The Process of ICT Integration in Schools

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ICT-metrics Measuring Tool

PhD Thesis

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Introduction

Originally, the use of information and communication technologies (ICT) in the Hungarian public education system was present as a separate field of study in the IC curriculum. However, the integration of ICT into the learning process in general has become widespread in the last few years. The recent research focuses on the question of whether the ICT-integration process in educational institutions can be controlled and adjusted. Based on previous research, it had been assumed that the lack of strategies for ICT improvement in educational institutions and the frequent "ad hoc" character of development could eventually be explained by the lack of proper measuring methods that measure the management of the ICT-integration process. We have assumed that integration within any institution can be managed systematically – based on realistic local objectives – provided the state of the HR situation in a given institution is measurable at any given time and, moreover, any change in HR can be traced. With no proper monitoring, the course of proceedings in an institution can be influenced merely by sudden burst geared at developing education, but often with unpredictable cost-benefit results.

Objectives

ICT-use in education in Hungary – thus its integration into learning – is influenced by the decisions of the teachers working according to state regulations, that give them broad methodological freedom and by the expectations of the school management. In accordance with our basic concept, we have worked out a measuring method which, considering many factors simultaneously, measures how much teachers use ICT in their teaching (and its boundary conditions). Then, with data reduction methods, the data is compressed into a few indicators for further study and comparison. This measuring method is also aimed at being able to shape, direct and monitor the process of integration of ICT-use in teaching. Based on the result of the chronological analysis of the individual ICT-metrics data collection, the objectives for development in the field of ICT could be reconsidered according to the changes in HR.

Applied research methods

The integration of ICT-use in institutions is contextually determined by influences from higher levels, which is why during the conceptualization of our research we reviewed the macro-processes in the spread of ICT in education present in the European Union and in Hungary.

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The ICT-metrics as a measuring tool, in correspondence with the results of previous research in the process of integration of ICT-use in teaching, considers the teacher as a key figure who works according to state regulations that give them methodological freedom. In accordance with our research-development objective focusing on empirical data collection[1] of ICT-use by teachers in teaching, we have devised a model that describes the status of individual teacher's ICT-use by five indicators. These measuring dimensions (indicators) are:

1. Teacher's ICT-access at home.
2. Teacher's ICT-access at school.
3. Teacher's ICT competence.
4. Teacher's level of involvement in ICT-use.
5. Teacher's attitude towards ICT use.

These indicators (indexes) show the data provided in the multi-item questionnaire filled out by the teachers via data reduction methods, using arithmetic mean and scoring procedures.

Analyzing the ICT-metrics, we have considered the results shown by each indicator (measuring dimension) in their conceptual meaning, thus defining the status of the individual teacher's ICT-use. In order to be able to analyze the teacher's ICT-use, different types have been developed. Six teacher types have been defined using the K-Means cluster method[2] on indicators by empirical data, and at the same time, using the ANOVA method, we have defined how strongly the different indicators influence the teacher cluster types.

To simplify the interpretation of ICT-metrics, the indicators have been presented in polar diagrams with data readable on a three-graded ordinal scale.

Scientific results

Development plans and processes that drive the educational integration of ICT on a macro-level have a reduced efficiency to control ICT integration on the institutional level. The success of the educational policy aimed at developing ICT in the overall educational system depends on how much the subsidy considers the HR, as well as the traditions and the local characteristics of the beneficiary institutions.

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[1] In one of the districts in Budapest, Hungary 609 teachers filled out our questionnaire, which is 55.7% ratio. Beforehand detailed studies were compiled in seven institutions, in which structured group interviews were conducted with the director, students and teachers.

[2] Term used in SPSS program package

In general, in the development policy on ICT it seems to be best to change from the principle of equal opportunity to the principle of differentiated opportunity extension; thus when defining the objectives of development, the needs and actual opportunities of the beneficiaries could be a more dominant factor.

Because of the lack of management of integrated ICT-use on the institutional level, the individual teacher's level of involvement in ICT-use becomes more significant. In general, teachers tend to use ICT when doing administrative school work or when using ICT for personal interests; a so-called "pedagogue-centred" ICT-use is becoming common in schools. Teachers rather use ICT as a tool for teacher's administration or logistics than ICT as a helping tool in learning.

The majority of the teachers surveyed claimed to be inexperienced in ICT-use connected with teaching. They are open and motivated to expand their ICT-use in teaching but with no SWAT analysis, proper management or guidance, the teachers are on their own and limited in using IT hardware and software in their teaching. Empirical data shows that teachers would need conceptual orientation in using computers in education.

Findings show that the growing number of home computers and access to the Internet makes the schools' former positions in ICT relatively less important. The teachers surveyed with high quality Internet-access at home claim that their school is falling behind in the "competition" of ICT-spread. (Research also clearly shows that the infrastructural levelling off in schools alone would not automatically result in more ICT-use in teaching.) One fourth of the teachers have satisfactory, fast Internet-access that would enable them to use ICT with no technical problem in their teaching.

In the teachers' mind it is not obvious to use their own home IT equipment for work connected with their teaching. The use of home computers and infrastructure for school work does not create a conflict between the teachers and their institutions in the short run, especially if the use is not intense. With more intensive use in the long run, the use of home computers can be a problem.

Due to a series of campaign-like actions concerning ICT-use on the national educational management's side, school directors have been deprived of the chance to perceive initiatives on ICT on a long-term basis – and professionally at a high level – of "investment" to fully internalize the imposed central expectations.
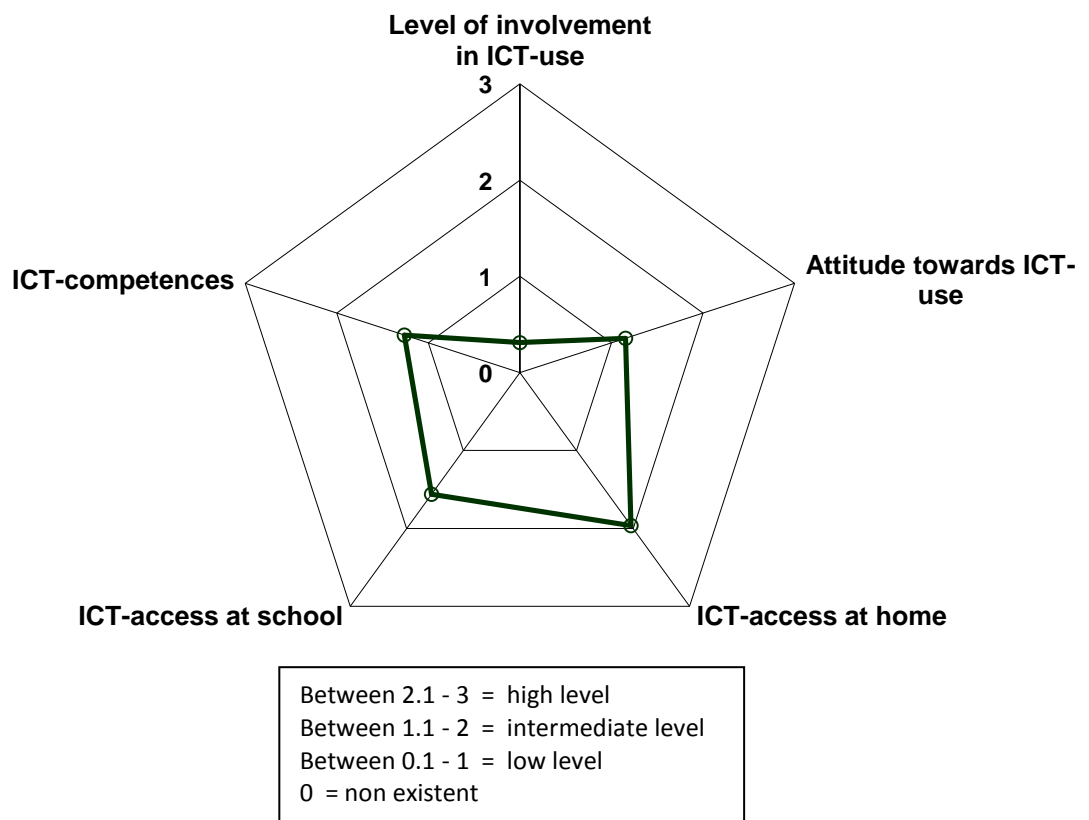
None of the school directors surveyed have claimed that they select from the applicants for a job interview according to their IT skills. ICT skills and ICT-use are not considered either when assessing the teachers' work. It can be detected that in practice the expectations from the teachers do not involve their competence in ICT-use or computer skills. Only "in theory" do directors expect their staff to be computer competent.

The surveyed institutions do not have a written policy on IT. This can be interpreted to mean that school management is not aware of the fact that for the school to have competent, motivated teachers in ICT, who are willing to use IT in their teaching and that to have more IT equipment is real "capital" waiting to be actuated. The process control of ICT integration is yet unresolved due to the lack of measuring and monitoring tools, so the existing human and material resources in the institutions are of low efficiency and their differentiated development cannot be projected. ICT-metrics evolved according to research data aims to solve this problem.

Teacher types based on ICT-metrics

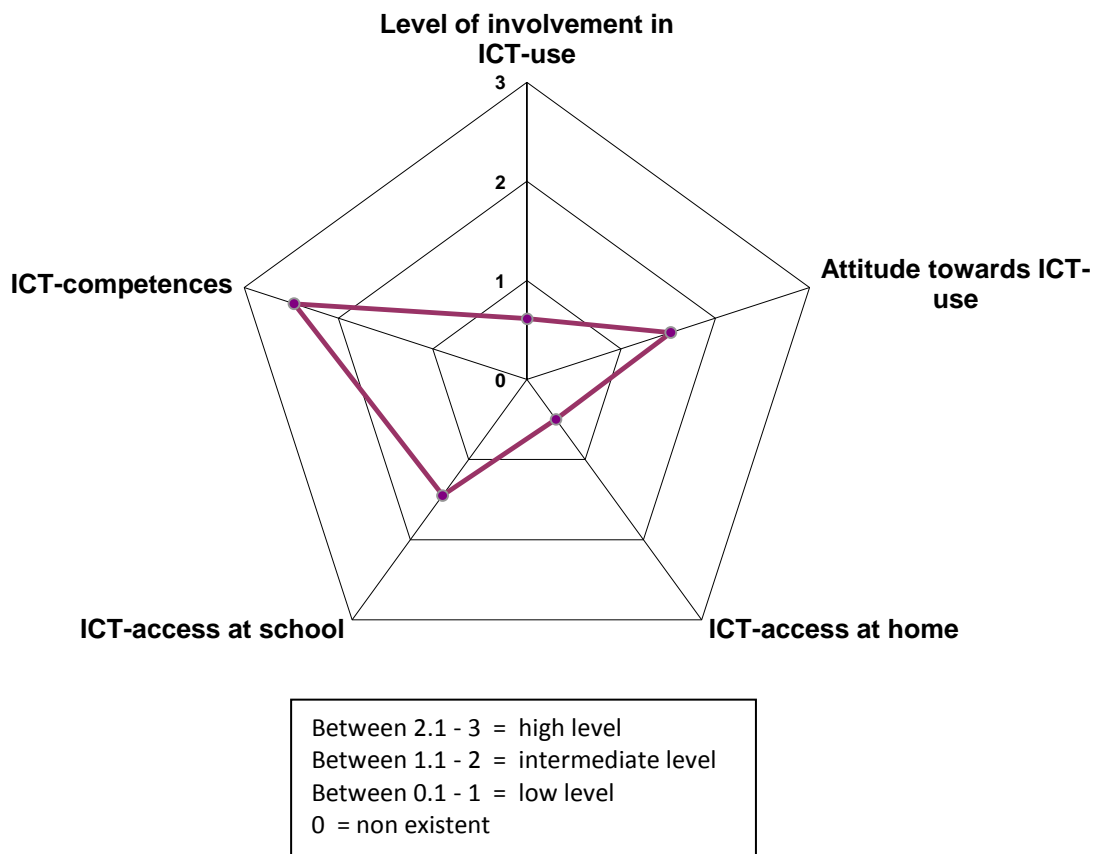The types defined by the cluster method described in the applied research methods are as follows:

Figure 1   ICT-metrics – Teacher cluster-type 1


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Between 2.1 - 3  =  high level
Between 1.1 - 2  =  intermediate level
Between 0.1 - 1  =  low level
0  = non existent
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The main characteristic of teachers in cluster-type 2, according to ICT-metrics, is that they are in a more favourable situation regarding ICT-access (both at home and at school) than they are regarding ICT competences. Presumably, their position in

ICT competences should be strengthened in order to increase their level of activity of ICT-use from the very low level they are at now. However, predictably, by widening their competences with more active involvement in ICT use, the teachers' "expectancy-horizon" will broaden as well, so their perception of ICT-access at school will become more adverse as compared to their situation today when they very rarely use ICT tools in teaching.
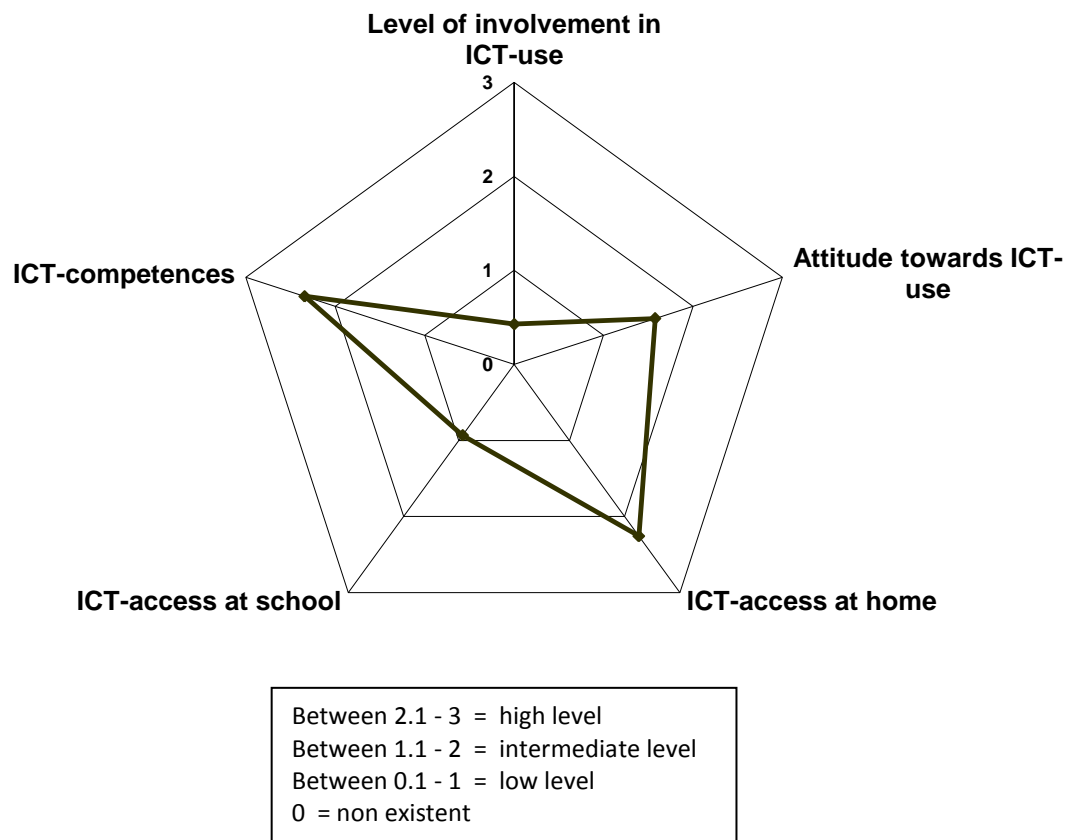
Figure 2   ICT-metrics – Teacher cluster-type 2

Between 2.1 - 3 = high level
Between 1.1 - 2 = intermediate level
Between 0.1 - 1 = low level
0 = non existent

The prominent feature of teachers in cluster-type 2, according to ICT-metrics, is that a significant difference can be detected between the low level of ICT-access at home and the high level of ICT competences. Specifically, for the pedagogue of this type, wider ICT-access could be a step forward. Since ICT-access at home is at a low level, ICT-access at school is overestimated. Research has shown that part of the teachers of type 2 have gained their experience by making good use of ICT-access at

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school. These teachers are more familiar with the ICT infrastructure at school, which means they have an advantage when using ICT at school to those who have gained their competences at home using their IT equipment (infrastructure) at home.
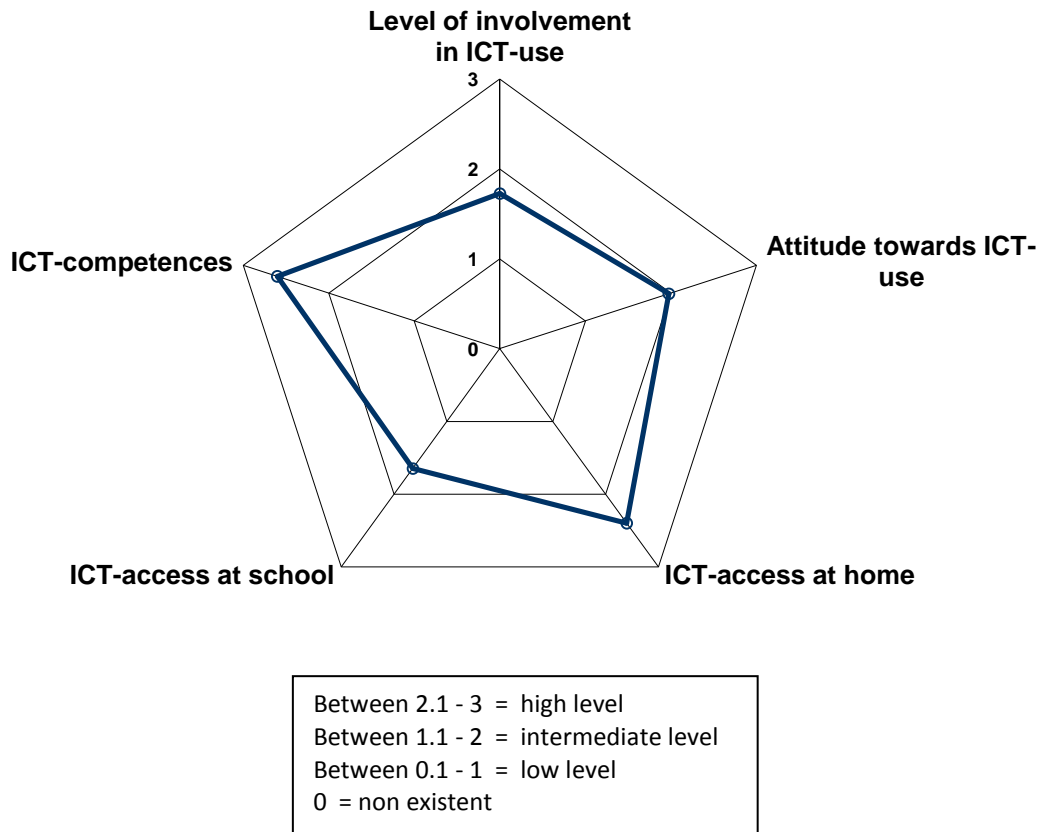
Figure 3   ICT-metrics – Teacher cluster-type 3

Between 2.1 - 3 = high level
Between 1.1 - 2 = intermediate level
Between 0.1 - 1 = low level
0 = non existent

The main characteristic of teachers in cluster-type 3, according to ICT-metrics, is a high level of ICT-access at home, which is accompanied by a high level of ICT competences. However, the low level of ICT-use in teaching and the relatively low level of ICT-access at school refer to the fact that the teachers of this type mostly use the computer for their personal interests as opposed to using the computer in teaching. A solution could be, on the one hand, to improve the level of ICT-access at school, which would, presumably, increase and improve the conditions of ICT-use in teaching. On the other hand, it could create such pedagogical objectives that enable
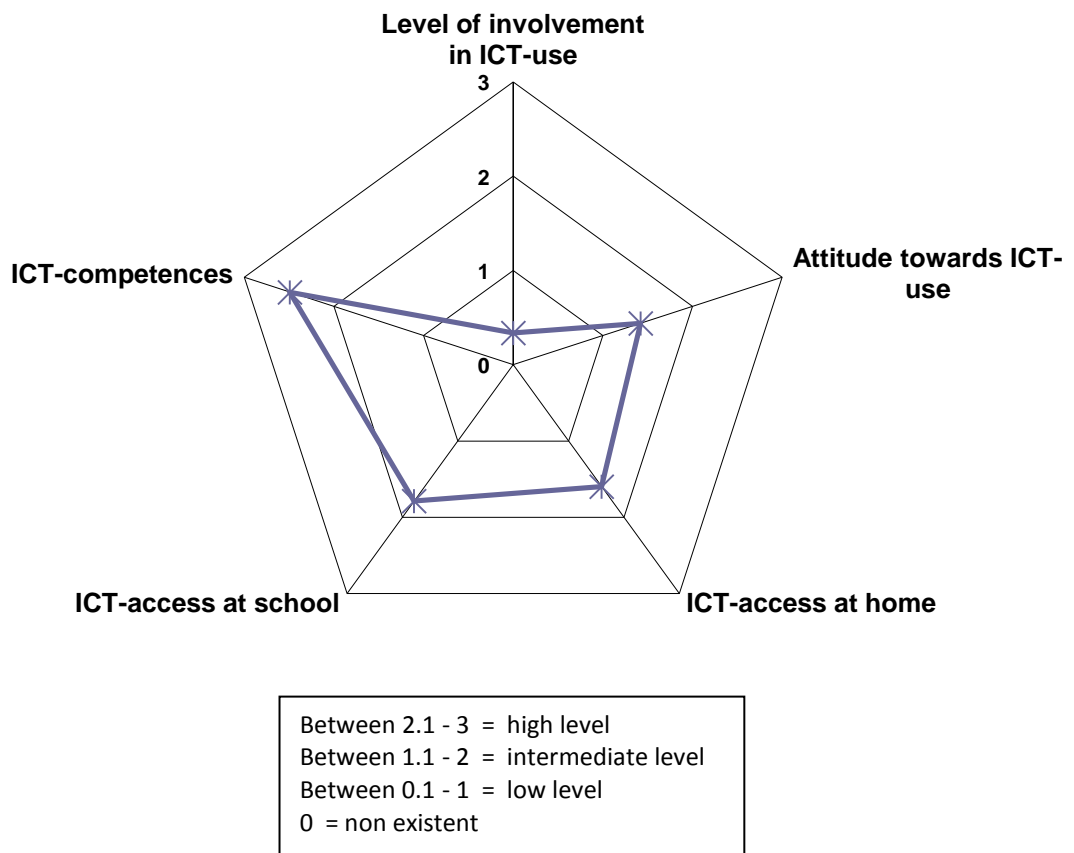
the teachers to better their methodological repertoire with ICT-use in teaching. Teachers belonging to cluster-type 3 should be considered a potential target group for ICT-use in teaching.

Figure 4   ICT-metrics – Teacher cluster-type 4


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Between 2.1 - 3  =  high level
Between 1.1 - 2  =  intermediate level
Between 0.1 - 1  =  low level
0  = non existent
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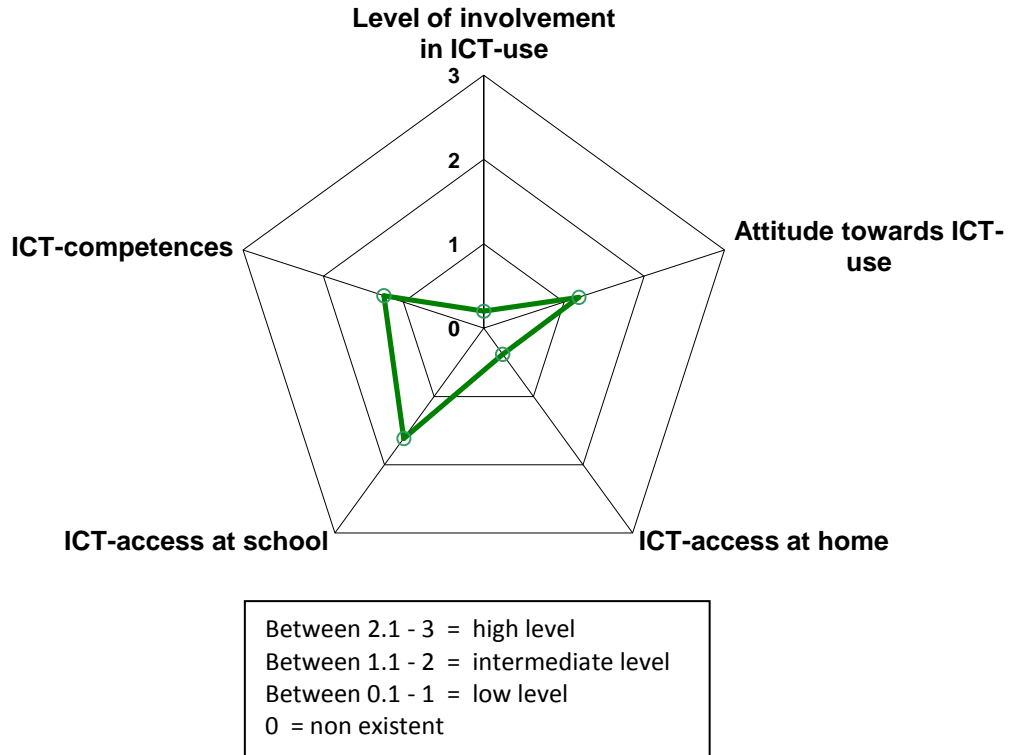
The main characteristic of teachers in cluster-type 4, according to ICT-metrics, is that with a high level ICT-access at home and with good ICT competences, their level of activity in ICT-use is intermediate. Since all the other types were characterized by a low level of involvement in ICT-use, type 4 should be considered the most active user of ICT in their teaching. Also, their attitude towards ICT-use is the highest of the six types.

Figure 5   ICT-metrics – Teacher cluster-type 5


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Between 2.1 - 3  =  high level
Between 1.1 - 2  =  intermediate level
Between 0.1 - 1  =  low level
0  = non existent
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The main characteristic of teachers in cluster-type 5, according to ICT-metrics, is that although having a high level of ICT competences, they position themselves at the intermediate level in ICT-access both at home and at school. Considering their capabilities, the teachers of this type could be regarded as the potential users of ICT in teaching. Their ICT-use in teaching is most likely to improve if they have a better than intermediate ICT-access at home as well as at school.

Figure 6   ICT-metrics – Teacher cluster-type 6

Between 2.1 - 3 = high level
Between 1.1 - 2 = intermediate level
Between 0.1 - 1 = low level
0 = non existent

The main characteristic of teachers in cluster-type 6, according to ICT-metrics, is that because of the low level of ICT-access at home and their intermediate level ICT competences, they tend to show characteristics of a beginner computer user. They use ICT mostly at school, so it is of utmost importance for this type to have access to ICT-use at their workplace. The fact that their attitude towards ICT-use is at an intermediate level shows that the teachers of this type do not have a "hidden rejection" towards ICT-use.

Having analyzed a large number of ICT-metrics, we have concluded that very often the five indicators intermix, thus obtaining a special, unique individual character. IT means that the ICT-metrics analysis cannot always be done by the cluster-types described above.

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The role of teachers belonging to different cluster-types in the process of ICT integration in education

In establishing the ICT strategy of a school, it seems critical to concentrate on the experience and opinion of teachers in type 4. (Figure 4) In their case the high level of ICT competences coupled with a high level of ICT-access at home results in active ICT-use in their teaching, so it can be assumed that their opinions are based on experience.

Considering their expertise, teachers in type 3 can play an important role in establishing the ICT strategy of a school as well, but unlike in the case of type 4 teachers, their opinion will not be based on their actual experience. (Figure 3)

Teachers in type 5 could be the potential base for ICT integration in schools. (Figure 5) they have all the potential – ICT competences, ICT-access at home and at school – that is needed for ICT-use in the teaching process.

The results of ICT-metrics show that teachers in types 1 and 6 should be offered ICT training courses. (Figures 1 and 6) Most likely, teachers in type 1 will benefit more from these courses since they have either an intermediate level or high level access to ICT at home, which alone justifies acquiring ICT competences for them.

Teachers in type 2 typically improve their ICT skills using ICT-access at school. A consideration could be to arrange such conditions for their ICT-use at school that results in a perceptible change in their ICT-use in teaching.

Establishing an ICT progress strategy is hindered by the fact that the teachers in the staff usually belong to different ICT-metrics types and there are a few who cannot be classified according to the above types. To succeed in this incoherent environment, a great deal of conciliation is required in order to establish a progress strategy in ICT integration. Moreover, school administrators have to comply with mandatory state metrics for measuring achievement which do not always agree with the teachers' needs and opinions originating from ICT-metrics.

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ICT-metrics as a monitoring tool

In the framework of the CALIBRATE[3] project directed by EUN[4] almost 40 teachers participated in the original Danish EPICT training course, organized by Eötvös Loránd University, Faculty of Science Centre for Multimedia and Educational Technology[5]. We evaluated the teachers using the ICT-metrics before as well as after the training. One of the outcomes of this monitoring survey was that ICT integration in educational institutions is a complex procedure, in which a threat might be the asynchronous development of the process constituents. ICT integration based on individuals with too intense development in a certain area might result in a setback in another area. A careful study of the examples has shown that increasing activity in ICT-use via trainings can be accompanied with a definite drop in the attitudes towards ICT-use for the same teacher. (Figure 7) Attention must be paid to the fact that overdriven, not very adaptive development can trigger hidden counter effects in certain teachers, which, in the long run, might defer or even decrease the effectiveness of the process of ICT integration.
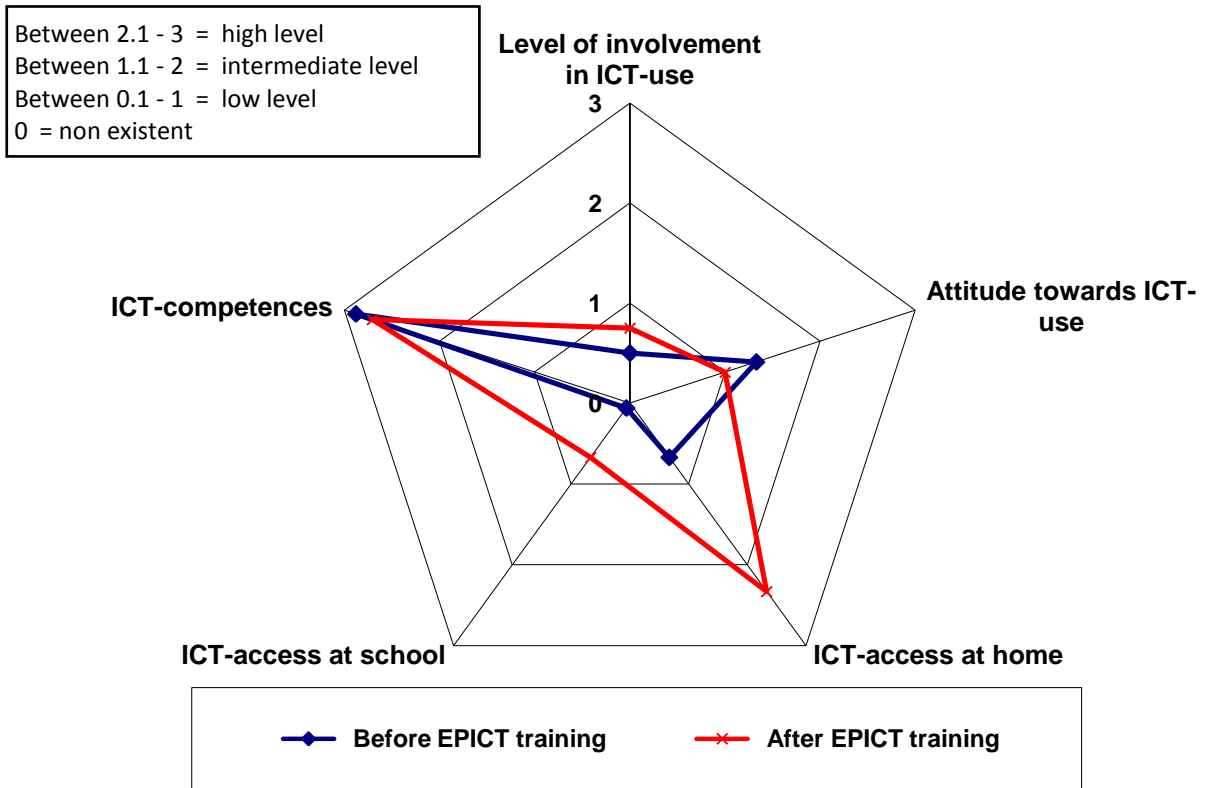
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[3] The CALIBRATE project aims to support the collaborative use and exchange of learning resources in schools. It brings together eight Ministries of Education including six from new member states and involves 17 partners in all. The project runs from October 2005 – March 2008.
http://calibrate.eun.org/ww/en/pub/calibrate_project/home_page.htm and
http://www.infoiranytu.h/calibrate/index.html
[4] http://www.eun.org/portal/index.htm
[5] http://edutech.elte.hu

Figure 7   **ICT-metrics – Before and after the EPICT Training**

Between 2.1 - 3 = high level
Between 1.1 - 2 = intermediate level
Between 0.1 - 1 = low level
0 = non existent

Level of involvement
in ICT-use
3
2
1
0

Attitude towards ICT-use

ICT-competences

ICT-access at school

ICT-access at home

◆ Before EPICT training   ✕ After EPICT training

38 years old woman, German language teacher,
18 years teaching experience; currently she teaches 2.,3.,5. grades.