ICT and Learning In School

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ABSTRACT

This study represents a test of systematically bringing together the results of a number of degree projects dealing with joint issues within the fields of ICT and learning. The method has been named a field-limited met study, in which increased validity and generalizability are expected to strengthen school development in the region comprised by the study. A total of 16 studies were conducted in a limited geographical area including a representative sample of 79 schools. Two questions asked in the study were: What is the approach to learning ICT in the schools studied? and What possibilities and obstacles may arise when implementing ICT in schools? By breaking down the structure into individual, technology and organization the result was analyzed from four learning approaches. It shows that the most frequently represented approach is the one referred to as progressivism, where the student is in focus and activity pedagogy dominates, while perrenialism, an approach that emphasizes the invariable character of knowledge, is very poorly represented in the study. The teachers represented in the various studies are largely positive to ICT, in which they envisage a range of possibilities for the learning environment. With regard to technology, a great number of schools are facing problems. There is a lack of maintenance and support, both technical and pedagogical, as testified by a great many teachers. In respect of the overarching organization, the principal is viewed as the key person. A clear pedagogical strategy for the use of digital tools is also requested. With the support of the overall picture emerging from the study analysis, there are good reasons for developing work on field-limited met studies. A further step in this direction may be to allow teacher-students to plan and take part in longitudinal projects to increase the validity of the overall picture of important fields of development.

Keywords: *ICT, learning, learning approaches, implementation, school, field-limited met studies*

1. INTRODUCTION

For many years those responsible for teacher education at Linnaeus University have expressed a mild disappointment that the knowledge and experiences generated in students' degree projects seldom lead to any school development in the region. Only exceptionally do reception and assessment of single essays leave a concrete imprint on the work done in schools. One reason is less attention given to the validity and generalizability of degree projects in comparison with other studies.

Although intended to confirm students' professional knowledge, the degree project is also expected to contribute to knowledge dissemination and educational development. Unfortunately, organizations rarely utilize the knowledge and experiences they represent, and only exceptionally do these projects leave any concrete mark on the schools where the studies have been conducted.

An important issue discussed as a consequence of this is how teacher education could increase the status and importance of the degree projects undertaken. One idea tested in the present study is to bring together the results of several degree projects to form the basis of a joint analysis in line with the methodology applied in met studies.

Since some issues are of immediate interest and relevance both to students and to their presumptive workplaces, it frequently happens that the same problem area is elucidated in several different studies. Against this background it may be of interest to gather a number of studies and expose them to a sharper analysis and a wider interpretive field. One problem area in focus for schools and, consequently, for many degree projects, is the implementation of ICT (Information and Communication Technology). Another example of a frequently occurring essay topic is how to include children in need of special support. In this article, the focus lies on issues that coincide in a number of degree projects about ICT and learning. These studies were selected within Linnaeus University's teacher education programmes over a three-year period. With the aim to increase the value of degree projects conducted by students, principles were constructed for a method here referred to as a field-limited met study.

2. AIM

The aim of the study is to:

- Systematically assemble a number of degree projects to increase the precision, validity and generalizability of joint issues
- Analyze and discuss the result from the perspective of theory of learning
- Generate suggestions for pedagogical innovation

2.1 Research Question/Problem Formulation

The joint issues of the study can be summarized in two questions:

- What type of learning approach has the implementation been directed?
- What may facilitate or obstruct the implementation of ICT?

3. METHOD

One prerequisite for carrying out the study was to analyze a number of degree projects that deal with similar issues elucidating the same problem area. The starting point for this analysis consisted of 16 degree projects focusing on ICT and learning completed and examined between the years 2013 and 2015. All degree projects included in the study, which correspond to essays at the Bachelor's and Master's levels, were written as part of Linnaeus University's primary teacher education. The work of the students was supervised by PhD teachers and approved by an examiner of at least docent (associate professor) competence. The major responsibility for the structure and implementation of the essay course has been carried by teachers with qualifications for a professorship.

All works included in the study have been awarded the grade of Pass or Pass with Distinction.

The field-limited Meta study is expected to elucidate the area by:

•	Joint issues
•	The use of several methods
•	An extensive sample of schools and respondents within a field-limited activity area
•	A number of autonomous essay writers gathering data and interpreting the empirics
•	Studies implemented at different points of time
•	A joint theory

The data of the present study was collected from different schools distributed over two counties in Sweden. The table below contains an overview of the types of degree project included in the study.

Table 1: Degree projects included in the study

Degr. Proj.	Problem area	Method	Sample
1. 2014	Teachers' teaching experience of ICT	Interviews	7 teachers at 2 comprehensive schools
2. 2014	Using tablets in leisure-time centres	Group interviews and on- site observations	6 students at 1 school
3. 2012	Teachers' perception of ICT in teaching	Interviews and on- site observations	9 teachers at 3 comprehensive schools
4. 2013	One-to-one computing initiatives	Questionnaires and interviews	61 teacher questionnaires and 4 interviews at 5 upper secondary schools
5. 2014	Teachers' attitudes to using tablets in teaching	Interviews	7 teachers at 3 schools
6. 2014	Teachers' use of modern technology in teaching	Interviews	4 teachers at 4 schools
7. 2013	Pedagogues' attitudes to ICT in preschool	Interviews	6 pedagogues at 5 preschools
8. 2013	Teachers' view of ICT	Interviews	7 teachers at 7 schools
9. 2013	Preschool teachers' and child minders' attitudes to ICT in preschool	Questionnaires	15 teachers at 5 preschools
10. 2013	ICT in teaching Swedish in upper secondary schools	Interviews	5 teachers at 5 schools
11. 2014	When, where, how and why are "learning tablets" used?	Individual and group interviews	8 teachers at 3 schools
12. 2014	The use of ICT in upper secondary school	Questionnaires	200 teachers at 17 schools
13. 2014	Teachers' use of and competence in ICT	Interviews	4 teachers at 4 schools
14. 2014	Computers' impact on upper secondary school teaching	Questionnaires and interviews	80 students 39 teachers at 6 schools
15. 2013	Students' use of computers and the Internet in school	Questionnaires	40 students at 2 schools
16. 2014	Principals' thinking about strategies and the integration of digital tools in school	Interviews	7 principals at 7 schools

All degree projects were scrutinized and the result of each was categorized according to three levels affecting teaching: the individual, technology and organization levels (Figure 1). The first core level of the analysis, the individual level, is limited to teachers and students. The second, the technology level, is defined as a system using digital technology to support learning by facilitating communication and dialogue. By organization is meant the overarching rules, routines and frames surrounding the activity. The concept of learning is defined in this study as a transformation of the subject's relation to the surrounding world, with communication and dialogue playing a central role. Learning thus affects and is affected by the world around [1].
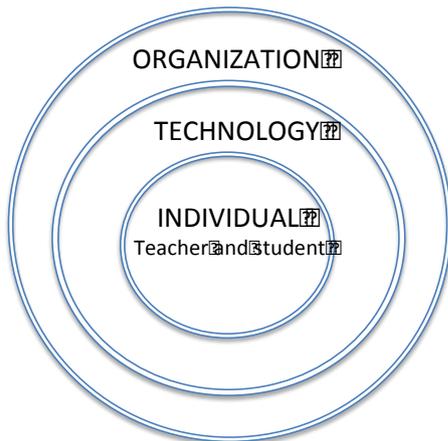
Figure 1: Three levels affecting ICT and learning

4. THEORETICAL ANALYSIS TOOLS

4.1 Implementation

Analyses of ICT initiatives in Swedish schools have been summarized by Jedeskog [2] in four arguments.

The first is the democratic argument that everybody has the right to digital technology. The second argument starts from what knowledge will be required in the society of the future. The third is to improve students' learning and the fourth concerns ICT as the power to change teaching in school. The two latter arguments relate to the last two steps in Puenteduras' [3] quadripartite reasoning around ICT, which are substitution, augmentation, modification and redefinition.

This model frequently forms the background of analyses of teachers' use of modern technology.

To introduce technology into teaching is not an entirely simple and self- evident matter. On the contrary, it is often a complicated and time-consuming process [4].

Using technology in learning situations more often involves a paradigm shift and changes in learning culture than purely technical solutions [5]. The interplay between human beings and technology is affected by the receiver's qualities and by the surrounding context [6].

There may be a number of obstacles causing people to oppose change. These obstacles may be divided into practical, psychological, power and value barriers [7].

To achieve an extensive change these barriers will have to be overcome. Practical obstacles may include matters like the economy, availability, or educational accessibility. One psychological barrier may be that teachers feel threatened in their teacher roles, being afraid that the students might know more. Valuation barriers may occur when the values accompanying the technology do not agree with those of the teacher. When a power

barrier exists, the whole situation of the teacher may feel threatened.

Target group adaptation is another important factor in using technology, including at least four different factors applicable to its usability, namely adaptation, user friendliness, user acceptance and user competence.

Adaptation implies that the technology is designed to optimally follow the structure of the task that the user tries to solve. User friendliness comprises a number of various aspects, one of which is accessibility.

Another important aspect of user friendliness is individualization. User acceptance means being positive to the programme and its functions, while user competence implies sufficient understanding and skills to interact satisfactorily with the application [8].

IT systems have been surrounded by great expectations to solve problems, facilitate and augment educational work. Unfortunately, the result has often failed to appear and the aspirations tied to the technology have not materialized. Occasionally, its use may even cause negative consequences. The major source of irritation for users of various aids concerns technical problems. In most cases, technical support is required to start and to maintain continuity in the technology applied [9]. Several factors have to cooperate to simplify ICT use, make it more reliable and more effective. It is not just a question of technology but also of human beings and organizations and their mutual relation.

4.2 Categorization of Digital Media

Digital artifacts like computers, tablets or mobile phones enable different pedagogical activities. According to Laurillard [10], their use can be divided into five different approaches, namely narrative, interactive, adaptive, communicative, and productive ones. The narrative approach is characterized by its linearity but lacks interactivity.

This means that the receiver cannot ask questions or affect the content of the media. This applies, e.g., to sound recordings and movable pictures for a passive audience. Presentations are made in a pre-set order to create a correct image of that which the sender wishes to communicate. By interactive approach is meant that receivers may freely choose the content to be presented.

The content is per se linear as in narrative media, while the receiver has the power to choose or reject what to be presented and in what order. This particularly applies to internet-based resources like digital encyclopaedias and web TV. The adaptive approach is primarily characterized by computer programs which keep changing depending on the instructions given by the user.

A clear example is a computer game where the player's command directly affects what is shown on the screen and takes place in the game. In contrast to the

interactive approach, the content is not linear but can be changed dynamically. The communicative approach requires more than one user. The communicative medium is simply used as a means to interact with another user.

The medium in itself does not affect the content but is exclusively determined by the users. Among communicative media are, e.g., e-mail, chat programs, video conferences and learning platforms. In productive approach and application, tools are used to produce other types of media. With the help of word-processing programs texts are created, and by visual programs films and pictures are presented on websites (ibid.).

4.3 Learning Approach

In the field of learning it is not uncommon for evaluations to focus on products which can be converted to measurable knowledge, instead of scrutinizing learning processes that have been effective. To reflect the result of the field-related meta-analysis employed, a division into education approaches, a.k.a. education conceptions, was made. In several countries the educational debate has been dominated throughout the 20th century by four different educational philosophies: perennialism, essentialism, progressivism and reconstructionism [11].

Perennialism means a conservative education where learning constitutes a core activity. This approach focuses on the constantly recurring questions of mankind. What is true and false, right and wrong, evil and good, beautiful and ugly? Some truths and values are permanent, and it is the responsibility of education to highlight these. The perennial educational ideal is classical humanism, emanating from the idea that man and nature remain the same over time. Teachers are supposed to stand as models for classical education and common sense [12].

Essentialism represents education which is subordinate to social progress whose core activity is learning and work. The starting point of this approach is that education should focus on academic subjects like languages, natural and social sciences. Activities are based on what constitutes essential, scientifically inherited and tested knowledge. Learning is directed towards distant goals, neglecting immediate interests. Introductory educational courses should concentrate on basic skills.

This approach focuses on teacher authority and subject expertise. Teachers communicate and students learn from hard work (ibid.).

Progressivism places the student in focus but is also subordinate to social progress. Its starting point is that education should be anchored in student interests, current and future needs. Education should be individual and socially progressive, focusing on problem solving.

Students are viewed as thinking, feeling and acting human beings in whom all personality aspects are involved. The education is marked by activity pedagogy and working via projects chosen by the students. The use of a research approach provides immediate experiences in contrast to accounts by teachers or handbooks. Education is life, not a preparation for it. The teacher's role is to stimulate and supervise students' goal-oriented activities (ibid.).

Reconstructionism focuses on dialogue/communication. The basis of this approach is that education should be future-oriented and visionary. Its preference is to build the good society. Activities are to be characterized by activity-pedagogical and boundary-crossing projects and theme studies. The role of education should be to change people's awareness and, with the support of newly formulated goals, ultimately change society. Hence, education forms an essential part of social planning. It can be regarded as a kind of social self-fulfillment preparing students for the task of building a new society. In syllabuses subjects have to be integrated into units to encourage an interdisciplinary attitude (ibid.). In the model below (Figure 2) the different approaches discussed above are summarized

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1. PERENNIALISM **Cultural heritage in focus** - What constantly recurs - Cultural heritage and education - Classical humanism based on the permanence of nature and man over time - Teachers as models.	3. PROGRESSIVISM **Students in focus** - Cooperation and social fostering, student-active working methods, themes - Problem solutions and social progress - Stimulating supervisory teachers - Activity pedagogy, cooperation individually chosen projects - Education encouraging cooperation
2. ESSENTIALISM **Subject in focus** - Communicating "essential" knowledge by subject - Teachers as knowledgeable authorities taking the initiative - Student learning – hard work - Teachers as communicators	4. RECONSTRUCTIONISM **The future in focus** - Transformation and change. - Education for critical fostering aiming at the future citizen - Future-oriented and visionary education - Activity pedagogy with boundary-crossing projects and theme studies

Figure 2: Map of education philosophies (adapted from England, 1995).

5. RESULTS

The predominant choice of method in the student degree projects is a qualitative approach. The majority of the essays, nine works in all, have chosen interviews as the method for gathering data. In two of these, questionnaires and interviews were combined, and in another two, on-site observations and interviews. In three, questionnaires alone were used as a data-gathering method. The joint analysis included 336 teachers, 60 of whom were interviewed, while 276 answered a questionnaire. A further 120 students answered a questionnaire, and six took part in interviews. Seven principals were interviewed, and a total of 79 schools were represented in the study.

The theoretical framework used in the different studies varies, but in the majority of the studies the sociocultural approach forms the starting point. The results have not been difficult to identify, as the students have provided a good structure in their essays, several of them having included summaries of the results. The results of the 16 studies display a convincing agreement with only a few deviations. The credibility of the studies has been safeguarded by supervision and examination.

5.1 What Type of Learning Approach Has the Implementation Been Directed?

In the presentation below the basic result of the 16 studies with regard to the four learning approaches has been categorized under the headings of individual, technology and organization. By way of introduction the figure below shows to which of the four conceptions each of the studies has been assigned.
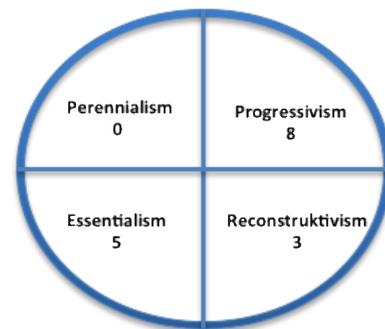
5.2 Individuals

Figure 3: The studies' individual position related to England's conceptions

During the implementation of the examination and categorization of the 16 studies, none was placed in the perennialism field. When digital technology is applied in combination with the Internet it is apparently difficult to maintain a conservatively based pedagogy built on the attitude that knowledge is unchangeable and teachers exert a strong control. A few teachers use the resources to introduce new subject areas and, occasionally, traditional, non-digital media dominate. Nor is it uncommon in such activities for computers and access to the Internet to be used as a reward to students.

Some of the studies (5 in all) contain descriptions where the teacher adopts a linear predetermined approach through digital tools. This approach may be classified as essentialism including an ample representation of the narrative medium. It also contains an overrepresentation of subjects like languages and mathematics. Here, traditional teaching materials like books, audiotapes, or newspapers can easily replace ICT-supported teaching. The essentialist approach may comprise a wealth of examples of repetitive exercises or drills. The majority of the studies (8 altogether) are anchored in the progressive

approach, in which the use of individually chosen projects and activity pedagogy dominate. A few studies (3 in all) focused on reconstructionism, emphasizing the power of change to result from the use of ICT.

The chance of reaching out from the classroom into the world, seeking an unlimited amount of knowledge, is basically perceived as a positive factor, even though in involves certain risks, according to some respondents. Comments like "We have now brought the whole world into the classroom" or "The global handbook is here to stay" exemplify the comments found among the interviews. There are plenty of teachers who describe the value of communicative possibilities offered by ICT. The supposedly most communicative services include e-mail, video conferences and learning platforms of various kinds. Practically all the respondents in the 16 studies were positive towards using ICT in teaching, viewing digital resources as an aid and not as a subject per se.

In all studies the need for in-service training is discussed as well as the lack of time for it. A great many teachers use their own spare time to update and maintain their ICT competence. In some (10) of the studies the possibility of using students as in-service instructors is mentioned, as they are considered by many teachers to possess considerable competence in the field. However, respondents in some studies (5 in all) assert that the notion of student competence is exaggerated and contains definite shortcomings when it comes to treating ICT as a learning tool. Student knowledge of information retrieval and source criticism were regarded as deficient by these teachers.

Many of the teachers interviewed describe the information stress that may be caused among both students and teachers by using ICT. Another circumstance that was highlighted, especially from the studies deriving from schools launching "one-to-one computing initiatives", was that students were given too great responsibility for their own learning. In a situation where students' ICT competence is low, they remain stuck in learning of a kind that may be defined as surface learning.

This means that students prioritize quick and relatively unelected solutions. The teachers are of the opinion that students need education to cope with the demands made on information retrieval and source criticism. In the current situation they are left to their own devices, which increases the risk that the knowledge they acquire is of a fragmented nature and lacks depth.

Although in the final results of several studies the advantages of using ICT for projects and individual work are held forth, respondents claim that this requires good digital competence in both teachers and students.

Teaching can contribute to developing students' interest in technology and their ability to undertake technological challenges innovatively. However, extensive competence is required to utilize digital resources effectively [10].

It frequently happens that teachers describe that ICT initiatives have led to more motivated students, albeit with some reservation. For students who have no computers at home, the motivation often increases, whereas for those who have a home computer the reverse may be the case if they are provided with a computer that does not correspond to the one they are used to working with. What is especially noticeable is that motivation increases when using games. The increasing interest in technology together with the competitive nature of games may trigger students to apply greater energy to learning.

An adaptive approach like this emerges from most of the studies presented in the 12 degree projects. Similar results have been presented by other researchers [13; 14; 15].

As previously mentioned, an overwhelming majority of the respondents pinpoint areas that are positive for ICT usage. If correctly used, language and communication abilities will develop, according to a number of respondents who also maintain that the use of ICT encourages subject integration and promotes reflection and analytic thinking. Several teachers are of the opinion that ICT has opened up possibilities for children with special needs. There is a broad arsenal of digital resources facilitating, for instance, reading ability and spelling correctness. Speech syntheses, word-processing and visual programs are examples of what is referred to in school contexts as compensatory aids.

Descriptions can be found of the writing functions of the computer being employed for learning to read according to the motto "writing into reading" [16].

In studies concerning the preschool use of ICT, digital activities like film and stills predominate. In preschools, digital resources are mainly used to document activities, mostly with the help of tablets. As there are, however, a number of preschool teachers who think that introducing tablets into preschools too much resembles the way they are used in the children's homes, they restrict the use of them in preschools. According to these studies, tablets are becoming more of an administrative tool for the staff. There is also an attitude of setting a higher value on what is produced without digital aids than on that which is produced with their support. There are few preschool examples of staff using ICT as a productive medium for creating their own learning material. Some preschool teachers even warn about the ergonomic risks entailed by ICT usage.

As the result shows that computers and the Internet are frequently used in school, many respondents agree with Barrow, Markman & Rouse [17] that this promotes students' competence in and motivation for school work. Nevertheless, digital resources have not yet replaced traditional teaching aids but tend to be viewed as a complement to the latter. In some studies teachers

complain that students are too inefficient in their search for information and keep using the Internet for tasks that are not linked to school work. The same respondents argue that students would become more efficient in their school work if the Internet were blocked for private surfing. There are also a few (5) studies in which teachers express the positive side of interactive contacts between teachers and students after school hours. This ranges from simple questions to unsatisfactory conditions in class that students wish to take up.

5.3 Technology

Most of the studies (9 altogether) contain information about technical problems. As maintenance is deficient in many schools, insufficient technical support causes stress among teachers and students. Three studies highlight the problem of poor Internet connection, which leads to irritation and delay, making teachers nervous and embarrassed. In many schools the availability of computers is an important success factor to achieve continuity in digital activities. This is a problem that does not affect schools that have implemented the "one-to-one computing initiative". Most studies (8 in all) mention the lack of technical and ICT-pedagogical support.

There occur a number of objections to depicting the advantages of the technology in flattering and exaggerated terms. One respondent makes the following statement: "Is there really any difference between a digital and a wooden chess game?" Quite a few respondents emphasize that digital resources must be accessible and easy to use. Although teachers view the new Web 2.0 technology positively, they partly object to using the new technology in teaching as it also leads to distraction for a large number of students.

5.4 Organization

A major problem emerging from nearly all studies is the lack of a pedagogical vision and a thoroughly planned strategy for using ICT in schools.

Quite often the technology is introduced without any clear goals of how to use it in teaching. The study results show that schools with clear goals and a well-founded IT strategy are more motivated to proceed further with ICT work. In many schools principals focus on other issues, and one-sided initiatives in other areas of competence add to its bad success. Penuel's [18] studies demonstrate that competence development must take place continuously to achieve a successful integration of ICT. In order to really benefit from the availability of computers, pedagogues need in-service training that inspires and motivates them to incorporate the computer and turn digital resources into a natural teaching ingredient. All the degree projects emphasize the need for in-service training, as supported by other studies [19].

The principals interviewed maintain the necessity of a national IT strategy. Today the differences between schools are too great and their equivalence has been lost. A standard for implementing digital initiatives in Sweden is called for.

5.5 What Can Facilitate or Prevent the Implementation of ICT?

The studies contained a few examples showing initially negative attitudes to ICT among school staff.

However, after some time the advantages of investing in digital resources have been realized. The kepticism and fear that used to be found among teachers are not apparent in the 16 projects included in the study.

On the contrary, teachers are anticipating the great opportunities that will arise for developing their own competence. The majority of them view ICT as a tool and not as a learning object. In some studies the possibility is discussed of making ICT into a separate subject in order to increase students' knowledge of ICT. There are many who insist on the necessity of patience and support for technology and pedagogy for both teachers and students.

Several respondents argue that is not possible just to introduce the technology and then leave teachers to take care of themselves. School leaders are the key persons in implementing ICT. If principals are uninterested in or totally ignorant of the field, there will be few chances for schools to go in for digital learning materials. In a study from Chile, Brun and Hinostroza [20] interviewed teachers to find out about their use of ICT and the training they received. It turned out that the majority of the interviewed teachers used ICT as often as possible, but that the problem lay in the extremely limited economy of many schools, which prevented them from purchasing more than one or two computers. It is beyond doubt that even in Sweden economic factors will play a crucial role for the success of ICT integration.

6. DISCUSSION

The discussion of the results from the 16 degree projects, including empirics from 79 schools, shows that teachers hold fairly similar views about ICT. As regards student attitudes, the picture is more diverse. What emerges without any doubt is that schools have to commit themselves to training aiming at both teachers and students. It is also a matter of organizing sustainable technical and pedagogical support. This may possibly be coordinated between schools to gain economic advantage.

Schools must have a clear pedagogical vision for their work on this, and strategies must be expressed in joint planning for ICT. Clear demands and continuous follow-up from the management are required. In this respect, school management and principals in particular play an important part to promote and take responsibility for strategic decisions. As this study leaves no room for doubt about the similarity of the problems from one school to another, a suitable decision can be for schools to take a joint initiative in this matter.

To heighten the value of degree projects performed by students, teacher education should facilitate and organize cooperation among them around joint issues, studies and research presentations. This can be planned and presented at joint study days or meetings of principals.

A further idea may be to make future students perform more action- and development-oriented studies where the measures suggested from field-limited met studies are implemented. As many teachers are calling for increasing students' knowledge, it is probably a good idea to reinforce their education in order to, for instance, communicate knowledge of how to search information that is valid and secure. This may provide excellent tasks for teacher-students to perform during their practice.

The use of ICT in teaching looks like contributing to more active and motivated students. One reason for this may be that teachers are adopting a student-centered and individually adapted attitude. Another reason may be that the technology is releasing more time for individual teacher support.

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