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- a description of conditioning

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Information Technology in the Process of Key Competence Development – a Description of Conditioning

Abstract

In an age of globalisation, knowledge-based economic development and information and telecommunications revolution, the concept of education focused on lifelong development of key competences is growing in significance in the education systems of European states. This article presents the results of a diagnostic survey with the aim of providing a description of conditioning in the process of key competence development with the application of information technology.

Introduction

None of us is in any doubt that changes are occurring with great rapidity on every plane of human existence. It may well seem that time passed once with less haste than it does in the contemporary world, which has come to be dominated by highly valuable ‘information’. Put colloquially, ‘life is moving on’ and we are, according to Montesquieu, attempting to adjust to it, “for it will not adjust to us” (A. Łaski, 1993, p. 11). The need for change and the expectations of European Union citizens with regard to social processes has led the European Parliament and Council to create ‘frameworks of reference’ for key competences in lifelong learning. In this document the following key competences are mentioned:

- Communication in the mother tongue,
- Mathematical competence and basic competences in science and technology,
- Digital competence,
- Learning to learn,

- Social and civic competences,
- Sense of initiative and entrepreneurship,
- Cultural awareness and expression,
- Communication in foreign languages.

Aim of the educational research

The research commenced at the end of May and beginning of June 2006 in Poland in the city of Katowice. The primary aim of the diagnostic survey was a description of conditioning in the process of key competence development with the application of information technology. The detailed aims of the research were:

- a) description of conditions in computer science teaching at primary schools,
- b) collection of primary school teachers' views on the subject of key competence development and evaluation,
- c) examination of the knowledge of computer software possessed by teachers at selected primary schools and application of the same,
- d) determination of the forms and methods for key competence development applied by teachers in their lessons,
- e) determination of methods in key competence evaluation,
- f) description of the configuration of computers and accompanying software used in key competence development.

In order to obtain information on conditioning in connection with key competence development, a survey was conducted among 77 teachers, of which 39% were primary school head teachers, 29% teachers of computer science and 32% remaining teachers.

The work experience of the teachers surveyed amounted to 11 years on average. The longest-serving teacher had been professionally active for 26 years, and the shortest career length was one year.

Before analysing the teachers' statements, it is worth adding that these were accompanied by similar statements provided by 87 fifth graders, i.e. pupils aged 11–12.

Analysis of diagnostic survey results

In developing the entire range of key competences it is impossible to overlook the computer, an indispensable medium in the development of 'the ability to utilise

information technology effectively'. What then is the computer? What role does it play in the work of a teacher?

For 42% of the respondents the computer is a universal teaching medium, which is to say that the device has a broad application in the teaching process, and is utilised:

- in formation of knowledge by pupils,
- in key competence development in every subject, both in the course of the lesson and during extracurricular activities,
- during the introduction, consolidation or evaluation of knowledge gained and competences being developed,
- by parties for communication (teacher-pupil, pupil-pupil and teacher-teacher),
- in rehabilitation, as well as in equalising the levels of educational achievement by pupils,
- in 'live' (i.e. performed in the course of a lesson) monitoring of educational achievement by pupils,
- in measurement of learning progress,
- in provision of updates to persons with an interest in the course of the teaching process, e.g. pupils' parents and school authorities.

Among the teachers surveyed, 28% consider the computer as 'a basic tool in the work of a teacher'. This is not a large number and it results from the fact that few of them have an opportunity to utilise this device in the course of the classes they take. However, the work of a teacher does not consist solely in the conduct of lessons. The computer is also utilised by teachers as a basic tool outside the classroom. Preparation of lesson plans, creation of both records of material covered and tests of educational achievement, and evaluation of projects saved in an electronic form are but selected examples of the activities performed by a teacher with the use of a computer.

Among the respondents, 26% claim that the computer is 'a useful medium, but not indispensable in the teaching process', 3% regard it as 'a medium to which an excessive number of virtues are ascribed', while 1% of the respondents were of the opinion that the computer should not replace other teaching media. The above responses were given by the teachers who rarely make use of a computer in their work and claim that to do so is unnecessary, and that this is not a device indispensable to the contemporary school. Many teachers apply methods which are 'tried and tested' in the belief that these methods are not in the least responsible for their pupils' low achievement. It would be advisable, therefore, to bring to the attention of those teachers out of touch with reality that the use of information

technology as the most effective medium is the result of the continuing process of development in contemporary teaching, both general and specific.

Analysing the responses of the head teachers and teachers (Table 1), it may be observed that the teachers consider the computer as a basic tool more often than the head teachers. As regards the response that it is a useful medium, but not indispensable, the head teachers, have in most cases also a different, less positive attitude to the computer than the teachers, with the teachers more prone to acknowledge the computer as an indispensable medium in the educational process than their superiors. The head teachers, therefore, despite the fact that they each make use of a computer in their work, are less open to the use of information technology in schools in comparison to their staff. The attitude of the teachers to the computer is, however, undergoing constant change. The new possibilities for the medium continually being discovered are raising awareness among teachers of the competences in terms of information technology that they ought to possess. These are expressed as:

- knowledge of a foreign language (or languages),
- knowledge of the principles for the use of the computer, video and other technological media (e.g. a database or a computer network, this including the Internet, as well as Internet services such as email),
- the ability to use modern technologies to support the processes of teaching and learning,
- the ability to create educational programs and make them available online (E. Perzycka, J. Nowotniak, 2001).

The abilities outlined above are simply goals which teachers aspire to achieve. Today it is insufficient to possess a store of knowledge on a single subject, the response to which is the dual specialisation model in teacher development. A teacher ought to be able to draw upon stores of knowledge from around the world and necessary for this are abilities linked with expertise in information technology and foreign languages.

The key competences at the basis of the primary school curriculum are developed by teachers with varying frequency. In response to the question 'Which key competences do you develop most often during your lessons? The order from 1 to 8, from the most often to the least often', the head teachers and teachers ordered the competences by the weight they attach to their development in the context of the subject taught, with this proving a difficult task.

The results show that the most frequently developed competence is 'the ability to seek, organise and utilise information from various sources', the least often developed 'the ability to use information technology effectively'. The results also

Table 1. The role of the computer in education – responses of head teachers and teachers.

Response	Head teachers	Teachers
A basic tool in the work of a teacher	14%	34%
A versatile teaching medium	45%	41%
A useful medium, but not indispensable for the teaching process	38%	21%
A medium to which an excessive number of virtues are ascribed	–	4%
Others	–	1%

show a clear division in the competences being developed. Those most often developed during lessons are ‘the ability to seek, organise and utilise information from various sources’, ‘the ability to communicate effectively in various situations and to present both oneself and the results of teamwork in a wider arena’, ‘the ability to plan, organise and evaluate individual learning and to learn independently’ and ‘the ability to relate knowledge acquired to practise and to create both necessary experiences and habits for the development of essential abilities’. The competences more rarely developed are ‘the ability to develop personal interests’ and ‘the ability to assimilate methods and techniques for the negotiated resolution of conflicts and social problems’, with the most rarely developed of all being ‘the ability to utilise information technology effectively’.

Analysing the pupils’ responses concerning key competences mastered best and juxtaposing them with the teachers’ responses concerning the most frequently developed ones, it transpires that the most rarely developed competence, ‘the ability to utilise information technology effectively’, is in fact that mastered best by pupils. The divergence in this regard is shown in Table 2.

A conclusion may be drawn that the frequency with which a key competence is developed during lessons does not always go hand in hand with the level of mastery. There is a complete lack of dependence as regards the same ability, that for use of information technology, with the divergence in responses here greatest, at seven points. Although it would seem that a competence rarely developed ought to be poorly mastered, the results of the survey contradict this statement. It appears that this competence is developed additionally outside school, e.g. at home or in after-school clubs. This is unsurprising that pupils surf the Internet for a minimum of 20 hours per week, while the amount of time spent on this activity by children who do so excessively is 32.3 hours per week. This number is comparable to the number of hours which a child spends at school. Furthermore, pupils experience

Table 2. Most frequently developed and best mastered key competences – responses of teachers and pupils

Key competence	Most frequently developed by teachers	Best mastered by pupils
The ability to seek, organise and utilise information from various sources	1st place	2nd place
The ability to communicate effectively in various situations and present both oneself and the results of teamwork in a wider arena	2nd place	6th place
The ability to plan, organise and evaluate individual learning and to learn independently	3rd place	6th place
The ability to relate knowledge acquired to practise and to create both necessary experiences and habits for the development of essential skills	4th place	5th place
The ability to interact and collaborate effectively in a team	5th place	3rd place
The ability to develop personal interests	6th place	3rd place
The ability to assimilate methods and techniques for the negotiated resolution of conflicts and social problems	7th place	8th place
The ability to use information technology effectively	8th place	1st place

no difficulty in communication in the course of a week as communication also takes place online (J.P. Gałkowski, 2003, p.37).

It is worth remembering, however, that ‘the ability to utilise information technology effectively’ does not refer solely to the use of computer games, although the editorial section of the *Secret Serwis* magazine points out that it is for precisely this purpose that 70% of its readers use the computer. Parents concerned about the intellectual development of their child, schooling and peer group function ‘move with the times’ in purchasing a computer and various games, this not infrequently filling the role of a first computer class (B. Kubiak, 2006, p. 53). Are these activities producing the effect anticipated? The fact that a child spends a great deal of time in front of a computer does not of course mean that he or she is able to make use of its basic functions. Indeed, it transpires that children make use of these to a limited extent, ending with the running of a computer game.

The second divergence in terms of size seen in the responses is also worth mentioning, this concerning ‘the ability to communicate effectively in various situations and to present both oneself and the results of teamwork in a wider arena.’ Here, however, it would appear that the teachers are rather ineffective in developing

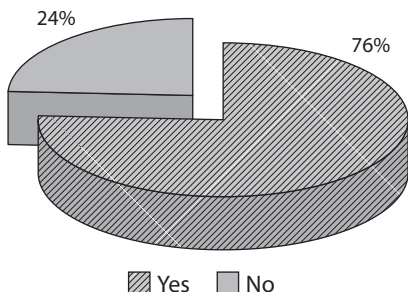
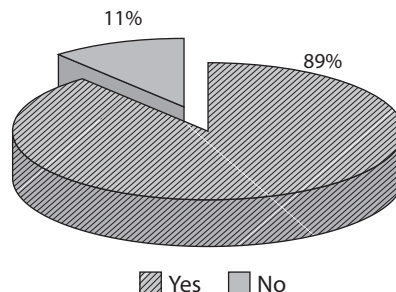
the given competence. The four-point divergence in the responses indicates that although the teachers often develop this competence (it takes second place in the classification), this is to little effect, in that pupils judge their level of mastery to be worthy only of the sixth place. Therefore, intentional educational activity on the part of the teachers does not always have an influence on their pupils' achievements.

It is necessary to pose the question of whether teachers evaluate the key competences. The results of the survey show that 98% of the teachers claim that they do evaluate their pupils' key competences, yet 2% of the teachers 'admit' that they do not. Among those surveyed, the most frequently evaluated competences were 'the ability to seek, organise and utilise information from various sources' (29%) and 'the ability to interact and collaborate effectively in a team' (29%). The competence most rarely subject to evaluation is 'the ability to utilise information technology effectively' (17%), which, as mentioned above, is also that most rarely developed by the teachers. In order to evaluate the key competences, 44% of the teachers evaluate the products of pupil activity, with this including 12% evaluating pupil presentations. A total of 18% of the respondents conduct written tests or assess spoken responses for the purpose of key competence evaluation, while in 27% of cases evaluation is performed on the basis of observation, including 16% where observation concerns group work, with 9% of the teachers evaluating with the use of the project method.

Of the teachers surveyed, 76% consider their pupils to be aware of the key competences being developed, with 24% claiming that their pupils lack this awareness. There is no doubt that awareness in the educational process is linked to collaboration with teachers in which pupils engage in the development of their competences. In the opinion of 89% of the teachers, pupils collaborate with teachers in developing key competences, while in the opinion of 11% this collaboration is absent.

Comparing the data concerning the pupils' awareness and collaboration, a slight difference may be noted between the results for the pupils collaborating with the teachers and the pupils aware of the key competences being developed. It may be concluded from this difference that there is a group of pupils unaware of their collaboration with teachers in the development process. This situation occurs in 13% of cases. It is not known, however, what outcomes arise from this type of competence development.

Key competences developed are utilised by pupils in situations arising both in and out of school, and through improvement pupils achieve their goal. The majority of the teachers surveyed (65%) stated that thanks to key competence development pupils are more active and involved in class work. The least frequent responses concerned pupil awareness of educational activities (19%) and pupil

Figure 1. Pupil awareness of key competence development**Figure 2.** Pupil collaboration with the teacher in key competence development

criticism in relation to information obtained (20%). Next most common were 'more rapid acquisition of information' (61%), followed by 'more rapid and fuller understanding of information' (41%), 'lack of anxiety as to the presentation of information obtained' (39%), 'curiosity in seeking information' (37%), 'utilisation of competences during lessons in other subjects' (33%) and 'increased organisation and efficiency in performance of tasks' (30%).

A high level of activity, involvement in class work and more rapid acquisition of information are behaviours with a significant influence on the educational achievement of pupils. The computer is a device supporting the creation of situations such as these. As A. Barańska claims, "work with the aid of a computer demands from the learner adherence to rules for the collection, processing and presentation of information, which leads to an increase in logical thinking, precise expression of thought and formulation of problems. The acquisition of these competences contributes to an increase in the effectiveness of self-education, essential for correct functioning in rapidly changing reality. The task of school is not only to equip pupils with certain stores of knowledge, but also to form in them the ability to seek information independently, to adapt to the conditions of a changing world" (A. Barańska, 2003, p. 5).

There exists then a relationship between a high level of key competence development and pupil achievement. This is maintained by 89% of the teachers surveyed (Figure 3) as well as by 89% of the pupils. Also by S. Juszczak (S. Juszczak, J. Janczyk, D. Morańska, M. Musioł, 2003, p.40), who believes that thanks to these competences the learning process may become more effective, and that the independence of the learner, along with his or her creativity, increases.

What forms and methods of teaching are preferred by teachers developing key competences? This open question was posed in the questionnaire, with the responses most often concerning independent pursuit of knowledge (51% of all statements), methods for assimilation of knowledge and practical methods (22% of all statements) and valorising methods (4% of all statements) (Figure 4). Teachers favour the development of the competences either individually or in groups.

In their work in applying the teaching methods outlined, 96% of the teachers make use of the computer. The function most often performed by the teachers with the aid of the computer is online search, with this response provided by 52% of those surveyed, followed by the ‘use of educational programs’ (44%), ‘performance of tests of knowledge and ability’ (28%), ‘creation of multimedia presentations by pupils’ (26%) and ‘use of a VCR to show films and educational presentations’ (22%). The results presented confirm the fact that the Internet is currently one of the most significant factors bringing change in various areas of contemporary life, including education, where the use of this global network is gaining ever greater significance. This gain is possible owing to the development of technology for distance learning as well as the widespread use of computers and Internet technology in education and professional life. It is thanks to these technologies that it has become efficient to acquire, amass and process data and to make information available, and that the exchange of information between various participants in the educational process has attained such speed. Utilisation of the Internet and its resources and services in the teaching process may vary.

Figure 3. The existence of a relationship between a high level of key competence development and educational achievement – responses of teachers

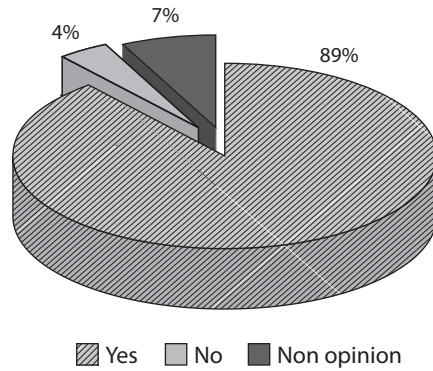
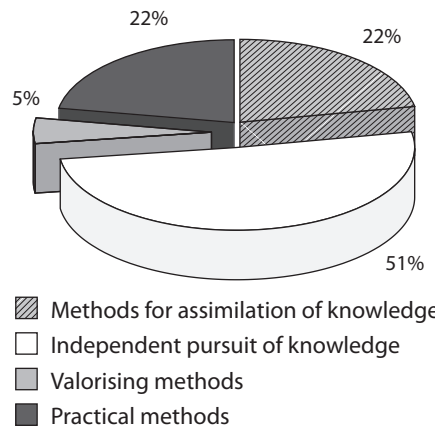


Figure 4. Methods utilised in key competence development



According to the educational need or the level of technological infrastructure available this utilisation may entail:

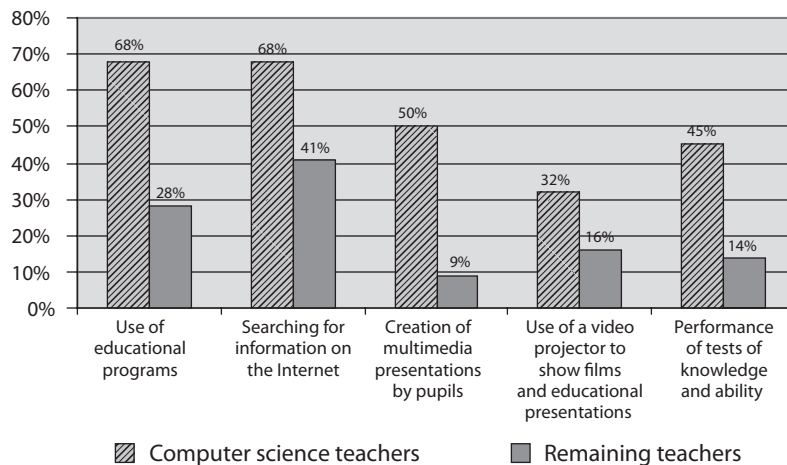
- delivery of basic information on the course and its progress to date,
- facilitation of communication with the individual leading group or other members,
- access to various sources of knowledge,
- publication of teaching materials online,
- location of an entire course on the Internet, together with the necessary exercises and tests (J. Pieronek, 2006, p. 278).

Analysing the statements made by the teachers of computer science and those made by the remaining teachers, a substantial divergence may be noted, presented in Figure 5. A decidedly greater number of the computer science teachers than that of the remaining teachers make use of the possibilities of the computer, which seems self-evident and a result of the specificity of the teaching of computer science, which consists in activities performed at a computer workstation. The largest difference between the statements (41 percentage points) appears for the response 'creation of multimedia presentations by pupils', this taking second place among the computer science teachers and final place among the remaining teachers. A further difference of 40 percentage points may be observed for the response 'use of educational programs'.

This results from the teachers' poor preparedness for the use of information technology or lack of opportunity for computer use in the course of a lesson. It should be recalled here that in only 24% of the primary schools surveyed were there computers in classrooms, with 29% of the teachers using a computer in their work.

The research conducted in the Netherlands and the USA confirms the above conclusions. The statements were made by the primary school pupils concerning activities for which a computer is used. The largest number of the pupils (63%) use a computer at school to browse the Internet, while 57% use it to read and write emails, 56% to gather information and 53% to learn vocabulary, mathematics or topography. The lowest number (11%) 'chat', while 12% use a computer to prepare presentations (Volman, E. van Eck, I. Heemskerk, E. Kuiper, 2005, p.8). Although these observations present the teacher activities at Dutch and American schools, they are in fact consistent with the observations obtained in the experiment described in this paper. We learn from the results of the research quoted that at the investigated Dutch and American schools the teachers emphasise first of all information search, followed by the use of educational programs (for vocabulary, mathematics and topography), use of email and finally use of a computer to present

Figure 5. Activities performed with the aid of a computer during lesson time – division by teachers of computer science and remaining teachers.



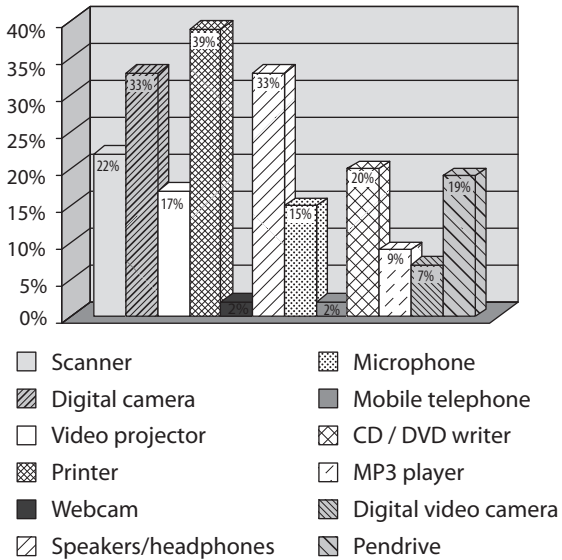
a personal point of view. The results of both surveys are thus comparable, with the reservation that the research quoted was conducted in 2003.

The software mentioned by the teachers surveyed includes functional programs, compilers, programs for teaching and operating systems.

The most frequently mentioned functional programs are *OpenOffice*, *MS Word*, *MS Excel*, *MS PowerPoint*, *CorelDRAW*, *PhotoShop* and *Gimp*. In the teaching program category are *Encounter with a Computer (Spotkanie z komputerem)*, *Adventure with a Computer (Przygoda z komputerem)*, *Computer Science 2000 (Informatyka 2000)*, *Computer Tales (Komputerowe opowieści)*, *Computer Magic (Komputerowa magia)*, *Mathematics 4–6 (Matematyka 4–6)*, *Dictation (Dyktando)* and *World History (Historia świata)*. The third category is that of operating systems, formed of *MS Windows*, *Linux* and *DOS*. In the final category are programs mentioned only by the teachers of computer science, the compilers *TurboPascal* and *Delphi*.

The programs mentioned by the respondents serve in the achievement of development goals at primary schools. It is advisable, nonetheless, to be aware that these programs are matched to the needs and conditions of schooling. The quality of the multimedia programs for children currently available on the market raises concerns. Pondering the reasons for this state of affairs, K. Chmielewska paid attention to the fact that electronic materials are frequently prepared by specialists in computer science, distant from the reality prevailing at schools and with little knowledge of child cognitive psychology (I. Nowakowska-Buryła, 2007, p. 221).

Figure 6. IT devices utilised in key competence development.



With functional programs utilised widely in everyday life, primary schooling prepares pupils for their effective future use, and in the course of the teaching process, beyond specific subject knowledge, competences essential for proper functioning in society are being developed. The development of pupils' ability to use functional programs necessary for the performance of a given task (A. Ogonowska, 2006, p.147) means that information technology education becomes an education correlating knowledge and abilities in individual subjects.

Software would not fulfil its role were it not used in combination with information technology devices. Word processing software, for instance, used in the editing of a document, works in conjunction with a printer to provide a given document in a physical form. This utilisation of a number of different devices alongside other equipment enhances lessons and assists in key competence development. The extent to which information technology devices are utilised by teachers is presented in Figure 6.

The device most frequently utilised in key competence development is the printer, by 39% of the respondents. This is followed by the digital camera (33%), speakers and headphones (33%), the scanner (22%), CD or DVD writer (20%), pendrive (19%), VCR (17%), microphone (15%), MP3 player (9%), digital video camera (7%) and mobile telephone and webcam (2% each). It is once again worth

recalling that the research results presented here are a consequence of poorly equipped computer rooms and the poor preparedness of teachers as regards the use of these devices.

Conclusions

Summarising the research results presented here, it should be mentioned that the process of pupil development depends to a large extent on the teacher's competence. It is precisely these teacher abilities which, in the development process, exert a direct influence on:

- application of methods and forms of teaching,
- conditions under which a lesson is conducted,
- media and teaching materials used to achieve goals,
- attitudes of pupils and teachers.

The question here arises of whether teachers are fully able to develop the required competences in themselves. In the case of the teaching profession, the premise of full preparedness for the role and possession of complete professional qualifications remains in conflict with the essential work of the teacher. On account of the specificity of teaching, its non-standard and communicative nature, the competences necessary for the work are continuously changing and demand that revision be performed. It is possible to influence things, objects exhibiting standard behaviour, yet when dealing with the individuals who are the subject of development, it is difficult to speak of rules for conduct. Pupils themselves form a unique, unconventional, non-standard and individualised whole. It is difficult to predict the questions, problems and tasks with which pupils will present a teacher for resolution (E. Perzycka, J. Nowotniak, 2001). Nonetheless, it is advisable to make teachers aware that the development of competences in young people depends on the competence level of teachers themselves (K. Szorc, 2005, p. 363). To conclude this discourse, there are several elements deserving isolation for exerting influence on key competence development and raising the level of pupil achievement. Among these elements may be counted teacher attitude, pupil attitude, forms of group activity, methods for independent pursuit of knowledge, instruments for key skill evaluation and conditions under which key competence development occurs. Central to enabling a high level of achievement in schooling, with parallel growth in key competence development during computer science lessons, is the activity of pupils in the course of the process.

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