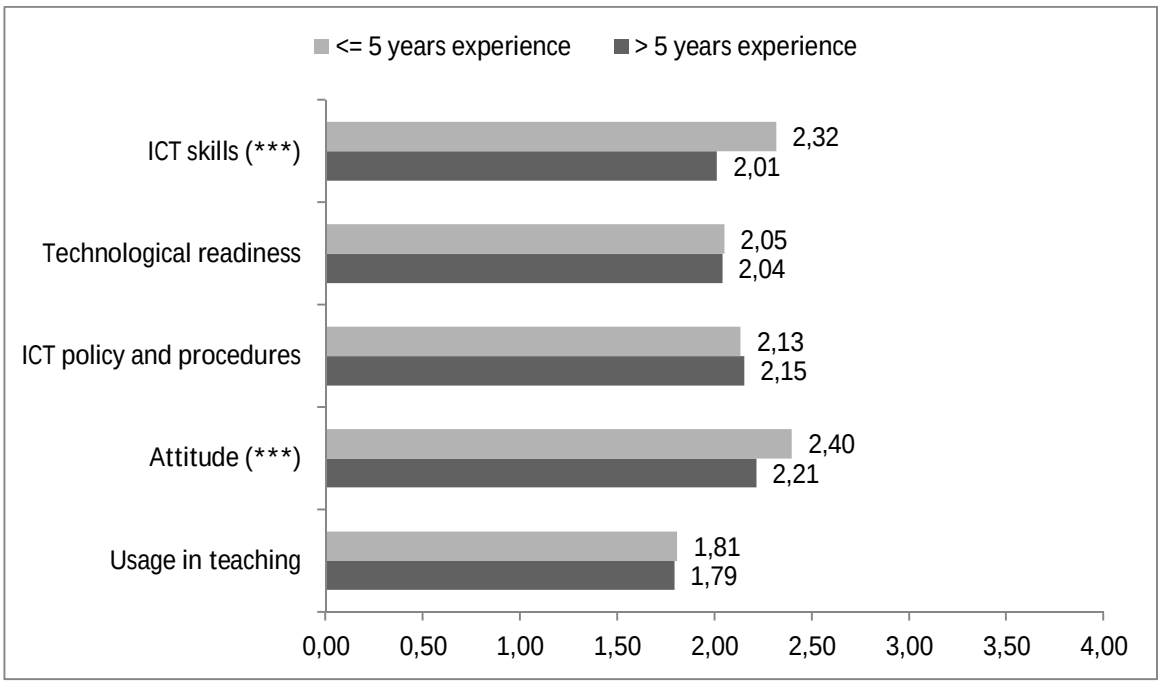

Figure 2 Sum variables for each experience group[1]

In the last figure we can see that the ICT skills sum variable is higher for the less experienced teachers. We have also constructed a more detailed picture of the ICT skills. We have 10 competences that are built in the same way as other sum variables, but these are built around a

[1] A convention is here established of marking $p < 0{,}1$ as *, $p < 0{,}01$ as **, $p < 0{,}001$ as ***.

smaller number of questions. Because of the low number of questions, we have to approach these more cautiously. These know-how sum variables can be seen in Figure 3.

The results are still very striking. Less experienced teachers have higher skill levels in all ten sum variables. The differences are highly statistically significant (at least $p < 0,001$) for digital communication, information retrieval and management, basic skills for computer use, pedagogical use of presentation technology, mobile devices and sound, video and images. Less significant ($p < 0,05$) differences can be found in digital content and learning environments, eSociety and media literacy. The least significant ($p < 0.1$) difference can be found in teaching via video and Information security.

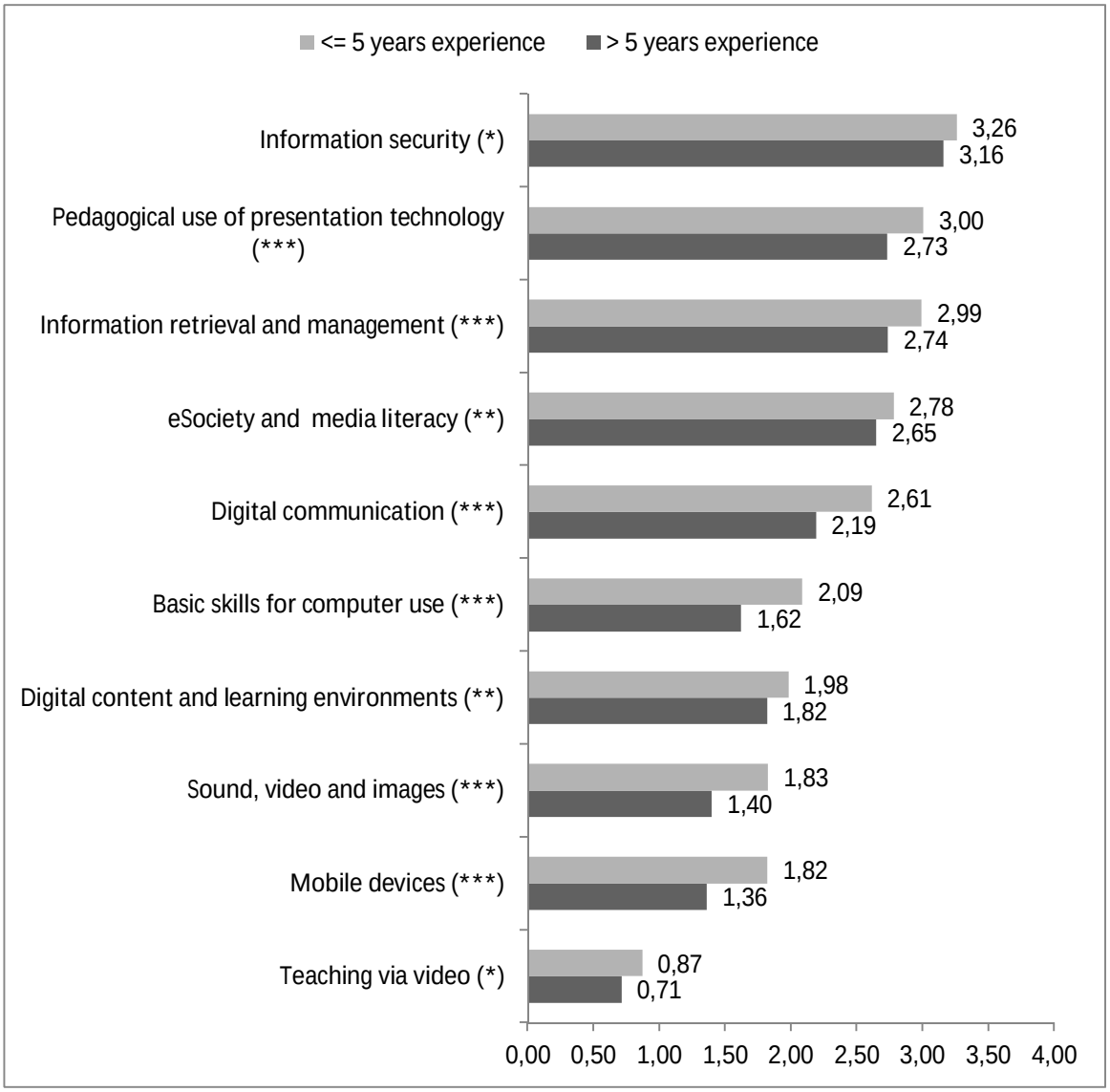

Figure 3 Sum variables about know-how for each experience group

The users were also asked about their training needs regarding the areas covered. The most wanted training is in digital content and learning environments which over 4/5 of less experienced teachers select and which almost 4/5 of more experienced teachers have selected. Also highly requested topics are digital communication and pedagogical use of presentation technology. The least requested topics for less experienced teachers include information retrieval and management, basic skills for computer use and teaching via video. However it should be noted that even the rarest topic (that is teaching via video) has been requested as a topic of training by about one fourth of the less experienced teachers.

In general less experienced teachers have listed less training needs than more experienced. Nevertheless the only statistically significant differences in requests are in Information security, Information retrieval and management and basic skills for computer use.

The comparisons can be viewed in Figure 4.

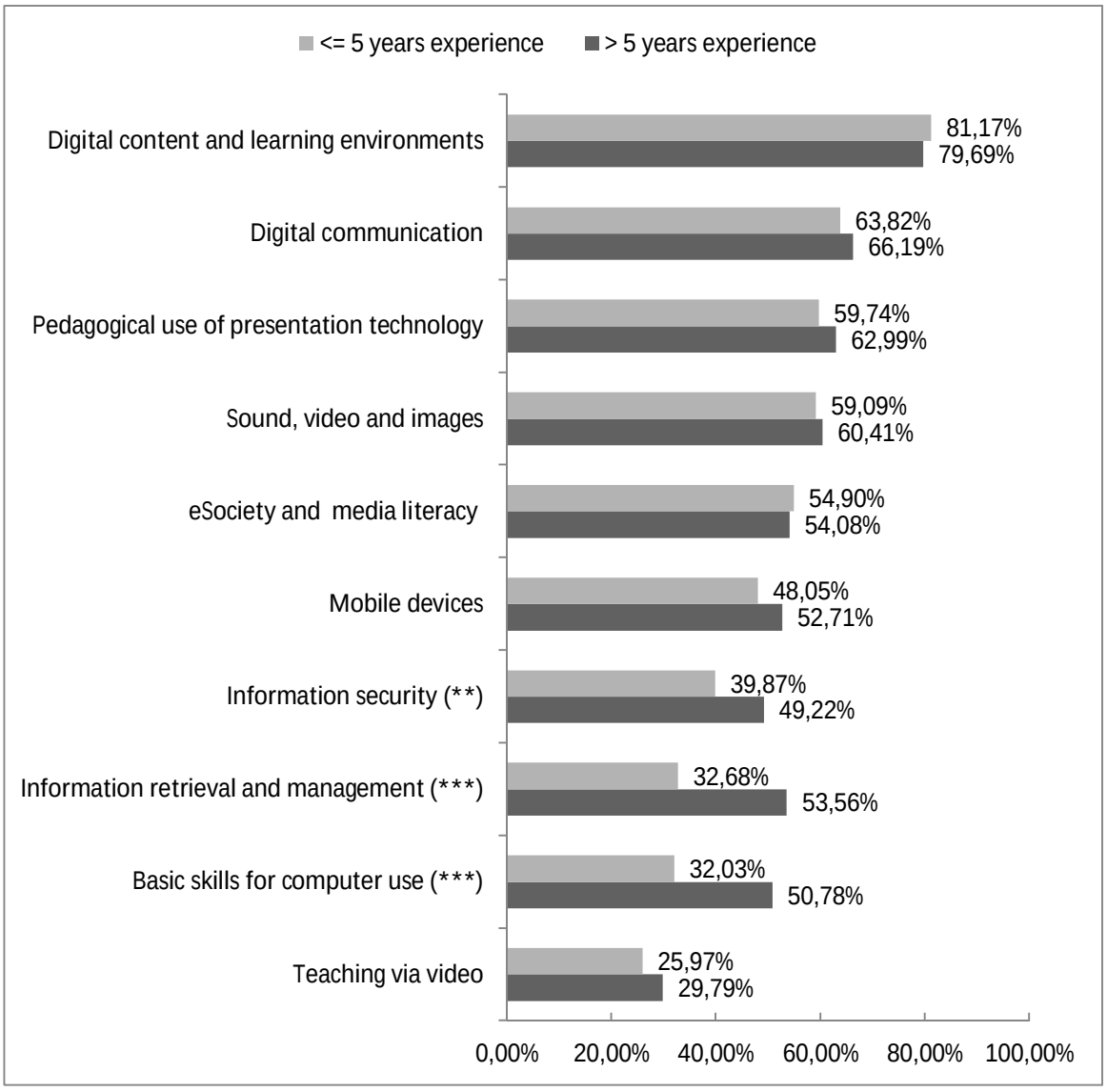

Figure 4 Requests for training in each topic by both experience groups

We have also included a question that can be seen as a companion to the training needs expressed before. This question is included as a tag question where each user can choose answers from readily available choices or input their own choices. If the user chooses to insert their own choice, their choice is available for the next users as well. This means that the answers, in this case, are totally user-created.

As such this can cause some problems because the most popular answers may not be perfect, however this system may allow us to see what choices are missing from the commonly asked questions. On the other hand, as the users are shown different selection of pre-typed answers, it is possible and likely that users act differently when faced with different choices.

In Figure 5 we have provided the 5 most selected topics for training by the less experienced group. The varied use of the devices, activating students and pedagogy and Smartboards are the most selected topics.

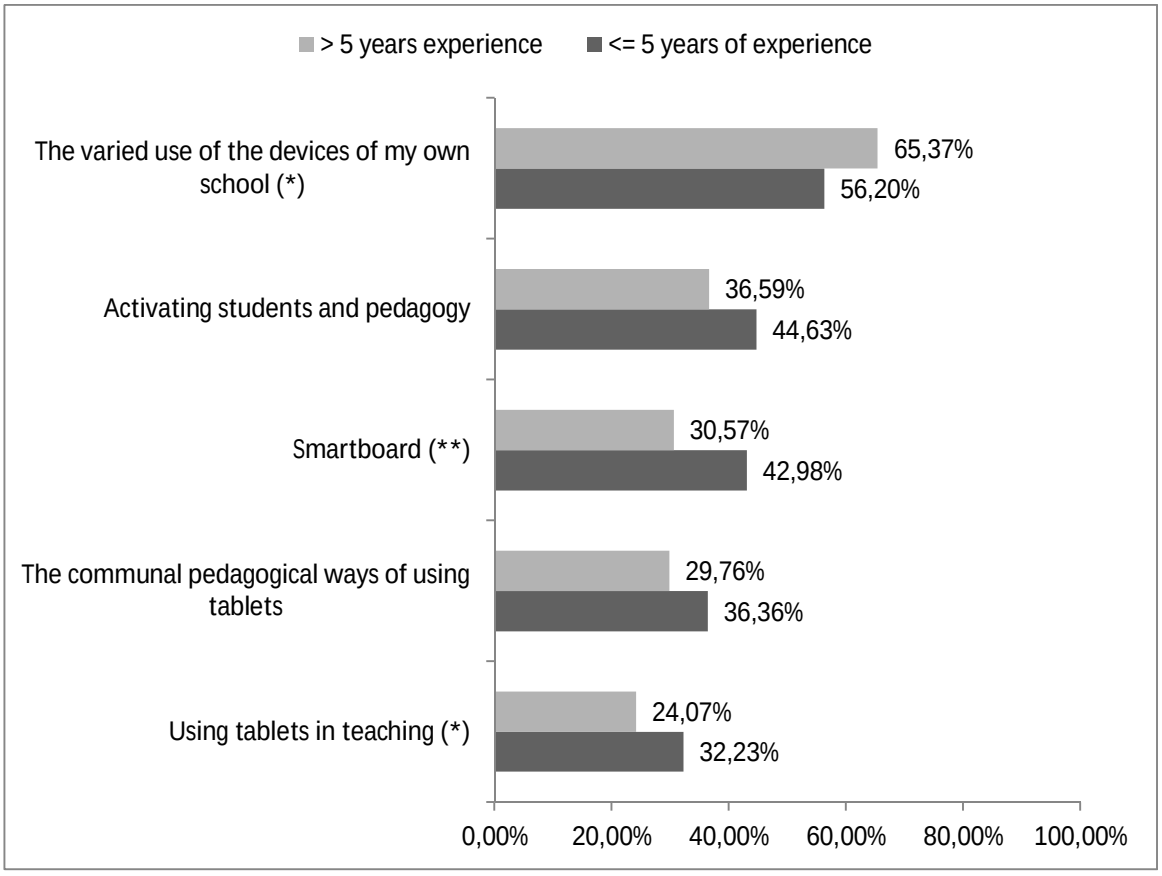

Figure 5 Requests for training in each topic by both experience groups for the most requested user-typed topics

In Figure 6 we have compiled a list of topics for which there is a difference between the less and more experienced groups. Less experienced teachers want training in Smartboards and using tablets

in teaching more often. More experienced teachers want training more often in the varied use of the devices of their own school, image-processing, the use of ICT in teaching their own subject, word and other basic programs and online shops.

The rest of the topics and their popularity can be found in the Appendix.

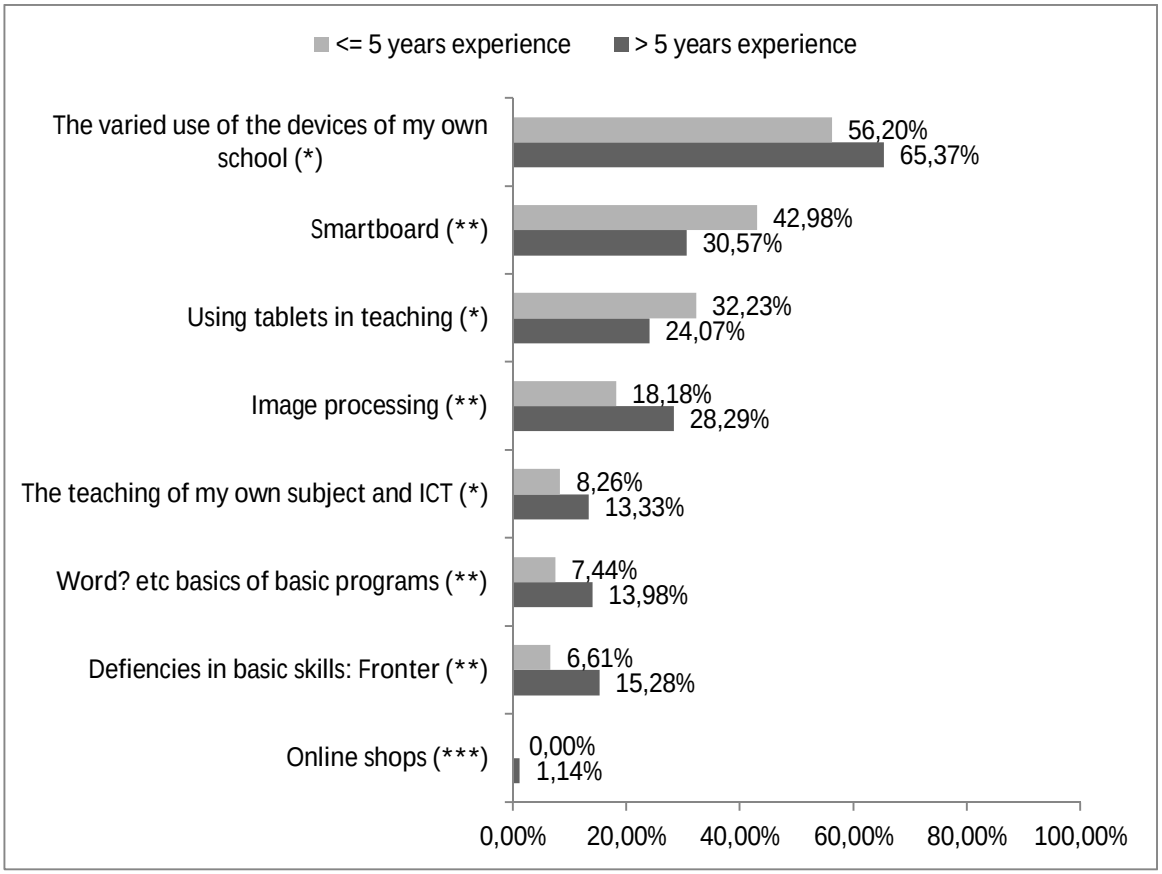

Figure 6 Requests for training in each topic by both experience groups for topics where the experience groups differ[2]

Discussion of results

We have compiled data using the Opeka system. The Opeka survey has been taken by more than 2500 Finnish teachers. In this paper we have analyzed the gathered data with regard to the experience they have in teaching. We are especially interested in the training needs of less experienced teachers as these needs could be addressed at least partly in teacher education.

[2] Fronter is a learning enviroment. The tags have been cleaned and translations are as verbatim as possible.

There are differences between the less and the more experienced teachers regarding their ICT usage. It seems that less experienced teachers have a better attitude towards ICT and they have better ICT skills on average than more experienced teachers. For some reason these do not seem to lead toward more and better ICT usage as this is almost the same for both groups.

The skill differences between the examined groups are also visible when we look at skills related to smaller areas of ICT. The less experienced group has statistically significantly better skills in all examined topics.

We also looked at the training needs that the teachers themselves had reported. These training needs are pretty similar for both groups. However, less experienced teachers want less training on topics related to basic computer usage. This is also true for the questions where the users were able to input their own answers. In these answers, however, there are some differences in training needs about interactive whiteboards and tablets. It seems that less experienced teachers are more interested in the newest ICT available.

It is of course important to keep in mind that we are dealing here with averages. Almost third of the less experienced teachers also would want training in basic computer usage and, naturally, there is a large numbers of more experienced teachers that do not require training on the basics.

In this paper we present these findings as a sample of what a system like Opeka can do for data collection. Our approach of combining the needs of ICT development of individual schools and municipalities can be seen as a success when we view the number of respondents.

Evaluating the reliability of our results is not an easy task. Our approach of offering our service free of charge has been successful in getting many teachers to use the system. However, our approach does not provide a fully randomized selection of teachers so there may be inherent bias in our sample. On the other hand we can get a ‘deeper’ sample, because in many cases the amount of respondents at a specific school approaches 100 percent. Our approach should be compared to other results where there are, at least in the Finnish context, real problems of getting even half of the respondents to questionnaires to respond. This also causes problems as for example more ICT oriented teachers may be over represented in the sample. Our approach is unique, so more work needs to be done in measuring its reliability. On the other hand, the reliability issues of other types of research and sampling approaches should not be overlooked. Within the sample, our work can be seen as quite reliable as there are many indicators that point in the same direction.

Conclusion

In this paper we have presented our approach to measuring ICT development and ICT usage in Finnish schools. We have presented a new web-based tool, Opeka, as a way of gathering and also distributing data about the ICT usage of teachers.

To recap we will answer the three questions we posed as examples of questions that can be answered with Opeka. 1.) How do young teachers differ in their use of ICT from other teachers? 2.) What kind of ICT training do young teachers want? 3.) What kind of ICT training do young teachers especially want?

As a sample of what Opeka can do in research, we have tabulated from the gathered database differences and likenesses of less and more experienced teachers. We find that the ICT usage of both groups is similar while the less experienced teachers seem to have a more positive attitude regarding ICT and also more skills in ICT. The differences between skills are also present when we view these skills regarding more distinct areas of expertise.

The training needs of less experienced and more experienced teachers are also quite similar. However, there are also differences. The less experienced teachers do not require as much training on basic computer usage as their more experienced colleagues and the less experienced teachers are a little more interested in newer technology. However, in both groups there are many teachers that want more training in basic skills so it is very important not to draw the wrong conclusions from the averages alone.

A tool like Opeka would be an advantage in designing training for a specific school or municipality. This would help in creating training that is both in demand and also helpful to all involved.

Appendix A: Data Tables

Name	<= 5 years of experience	> 5 years of experience
Digital video editing	19.83 %	17.56 %
Defiencies in basic skills: Fronter (**)	6.61 %	15.28 %

Concrete ways of utilizing tablets in teaching languages	9.09 %	8.94 %
Concrete ways of utilizing tablets in teaching languages [with slightly altered spelling]	4.96 %	4.39 %
ICT development of the school	7.44 %	11.87 %
Image processing (**)	18.18 %	28.29 %
Media literacy	19.83 %	14.15 %
The training that is needed for educational use of ICT in the school	1.65 %	2.93 %
The teaching of my own subject and ICT (*)	8.26 %	13.33 %
The material of my own subject (biology and geography)? What are available + where can they be found?	14.05 %	8.94 %
The varied use of the devices of my own school (*)	56.20 %	65.37 %
The varied use of the software of my own school	29.75 %	30.73 %
Activating students and pedagogy	44.63 %	36.59 %
The utilization of students own mobile phones and tablets in practical teaching	2.48 %	1.63 %
Smartboard (**)	42.98 %	30.57 %
Using tablets in teaching (*)	32.23 %	24.07 %
The communal pedagogical ways of using tablets	36.36 %	29.76 %
ICT in teaching English	2.48 %	5.20 %
Vector graphics / Bitmap graphics	3.31 %	1.30 %
Online shops (***)	0.00 %	1.14 %
Word? etc basics of basic programs (**)	7.44 %	13.98 %

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