RESEARCH REPORT
AND HANDBOOK FOR QUALITY TEACHING

IMPROVING EDUCATIONAL EFFECTIVENESS OF PRIMARY SCHOOLS (IEEPS)

Research report on the schools' educational effectiveness and handbook for improvement of teaching practices

IEEPS
Improving educational effectiveness of primary schools

Lifelong
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RESEARCH REPORT AND HANDBOOK FOR QUALITY TEACHING

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2017

RESEARCH REPORT AND HANDBOOK FOR QUALITY TEACHING

"IMPROVING EDUCATIONAL EFFECTIVENESSOF PRIMARY SCHOOLS" (IEEPS)

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This publication presents the two outcomes of the Comenius project ''Improving educational effectiveness in primary schools'' (IEEPS): (1) the research report and (2) the handbook for quality teaching.

The Comenius project is being realized within the European Lifelong Learning Programme (LLP), subprogramme Comenius – Comenius Multilateral Projects. The Education, Audiovisual and Culture Executive Agency (EACEA) has registered the project as 538992-LLP-1-2013-1-RS-COMENIUS-CMP. It is implemented from December 1st, 2013 to May 30th, 2017. It is the first Comenius project coordinated by an institution from Serbia. The project is realized by the Faculty of Education (University of Kragujevac, Jagodina, Serbia), the Institute for Educational Research (Belgrade, Serbia), KU Leuven University (Leuven, Belgium), University of Cyprus (Nicosia, Cyprus), National Examinations Centre (Ljubljana, Slovenia), primary School "Jelena Ćetković"(Belgrade, Serbia) and C' Makedonitissa's Primary School (Nicosia, Cyprus). Additional information about the project ''Improving educational effectiveness in primary schools'' is available at http://ieeps.edu.rs/.

As a way of improving educational effectiveness in primary schools, the project includes publication of the materials resulting from the main project activities. The materials are distributed to schools and offered to professional and wider public as a starting point for deliberating and better understanding, development and improvementof the teaching practice. The research report contains the most important results of the data analysis that included a great number of schools, and as such it represents a significant source of explanation for the impact that different factors have on educational outcomes. This report is significant consideringthat there have not been any comprehensive studies of educational effectiveness of primary schools in Serbia. The second part of this publication contains handbook materials created for the purpose of teaching improvement, that is, the improvement of the aspects of teaching that many researches recognize as key factors for the stimulation of pupil achievement. This handbook is valuable because it is founded on a theoretical model of educational effectiveness, but it is also verified in practice. Namely, the presented materials rely on the experiences of three accredited three-day long professional development training programs *Quality teaching 1, 2 and 3*.

We believe that the real value of this publication will present itself in the extent of its usage in schools, that is, in teaching. In other words, although the listed data and working guidelines can be seen as a starting point for theoretical discussion about the most important pedagogical and didactical problems, the authors' basic idea is for the publication to become one of the pillars for the school employees – mainly the teachers and school counselors. The creation of this report included Dr. Jelena Teodorović, Dr. Vladeta Milin, Dr. Bojana Bodroža, Dr. Ivana Đerić, Dr. Milja Vujačić, MA Ivana Jakšić, MA Dejan Stanković, Dr. Vesna Petrović, Dr. Irena GolubovićIlić, Dr. Aleksandra Mihajlović, Dr. Nenad Stevanović, MA Bojana Dimitrijević and Dr. Dušan Ristanović, and cooperatives from partner institutions engaged in the project, first of all Dr. Leonidas Kyriakides, Dr. Charalambos Charalambous, Dr. Jan Van Damme, Dr. Beatrijs de Freine and Dr. Gašper Cankar.

CONTENTS

INTRODUCTION

Pupils` progress in achieving higher levels of knowledge and education is one of the strategic aims of *Europe 2020* and *ET 2020*. There is a whole set of preconditions for the realization of this important aim. As a particularly important presumption, schools need to be informed about some basic questions such as: (a) how school contributes pupil achievements – aside from other factors that influence this achievement (e.g. the socioeconomic status of a pupil`s family), (b) what educational and organizational practices (e.g. exercising tasks in class) are effective, and which are ineffective in raising pupil achievement levels and (c) how schools can additionally improve their most effective practices, that is, the teaching quality.

Taking these, but also other key problems, into consideration, the project "Improving educational effectiveness of primary schools" sets four basic aims:

(1) Determining how school and teaching influence the pupil achievements in mathematics and sciences, considering the diversity of pupil population regarding individual pupil characteristics;

(2) Delivering individual feedbacks to schools about pupils achievements and schools value added;

(3) Creating a report about factors of quality teaching, designed to help teachers improve their teaching, based on the findings of this study;

(4) Designing and implementing of professional development training programs for teachers based on the results of this research and the recommendations for the development of quality teaching.

The first step in realization of these aims was conducting the research in which your school participated. In order to determine how school and teaching affect achievement independent from different pupil characteristics, the data about various school organizational and teaching factors and a wide set of individual pupil characteristics were collected. The schools` organizational data were provided by teachers, while the teaching data were provided by pupils. The data about individual pupil characteristics were provided by both pupils and their parents. The results from practice exam and final exam the pupils took in 2015 were used as a measure of the actual pupil achievement. The results of the TIMSS study in which these pupils participated in 2011 were used as a measure of prior achievement, which is an important factor of the actual achievement. The analysis of this abundant data enabled us to realize the first aim of the project – identifying factors that influence the achievement of primary school pupils in Serbia.

The findings of these analyses indicate to what extent the differences between pupil achievements can be assigned to individual pupil characteristics, and to what extent they are caused by the differences between schools the pupils are attending. On the basis of these data, for each school from the sample a unique report was designed, which shows whether pupils achieve higher or lower levels of achievement in particular subjects from what would be expected on the basis of their individual characteristics. This realizes the second aim of the project.

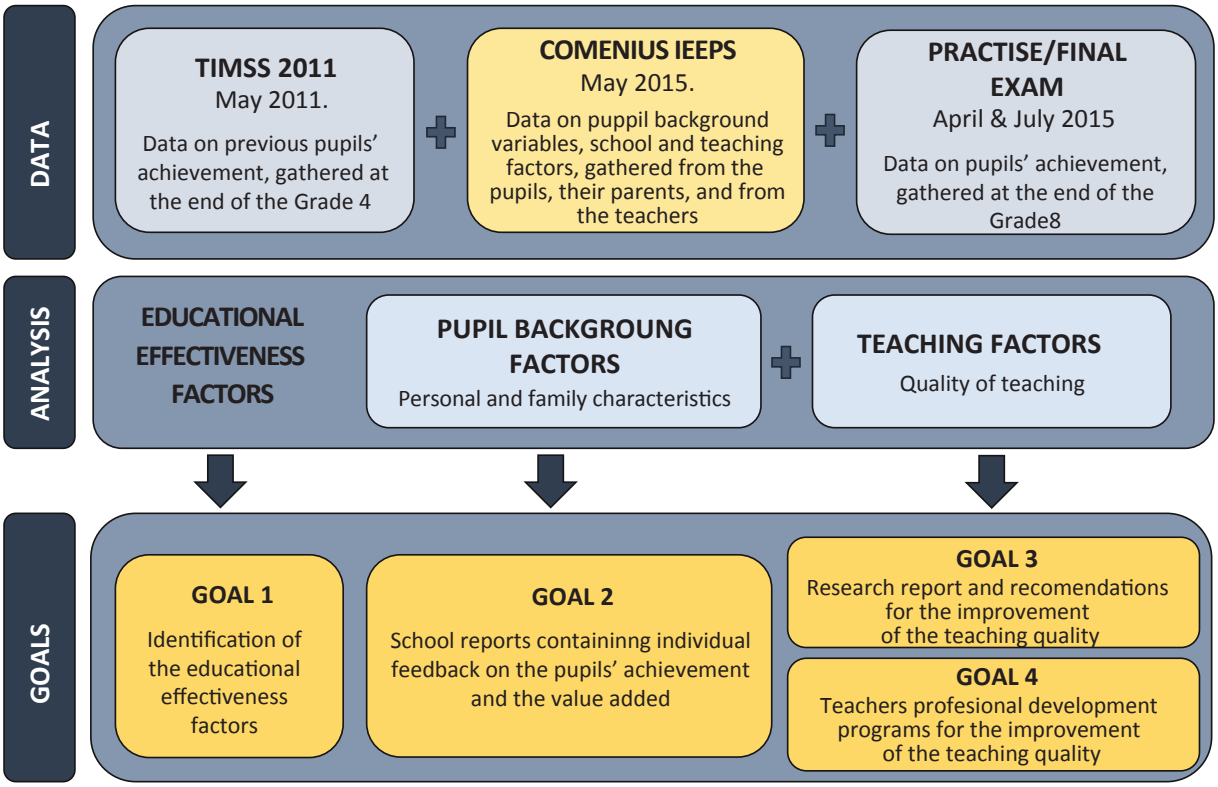
One of the outcomes of this project is the publication you are reading, which describes the findings about the most effective teaching practices in Serbia and offers recommendations for the improvement of teaching. This publication is printed and distributed to schools that participated in the research, but is also intended for other Serbian schools and it can be downloaded in digital format. This realizes the third aim of the project.

The fourth aim of the project was also realized being that during the 2015/2016 school year a nine-day long cycle of training programs for professional development were held based on the findings of the project. A total of 236 teachers, school counselors and principals from 36 schools in Serbia were trained in order to improve the most effective educational school practices. The three-day long seminars were accredited by the Institute for the improvement of education for 2016/2017 and

2017/2018 school years: Quality teaching I – Social aspects of successful teaching (catalogue number 397), Quality teaching II – Organizational aspects of successful teaching (catalogue number 398) and Quality teaching III – Cognitive aspects of successful teaching (catalogue number 399).

The basic concept and main steps in the Comenius IEEPS study can be graphically presented as follows (Figure 1).

Figure 1. Data sources, conducted analyses and aims of the Comenius IEEPS Study



PART I RESEARCH REPORT ON THE SCHOOLS' EDUCATIONAL EFFECTIVENESS

1. Methodology

1.1. The sample

This study was conducted on a nationally representative sample consisting of 125 primary schools in Serbia which also participated in the TIMSS 2011 international testing1. In 115 schools, two eighth-grade classes were included, while in 10 schools one class per school was included in the study. Most of the pupils with TIMSS results from those schools were included in the study, but it also included additional classes, in order to achieve better representativeness of data for each school individually. The whole sample consisted of 5476 pupils from 240 classes2, with 3329 pupils (60.8%) who also participated in the TIMSS 2011 study, and 2147 (39.2%) pupils that didn't participate in the TIMSS study, but were included in the Comenius IEEPS project. A total of 5021 parents and 2500 teachers participated in the Comenius IEEPS study.

1.2. Data collection

The research was conducted with help from school employees – the school coordinators – that were in charge of the research implementation in the school. Data collection lasted from April till June 2015. The pupils, parents, and teachers' data were collected during April and May 2015. The data from the practice exams organized at schools were collected in April 2015, while in June the pupils also took the final exam. Linking the data from different phases and different sources (teachers, parents, and pupils) was enabled by a coding system. All research participants were guaranteed anonymity with questionnaires sent to the research team without personal information, only with a code, within closed envelopes and through school coordinators. The pupil achievements in the TIMSS 2011 international testing were provided with consent of the Ministry of Education, Science and Technological Development.

1.3. Data analysis

The pupil achievement is affected by numerous factors: the ones related to individual *pupils* (socioeconomic status, motivation, personality traits, preschool education, etc.), the ones related to *teachers* teaching the pupils and to the *classes* the pupils are attending (the clarity of teaching, the pupil cognitive activation level during class, maximizing the effective time for learning in class, etc.), and factors related to *school* the pupils are attending (principal's leadership, school climate, teacher cooperation, etc.). All these factors have to be taken into considerationat the same time if we wish to determine the individual contribution of each of them. In this study, a sophisticated analytical tool that allowed this was used – the hierarchical linear modelling – so the most of the available factors of pupil achievement were simultaneously analyzed. Considering that the focus of this report is on teaching practices, a two-stage model was used, which included pupil level and teaching level (but not the school level). After we considered the individual pupil characteristics, we analyzed the effect of particular teaching practices on mathematics and biology achievements. We also examined the effect these teaching practices have on pupil interest in mathematics and biology.

It should be mentioned that the teaching practices were evaluated by the pupils, while the different school work aspects were evaluated by the teachers. This way we could obtain a more objective evaluation of these phenomena. The measures of the teaching factors were obtained as an

1 Out of the 156 schools that participated in the TIMSS 2011 study, 27 of them were excluded from the Comenius IEEPS project because less than 10 pupils from these schools participated in TIMSS 2011 research, which was inadequate for the design of the Comenius IEEPS study. Also, a small number of schools declined participation in the Comenius research. To a small degree, this disrupted the representativeness of the sample.

2 Some of the analyses were based on smaller samples, in order to respect the specificities of different variables and meet the aims of the planned analyses.

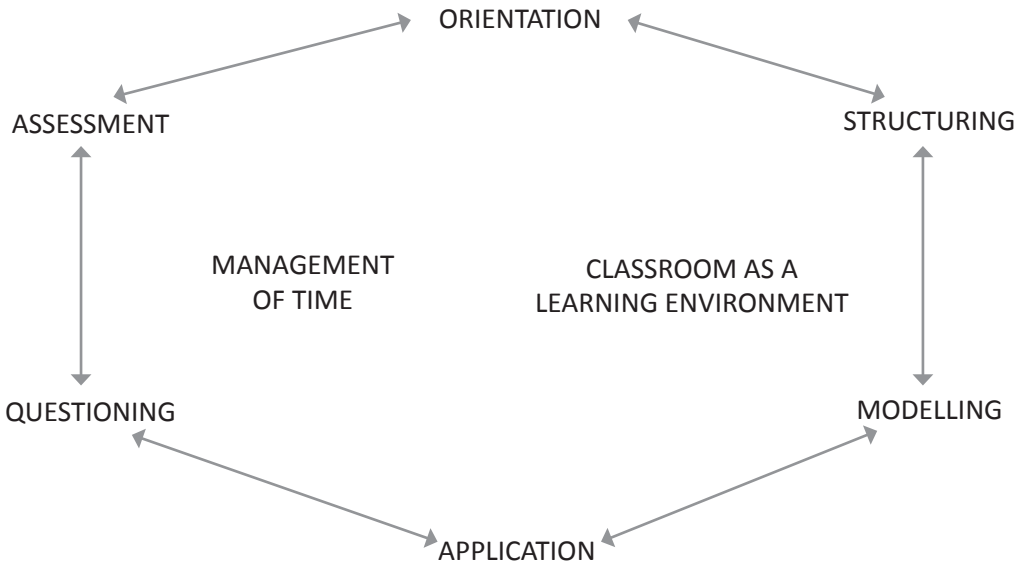
average of all answers from pupils who evaluated a particular teacher's practice. Within every class, a half of pupils evaluated the teaching of the mathematics teacher, while the other half evaluated the teaching of the biology teacher.

1.4. The dynamic model of educational effectiveness: pupil and teaching factors

The Comenius IEEPS Study examined a vast number of pupil characteristics, recognized in literature as significant for pupil achievement: their age, gender, preschool attendance, number of children in the family, single parent families, number of household members, socioeconomic status (combined information on parental education, their profession, and certain aspects of family resources), parental expectation regarding their child`s education level, pupil`s spare time reading habits, impulsivity, conscientiousness, and parental involvement. The data on these characteristics were gathered through pupil and parent questionnaires. Aside from these characteristics, the actual pupil achievement can be predicted to a large degree on the basis of previous pupil achievement, which was measured according to the pupil results on the tests taken in their fourth grade of primary school within the TIMSS 2011 study. Statistical levelling of the key pupil characteristics, as well as the achievement at the end of the fourth grade, enabled us to examine the isolated contribution of teaching practices to pupil achievement in higher grades of primary school.

The study of educational effectiveness was based on a theoretical model – a dynamic model of educational effectiveness – which identified the teachingfactors[3] that affect pupil learning and achievement the most (Creemers & Kyriakides, 2008). In this model, the factors are determined as mutually correlated aspects of teaching, with two teaching factors as core factors which permeate the other six factors. The model can, accordingly, be graphically presented as a hexagon (Figure 2).

Figure 2. Teaching factors in the dynamic model of educational effectiveness
(Source: Creemers & Kyriakides, 2008: 104)



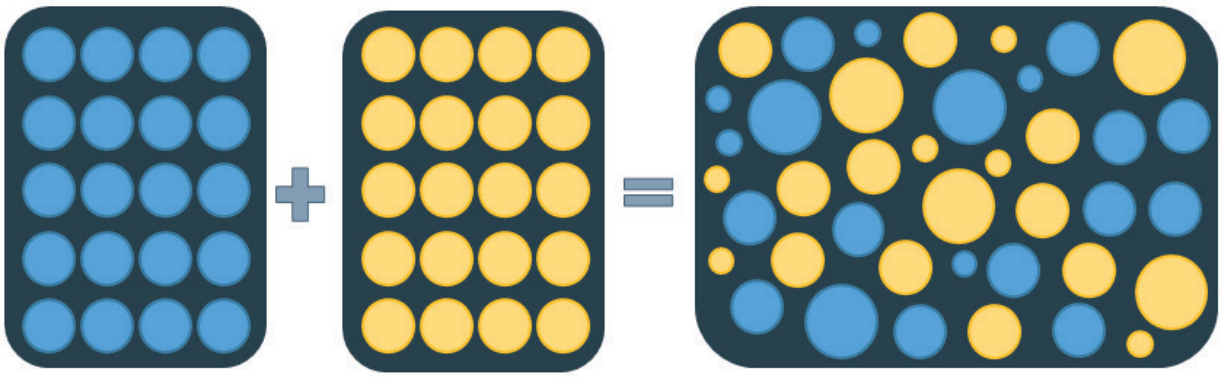
3 Although in this theoretical model authors use concept ''classroom level factors", our research was focused on the teaching practices, so the term ''teaching factors" was used instead.

Our research also included the examination of eight teaching factors suggested by the dynamic model of educational effectiveness: management of time, classroom as a learning environment, structuring, orientation, application, modelling, questioning, and assessment. The description of these teaching factors can be found in the second part of this publication (A handbook for quality teaching), while the variables used to measure these teaching factors are presented in the Appendix 5.1.

1.5. Pupil achievement and interest in subject: measuring scales and scores

The achievement in mathematics is calculated on the basis of the pupil's results on two tests: (1) the practice mathematics exam and (2) the final mathematics exam. The analysis used both tests results in order to enhance the validity. The two tests contained 20 tasks each, with possible task scores of 0.5 or 1. While the pupil achievement on both exams is expressed through the summation scores obtained by plain addition of acquired points, the Comenius IEEPS Study applied a more sophisticated technique of calculating pupil achievement. The IRT analysis (item response theory) was applied in calculating the scores, respecting the difficulty of tasks and assigning different weights to tasks on the basis of their difficulty. Therefore, the more difficult tasks participated in the total score with a greater number of points, and the easier ones, respectively, with a lesser number of points. The IRT scores were transformed into a scale varying from 0 to 20, with higher scores indicating higher achievement (Figure 3). On the basis of the data, it was determined that the average pupil achievement in the sample was 8.83 points.

Figure 3. The formation of the Comenius IEEPS achievement results based on the practice exam and final exam results



Practice exam Final exam the Comenius IEEPS score

The achievement in biology was measured through results of the practice exam (five questions in biology) and the final exam (five questions in biology). IRT scores were also calculated, transformed into a scale varying from 0 to 10, with higher scores indicating higher achievement. The average pupil achievement in biology was 7.44 points.

Pupil interest in mathematics and biology were measured through the questionnaire constructed for the needs of the study. The questionnaire consisted of seven items (i.e. ''I enjoy learning mathematics/biology.''), four of which were taken and adapted from the PISA study, while the rest were additionally constructed. The pupil scores were presented on a scale from 1 to 5, with the higher number standing for higher interestfor the said subject. The average interest in mathematics was 2.78, and 3.27 in biology.

2. Research findings

2.1. Relevant pupil characteristics and teaching practices in relation to pupil achievement in mathematics

Before the teaching practices analysis started, it had been determined that *80.90%* of differences between pupil achievements in the final exam in mathematics was due to the *pupils'* individual differences (potentially due to having different parents, living in different households, having different resources and different levels of motivation, different intellectual abilities, different gender, etc.), while *19.10%* of differences in pupil achievement came from the differences between the *teachers* (potentially because of the different styles of teaching, nurturing different class climate, and having classes that differ in the pupil structure). The following pupil and their family characteristics explain *45.79%* of differences in the pupil achievement in mathematics: *gender, socioeconomic status of the family, conscientiousness, impulsivity, reading habits,* and *previous achievement* (the achievement in mathematics in the TIMSS 2011 study)[4]. The results show that girls, children with higher socioeconomic status, those who are more conscientiousness and less impulsive, and those with more developed reading habits have higher achievement in mathematics. Also, the pupils who obtained better results in the fourth grade also have higher achievement in mathematics in the eighth grade.

After the control of the listed pupil characteristics, there remained 44.39% of differences at the pupil level that can be explained by factors that this study did not include, and 9.83% of unexplained differences in pupil achievement at the teachinglevel. These analyses indicate that, after the pupils and classes were levelled according to the listed pupil characteristics, only 9.83% of differences in pupil achievement can potentially be attributed to teaching factors.

However, when the teaching factors were introduced in the hierarchical linear model, it showed that none of them had a significant impact on the achievement in mathematics. Individual teaching variables could explain from 0% to 0.17% of variance in pupil achievement in mathematics, which is not a statistically significant contribution. It should be noted that different aspects of teaching are mutually correlated to a certain degree, which is why each of the teaching factors was analyzed in a separate hierarchical linear model (detailed representation of results is in the Appendix 5.2.1).

In this research, among other things, it was important to determine the total contribution of teaching quality to pupil achievement in mathematics. Being that the examined teaching factors were intercorrelated and ''overlapping''[5], the summation of their individual contributions would not give a realistic assessment of total contribution of teaching. Therefore, by using factor analysis, a unique measure was constructed – the general *teaching quality* factor. This factor included all of the examined teaching factors except the *pupil-pupil interaction*[6]. However, it was determined that even this general factor of teaching quality doesn't contribute significantly to explaining pupil achievement.

4 Analyses of the teaching factors impact on achievement in mathematics and biology, as well as the interest in subject were conducted on a significantly lower number of pupils than the number that was included in the study itself. The difference in the sample was due to analysis including only those pupils who participated in the TIMSS 2011 study, but also because some of the variables had missing data. The exact number of examinees for each analysis is presented in Appendixes with detailed representation of results.

5 The intercorrelation and ''overlapping'' of different teaching related factors means that the teacher who is good in i.e. orientation is often also good at teaching-modelling. Therefore, although these are different teaching practices, an effective teacher is usually successful in more than one teaching aspects, while an ineffective one is usually unsuccessful in more than one teaching practices.

6 This result is due to the fact that only the factor *pupil-pupil interaction* does not speak directly about what the teacher is doing in classroom, but is primarily related to what pupils are doing between themselves (see the detailed description of measured variables in Appendix 5.1).

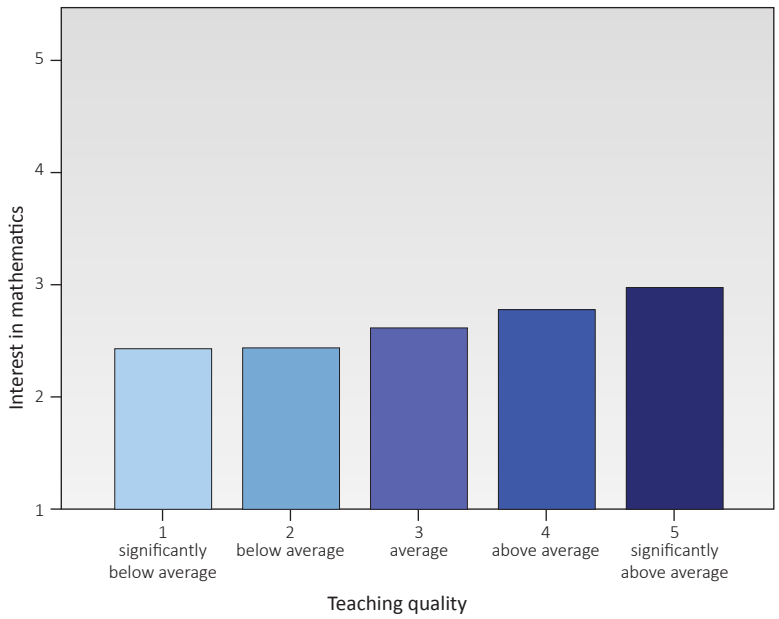
2.2. *Relevant pupil characteristics and teaching practices in relation to pupil interest in mathematics*

The analysis of the impact of individual characteristics and teaching factors on pupil interest in mathematics showed that 84.40% of variance in pupils interest in mathematics can be assigned to the differences between pupils. Among the various pupil characteristics, the statistically significant impact is evident in the following: *reading habits, impulsivity, conscientiousness* and *pupil achievement* in said subject, with individual pupil characteristics explaining 11.60% of differences in pupil interest. The pupils with more developed reading habits, those who are more conscientious and less impulsive, as well as pupils who have better scores in mathematics in the final exam also have higher interest in this subject. When these individual differences between pupils are controlled, the 15.96% of pupil motivation in mathematics is left and can potentially be attributed to different characteristics of teaching.

The analysis of the contribution of individual teaching factors to pupil interest in mathematics showed that all ten measured teaching related factors have a statistically significant impact. These factors individually explain from 1.11% to 10.15% of differences in interest in mathematics (Appendix 5.2.2). Figures 5–14 show how the pupil interest changes with the enhancement of quality of each of the mathematics teaching factors.

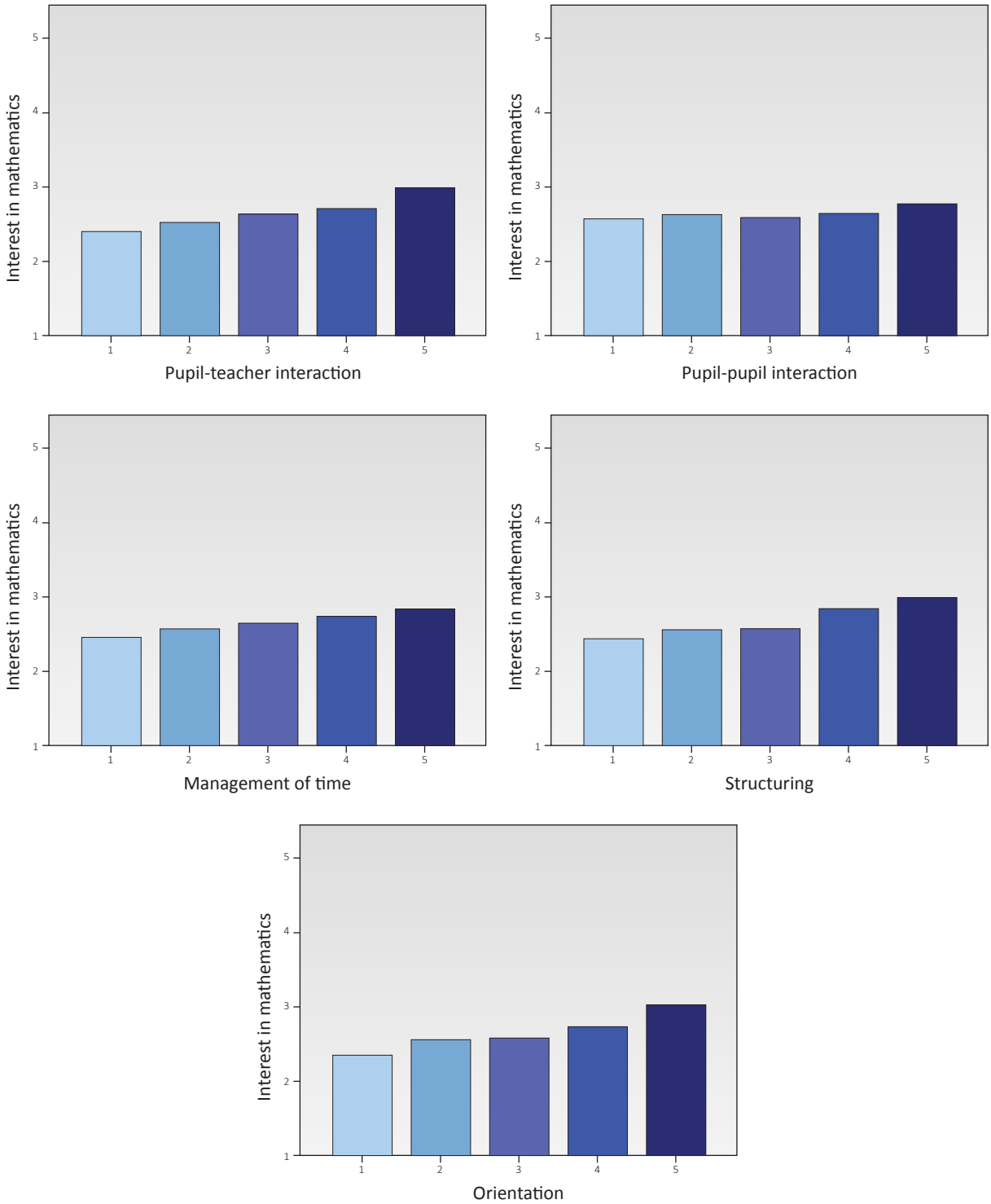
In order to determine the total contribution of teaching to the pupil interest in mathematics, the impact of the general factor – *quality teaching* – was tested, and it was determined that the factor explains 9.13% of differences in pupil achievement out of 15.96% that can be assigned to the impact of teaching. The impact that teaching has on pupil interest in mathematics is shown on Figure 4.

Figure 4. Differences in pupil interest in mathematics depending on the teaching quality



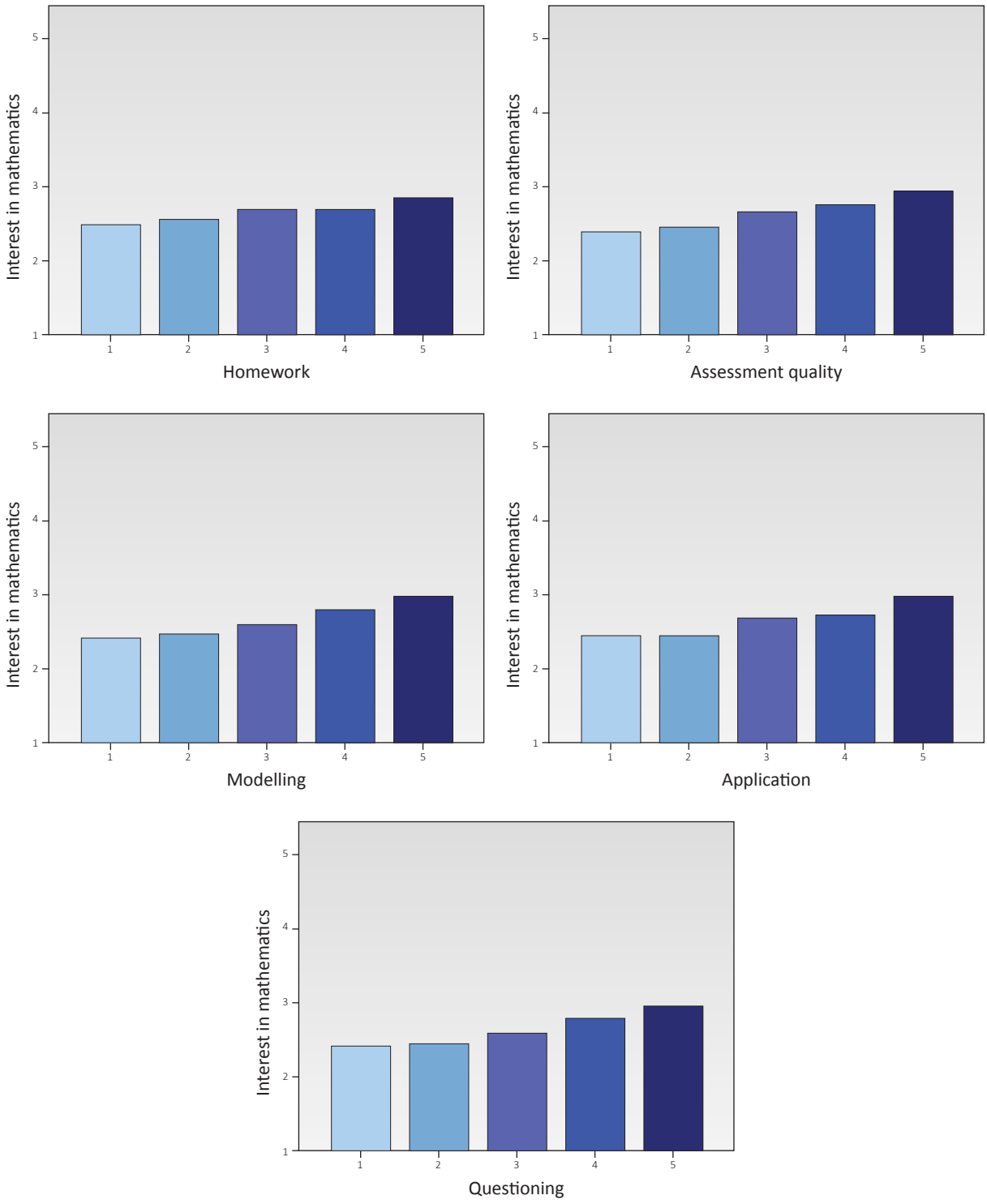
Note. The chart shows the pupil interest in mathematics after the pupils have been levelled up by their reading habits, impulsivity, conscientiousness and mathematics achievement.

Figures 5–9. Differences in pupil interest in mathematics depending on teacher's success in encouraging pupil-teacher interaction, pupil-pupil interaction, management of time, structuring, and orientation



Legend. 1 – significantly below average, 2 – below average, 3 – average, 4 – above average, 5 – significantly above average.
Note. The chart shows the pupil interest in mathematics after the pupils have been levelled up by their reading habits, impulsivity, conscientiousness, and mathematics achievement.

Figures 10–14. Differences in pupil interest in mathematics depending on teacher's effective use of homework, the assessment quality, teaching-modelling, application,and questioning



Legend. 1 – significantly below average, 2 – below average, 3 – average, 4 – above average, 5 – significantly above average.
Note. The chart shows the pupil interest in mathematics after the pupils have been levelled up by levelled up by their reading habits, impulsivity, conscientiousness, and mathematics achievement.

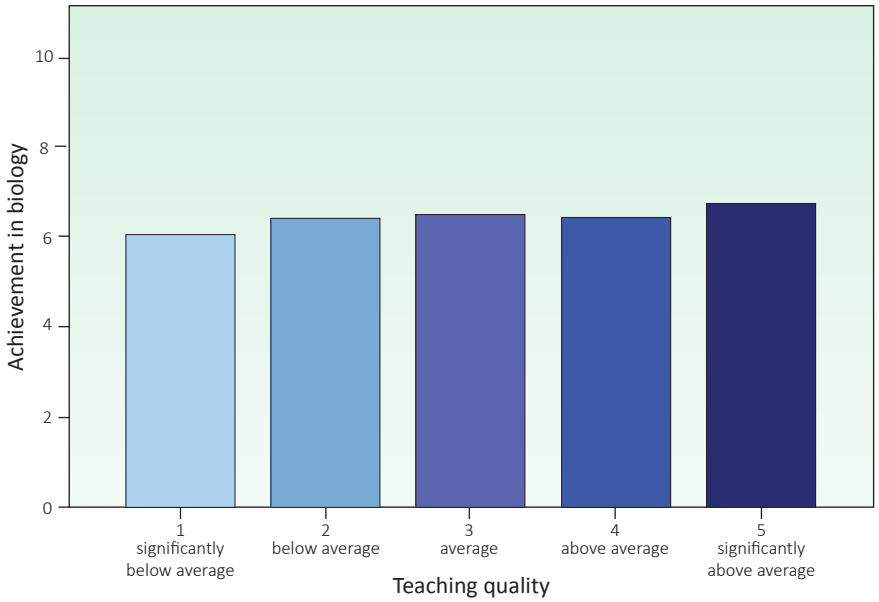
2.3. Relevant pupil characteristics and teaching practices in relation to pupil achievement in biology

The analysis of the effect of pupil and biology teaching characteristics on achievement on the practice exam and the final exam in biology showed that 78.47% of differences in pupil achievement in biology comes from the differences between the pupils, while 21.53% is due to different teaching practices of their biology teachers.

When it comes to pupil characteristics, the significant contribution to achievement in biology can be attributed to *gender, socioeconomic status, previous achievement* (the achievement in biology in the TIMSS 2011 study), *reading habits,* and *conscientiousness***.** Girls, children from families with higher socioeconomic status, children with more developed reading habits, and those that are more conscientious have higher achievements. Also, higher achievement in biology on the TIMSS testing in the fourth grade is related to higher achievement in this area in the eighth grade. The listed characteristics of pupils and their family environments explain a total of 10.48% of variance of pupil achievement. After levelling the individual differences between pupils, a total of 69.83% of differences was left unexplained, so they can be attributed to the pupil characteristics that weren't measured in this study.

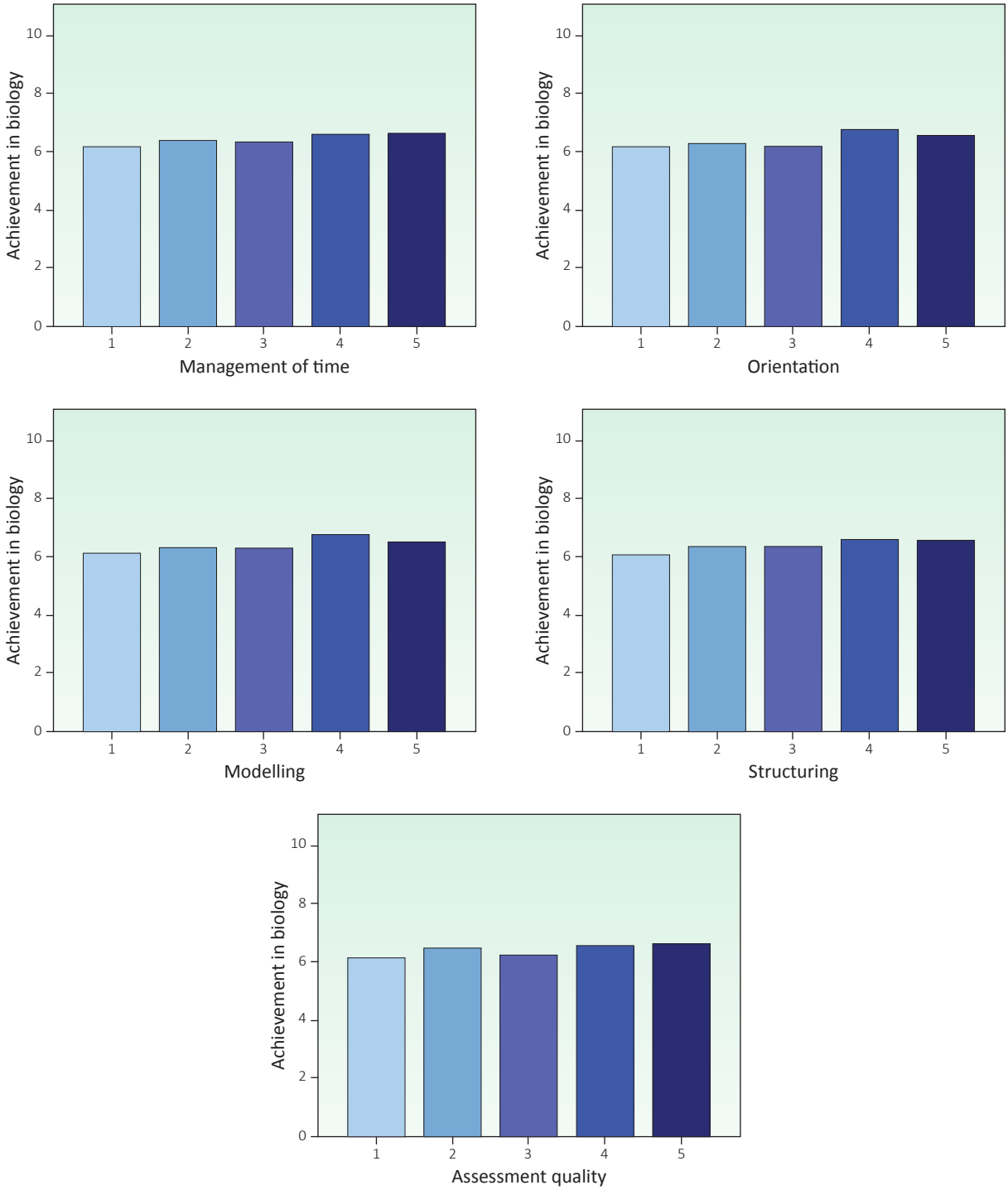
At the teaching level, 19.69% of differences in pupil achievement in biology was left unexplained. Out of ten examined teaching factors, statistically significant impact on the achievement in biology was determined for seven factors: management of time, structuring, orientation, assessment, teaching-modelling, application, and questioning. These factors, taken separately, explain from 0.99% to 1.56% of differences in pupil achievement (Appendix 5.2.3). The general factor of teaching quality explains a total of 1.42% of differences in pupil achievement in biology. The figures 15–22 show how individual teaching factors, as well as the general factor of teaching quality affect pupil achievement in biology.

Figure15. Differences in pupil achievement in biology depending on the teaching quality



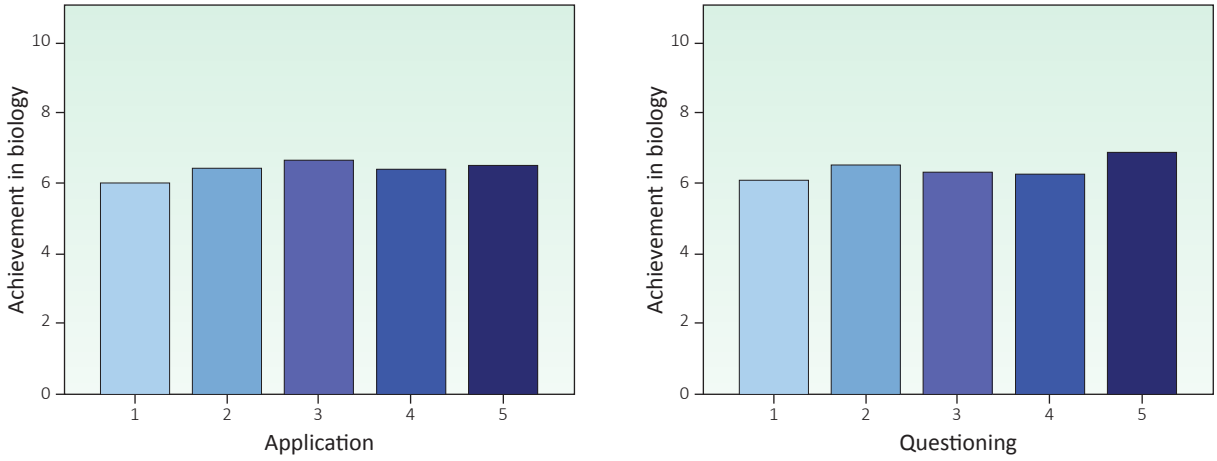
Note. The chart shows the pupil achievement in biology after the pupils have been levelled up by their gender, socioeconomic status, previous achievement, reading habits, and conscientiousness.

Figures 16–20. Differences in pupil achievement in biology depending on teacher's success in effective management of time, orientation, teaching-modelling, structuring, and assessment quality



Legend. 1 – significantly below average, 2 – below average, 3 – average, 4 – above average, 5 – significantly above average.
Note. The chart shows the pupil achievement in biology after the pupils have been levelled up by their gender, socioeconomic status, previous achievement, reading habits, and conscientiousness.

Figures 21–22. Differences in pupil achievement in biology depending on teacher's success in application and questioning



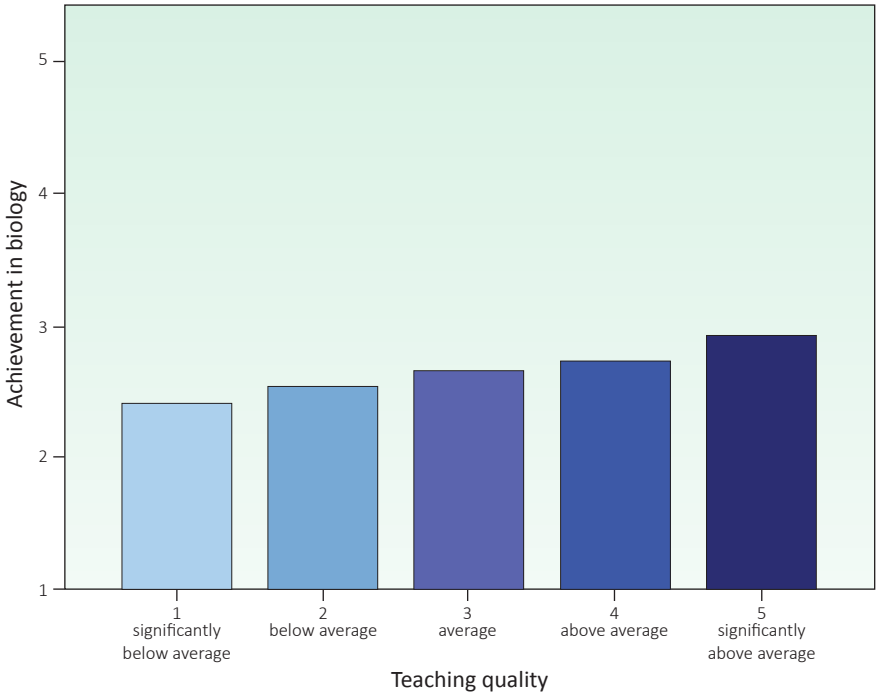
Legend. 1 – significantly below average, 2 – below average, 3 – average, 4 – above average, 5 – significantly above average.
Note. The chart shows the pupil achievement in biology after the pupils have been levelled up by their gender, socioeconomic status, previous achievement, reading habits and conscientiousness.

2.4. Relevant pupil characteristics and teaching practices in relation to pupil interest in biology

The analyses show that 87.40% of differences between pupils in their interest in biology comes from the individual differences, while 12.60% of differences in their interest can be assigned to the fact that they attend different classes with different teachers. Amog the examined pupil characteristics, statistically significant are the *achievement in biology, reading habits, impulsivity, conscientiousness,* as well as *parentalinvolvement.* As expected, the pupils who are more successful in biology show higher interest in this school subject. Additionally, children with more developed reading habits, lower impulsivity, higher conscientiousness, and those whose parents are more involved and interested in their school activities and duties show higher interest in biology. These characteristics of pupils and their family environments explain a total of 14.20% of differences between the pupils in their interest in biology.

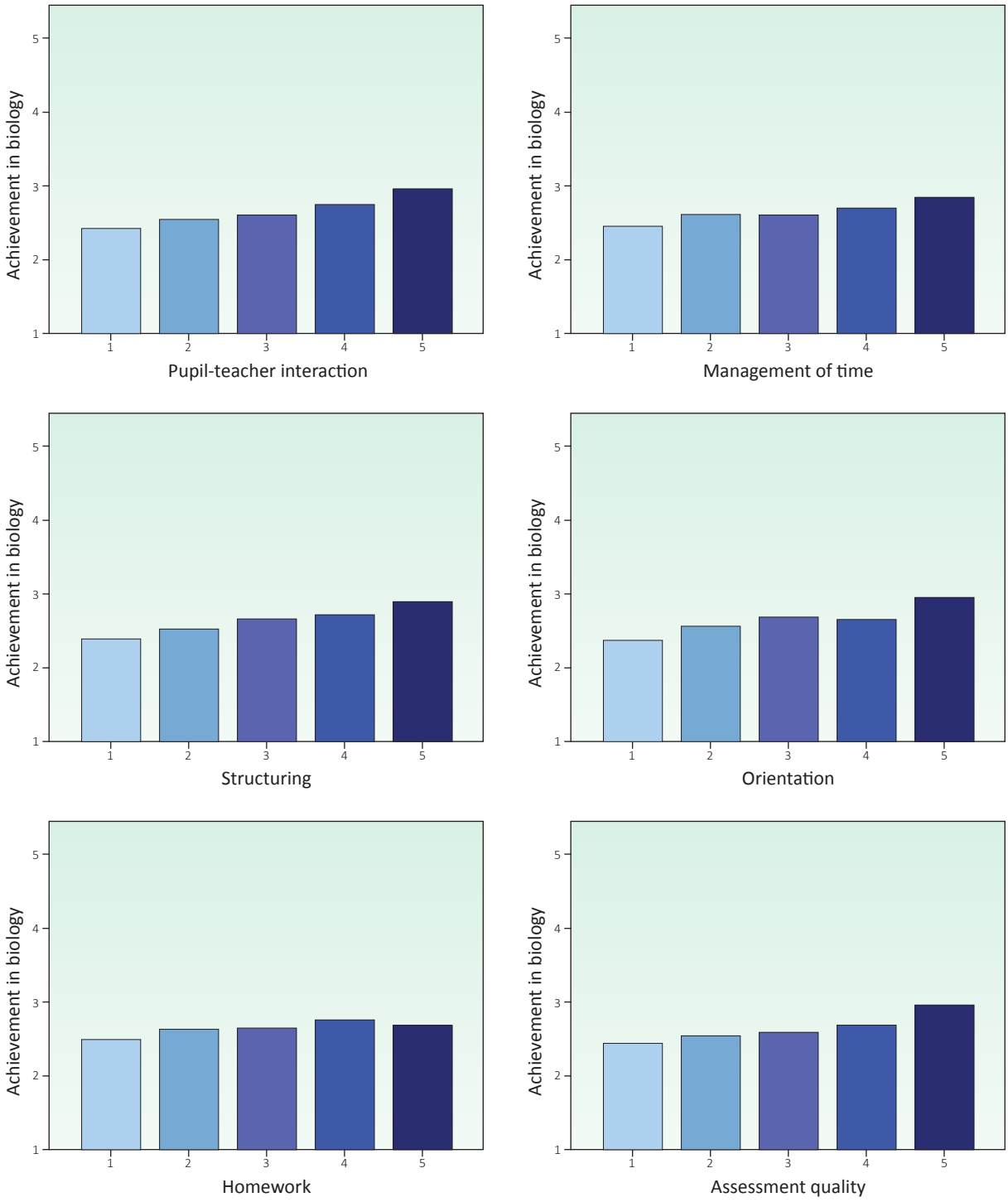
After the pupils were levelled up by relevant individual characteristics, there was 10.60% of variance left in their achievement that potentially comes from the factors related to teaching. The analyses of examined teaching factors showed that out of ten factors measured in this study, nine of them have a statistically significant contribution to pupil interest in biology. All factors, except pupil-pupil interaction, are significantly correlated with pupil interest in biology (the contribution of these factors to the interest in biology is represented on Figures 24–32; the detailed representation of the results is given in Appendix 5.2.4). The general factor of teaching quality which conjoins all examined teaching factors except the pupil-pupil interaction is responsible for 8.15% of differences in pupil interest in biology, while only 2.58% of teaching related differences are left unexplained (Figure 23).

Figure 23. Differences in pupil interestin biology depending on the general factor of teaching quality



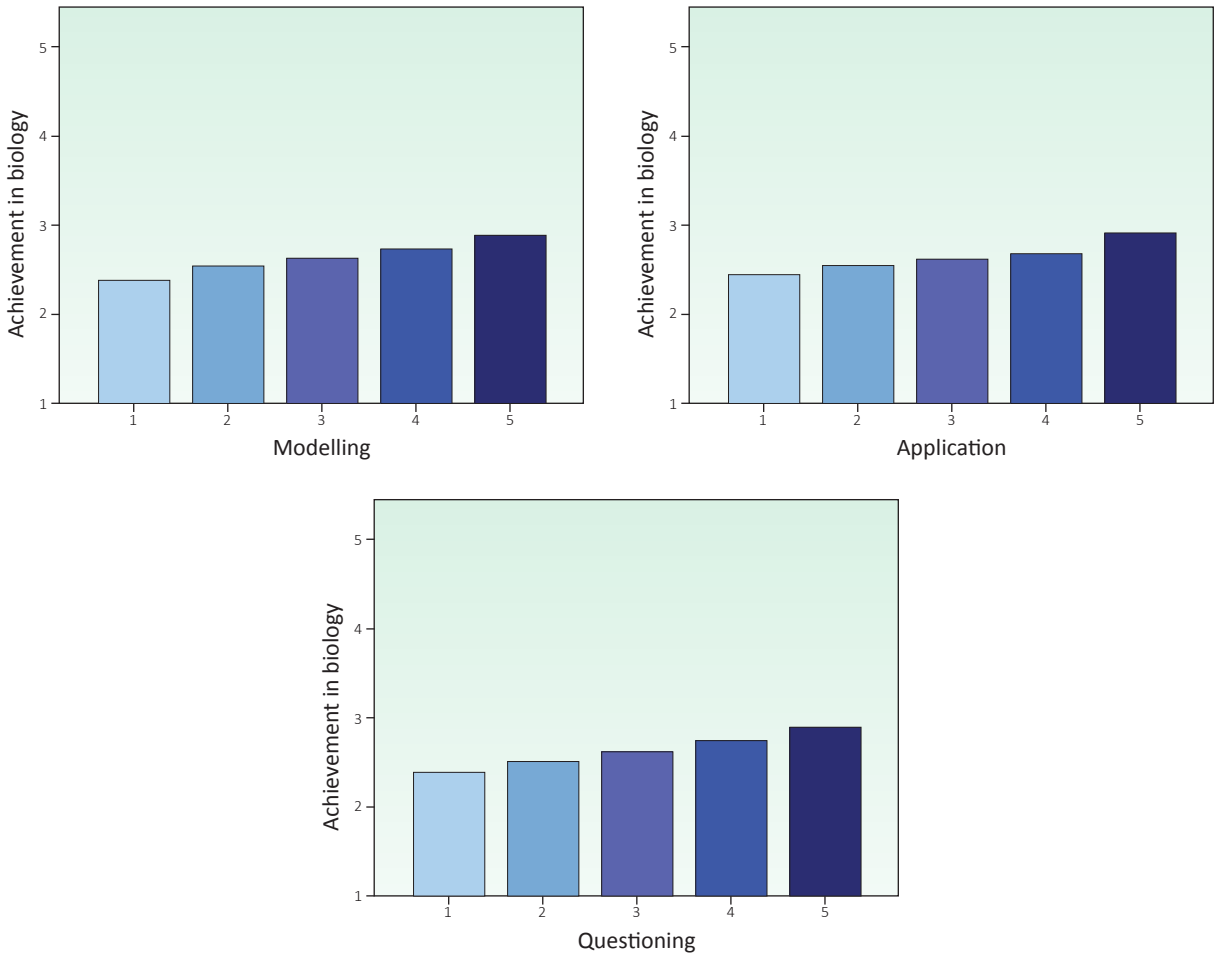
Note. The chart shows the pupil interest in biology after the pupils have been levelled up by their achievement in biology, reading habits, impulsivity, conscientiousness, and parental involvement.

Figures 24–29. Differences in pupil interestin biology depending on the teacher's success in encouraging teacher-pupil interaction, management of time, structuring, orientation, homework, and assessment quality



Legend. 1 – significantly below average, 2 – below average, 3 – average, 4 – above average, 5 – significantly above average.
Note. The chart shows the pupil interest in biology after the pupils have been levelled up by their achievement in biology, reading habits, impulsivity, conscientiousness, and parental involvement.

Figures 30–32. Differences in pupil interestin biology depending on the teacher's success in teaching-modelling, application, and questioning



Legend. 1 – significantly below average, 2 – below average, 3 – average, 4 – above average, 5 – significantly above average.
Note. The chart shows the pupil interest in biology after the pupils have been levelled up by their achievement in biology, reading habits, impulsivity, conscientiousness, and parental involvement.

3. Conclusion

Based on the results of our research, we can conclude that in Serbia, like in many other countries, the pupil factors crucially affect pupil achievement and motivation. That is why the school mission is, among other things, to provide equal educational possibilities to pupils with different socioeconomic status, so that the pupil's personal and family factors would not play a decisive role in their achievements and motivation. This way the educational system becomes more just and, consequently, contributes to social cohesion, to economic benefits for both the society and individuals and to exercising rights on equal education for all (Fild, Kučera & Pont, 2007).

Numerous authors indicate the importance of creation of educational policy that would simultaneously promote quality and justness in education and suggest series of possible measures: the effective identification of pupils from vulnerable groups; better connection of educational, health and social sectors; provision of quality preschool education andwide coverage education; creation of early, preventive and intensive educational and social interventions for children from vulnerable groups (i.e. intensified individual teaching; provision of free meals in schools, transportation and textbooks; active inclusion of pupils in remedial teaching and quality extracurricular activities; organization of summer education camps[7]; etc.); promotion of reading at the early age; using strategies to control impulsive behaviour; providing better mobility between different educational levels and educational programs; postponing the age when pupils are sorted into schools with different academic pathways (i.e gymnasiums, four-year and three-year long vocational high-schools); realization of quality cooperation with parents, etc. (Alexander, Entwisle & Olson, 2001; Barnett, 1985; Fild, Kučera & Pont, 2007; Henderson & Mapp, 2002; Schweinhart, Montie, Xiang, Barnett, Belfield & Nores, 2004; Teodorović, Stanković & Bodroža, 2015).

The Serbian educational system should, therefore, develop the aforesaid educational policies intensively. Besides, regarding schools and teachers, the teaching practices found in literature and proven as effective, that we wanted to identify in this study, should be enhanced. Regarding the teaching and school factors of pupil achievement and interest, our study results are not unambiguous. It is confirmed that the effective teaching factors didn't show a significant correlation with pupil achievement, but they did show correlation with pupil interest in mathematics and biology. Furthermore, these factors explain most of the differences in interest that can be assigned to teaching and not to individual pupil characteristics.

The most important findings of our study can be interpreted in different ways:

(a) *The selected teaching factors have no impact on achievement*. This interpretation, however, is inconsistent with consecutive and robust findings of numerous studies in the world and in Serbia (Antoniou, Kyriakides & Creemers, 2011; Brophy & Good, 1986; Creemers, 1994; Klieme, 2012; Kyriakides, Creemers & Antoniou, 2009; Mortimore, Sammons, Stoll, Lewis & Ecob 1988; Muijs & Reynolds, 2000, 2010; Muijs, Kyriakides, van der Werf, Creemers, Timperley & Earl, 2014; Scheerens, 2000; Scheerens & Bosker, 1997; Teodorović, 2011, 2012; Walberg & Paik, 2000), so this interpretation is not likely.

(b) *The teaching factors in Serbia are not significantly different regarding teachers individually, and it is therefore difficult to detect their influence on achievements*. This possibility is, also, not very likely, being that the diversity of teaching practices was sufficient to identify their influence on pupil interest in mathematics and biology.

7 During the summer, when pupils are out of schools, the learning hours drop significantly compared to the school year. However, the differences in achievement of the richer and poorer children increase, because the richer children have more learning opportunities outside of school (field trips, camping, etc.) in comparison with the poorer ones (Alexander, Entwisle & Olson, 2001). This phenomenon is called summer achievement gap.

(c) *The measure of achievement used in this study* (a test consisting of practice exam and final exam) *depends on a number of factors outside of regular teaching* – i.e. of the preparation of pupils for the test by means of private tuition, preparatory classes at school/municipality or homework – *so the effects of the examined teaching practices can hardly be applied in that situation*. Unlike the final exam, interest is not subject to outer conditions and pressures on pupils (interest is not subject to evaluation through grades, nor are pupils prepared for it), therefore in this case the effects of examined teaching factors manifest more easily.

(d) *The practice exam and the final exam do not adequately represent what is taught and learned during the final grades of primary school and are not under the influence of the examined teaching factors*. In that case, the examined variables would not show a correlation with this measure of pupil achievement. On the other hand, the interest was not measured with any external tests, and it represents pupil opinions, so it is logically correlated with effective teaching factors.

Authors of this publication think that one or both of the latter options are the most acceptable explanations for the results of the study. If we know that intrinsic subject motivationis important for pupil achievement (Köller, Baumert & Schnabel, 2001; Wigfield & Cambria, 2010), we can see that the improvement of the examined teaching practices in our schools is crucial. The second part of this publication presents in detail the recommendations for the improvement of each of the examined teaching factors in practice.

4. Limitations to the study and the recommendations for the use of the study results

Although, compared to previous domestic research, this study covered the widest so far aggregate of pupil characteristics, it is important to note that no study can cover all potential factors of pupil achievement (for instance, this study did not cover the pupils' intelligence). Also, every variable measuring means accepting the existence of different methodological errors and limitations, especially when examining personal impressions of complex and context-dependent processes, as is case with teaching practices. Being that it is impossible to gather and thoroughly measure all potentially significant variables in one research, every study of this kind, including the Comenius IEEPS, produces results that should be interpreted as approximate and in accordance with such limitations.

The data in this report refer to the school sample in Serbia, and are not directly related to individual schools. We encourage the school staff to use this report as a tool for improvement of the quality of school practices and to discuss and analyze the results with their school colleagues. We tried to present the results in this report in a clear and understandable way. If, in spite of our efforts, you still have questions regarding the report, please do not hesitate to contact us (the contact info can be found at the back of this report).

5. Appendixes

5.1. Variable description

5.1.1. Pupil characteristics

Gender. The sample included 51.20% of girls and 48.20% of boys, while 0.60% of pupils didn't answer the question about gender.

Age. We included pupils from thirteen to fifteen and a half years of age, with an average value of 14.5 years.

Preschool education attendance. The pupils answered the question about preschool attendance with following answers: ''No'' (14.60%), ''Yes, for one year'' (25%) or ''Yes, for two years'' (57.30%).

Number of children in the family. The question about the number of siblings was answered by writing down the relevant number. The median of the number of siblings in the included pupil sample is 1, while the values vary from 0 to 14.

*Family incompleteness.*On the basis of answers about family members they live with, a variable indicating the family incompleteness was constructed. One group consisted of pupils who live with both parents (96%), while the other group consisted of pupils living with one or no parents (3%).

SES. Calculating the index of socioeconomic status of the family was performed using an algorithm developed for the purposes of the PISA study. This SES index consists of three components: parental education, parental occupation and wealth[8], based on which the global SES index of the pupil's family was calculated. Being that SES index was calculated as the first main component extracted from three components of SES, the values vary from -2.80 to 2.25, with an average value of 0.

TIMSS achievement in the fourth grade. The data about the pupil achievement on the TIMSS 2011 testing were taken from this international study's database. The statistical levelling of the pupil achievement in the fourth grade enabled us to track their progress in the next four years, that is, until the end of the eighth grade. As a measure for previous achievement in biology, we considered the pupil's results in the questions referring to the living world from relevant scientific fields included in the TIMSS study. The pupil's TIMSS score in mathematics was taken into consideration as a measure for previous achievement in mathematics.

Parental involvement is a scale consisting of seven items and used for measuring the extent of parental interest and active involvement in the child's school activities (for example: ''Parents help me understand the lesson or explain when something is not clear to me.'').

Reading habits were measured with a scale consisting of 4 items that show how much a pupil enjoys reading (for example: ''Reading is one of my favorite hobbies''; ''I read only when I have to'' – reverse coding).

Impulsivity was measured with a questionnaire *Domain-specific impulsivity* for school-age children (Tsukayama, Duckworth & Kim, 2013). This dimension of personality is about the impossibility to control impulses in behaviors that are characteristic of school context. The scale consists of 8 items (for example: ''I interrupt other pupils when they speak''; ''Sometimes I lose my temper at home or at school'').

*Conscientiousness*is a personality trait measured with a questionnaire consisting of 5 items (Demetriou, Kyriakides & Avraamidou, 2003; Demetriou & Kazi, 2001). This dimension of personality is about a pupil's commitment, thoughtfulness, tidiness, an ability to plan and timely execute different tasks (for example: ''I am careful and committed in everything I do.'')

8 Instead of taking into account general wealth which refers to ownership of objects that can be considered a measure of a lesser or greater luxury (a car, a television set, a washing machine, a dishwasher etc.), in this study the pupils only reported the resources relevant for learning and school achievement: a desk, own room, a number of books available, a computer available for learning, educational software, internet, classic literature, poetry collections, artwork, dictionaries and other books useful for learning.

All questionnaire related measures are given in a form of the five-level Likert scale (1 – Strongly disagree, 5 – Strongly agree). The internal consistency of all instruments is good (αs>.75).

5.1.2. Teaching factors

The questionnaires for measuring eight different teaching factors were constructed for the purposes of the Comenius IEEPS Study, with two of the eight factors measured with two subdomains.

MANAGEMENT OF TIME in this study was measured through the unique score consisting of three aspects: establishing order in the classroom as opposed to disorder, waste of time in teaching, and teacher's management of activities in the class. Establishing order in class refers to teacher's capability to control the pupil discipline. Waste of time refers to class time spent on activities that are not related to teaching. Teacher's class activity management refers to teacher's capability to establish clear rules of behaviour in class that allow for undisturbed teaching.

CLASSROOM AS A LEARNING ENVIRONMENT. This factor consisted of two subscales: (1) Teacher-pupil interaction and (2) pupil-pupil interaction. The subscale *Teacher-pupil interaction* refers to teacher's incentive and encouraging behaviour responsible for creating a positive classroom climate (item examples are ''The teacher offers additional assistance when we need it''; ''The teacher has a good relationship with us''). The subscale *pupil-pupil interaction*is focused on the quality of pupils' relationships (''Pupils in my class get along well''). Although the content of this dimension does not directly refer to teacher's activities, these are important aspects of the general classroom climate, which can also influence the academic outcomes of education.

STRUCTURING refers to the practice of creating structure within the lesson, that is, announcement of a particular question or problem within a lesson, an announcement of transiting to another topic and an emphasis and repetition of the most important ideas at the end of the class.

ORIENTATION was examined on the basis of frequency of the practice of positioning the materials taught in class within a wider context of pupil knowledge (a questionnaire example would be ''The teacher connects the lesson material with lessons from other subjects'').

APPLICATION included the ways of encouraging application of already taught materials, as well as encouraging application of the teaching materialsin relatively different situations, that the teacher is organizing in class.

TEACHING-MODELLING in our research referred to teaching pupils the strategies for problem solving, that is, metacognitive strategies such as how to divide lessons into parts for easier learning, how to learn, how to spot important lesson parts, how to find and research different information sources, how to solve and approach problems in different ways, how to analyze tables, charts etc.

QUESTIONING referred to the frequency of questioning, rephrasing the questions the pupils didn't understand, allowing pupils time to think about the answer, directing pupils with subquestions, asking them to explain their answer and reviewing the extent to which the pupils understood the lesson.

CLASSROOM ASSESSMENT was measured through two subscales: Homework and Assessment quality. The subscale *Homework* measured the frequency of giving, reviewing and checking homework. The subscale *Assessment quality* referred to correction of pupils' answers and giving feedback about how the task should have been done, as well as feedback about specific aspects of pupils' work.

5.2. Analyses

5.2.1. Parameter estimates and standard errors for analyses of achievement in mathematics

	Empty model			Basic model			M1			M2			M3			M4			M5		
	B	SE	p	B	SE	P	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Intercept	8.65	(.14)	***	8.59	(.11)	***	8.58	(.11)	***	8.59	(.11)	***	8.59	(.11)	***	8.59	(.11)	***	8.59	(.11)	***
PUPIL LEVEL																					
Gender (0 – male, 1 – female)				0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**
SES				0.63	(.05)	***	0.63	(.05)	***	0.63	(.05)	***	0.63	(.05)	***	0.63	(.05)	***	0.63	(.05)	***
$TIMSS_{mat}$				1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***
Reading habits				0.24	(.05)	***	0.24	(.05)	***	0.24	(.05)	***	0.23	(.05)	***	0.24	(.05)	***	0.24	(.05)	***
Impulsivity				-0.15	(.05)	***	-0.15	(.05)	***	-0.15	(.05)	***	-0.15	(.05)	***	-0.15	(.05)	***	-0.15	(.05)	***
Conscientiousness				0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***
TEACHING LEVEL																					
Pupil-teacher interaction							-0.09	(.09)													
Pupil-pupil interaction										-0.02	(.09)										
Management of time													0.13	(.09)							
Structuring																-0.03	(.09)				
Orientation																			-0.05	(.09)	
Homework																					
Assessment quality																					
Teaching-modelling																					
Application																					
Questioning																					
TEACHING QUALITY																					
Unexplained variance (%)																					
Teaching level	19.14			9.83			9.77			9.83			9.63			9.83			9.83		
Pupil level	80.85			44.39			44.39			44.39			44.40			44.39			44.39		
Explained variance (%)																					
Total				45.79			45.84			45.78			45.97			45.79			45.79		
Introduced variables							0.05			-0.02			0.17			-0.01			-0.01		

Note. N=2841; **p<.01, ***p<.001.

(Table continues on the next page)

5.2.1. (continued). Parameter estimates and standard errors for analyses of achievement in mathematics

	M6			M7			M8			M9			M10			M11		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Intercept	8.60	(.11)	***	8.59	(.11)	***	8.59	(.11)	***	8.60	(.11)	***	8.59	(.11)	***	8.59	(.11)	***
PUPIL LEVEL																		
Gender (0 – male, 1 – female)	0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**	0.26	(.09)	**
SES	0.63	(.05)	***	0.63	(.05)	***	0.63	(.05)	***	0.63	(.05)	***	0.630	(.05)	***	0.63	(.05)	***
$TIMSS_{mat}$	1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***	1.81	(.05)	***
Reading habits	0.23	(.05)	***	0.24	(.05)	***	0.23	(.05)	***	0.24	(.05)	***	0.24	(.05)	***	0.23	(.05)	***
Impulsivity	-0.15	(.05)	***	-0.15	(.05)	***	-0.15	(.05)	***	-0.16	(.05)	***	-0.15	(.05)	***	-0.15	(.05)	***
Conscientiousness	0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***	0.21	(.05)	***
TEACHING LEVEL																		
Pupil-teacher interaction																		
Pupil-pupil interaction																		
Management of time																		
Structuring																		
Orientation																		
Homework	0.13	(.09)																
Assessment quality				-0.02	(.09)													
Teaching-modelling							0.04	(.09)										
Application										0.13	(.09)							
Questioning													-0.03	(.09)				
TEACHING QUALITY																0.02	(.09)	
Unexplained variance (%)																		
Teaching level	9.66			9.83			9.81			9.63			9.82			9.83		
Pupil level	44.39			44.39			44.40			44.40			44.39			44.39		
Explained variance (%)																		
Total	45.95			45.79			45.79			45.97			45.79			45.79		
Introduced variables	0.16			-0.01			0.00			0.17			0.00			-0.01		

Note. N=2841; **p<.01, ***p<.001.

5.2.2. Parameter estimates and standard errors for analyses of interest in mathematics

	Empty model			Basic model			M1			M2			M3			M4			M5		
	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p
Intercept	2.78	(.04)	***	2.77	(.04)	***	2.78	(.03)	***	2.77	(.04)	***	2.77	(.03)	***	2.78	(.03)	***	2.78	(.03)	***
PUPIL LEVEL																					
Mathematics combined test				0.2	(.02)	***	0.19	(.02)	***	0.2	(.02)	***	0.19	(.02)	***	0.19	(.02)	***	0.19	(.02)	***
Reading habits				0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***
Impulsivity				-0.18	(.02)	***	-0.17	(.02)	***	-0.18	(.02)	***	-0.17	(.02)	***	-0.18	(.02)	***	-0.17	(.02)	***
Conscientiousness				0.11	(.02)	***	0.11	(.02)	***	0.1	(.02)	***	0.1	(.02)	***	0.1	(.02)	***	0.1	(.02)	***
TEACHING LEVEL																					
Pupil-teacher interaction							0.3	(.03)	***												
Pupil-pupil interaction										0.11	(.04)	**									
Management of time													0.2	(.03)	***						
Structuring																0.29	(.03)	***			
Orientation																			0.33	(.03)	***
Homework																					
Assessment quality																					
Teaching-modelling																					
Application																					
Questioning																					
TEACHING QUALITY																					
Unexplained variance (%)																					
Teaching level	15.59			15.96			7.38			14.85			12.08			8.21			5.81		
Pupil level	84.40			72.40			72.40			72.40			72.40			72.40			72.40		
Explained variance (%)																					
Total				11.60			20.20			12.70			15.50			19.40			21.80		
Introduced variables							8.58			1.11			3.87			7.75			10.15		

Note. N=2575; **p<.01, ***p<.00.

(Table continues on the next page)

5.2.2. (continued). Parameter estimates and standard errors for analyses of interest in mathematics

	M6			M7			M8			M9			M10			M11		
	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p
Intercept	2.77	(.04)	***	2.77	(.03)	***	2.78	(.03)	***	2.78	(.03)	***	2.78	(.03)	***	2.78	(.03)	***
PUPIL LEVEL																		
Mathematics combined test	0.2	(.02)	***	0.19	(.02)	***	0.19	(.02)	***	0.19	(.02)	***	0.19	(.02)	***	0.19	(.02)	***
Reading habits	0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***	0.09	(.02)	***
Impulsivity	-0.18	(.02)	***	-0.18	(.02)	***	-0.18	(.02)	***	-0.18	(.02)	***	-0.18	(.02)	***	-0.18	(.02)	***
Conscientiousness	0.1	(.02)	***	0.1	(.02)	***	0.1	(.02)	***	0.1	(.02)	***	0.1	(.02)	***	0.1	(.02)	***
TEACHING LEVEL																		
Pupil-teacher interaction																		
Pupil-pupil interaction																		
Management of time																		
Structuring																		
Orientation																		
Homework	0.15	(.04)	***															
Assessment quality				0.31	(.03)	***												
Teaching-modelling							0.31	(.03)	***									
Application										0.27	(.03)	***						
Questioning													0.3	(.03)	***			
TEACHING QUALITY																0.31	(.03)	***
Unexplained variance (%)																		
Teaching level	13.70			7.01			7.01			8.95			7.20			6.83		
Pupil level	72.40			72.30			72.40			72.50			72.40			72.40		
Explained variance (%)																		
Total	13.90			20.70			20.60			18.50			20.40			20.80		
Introduced variables	2.31			9.04			8.95			6.92			8.76			9.13		

Note. N=2575; **p<.01, ***p<.001.

5.2.3. Parameter estimates and standard errors for analyses of achievement in biology

	Empty model			Basic model			M1			M2			M3			M4			M5		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Intercept	3.69	(.04)	***	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***
PUPIL LEVEL																					
Gender (0 – male, 1 – female)				0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**
SES				0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***
$TIMSS_{bio}$				0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***
Reading habits				0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***
Conscientiousness				0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**
TEACHING LEVEL																					
Pupil-teacher interaction							0.07	(.04)													
Pupil-pupil interaction										-0.023	(.04)										
Management of time													0.107	(.04)	**						
Structuring																0.102	(.04)	**			
Orientation																			0.082	(.04)	*
Homework																					
Assessment quality																					
Teaching-modelling																					
Application																					
Questioning																					
TEACHING QUALITY																					
Unexplained variance (%)																					
Teaching level	21.53			19.69			18.98			19.69			18.13			18.27			18.70		
Pupil level	78.47			69.83			69.83			69.83			69.83			69.83			69.83		
Explained variance (%)																					
Total				10.48			11.19			10.48			12.04			11.90			11.47		
Introduced variables				10.48			0.71			0.00			1.56			1.42			0.99		

Note. N=2635; *p<.05, **p<.01, ***p<.001.

(Table continues on the next page)

5.2.3. (continued). Parameter estimates and standard errors for analyses of achievement in biology

	M6			M7			M8			M9			M10			M11		
	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p	B	SE	p
Intercept	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***	3.64	(.04)	***
PUPIL LEVEL																		
Gender (0 – male, 1 – female)	0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**	0.11	(.03)	**
SES	0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***	0.10	(.02)	***
$TIMSS_{bio}$	0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***	0.17	(.02)	***
Reading habits	0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***	0.07	(.02)	***
Conscientiousness	0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**	0.06	(.02)	**
TEACHING LEVEL																		
Pupil-teacher interaction																		
Pupil-pupil interaction																		
Management of time																		
Structuring																		
Orientation																		
Homework	0.04	(.04)																
Assessment quality				0.093	(.04)	*												
Teaching-modelling							0.095	(.04)	**									
Application										0.093	(.04)	*						
Questioning													0.112	(.04)	**			
TEACHING QUALITY																0.105	(.04)	**
Unexplained variance (%)																		
Teaching level	19.55			18.56			18.41			18.56			18.13			18.27		
Pupil level	69.83			69.83			69.83			69.83			69.83			69.83		
Explained variance (%)																		
Total	10.62			11.61			11.76			11.61			12.04			11.90		
Introduced variables	0.14			1.13			1.28			1.13			1.56			1.42		

Note. N=2635; *p<.05, **p<.01, ***p<.001.

5.2.4. Parameter estimates and standard errors for analyses of interest in biology

	Empty model			Basic model			M1			M2			M3			M4			M5		
	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p
Intercept	3.26	(.04)	***	3.27	(.03)	***	3.27	(.02)	***	3.27	(.03)	***	3.27	(.03)	***	3.27	(.02)	***	3.27	(.02)	***
PUPIL LEVEL																					
Biology combined test				0.05	(.02)	*	0.05	(.02)	**	0.05	(.02)	*	0.04	(.02)	*	0.04	(.02)	*	0.05	(.02)	*
Reading habits				0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***
Parental involvement				0.06	(.02)	**	0.05	(.02)	**	0.06	(.02)	**	0.05	(.02)	**	0.05	(.02)	**	0.05	(.02)	**
Impulsivity				-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***
Conscientiousness				0.16	(.02)	***	0.15	(.02)	***	0.16	(.02)	***	0.16	(.02)	***	0.15	(.02)	***	0.15	(.02)	***
TEACHING LEVEL																					
Pupil-teacher interaction							0.27	(.02)	***												
Pupil-pupil interaction										0.04	(.03)										
Management of time													0.2	(.03)	***						
Structuring																0.27	(.02)	***			
Orientation																			0.27	(.02)	***
Homework																					
Assessment quality																					
Teaching-modelling																					
Application																					
Questioning																					
TEACHING QUALITY																					
Unexplained variance (%)																					
Teaching level	12.60			10.60			2.58			10.50			6.50			3.20			2.99		
Pupil level	87.40			75.10			75.10			75.10			75.10			75.10			75.00		
Explained variance (%)																					
Total				14.20			22.30			14.30			18.40			21.70			22.00		
Introduced variables				14.20			8.05			0.10			4.13			7.43			7.74		

Note. N=2270; *p<.05, **p<.01, ***p<.001.

(Table continues on the next page)

5.2.4. (continued). Parameter estimates and standard errors for analyses of interest in biology

	M6			M7			M8			M9			M10			M11		
	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p	B	S.E.	p
Intercept	3.27	(.03)	***	3.27	(.02)	***	3.27	(.02)	***	3.27	(.03)	***	3.27	(.03)	***	3.27	(.02)	***
PUPIL LEVEL																		
Biology combined test	0.05	(.02)	*	0.05	(.02)	**	0.05	(.02)	*	0.05	(.02)	*	0.04	(.02)	*	0.05	(.02)	*
Reading habits	0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***	0.16	(.02)	***	0.16	(.02)	***	0.15	(.02)	***
Parental involvement	0.06	(.02)	**	0.05	(.02)	**	0.05	(.02)	**	0.05	(.02)	**	0.05	(.02)	**	0.05	(.02)	**
Impulsivity	-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***	-0.1	(.02)	***
Conscientiousness	0.16	(.02)	***	0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***	0.15	(.02)	***
TEACHING LEVEL																		
Pupil-teacher interaction																		
Pupil-pupil interaction																		
Management of time																		
Structuring																		
Orientation																		
Homework	0.08	(.03)	**															
Assessment quality				0.27	(.02)	***												
Teaching-modelling							0.27	(.02)	***									
Application										0.23	(.03)	***						
Questioning													0.26	(.03)	***			
TEACHING QUALITY																0.28	(.02)	***
Unexplained variance (%)																		
Teaching level	9.91			3.10			2.99			4.85			3.72			2.58		
Pupil level	75.10			75.00			75.00			75.10			75.00			75.00		
Explained variance (%)																		
Total	15.00			21.90			22.00			20.00			21.30			22.40		
Introduced variables	0.72			7.64			7.74			5.78			7.02			8.15		

Note. N=2270; *p<.05, **p<.01, ***p<.001.

PART II A HANDBOOK FOR QUALITY TEACHING

In accordance with the theoretical model of educational effectiveness (Creemers & Kyriakides, 2008), the following text presents recommendations for the improvement of teaching practice. Within each factor, its theoretical definition is presented (Ibid.), followed by guidelines, possible approaches and specific actions that teachers can undertake in their work with pupils.

I Management of time

WHAT is effective management of time?

The concept of an effective use of time in a dynamic model of educational effectiveness is defined as a time percentage of cognitive engagement of pupils in the activities and assignments in class. The effective teachers organize time well and use efficient procedures for class management, making the classroom climate learning-oriented. Although it is impossible for all pupils to be maximally engaged for the whole 45 minutes of a class, the goal is to achieve the maximum number of pupils thoughtfully activated in relevant cognitive activities ("pupils are on task") for a maximum amount of time.

One of the basic limitations of effective time management that cause inadequate engagement of pupils in relevant tasks in class ("pupils are off task"), are different forms of interfering or unacceptable pupil behaviour. The class is most commonly disturbed by following pupil behaviour: *unengagement of pupils on planned activities* (i.e. doodling on a book, reading the newspapers, watching the mobile phone, daydreaming); *verbal interruption* (i.e. conversations, singing, laughing, whispering, answering questions without asking for permission); *physical movement that distract and interfere* (i.e. walking around the classroom, standing up, rocking on a chair, throwing objects, passing messages); *disrespecting the teacher* (i.e. arguing, heckling, refusing to talk or answer, using inadequate language). These forms of behaviour are typical and expected (they exist in every school, every class, every day). The effective teachers develop different approaches, procedures and actions to limit their negative influence on the learning process in teaching. It is determined that the effective time management in class engages the pupils in the planned activities more, but also improves the pupil achievement.

HOW to manage time effectively?

There are different techniques, activities and procedures that can be applied in order to effectively manage time in class:

- Organize the physical learning environment so that you enable a good visibility and overview of the space, an adequate seating order and accessibility of working materials.
- Prepare for class adequately and make a plan which coordinates the most important goals, activities and the available time.
- Devote less time to classic lecturing, and more to activities that activate and cognitively engage pupils.
- Prepare the more difficult tasks for better pupils so that they need approximately the same amount of time as other pupils need for easier tasks.
- Prepare the tasks according to pupil abilities, for knowledge, motivation and experience.
- For a group work and/or work in pairs, prepare the tasks for every pupil individually.
- Establish and sustain the rules of behaviour in classroom – reach an agreement with pupils regarding the rules and sanctions; provide their continued and consistent application. The rules should be clear, concrete, visible (publicly displayed) and accepted by all participants, revised occasionally; the measures should be taken quickly, consistently, equally towards all participants.

- Establish a mutual agreement with pupils over the routine and procedures for certain situations – what a pupil should do when he/she finishes the task early; when he/she wants to use the toilet; when he/she needs a pen, rubber, paper, the teacher's assistance etc.
- Provide adequate transition between activities – teach the pupils how to master the routines and rules of transitioning between activities (i.e. from frontal to group activity).
- While questioning a pupil, let other pupils be active also (give them previously prepared working sheets or ask them to answer the questions in the textbook).
- Pupils will be more focused on the task if you limit the time they to solve it.
- Provide the ways for tracking and monitoring the pupil work in order to understand whether the pupil is engaged or not.
- To save time, have pupils deal out the materials, reorganize tables etc., with you or on their own.
- Give precise explanations and instruction to pupils about what is expected from them in a task.
- Provide feedback that is detailed, accurate, clear, timely and continued.
- Design homework that is functional in reaching the aims of the class.

Finally, we list techniques that could help reduce and lessen inadequate pupil behaviour:

- Non-verbal techniques: (1) ignore inadequate behaviour (if the misdemeanor does not significantly disturb classroom activities, so teacher reaction would cause more damage) (2) use gestures and signals to tell the pupil to change his/her behaviour, and (3) approach the pupil.
- Verbal techniques: (1) point to desirable and recommended behaviour, (2) call out the pupil behaving inappropriately to answer a question, or use his/her name in an example for the taught lesson, (3) use non-offensive humor as a way to decrease tension and redirect the pupil behaviour, (4) point out to the pupil the negative effects of a certain behaviour, (5) shape your comment in a positive way (i.e. highlight positive consequences of changing the inappropriate behaviour), (6) use the ''I-messages'' (''I want you to pay more attention in class'', instead of: ''You are rude, troublous, bold...''), and (7) directly demand from the pupil to stop behaving inappropriately.
- Logical consequences of a behaviour are logical answers to a given behaviour, and not those that are given arbitrarily. The effectiveness of this technique depends on the strength of a logical connection that is set between an inappropriate behaviour and the consequence that is produced by that behaviour. In applying the logical consequence, the teacher is expected to direct the pupil to what was actually inadequate in his/her behaviour, offer a possibility to substitute the unacceptable with an acceptable behaviour and apply the appropriate logical consequence if a pupil wants to continue with inadequate behaviour. Basic approaches in application of logical consequences are ''if you spoil something – you have to fix it'', ''loss of privileges'' (if a pupil won't put the scissors down, the scissors will be taken from him/her and he/she will have to finish the task in another way) and ''creating a pause'' (the pupil will be moved to sit by him/herself if he/she is bothering another pupil). This way the pupils are encouraged to choose between acceptable and unacceptable behaviour, which develops their ability to make decisions.

II Classroom as a learning environment

WHAT is a learning environment?

Classroom climate focused on learning is recognized in the research as an important factor of pupil achievement. In the dynamic model of educational effectiveness, a learning environment consists of five elements: (1) positive pupil-teacher interaction; (2) positive pupil-pupil interaction; (3) pupils' treatment by the teacher; (4) competition between pupils (the positive aspects) and (5) proactive classroom discipline.

HOW to create a learning environment?

- Try to organize a learning environment by engaging pupils in learning with establishing a relevant and complex classroom interaction.
- Apply interactive methods, techniques and actions that contribute to creation of the climate oriented towards learning and greater engagement of pupils in class (a learning environment is created for the pupils to research, question and make connections).
- Make your decisions about work and learning in classroom considering the differences between pupils so that you don't develop a uniform relationship with the pupils.
- Chose relevant, authentic and challenging learning content within the curriculum. Sometimes you can do it in agreement with the pupils, so that they can make choices and decisions regarding the content they learn.
- Create tasks that demand pupils to follow and regulate their learning. Those are the tasks that help pupils understand whether they have learned or not, without having to ask the teacher if their answer is correct.
- Design tasks and questions that enable them to find answers in real life.
- Point the pupils to your criteria, expectations and procedures for grading their knowledge.
- Develop an atmosphere where pupils are aware that they can't get high grades until they master the lessons.
- Avoid increasing or lowering pupils' grades on the basis of their (positive or negative) behaviour in classroom and/or their high or low engagement in class that is not related to learning results.
- When a pupil is answering a question, you should give him/her additional time, and use different techniques to help him/her get to the correct answer. Avoid ''catching mistakes'' and focusing on what the pupil does not know.
- When giving a constructive criticism, do it in a clear, precise and positive way; always start with what is good, and then inform about what should be changed, and then again emphasize something positive (i.e. ''Excellent structure of the text, maybe you can think about how to describe the characters by pointing out their specific features. Otherwise, you have made a significant progress in formulating the main message of the text.'')
- Actively listen to pupils by recognizing the dominant needs, motives, expectations and feelingsin their statements, so that you can show your understanding (i.e. ''It seems to me that this task was challenging for you'').
- While listening actively, paraphrase by retelling in your own words what you heard in the pupil's statement.
- Develop a feeling of unity and belonging by devising mutual values and goals about learning (what you would like to achieve with your pupils regarding knowledge and skills) and mutual relations (how you would like to treat each other) together with your pupils at the beginning of the school year.
- Take time to know your pupils (their key abilities and skills, their interests, life goals, educational aspirations, their motivations and learning strategies) and use that knowledge in your teaching. For instance, to motivate a pupil, relate the learning content with pupil's interests, goals, his/her educational aims and the like.
- It is sometimes good to ''sacrifice'' time in class in order to better get to know your pupils, their interests, needs, affinities.
- At the beginning of a school year, make an inventory of motivations – ask pupils to write down what they want to know about a school subject or their general interests.
- Develop a culture of learning and show your pupils on your own example that no one is unmistakable or omniscient, and that you also learn new things every day.
- Trust is developed when pupils feel free to ask questions, make suggestions and check their ideas ''out loud'', experiment in their thinking and solutions they come upon.

- Use situations in which pupils make mistakes while learning by helping them understand their mistakes, where and why they make them – which is a guideline to correcting those mistakes.

How to effectively encourage pupil-pupil interaction?

- Pair up the pupils who know less with those who have more knowledge, skills and confidence (enabling the peer learning). Make sure you divide roles and assignments adequately, so that the better pupil wouldn't take over and do the most of the work. A significant number of research shows that both of the paired pupils - the ''tutor'' and the ''disciple'' – have benefits from peer learning.
- Create tasks that are slightly above the pupil's abilities, knowledge and skills, so that they can overcome them with help from their more competent peer.
- While discussing, ask your pupils to relate their statements with a previous statement of another pupil (instead of always addressing the teacher).
- Organize the dialogue so that you incite the interaction between the pupils using "the chain" technique (a short statement of each of the pupils in ''the chain'' is attached to the previous statement by another pupil), "the star" technique (the pupil with some valuable knowledge, skills or experiences answers the questions from other pupils from the ''star'' position) and "the network" technique (a ''network'' like conversation between the pupils).
- To incite interaction, you can, together with your pupils, keep the diary about the each pupil's learning progress.
- Set the limits in interaction with pupils, so that they know what is acceptable and what is unacceptable behaviour.

How to create a learning environment in a group?

- Teach the pupils about the rules and procedures of a group work (teach them about the techniques of a group work, encourage them to help each other, to be tolerant about ideas and the like).
- The group work should be organized in such way that pupils would work on one mutual assignment ''as a group'', not on the individual assignments ''in a group''.
- Divide pupils into small groups according to specific criteria (their needs, interests).
- Organize the pair and group work using multiple ways of communication (discussion or ''the brainstorming'').
- Put the shy pupils into three-member groups (this way they will contribute to the discussion, while in a more numerous group it is harder for them to join, and much easier to draw back).
- Monitor the work of each group, encourage their activities and assignments, don't stay too long with one group.
- Make sure that everyone is included in the group work, that no one is left out – you can do this by giving out different tasks and roles to each of them.
- To incite the participation in group work, enable the pupils to change their roles.
- Limit the time or give pupils a specific deadline so that they can learn to plan the work pace and finish the assigned task in due time.
- From task to task, regroup the pupils periodically, so that no group would always have the same members.
- Set the topics and problems mutual to groups of pupils by, for example, gathering the pupils with problems in understanding the basic notions and helping them analyze the given problem together (eventually with help from the teacher).
- Combine competition and cooperation between pupils during the group work (but also in other work forms).

III Orientation

WHAT is orientation?

Orientation is a factor in the dynamic model of educational effectiveness which refers to significance and purposes of specific teaching contents. This factor focuses on questions such as: why it is important to learn the subject contents, how they can be useful in everyday situations and the future activities, when and how the learned can be applied in practice, what kind of problems can be solved by using the acquired knowledge and skills. Hence, orientation means establishing meaningful, conceptual and logical connections within theoretical knowledge, as well as between theory and practice.

Orientation activities in class address the problems of decontextualization and remoteness of what is learned at school from pupils' everyday life (as is recognized in many studies in the area of education, worldwide and in our country). School learning is happening in an environment separated from the outer world and it most often prepares the pupils for future assignments, rarely for those in the present. Also, pupils gain knowledge and skills they need for school and, often – nowhere else. However, orientation activities incite the development of an inner pupil motivation (some authors see this as the most important task of primary school education) and contribute to the activation of pupil's classroom learning process. Placing the teaching content into real life context enables a personal and emotional engagement of pupils, which enhances the pupil's attention, persistence and dedication in work, and positively affects the durability of memory and better understanding of the treated topics.

HOW to apply orientation in class?

There are basic guidelines for orientation incitement and possible concrete actions that point to the significance and values of subject contents, addressed in the following text.

- Get to know your pupils' motivations, hobbies and activities outside of school:
- Offer the pupils to fill the ''interests' inventory'' and write down their motivations regarding a specific subject, as well as their other personal interests.
- In conversation with pupils (in class and outside of class), try to find out what extracurricular activities they are most often engaged in and why they are attracted to it.
- Create a pupil ''portfolio'' which presents the motivations of each pupil.

Encourage connecting the subject content with pupil foreknowledge and personal experience:

- Include pupil motivation in the class preparation, connect it with your presentation of new lessons, during the questioning of pupils etc.
- Allow pupils to present some of the teaching units by themselves and explain their importance.
- Incite pupils to use their foreknowledge and specific personal experiences while doing their homework (the individual or group ones).

Encourage recognizing the importance and values of the subject contents:

- Ask pupils what they think about the importance of a specific topic or subject content.
- Point to the scientific or practical, future or immediate significance of a subject content for pupils.
- Encourage pupils to discover by themselves (in class or as a school project or homework) the significance of particular subject contents.
- Demonstrate the relevance of subject contents by connecting them with the current events in the world or in the scientific field (showing selected video materials in class, using original sources, making connection between subject content and current media topics etc.).

Possible limitations and errors in orientation application:

- It is necessary to make orientation activities meaningful and timely, so it is not vital to create and realize these activities in every single class.
- You need to avoid the ''quasi orientation'' activities, where you only formally cite the general significance of a certain subject content.
- Avoid actions that draw pupils attention, but aren't relevant for the main topic of the class. An example of such action is retelling of an anecdote or interesting, but irrelevant details which distract pupils' attention from the important information and relations (for example, taking too much time in class to emphasize unusual biographical information about an author, which does not adequately explain the connection with the written piece that is being presented in class).

IV Structuring

WHAT is structuring?

Structuring in the dynamic model of educational effectiveness refers to organizing content of teaching so that the pupils would more fully understand the scheduled topics. Structuring is, therefore, focused on helping the pupils develop conceptual schemes, that is, it should contribute to pupil's inner structuring of subject contents. Rosenshine and Stevens (Rosenshine & Stevens, 1986, according to: Creemers & Kyriakides, 2008) show that the pupil achievement is maximized when a teacher not only actively presents the content, but when he/she also structures it by: (a) beginning the class with the overview of previous content and review of objectives, that is connecting the previous content with the content that will be the topic of the lesson; (b) outlining the content to be covered and signaling transitions between lesson parts; (c) calling attention to main ideas, and (d) reviewing main ideas at the end of the lesson. The teacher's actions significant for structuring of the content refer to particular parts of lesson, to the whole lesson, to a lesson unit or an area, as well as to a subject itself. These activities are most evident in systematization (Brophy & Good, 1986) and revision classes, but their presence is important in all types of classes. The teachers differ in the frequency and quality of these structuring activities in class. The research showed that the effective teachers dedicate between 15% and 20% of time to a weekly and monthly revision of previously elaborated materials. Also, the effective teachers check during classes if their pupils understood the contents, by asking from the pupils to retell the most important topics, to connect the key aspects, concepts or actions, to give new examples etc. Research also shows that the structuring helps in the process of memorizing information, but it also enables the understanding of subject content as an integrated whole and recognizing the relations between the parts of that content.

HOW is structuring applied in teaching?

Structuring is found in four basic groups of activities in class, that is, it can manifest in different actions of pupils and teacher, listed in the following text.

Encourage repeating of a relevant previously learned materials and pointing at the connection with subject contents that is yet to be learned:

- Ask questions related to relevant previously learned concepts.
- Create short quizzes as a preparation for learning the new materials and activation of the existing pupil knowledge.
- Give homework so that the pupils can repeat the most important concepts necessary for new subject contents.
- Give pupils an assignment to write down resumes of the previously elaborated unit.

Emphasize the content of a lesson and point at the transition between the parts of the lesson:

- In the beginning of the class, inform the pupils about the anticipated objectives, outcomes and expectations.
- Summarize the elaborated unit during class.
- Introduce new units during class.
- Give short reviews of the next unit during class.
- Draw pupils' attention verbally (i.e. ''And now we are going to talk about...''), paralinguistically (changing intonation) or nonverbally (stand up, change position).

Emphasize the key ideas, concepts and terms during class:

- Keep the focus on one topic during class.
- Be concise and clear in your presentation.
- Draw pupils' attention verbally (i.e. ''Please, pay attention, this is important/a little bit more complicated...''), as well as paraverbally and nonverbally.
- Write down the key ideas and concepts on the blackboard, tell pupils to write them down in their notebooks, etc.

At the end of the class or a bigger lesson part, make a content summary or a review of main ideas:

- Ask questions to check if the pupils understand the contents that have been taught.
- Pose problem situations and encourage pupils to solve them by using what they have learned in class.
- Occasionally summarize the subject content.
- Ask pupils to occasionally summarize the subject content.
- Assign pupils to create a list of questions regarding the main ideas elaborated in a lesson.
- Advise pupils to consult their textbooks or other sources that summarize the basic ideas and concepts.
- Make conceptual schemes, tables, charts or sketches with your pupils in order to emphasize the content and the relation between the main ideas or concepts.

Finally, structuring can be encouraged with the following:

- Connect the elaborated materials with the materials that will be elaborated in the following lessons.
- Plan the time well, in order to avoid interruption of an important activity due to the end of class (the bell ring).
- Take time to comment on errors or mistakes and pupils' misconceptions.
- Present the contents from simpler to more complex, from concrete to abstract.

V Application

WHAT is application?

Application in the dynamic model of educational effectiveness implies determining and applying the learned during the task solving and problem situations connected to the lesson and a particular topic of the class. This factor is related to the model of direct teaching (Rosenshine, 1983, according to: Creemers & Kyriakides, 2008), which implies that what is taught must be immediately applied. Creating opportunities for this form of practical pupil work is based on creating the class conditions that allow for a direct application of acquired knowledge. It is important that the application comes immediately after learning new contents, because research suggests that (1) human brain is capable to remember

and process a limited amount of information in a specific period of time, therefore the application activities prevent information accumulation and overwhelming of the pupils, and also that (2) forgetting comes right after new content is presented, so the application prevents and slows this process down. The effective teachers design and give their pupils different individual and group assignments and problems that include activating the existing knowledge. These teachers, also, follow, monitor, direct and coordinate the process of pupils' application. It is of a specific importance that the teacher provides feedback about the pupil's work quality, as well as about good and inappropriate solutions.

HOW to implement application in teaching?

Application can be encouraged in different ways, and we will suggest only some of the possible approaches and actions:

- Formulate the class objectives so that they imply application.
- Design application activities in classes where you present new materials, as well as in revision, systematization, questioning and exercising classes.
- Include a pupil in application activities in different forms of work organization (individual work, work in pairs, group work, and the whole class work).
- Organize the application activities in the introductory part of the lesson as a warm-up and start of the learning process.
- Practice short sequences of application during the middle part of the lesson, after particular parts of content that function as wholes.
- Organize application at the end of lesson to connect the whole content presented in class.
- Design tasks aimed at different levels of cognitive activation of pupils – beside the tasks that involve knowledge of facts, create tasks that request solving practical problems and problem situations, as well as those where pupils have to discover and articulate conclusions on the basis of questioning, research, critical thinking, relation analysis, synthesis of different elements, etc.
- Use different forms of application, such as oral, written, graphic, laboratory and technical exercises.
- Adjust the task to individual pupil characteristics, their capabilities, foreknowledge, interests, cognitive style, etc.
- Ask unusual and hypothetical questions and problems that demand pupils' creativity and imagination, but also critical and logical thinking, based on pupils' knowledge and experiences.
- Establish a routine of exercising in class, get pupils used to situations where they must activate their knowledge and practically apply the learned.
- Give homework and pupil projects that imply application of acquired knowledge and skills.
- Exchange the existing and design new suggestions for applications and particular tasks with your colleagues; consult various sources (methodical handbooks, knowledge tests, etc.).

VI Teaching-modelling

WHAT is teaching-modelling?

Teaching-modelling in the dynamic model of educational effectiveness implies that teachers help the pupils to develop and use different strategies for understanding and learning which can help them do various types of tasks, solve various problems, learn the subject content, plan and evaluate their learning, etc. Teaching-modelling also includes using numerous teaching sources to explain the content. In teaching-modelling, the focus is not on content (what is learned), but on influencing the development of pupils' thinking, that is the development of intellectual abilities and techniques for a systematic acquisition of knowledge, ways of dealing with problems and solving those problems. Teaching-modelling refers to all teaching activities when pupils are asked to get engaged in higher

thought processes (demands for knowledge application in different contexts, explaining the ideas, interpretation of texts, foreseeing the event outcomes, constructing arguments on the basis of the available data). The content of every subject envisages specific models of thinking for that particular field. It is important for efficient learning that the teachers initiate, recognize and encourage relevant thought activities that are characteristic of their subject. Teachers can influence the development of complex thought operations by helping the pupils develop the conceptual systems. The other important field in which it is possible to influence the development of thinking is the area of *problem solving*.

HOW is modelling applied in teaching?

Encouraging the development of the system of concepts:

- Try to introduce new concepts into teaching by connecting them with other, related, superior or subordinate concepts.
- Encourage pupils to classify the given concepts (subsuming the new concept under the superior one).
- Encourage pupils to search for similar and different qualities of concepts, which directs them towards the essential qualities (not just perceptional ones).
- Allow opportunities for concept comparison based on semantic features (i.e. slavery system, feudalism and capitalism).
- Encourage pupils to give examples (i.e. in mathematics classes, ask pupils to give all examples of right angles they can find in the classroom).
- Include the inductive reasoning and concept defining (i.e. defining the literary genre on the basis of a series of examples of literary works).
- Ask pupils to recognize what is specific for a phenomenon (concept, event, person, and object) which differs it from others of the same category.
- Allow pupils to find differences between related concepts (i.e. in history classes, ask pupils to make differences between the monarchists and the republicans).

Encouraging the problem solving:

- Ask pupils as many open questions as you can (the questions that don't imply one correct answer).
- Give tasks with different weight and levels of solving.
- Design tasks in which pupils would have to apply the learned and individually determine which knowledge are necessary for solving the task (solving problem tasks in mathematics, determining which genre a particular text belongs to, correcting grammar errors in a text).
- Give assignments that demand connecting of knowledge, where pupils would have to make these connections by themselves (connecting knowledge from different school subjects).
- Offer the pupils tasks that demand them to connect the lesson content with everyday life (after learning about sea currents and water transport of goods, the pupils are shown old maps of three harbors and asked to guess which one of them became the main harbor).
- Give tasks that presuppose comparative research of a given phenomenon (i.e. the status of women through centuries).
- Design the research, problem tasks in which pupils are given an opportunity to go through all phases of problem solving (defining and recognizing the problem, categorizing of different types of problems, presentation of problems (through pictures, symbols, charts, words), separating important and unimportant information, independent collection and analysis of facts necessary for problem solving, giving ideas for solutions, independent detection of techniques and methods for problem solving).
- Lead the pupils through the process of solving complex tasks by demonstrating them the process or procedure of solving problem and exploratory tasks, pointing them to the most important characteristics of problems, and use words to describe what you are doing.

- In the process of problem solving, it is important to balance the level of your involvement well, because being involved too much can result in pupils solving problems only apparently. On the other hand, restraining too much can create additional problems, where the pupils are wandering too much, because they don't have the needed assistance.

VII Questioning

WHAT does questioning stand for?

According to the dynamic model of educational effectiveness, questioning pupils often (Muijs & Reynolds, 2000) and encouraging pupil questions in class represent one of key teacher skills that have a positive influence on pupil achievements. The effective teacher uses different kinds of questions, with a goal to engage pupils as much as possible in relevant activities during the learning process (questions that encourage pupils to use more complex cognitive processes while learning in order to solve a problem or apply the learned on new situations). Questioning does not refer only to lessons of verification and control of knowledge, but other types of lessons as well (i.e. teaching new content). This model stresses five key elements. First of all, the teacher is expected to combine *product questions*(i.e. a factual knowledge is required) and *process questions* (i.e. a pupil has to analyze, estimate or argument something). Effective teachers ask more process questions (Askew & William, 1995; Evertson *et al*., 1980, according to: Creemers & Kyriakides, 2008). Second, the teacher should make pauses of an appropriate length after he/she asks ta question, and waiting for the answer should vary depending on the question's level of difficulty. Third, the questions should be clear and unambiguous so that the pupils would understand what is expected from them. Fourth, it is necessary to take into account the optimal difficulty of questions (Redfield & Rousseau, 1981, according to: Creemers & Kyriakides, 2008), which depends on cognitive requirements placed in front of the pupils, their developmental level, foreknowledge, and the context in which the teacher is asking the questions. For example, teaching basic skills (i.e. table of multiplication) demands a lot of repetition, so it demands quick questioning in which most of the questions are answered fast and correctly. However, when teaching something cognitively complex or when the pupils are asked to generalize, evaluate or apply the learned materials, the effective teachers use questions that can be answered by several pupils or those that don't have only one possible answer. Also, at the beginning of the lesson, at the start of learning, often mistakes in answering can be expected, while later in the process, when the pupils have overcome the lesson, mistakes should be minimal. The fifth element refers to the way teachers react to pupils' answers.

HOW to ask questions in class?

Combining different types of questions:

- Ask more open, divergent and process questions (questions of a higher cognitive level) as opposed to closed, convergent and product questions (questions of a lower cognitive level). Process questions should be asked more often (i.e. ''Try to think about why Ra – the Sun-god and god Nun are the most important deities in Egyptian mythology?'' – this question incites higher cognitive processes such as detecting connections. It is important that the teacher is convinced that the pupil has mastered basic knowledge enough to ask the process question.
- It is important that process questions do not prevail, because only the factual knowledge is checked through them (i.e. ''What deities did the Egyptians believe in?'' – this question incites memory and convinces a pupil that he/she has learned the content if he/she can repeat the correct answer).
- Avoid asking quasi-questions that suggest the teacher's intent (guess what I am thinking).
- Ask questions that demand pupils to explain their opinion in detail (i.e. ''What do you mean by that exactly?''; ''What would be the opposite of that?''; ''How does that manifest?''; ''How do you know that?'' and the like).

- Use questions to encourage pupils to review the validity of arguments for different opinions about topics they discuss in class (i.e. ''Does someone think differently about this?''; ''What other argument do you think is important for this problem?''; ''How can we approach this problem differently or solve this task in a different way?'' etc.).

Types of questions that incite higher levels of comprehension in pupils:

- Questions that encourage interpretation with paraphrasing, translating from one form into another (i.e. ''How can we present this sentence in a form of equation: There are twice as many girls than boys in the class?''; ''How can we present a process of photosynthesis in a several diagrams/pictures?'' etc.).
- Questions that encourage giving examples, a choice between given examples or separating the examples from quasi-examples (i.e. ''Think about what inorganic matters exist in the school yard?''; ''Which of these pictures are painted in pastel technique?'').
- Questions that encourage classifying (i.e. ''What out of the given is inorganic matter?''; ''Why are those inorganic matters?''; ''How do we know that?'').
- Questions that encourage generalizing/abstracting (i.e. ''What could be the title of this text?''; ''What are the key words/messages in this text''').
- Questions that encourage deriving conclusions by noticing principles in a series, applying analogy, noticing what does not belong (i.e. ''See the difference between singular and plural: ''birds sing/bird sings; balls roll/ball rolls; people dance/boy dances"; ''What is the connection between ''x" and ''y"?; ''Find the intruder: door, children, scissors, glasses?'').
- Questions that encourage comparison (i.e. ''What are the similarities, and what the differences between a square and a rectangle are?''; ''What are the differences and what are the similarities between apples and oranges?'').
- Questions that encourage recognizing cause-effect connections (i.e. ''Explain how the World War I began?''; ''What factors influenced it?''; ''Explain the Ohm's Law. What will happen if we add another battery into the circuit?'').
- Questions that encourage derivation/exercising (i.e. ''Divide two whole numbers.''; ''Declinate the noun.''; ''How many meters will Marko cross if he is riding his bicycle 15 kilometers per hour?'').
- Questions that encourage application of the learned, with pupils choosing appropriate procedures and applying them on an unfamiliar task (i.e. the pupils have a table in which are the reviews made by several reviewers regarding the esthetics, functionality and material quality for several mobile phone models. The reviewers chose a model A, but the manufacturer of model B complained about the decision, deeming the review of the esthetic characteristics of a model was valued more than the other two characteristics. It is the pupils' task to come up with a formula that would make a model B the reviewers' first choice).

Waiting for the pupil's answer:

- Give the pupil enough time to think *before* and *after* giving an answer. Before answering complex questions, pupils should be given no less than three seconds to think. The questions referring to abstract concepts should take more time to answer than the questions that involve remembering. After answering, pupils should be given time to think about the answer they gave.

Teacher's reaction to pupils' answers:

- Create acclimate of trust, a safe surrounding where the pupil questions, their opinions and ideas are welcome, and errors in answers are accepted as an integral part of the process of learning. It is not desirable to focus on the mistakes only.
- Avoid comments regarding pupil personality (i.e. ''You shouldn't be so shy''; do not use sarcasm, deprecation, accusations).

- Listen actively to the pupil answering a question by focusing on key elements in his/her speech (some children are prone to making excursions and digressions).
- Always accentuate that an answer is correct – a pupil who answered might know that it is a correct answer, but the rest of the pupils might not know this.
- When a pupil gives a partially correct or incorrect answer, continue interaction with the pupil, point out what was good in the answer, additionally reformulate the question or give the pupil a hint of a correct answer. Use help from other pupils in commenting the answer or giving hints of the correct answer.
- When a pupil gives an incorrect answer, point out that the answer is not correct and explain why it is not correct.
- Commend the answer that is well formulated, unusual and interesting, the answer that indicates deeper reflection.
- Ask additional questions that clarify the pupil's answer (i.e. ''Can you say it in your own words?''; ''Can you clarify that for us?''), the questions that deepen the answer (i.e. ''What are you basing your opinion on?''; ''How would someone who disagrees answer this question?''), redirection questions (i.e. ''If this is correct, what would the consequences be on...''), questions of reminding (i.e. ''What do we know about that already? If we know that is X, what does that tell us about Y?'').
- It is undesirable to interrupt the pupil while he/she is answering a question (except when mistakes are too big, if the other pupils are not focused, or behave inappropriately).

General recommendations for questioning:

- Ask questions in different parts of the lesson (the key questions should be asked at the beginning of lesson to point out the objectives you want to achieve or connect the new with the previous lesson; in the middle of the lesson ask questions that discover the difficulties that pupils have with the content and what should be clarified additionally; at the end of lesson ask questions to evaluate what pupils have learned).
- You don't have to stick strictly to the prepared questions and their order.
- Ask questions that encourage multiple pupil-teacher interactions and pupil-pupil interactions (i.e. during the discussion or in the situations such as: ''Did we answer this? Consult with your pair. What else should you find out in order to answer this?'').
- Consider your expectations regarding pupils with learning difficulties and adjust your questions to their individual needs.
- Pay attention whether you ask questions only to a small number of pupils or always to the same pupils.

Examples of encouraging pupil questions:

- Give an assignment to pupils to formulate their expectations from the lesson in form of questions.
- Ask pupils to formulate questions on the basis of the text they have read or to ask one or two questions about the lesson during the class.
- Ask pupils to compose questions for an interview with the writer of the textbook and/or regarding the content for an interview with a celebrity.
- Ask pupils to compose questions for a quiz, or a written exam.
- Give an assignment to pupils to ask questions in pair or in the group.

VIII Assessment

WHAT is assessment?

Assessment is an integral part of teaching (Delandshere, 2002; Stenmark, 1992; Willis, 1993, according to: Creemers & Kyriakides, 2008)and one of the most important factors of its quality. The main functions of assessment are: informative, instructive or developmental, motivational and evaluative. These functions are categorized in two forms of assessment: *summative* and *formative*. Summative assessment is overlapping with the evaluative function, while formative assessment includes informative, developmental and motivational functions. Formative assessment is considered one of the most important factors connected with the effectiveness at all levels, especially at the classroom level (de Jong *et al*., 2004; Kyriakides, 2005a; Shepard, 1989, according to: Creemers & Kyriakides, 2008). Information gathered during the pupil assessment should direct teachers in identifying the pupil needs and evaluating their work (Krasne *et al*., 2006; Kyriakides, 2004b, according to: Creemers & Kyriakides, 2008). Giving constructive feedback to pupils and taking corrective steps in one's own work so that the pupil can master the content is an integral part of quality assessment. The assessment criteria are determined by the teacher taking into account the specifics of his subject, based on the outcomes and standards of achievement, but also based on the individual pupil characteristics. Self-evaluation is a process of formative assessment during which pupils think about their learning, evaluate to what extent it reflects the objectives or criteria and correct it in accordance with that.

HOW is assessment applied in teaching?

The process of providing feedback to pupils:

- Create acclimate where mistakes are allowed, sometimes even welcome, by making it clear to your pupils, or by excluding unconstructive criticism, disrespect or labeling from your feedback in situations when a pupil makes a mistake.
- Check with your pupils whether they understood your message entirely.
- Always explain your grade to pupils – tell the pupil what grade he/she got, why you gave that grade, what should he/she additionally learn in order to progress.
- When formulating feedback, it is important for you and your pupils to understand the assessment criteria (make the criteria clear, concrete, measurable and based on outcomes and standards of achievement).
- The way of acting regarding the correctness or incorrectness of the answer should be based on recommendations for the ''questioning'' factor.
- Articulate the feedback concretely, specifically and comprehensively (i.e. instead of ''You did that well'' it is better to say ''You applied the definition well, you gave good examples for...'').
- The comments you give to pupils should refer to the effort, persistence and progress, not to individual pupil characteristics and abilities.

Actions that encourage teacher-pupil cooperation during assessment:

- Make a plan that will define ways in which you will, together with a pupil, reach information about the pupil's progress towards the expected outcomes and how you will use that information.
- The plan should be flexible so that it can meet the original and later developed ideas and pupil skills.
- The plan should envelope strategies that would enable pupils to understand the objectives and outcomes, as well as the criteria that would be used for assessment of their work.
- The plan should also include how the pupils will get their feedback, how will they themselves participate in the assessment of their learning and what kind of help they will get regarding their future progress.

- Allow pupils a certain level of choice and decision making regarding the objectives and the identification of the criteria for progress assessment.
- Discuss the assessment criteria with pupils by using the expressions they can understand, give examples how to fulfill the criteria and include pupils in the peer assessment and self-evaluation.
- The pupils should learn how to plan the next steps in their learning. Point them out to their strong sides and advise them how to continue developing them; be clear and constructive when it comes to their weak sides and how they can continue working on them; give them a chance to improve their learning.
- Recognize and acknowledge pupils' effort during the assessment of the outcomes and the learning process.

Self-assessment:

- Clearly formulate what is expected from pupils, how well they must master it and how they can show that they have accomplished it (i.e. ''By the end of the semester you should learn..., and these are the criteria based on which you would know to what extent you have mastered the given...you can overcome it this way...'').
- Inform the pupils about your grading criteria and point out to them what a well done assignment is, what is a good answer and based on which criteria they can self-assess their work.
- Allow pupils an opportunity to get to know how you assess the solved tasks/given answers – that is how you are helping them get acquainted with the process of (self)evaluation.
- Present the solved tasks to pupils (i.e. chose a well-drawn drawing and explain pupils what are the criteria of successfulness you applied in the assessment of that drawing).
- In encouraging pupils to self-assess their work, you can suggest them to use a reflexive diary, to check whether the criteria of successfulness were met by using a check-list or tables.
- Include the peers in the process of self-assessment (i.e. ask very pupil to anonymously write down an answer to a question on a piece of paper. Mix all the answers and give one to each pupil. The pupils' task would be to assess the answer they got on the basis of previously given criteria).

The idea of this handbook is to offer teachers the guidelines in order to improve their practice, and by that, contribute to the growth in pupil achievement. The basic suggestion is for teachers to first get acquainted with the given actions and techniques, reconsider them and adjust them to school and class context, but also to individual pupil characteristics. Finally, during the application of the said suggestions, it is necessary to perceive and balance out different factors that influence the quality of teaching, and, thus, influence pupil achievement.

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