

Differentiated instruction not only for Mathematics teachers

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Abstract. The aim of differentiated development in a heterogeneous group of learners (DDHG) is to reduce school leaving without education, using an adaptive and innovative teaching-learning environment and using the most effective strategies, methods and techniques. Furthermore, this strategy helps in developing skills for learners and building cooperation between learners in heterogeneous classes through the use of the special, status-management educational procedure, and finally its strength is to sort the status ranking among learners, and to change the social structure of the class. Our goal is to figure out how to share best practices with teachers. One of the effective ways to renew teaching practice is through further training for teachers. As a trainer of the Logic-based subprogram of the Complex Basic Program (CBP) the author of the paper has experienced how well logic-based and decision-making strategies work in other subjects as well as in mathematics.

Key words and phrases: differentiated development, heterogeneous classes, problem-solving, strategies, teaching practice, logic-based, complex basic program, collaborative techniques, further education.

MSC Subject Classification: 97D40.

The problem and a possible solution

The world is constantly changing, so the reason for the need for change is that the methods used decades ago cannot be applied exclusively and effectively in today's educational practice. In Hungary differentiated education strategy moves towards methodological development instead of content development in terms of pedagogical innovation. This reform and innovation can be transferred to other

institutions. The aim of the present paper is to show how good practices and methodological strategies tested in mathematics can be transferred to other subjects.

The basic idea of the CBP in Hungary is that schools keeping their good practices should be open to reform, which can trigger internal innovation processes (Révész & K. Nagy, 2019). The author of the paper held further training in the logic-based subprogram of the CBP for primary school teachers. Being a mathematics teacher, it was surprising for me to see how teachers of other subjects managed to implement ideas of logic-based teaching and learning strategies in their subjects after the course of further training in the subprogram.

Differentiation is a process through which teachers enhance learning by matching learners characteristics to instruction and assessment. When teachers differentiate, they do so in response to a learner's readiness, interest and learning profile. Differentiated instruction allows all students to access the same classroom curriculum by providing entry points, learning tasks, and outcomes that are tailored to students' needs (Hall, Strangman, & Meyer, 2003). Differentiated instruction is not a single strategy, but rather an approach to instruction that incorporates a variety of strategies.

Results showed that increased school diversity is negatively related to academic achievement at schools (Johnson & Johnson, 1997). A wide range of ethnic and cultural diversity among students in the classroom requires a differentiated approach to instruction. Group investigation through positive peer interaction in small groups increases students' motivation to learn while providing for flexibility and variety in teaching and learning. Students can be assigned purposefully to a group or assigned randomly. This strategy allows students to work with a wide variety of peers and keeps them from being labelled as advanced or struggling.

The Hungarian CBP targets experience-based learning. The strategy should be adapted to the different skills, motivation and knowledge of learners. In addition to the description of different learning organization methods and techniques, the Complex Instructional Program (KIP) (K. Nagy, 2006, p. 19) based on a special, collaborative technique (CT) also plays an important role in the strategies. The special feature of KIP is that it can handle the status ranking among pupils, one of the determining factors of pupil performance. The goal of status management is to ensure that ranking among pupils in terms of the skills considered important by the school is arranged in such a way that pupils who are most

successful in learning should continue to be excellent, and those who are less successful should be scattered around the average performance of the class rather than lagging behind.

Logic-based subprogram of the Complex Basic Program

The implementation of the CBP was supported by subprogram concepts, which help mainly in the subprogram occupations during the afternoon period, however, they can also be used during complex lessons. Sub-programs supporting the CBS are Logic-based, Digital-based, Practice-based, Art-based and Exercise-based. We are going to focus on the Logic-based subprogram.

The main purpose of the subprogram is to integrate playful, experience-based methods into education that can help improve learners' ability to think and solve problems. Playing is one of the most important activities of children, one of the steps of the natural learning process. We want to ensure that the use of different educational games improving logical thinking is integrated into the relevant part of the curriculum, closely linked to what is being learned. Most games require more participants, so group activity provides opportunities to develop social skills in addition to thinking skills such as communication skills, tolerance, adherence to rules, self-expression.

In the course of the subprogram teachers are presented with logical, strategic, creativity enhancing methods and strategies with the help of which one can achieve versatile personality development in both subprogram activities, and which can also be integrated into complex lessons. Topics of the logic-based subprogram are suitable for the development of logical and algorithmic thinking, problem solving, and learning skills in all grades of any primary school. Hence learners acquire strategies that can help them learn a wide range of subjects from mathematics to foreign languages and art.

In order to develop problem-solving thinking in practice, teachers taking part in the subprogram could identify winning strategies and apply algorithms in everyday life. In model lesson plans the role of visuality and the role of arts were presented in the development of thinking. Game-based approaches were also presented, with the help of jigsaw puzzles, to develop planar and spatial orientations. Learners could acquire how to develop mathematical thinking while mastering the basics of the game of chess and incorporating it into school learning. For the development of strategic thinking they could learn how to play board games, paper-pencil games. These game-structured approaches including card

games, logic games, logic-stories, guessing games, situation games (Révész et al., 2019), creativity and reflection games help in the application of logical conclusion schemes.

Differentiated development in heterogeneous groups and support for learning are well adapted to the playful approach of different subjects and individual occupations. This will strengthen conceptual learning, maintain a high level of motivation related to games, maintain and strengthen a positive attitude towards learning. In order to achieve this, the introduction and application of the Dienes method and the acquisition of Polya's problem-solving techniques, as well as the internationally recognised chess logic method developed and tested in the Telki Pipacsvirág Primary School play an important role in the subprogram.

Logical games and playful activities are integrated into the teaching-learning process in such a way that they can increase the effectiveness of the learning process and monotony of the classroom learning can be broken. Activities in the lesson are organized according to individual needs of pupils, toys used correspond to the child's level of development and the basic idea of adaptability is taken into account.

In the common game, the common design and adoption of the rules develop the social sensitivity and individual responsibility of pupils, which also appears in other areas of life. The aim is to display the learned methods in school free time, to create voluntary pupil self-organizations which result in constructive spending of leisure time and develop a sense of community life.

Learning Applications (LearningApps) have been presented in the logic-based subprogram. LearningApps.org is a web 2.0 interface for creating interactive educational resources. After registering on the site, using templates it is relatively easy to create and share diverse, interactive and multimedia applications. Learning applications created on the LearningApps interface are game-based learning tools that can be used on any browser-enabled device. These applications help to transfer knowledge, improve digital competence and provide the experience of co-learning in a playful environment. Teachers can use learning applications to make their lessons more colourful and enjoyable as text, picture, audio or video clips can be displayed within a learning application. They can be used at any stage of the lesson to increase pupils' activity and motivation. These are also excellent for differentiation, because their content can be tailored to the individual learner. Applications are also suitable for distance learning and formative evaluation, and pupils also have the possibility to produce creative content. The

interface facilitates knowledge sharing because applications can be made public, so they can be used by the others.

The most frequently used evaluation methods in pedagogical practice are also presented in the Logic-based subprogram. Diagnostic, formative and summative evaluations are included in the program and their strengths are highlighted. In addition to the formal evaluation proposed by the program, pupil self-evaluation is also displayed. A number of supporting materials help to expand the evaluation methods used by teachers with evaluation sheets and it also helps to introduce pupil self-assessment or to use it more frequently.

Collaborative techniques

Group tasks based on the central topic of the lesson should be designed to be open ended and to have several solutions. They should instruct learners on essential skills that are provided at different levels of complexity, abstractness and open-endedness to allow learners to engage in a variety of activities using their knowledge and problem-solving thinking. In order to solve tasks, each member of the group must work, so that a pupil cannot solve them alone during a given period of time. Each group of 4-5 pupils should be given a different task concerning a given topic. When compiling group tasks, care should be taken not to create a competition between groups, the task should not be copied from the textbook. The task is not appropriate if: there is only one solution; it is faster to solve it alone than in a group; it is not at sufficient level or it requires simple memorization or routine acquisition of knowledge. It should also be ensured that the group task does not contain too many detailed instructions, because it does not allow for innovative thinking and debate between learners (Cohen & Lotan, 2014).

After group work, each pupil gives an account of his/her knowledge individually in writing or verbally. The individual task is based on the task of the group, uses its results and is not possible to be solved without using the group task. This, however, requires active participation by all pupils in the joint work. Those who do not participate in group work will most likely fail to perform their individual task. When designing individual tasks, care must be taken because the groups are heterogeneous in knowledge, each pupil should be given a tailored task to suit his/her ability. Different ways of solving individual tasks are possible, such as completing a group task, further thinking about the task, forming an opinion, etc. The task can be solved orally or in writing, or even by drawing or creating something. More information about collaborative techniques can be found in (Lew, Mesch, Johnson, & Johnson, 1986).

Further education for primary school teachers in the Logic-based subprogram

The author of the paper held two courses for a total of 25 teachers from different primary schools in the Logic-based subprogram. Considering the structure of these further education courses, 2 times 10 lessons were planned to be contact education and 10 times 45 minutes to be online. Because of the Covid pandemic, both courses were held completely online. The design was changed and the curriculum was available online in a written form. As the trainer of the further training I kept contact with the participants via online forums and email messages. These training courses were monitored by a specialist on behalf of the Ministry of Education. Therefore, reliable information on the effectiveness of further training has been collected.

The Logic-based subprogram increases teachers' methodological repertoire in three areas of school life by offering learning methods and strategies to support the development of learners' thinking: a playful approach to mathematics classes, logic games used in different subjects in a classroom environment, and playful organization of leisure activities.

Let me present some examples from the teachers taking part in further education in the Logic-based subprogram.

The first milestone participants had to complete was to create an algorithm for specific problems. They had to find examples how to visualise concepts. They could build 3-dimensional shapes using a modelling kit, or making mosaics, patterns, mazes from specific modules. They had to provide a photo of their work and submit it on the fifth day of the training.

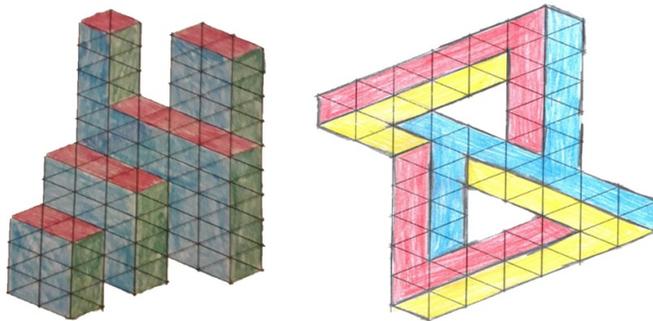


Figure 1. Representation of non-existing shapes

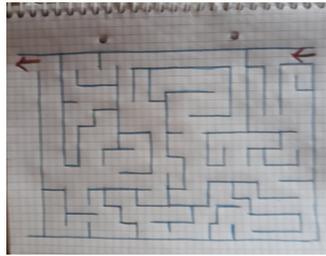


Figure 2. Representation of a maze

The second milestone was to design decision-making tasks from everyday life, orientation on the chessboard, game recording, strategies, and endgames. They had to provide a photo and submit it on the seventh day.

Finally, participants had to design a lesson plan or plan an afternoon session using DDHG strategies.

We often find ourselves in a situation where we cannot solve a problem. Then we lose motivation and interest and experience failure. Therefore when we manage to draw shapes that do not exist in reality and we still can create them, we may regain our hope to be able to solve problems that seem impossible. On the other hand, these drawings can help teachers understand how learners might feel when they encounter a new problem, thereby making them more understanding.

Orientation on a chessboard

- Name of the game: Who gets to the other side first?
- Organisation of learning: pair work
- Preliminary knowledge: knowledge of chessboard, names and movements of figures
- Process of the game: Move Knights and Bishops to the other side of the chess board according to the rules of the game. Whoever gets to the other side first wins!

Variation: Move the chess pieces as quickly as possible to the opposite side according to the rules of the game. Whoever gets to the other side in the least steps wins.

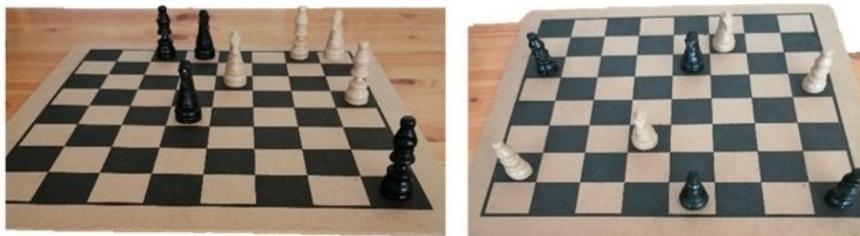


Figure 3. Representations of a chess game

Some games from the participants' lesson plans show the application of the strategy for different subjects.

Decision-making situations 1

- Name of the game: Find the word!
- Subject: English
- Organisation of learning: pair work
- Preliminary knowledge: knowledge of chessboard
- Areas to be developed: localization on the chessboard, English vocabulary development, exercise of the English alphabet
- Process of the game: Letters are placed on the fields of the chessboard according to the English alphabet. For example, letter elements in a word game called Scrabble are suitable for this. The first player thinks of an English word with a maximum of 5 letters from the letters on the board and gives the position of each letter, which allows the other player to guess which word his or her partner thought of. Then they will change roles. Letters already used are removed from the board and they can no longer be used. The game ends when all the letters have been used, or when no player can think of a new word.
- Example: C3, F8, H6, A1 – cold
- Duration of the game: 10 minutes

8	F	H	I	K	G	O	M	A
7	X	F	U	P	W	E	R	B
6	A	S	D	G	N	I	R	L
5	L	J	B	I	D	C	E	O
4	Q	S	I	A	O	T	V	Z
3	N	H	C	L	K	E	A	F
2	P	O	U	L	D	F	V	Y
1	D	A	O	M	E	G	I	A
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>F</i>	<i>G</i>	<i>H</i>

Figure 4. Representing a chessboard with letters

Decision-making situations 2

- Name of the game: Answer in one movement on the chessboard!
- Subject: English
- Organisation of learning: individual work
- Preliminary knowledge: knowledge of chessboard, names of the chess pieces in English and knowledge of their movements
- Areas to be developed: development of chess skills, exercise of locative words in English
- Process of the game: The pupil either works on the given work sheet or puts the chess pieces in the position on the work sheet on his or her own chessboard. After that the player searches for a chess piece that can be placed in the position corresponding to the given English sentence with one movement according to the rules.
- Example: Which chess piece can you move to be between the Rook and the Pawn? Which piece can you move next to the King? Which piece can you move under the Knight? Which piece can you move into the top left corner? Which piece can you move above the Bishop?
- Duration of the game: 5 minutes

Variations: The player only sees the chessboard and he or she has to invent something similar to the question above.

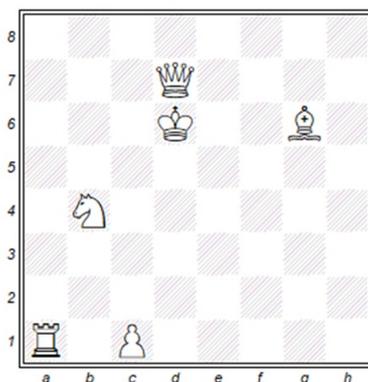


Figure 5. Representing a chessboard during a game

The task is easier if the player writes true statements about the position of the chess pieces on the chessboard in English.

The task can be converted into pair work if another player tries to find the right pieces on his or her chessboard according to the sentences written by his or her partner or on sentences describing their position.

Decision-making situations 3

- Subject: Chemistry lessons
- Organisation of learning: group work
- Experiment: separation of the components of a mixture
- Available tools: magnets, water, filter paper, wire mesh, iron-leg rack, wine burner, beaker, watch-glass
- Available methods: dissolution, mixing, sedimentation, evaporation, crystallisation, filtration, magnetization
- Areas to be developed: experimentation develops design and decision making skills, deepens the chemical concepts, methods and material knowledge
- Process of the experiment: The mixture consists of four components: sulphur powder, iron powder, sand and salt. The problem pupils need to solve is how to separate the components of a mixture. Children work in groups. First they find out a strategy how to solve the problem in theory and then they carry out the experiment. They need material knowledge for this to help them in building the sequence of the experiment. If they make the wrong choice, the experiment stops somewhere and they cannot move on. After each successful

step a new decision will be made on which device and which mixture separation method will be appropriate to move forward. The first step is to remove the iron from the mixture using a magnet. This is an easy decision for pupils. After that they have a harder job because they can only move on if they choose to dissolve in water. However, many of them here are uncertain because they do not consider the properties of the remaining materials. After dissolving in the water, the sulphur floats on the surface of the water and the sand settles on the bottom if they wait patiently. After that it is not difficult to make a decision, the mixture needs to be filtered. They may still think about whether to filter carefully or quickly. Which is the best way to keep the sand from mixing back up? In the last step they need to decide again how to recover the salt. They have two solutions here. Evaporation or crystallisation may also be selected. If they have planned well and carried out their plan correctly, they can see all four components on the watch-glass.

Part of an English lesson plan 1

- Group work: Write a short dialogue using as many adjectives as possible that are written on the blackboard. Be prepared to present the dialogue to the others.
- Individual tasks related to the group's work:
 - (For a struggling learner): Continue the list of words on the blackboard (rich, funny, beautiful, small, happy) with a minimum of 5 additional adjectives.
 - (For an average learner): Try to write as many adjectives in comparative form as you can.
 - (For an average learner): Write from memory as many adjectives from the conversation as you can.
 - (For an advanced learner): Write from memory as many adjectives from the conversation as you can and write their comparatives next to them.

Part of a Hungarian lesson plan 2

“The Mitten” is a folk tale, which has numerous variations, the general story line is as follows: a man loses his mitten in a forest. One by one various animals come and settle in the mitten planning to spend cold winter in the warm mitten. Prior to settling, a new-comer asks permission from the animals already living there.

The range of animals also varies in different versions and includes: a mouse, frog, hare, fox, wolf, bear and boar. They have nicknames, for example: “Munchy

the Mouse” and ”Skippy the Frog”. The animals arrive to the mitten in increasing order of their size.

- Group work: You will find some picture cards showing the characters of the story on your desk. Place the characters on the sleeves of the glove drawn on the wrapping paper as they moved in it according to the tale. How else could they have moved in? Put them in a different order. Draw five other options.
- Individual tasks related to the group’s work:
 - (For a struggling learner): Choose a solution of the group task and put down the names of animals in alphabetical order.
 - (For an average learner): Describe what else could these animals use the lost glove for.
 - (For an average learner): What lost objects could these characters move into?
 - (For an average learner): Choose one of the characters. Describe its neighbours without saying their names. What lost objects could these characters move into? Tell your riddle to the others.
 - (For an advanced learner): Calculate how many residents of the glove will be there in a year if they all get married and each couple has one child! Write down with operations signs how you calculated.

Part of a Mathematics lesson plan 3

- Group work: You will find some number cards with numbers (2.45; 4.56; 7.2; 1.41; 4.55; 0.2; 3.98; 7.3; 1.45; 6.02) on your desk. Use 4 number cards to write a sequence of operations with at least two different operational signs.
- Individual tasks related to the group’s work:
 - (For a struggling learner): Choose 5 decimal fractions and write them in letters.
 - (For an average learner): Use brackets to change the result of the operations.
 - (For an average learner): Choose 5 decimal fractions from your cards and write them as a sum of numbers according to decimal places of the digits.
 - (For an advanced learner): Choose 5 decimal fractions from your cards, round them to one and two decimal places.

Part of a Science and Geography lesson plan 4

- Group work: Put together the puzzle of the planets. Where is our place in the universe? Determine the Earth’s location in the universe. Use books and the internet to help.

- Individual tasks related to the group's work:
 - (For a struggling learner): What is the solar system? Write the planets of the solar system in alphabetical order.
 - (For an average learner): List the planets in ascending order by size. Make a drawing of the planets.
 - (For an average learner): What kind of materials the sun is made of? What effect does it have on Earth? Describe it briefly.
 - (For an advanced learner): Which planet would you visit and why? Make an essay of 6-8 sentences in length and make drawings.

Part of an Ethics lesson plan 5

Alive is a 1993 American biographical survival drama film based on Piers Paul Read's 1974 book *Alive: The Story of the Andes Survivors*, which details a Uruguayan rugby team's crash aboard Uruguayan Air Force Flight 571 into the Andes mountains on October 13, 1972.

Based on the film *Alive*, the story is as follows. It is July 20th, 11:00 a.m. You have just made a tragic forced landing somewhere in Mongolia in the desert. The small twin-engine passenger plane with the corpses of the pilot and navigator completely burnt out. The only thing left of the plane is its frame. The group of passengers, however, survived the crash safely. The pilot was unable to tell the exact location of the plane before the accident. They were in contact with the ground control until the very last moment. According to their information, it was known that they had deviated from the designated direction of flight about a hundred kilometres. Before the crash the pilot said that you were 110 km from the nearest inhabited settlement in a north-eastern direction. The area where you landed is a rocky plain, the horizon is cut by sand dunes otherwise completely extinct. According to the latest weather forecast, temperatures can reach 42 degrees during the day, equivalent to 52 degrees at ground level. You are in light summer outfit. You are wearing short-sleeved shirts, shorts, socks, shoes. Everybody has got a handkerchief. You have 14,000 HUF, 1,200 dollars, two packs of cigarettes and a ballpoint pen. Before the plane went on fire, fifteen different objects were quickly saved. Now you can think how to use them to survive this adventure.

- Group work: Go or stay? Members of the group must agree whether to stay at the crash site or to seek for help. Collect 5 arguments and objections to stay. There are 15 objects you can take with you. Arrange these objects in order of importance.

- Individual tasks related to the group's work:
 - (For a struggling learner): Write the arguments and objections collected in the group work in alphabetical order. Which ones are more? Did they convince you to stay or go?
 - (For an average learner): Write more arguments and objections to stay at the crash site in addition to the list of the group.
 - (For an average learner): If you could exchange 5 objects in the list of the 15 you can take with you, what other things would you choose to increase the chance of your survival?
 - (For an advanced learner): Write 10 objects to take with you to survive and justify your choice. Arrange the 10 objects in order of importance.

Some first results

Feedback from the introductory phase on the teaching strategy of the program was positive. Satisfaction concerning trainings in the subprograms was also one of the best considering the overall program. More than 85 percent of the teachers participating in the DDHG trainings were particularly pleased with the training, one of the strengths of which was its practical aspect. Positive experience has shown that no significant conceptual change to DDHG is needed. One of the key points of the effective use of the strategy is to use the lesson organization procedures in an appropriate proportion. In the case of DDHG, we propose to implement 20 percent of the annual number of lessons in a subject with this strategy (differentiated individual work, pair work, group work, cooperative methods, drama and project work) (K. Nagy & Révész, 2018).

In summary, the teacher can hold approximately 80 percent of lessons based on his or her previous usual practice, which is a higher proportion than the 20 percent that should be adjusted, however, in a few months (3–5 months) there is a noticeable change in pupils' motivation, attitudes towards learning and their social relations.

Opinions of the participants in the Logic-based subprogram training

Open-ended questionnaires were used to assess opinions of the teachers participating in the training as part of the project (K. Nagy & Révész, 2018). From these questionnaires completed at the end of the training we wanted to get answers

to what teachers regard as the most prominent virtues of group work. We also looked for the answer to the question of how much time it takes for teachers to prepare for their lessons as well as whether teachers have changed the attitude of learners to work in class in the course of applying the method DDHG. Furthermore, it was important to assess how the teachers felt in the classroom during teaching with this method, how regularly they used this method and whether they consider it important to recommend the regular use of this method to their colleagues, and if so, why. In the end, we looked for reasons for using group work. Some typical answers to the question “Have children’s attitudes to classroom learning changed?”:

- “More pupils became active participants instead of passive recipients in the lesson.”
- “They really like lessons like this.”
- “Interestingly, they memorize the curriculum better.”
- “Everyone accepts each other. They can and want to work together.”
- “They enjoy the lessons.”

The majority of the respondents think that children are more active, learn more effectively, have significantly fewer behavioural problems preventing progress and they seem to enjoy the lesson.

In terms of the effectiveness of the educational work, it is an extremely important issue how the teacher feels while teaching. Some of the typical answers to the question “How did you feel while teaching in the class?”:

- “I was really worried about how this lesson was going to work out.”
- “I see I need to improve.”
- “I am pleased.”
- “It was a pleasure to watch the children work together. I did not think they could do it.”
- “Several children are revealed to have hidden strengths.”
- “I was surprised how creative the children are.”
- “I was surprised it works.”

Most of the teachers mentioned that by using this method they at last have the opportunity to activate all children and get to know the children’s personality better, which fills them with satisfaction and joy.

Some of the typical answers to the question “Do you recommend this method to your colleagues? If so, why?”:

- "I recommend it to those who feel that pupils have changed and it is becoming increasingly difficult to make work during the lesson. You will succeed with this method."
- "I suggest it to those who feel they are on the verge of burnout. It is a renewal."
- "If you are an innovative colleague, you will like this, as it gives you the pleasure of creating."
- "If you are looking for a new method, you will find it in this."
- "It is always a problem how to put tasks in a close-to-life situation. Here I learnt how to do it."
- "Children's behaviour changes. The class becomes a community."
- "Children learn to speak, present."
- "You can get closer to the children."
- "This method is good primarily because both pupils and teachers can experience more success."

In addition to the numerous positive opinions contained in the questionnaires, we should not ignore the doubts, questions and negative experiences raised by the method. Some doubts and concerns are mentioned below:

- "I do not think it works in my class."
- "I am old for this. I will retire in two years."
- "I know it is good, but I do not have time for this."
- "I do not want it."
- "They say that it will be successful in two or three years. I do not think so."
- "What makes it good to have fun?"

According to the respondents, daily school work is easier as learners are greatly motivated and the cohesion of the class community is also stronger. The development of communication skills, the recognition of the importance of cooperation, the ability to be independent and to argue can be understood as the aims of education and pedagogical work.

95 percent of the respondents considered that this form of work with DDHG requires more preparation than other teaching methods. In the majority of the answers to this open question, it was considered that the compilation of open-ended tasks requires even several days of thinking and many of the respondents called it "creative work". However, it takes 2-3, or possibly 4-5 hours, even a day, to work out specific tasks. Even more challenging is the selection of differentiated individual tasks and the compliance with the criterion that individual tasks cannot

be solved without using the result of group work. Teachers often found that even if the group work seemed to be perfect, it had to be changed in order to be able to perform individual tasks according to the method DDHG-KIP.

The specialist who monitored the Logic-based subprogram made another questionnaire, as he wanted to examine the effectiveness of the training. The questionnaire was filled in by 14 teachers participating in the subprogram.

With the exception of two, the teachers received all the necessary information about the training in advance. Two participants indicated that they did not know much about the milestones to be achieved in advance from the website and the curriculum, and finally they managed to understand roughly what their task was during the training.

Participants were satisfied (an average score of 8.9 on a scale of 1–10) with the quality of the continuing education materials (PowerPoint presentations, participant manual, workbook, etc.).

With two exceptions, they agreed to receive a sufficient number of practical examples in the course of further training, so that they could apply what they learned in their teaching practice well.

Two members of the group indicated that they felt they had not received any other methodological clues to use than a simple description of the games.

Participants were fully satisfied with the recommended literature to deepen the content of further training and with the duration of distance learning to acquire further training content.

12 participants agreed that the time frame (2 weeks) was sufficient to meet the training requirements. Two participants indicated that the time frame was so limited that during this period the time they spent in training affected their job and even their personal life badly.

Four out of the 14 respondents considered continuous feedback, encouragement, and quick response to questions (even on weekends) asked by e-mail to be the most effective support activities of the consultant.

2 participants requested and received appropriate support from the consultant during distance education. 10 of them knew exactly what they were supposed to do during distance education. For 2 participants it was not entirely clear which task was only recommended and which was mandatory in addition to the tasks to be submitted. For another 2 participants the description of the tasks of the milestones was not clear, so they needed the consultant's help to interpret.

The respondents considered the control of the acquisition of the curriculum to be fully adequate.

3 respondents expressed their experience of the training. In their view, this further training provided them with a new approach, methodology and motivation. They could recall their mathematics knowledge and learn new logical games. According to them, a task that seems to be unrelated to their subject can also be implemented and converted to fit.

4 of them made proposals to improve further training. In their opinion, it would be appropriate to provide more examples for practical tasks and to develop a more logical structure of the curriculum.

In the opinion of the monitoring expert, the milestones and the lesson plan with the new DDHG strategy required the participants to perform tasks which were not only relevant to the training process, but also suitable for improving direct teaching practice. The training material was well-structured and easy to process.

The expert commented to improve distance learning and he recommended to find a communication form during the whole period of distance learning that allows for a real dialogue between the participants and the consultant. Furthermore, it is recommended to place a training-specific document as well as other necessary information on the training surface.

Concluding remarks

Based on the analysis of the literature, it seems clear that heterogeneous mixed groups meet the best the learning and social needs of primary school pupils (Báthory, 1997), especially if the heterogeneous group does not mean that class members are in the same group for each learning occasion. It is particularly important at this stage of the school that, in addition to the various ways of differentiating lessons, ad hoc groups be formed temporarily to develop slow learners and talents.

Results in the work of learners during group work organisation according to the DDHG-KIP requirements can be expected in the following areas.

A joint, group-based, independent work is created, the result of which is the achievement of a good and even outstanding individual performance in respect of each pupil.

Pupils realise that there is a task for everyone that they can perform properly within the group.

The principle of ‘giving everyone a leadership role’ increases the effectiveness of the status management work.

Through the application of status managing group work and individual tasks, progress is made in maintaining and moving the social field in a positive direction and directing lonely, underprivileged children towards the social field.

In terms of the frequency of future use of the method, there are basically two opinions: nearly half of the teachers plan to use DDHG-KIP every four to five lessons, while the other half of the respondents are not clear about the planned frequency, they make it dependent on the topic being taught.

In group sessions it is possible to prepare learners for cooperation rules and to develop talent applying a diverse curriculum through the use of special instruction procedures in heterogeneous classes. Tasks give learners the opportunity to contribute to successful problem solving with their different skills or different problem-solving strategies, which further develops learners’ strengths while also acquiring new ones. The complexity of tasks gives every learner the opportunity to access and display their intellectual competence through which children with different social background and knowledge have the chance to successfully complete the tasks and complete the group work.

According to the consultant of the distance education courses within the Logic-based subprogram, such a lot of good teaching plans and problem-solving games were created by the participants that these should be shared on the internet in the appropriate forums so that other teachers interested in renewing their teaching methods could learn good teaching practices. In order to improve further trainings, she recommends that a number of other examples in different subjects should be included in the curriculum because the existing ones relate primarily to mathematics. However, it was good to see that examples for games, decision-making and problem-solving strategies shown in the distance education training can be applied to almost all subjects. Therefore these strategies are independent from subjects and can be used by all teachers.

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