METHODOLOGICAL GUIDE FOR ADAPTATION

Seven Smart Steps projekt

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INTRODUCTION

The Seven Smart Steps project aims at a wider adaptation of our previously developed methodology for differentiated, adaptive learning along individual learning pathways in upper primary schools. This Methodological Adaptation Guide provides a broad overview of the whole adaptation process, with the aim of supporting teachers and institutions who wish to apply the methodology. The document describes the general development objectives of the project, the e-learning pedagogical methodology used, the methodology for training mentors, the results and lessons learned from the adaptation process and pilot training, and the features of the Tanlet interface. The Handbook for the training of mentors, using a self-

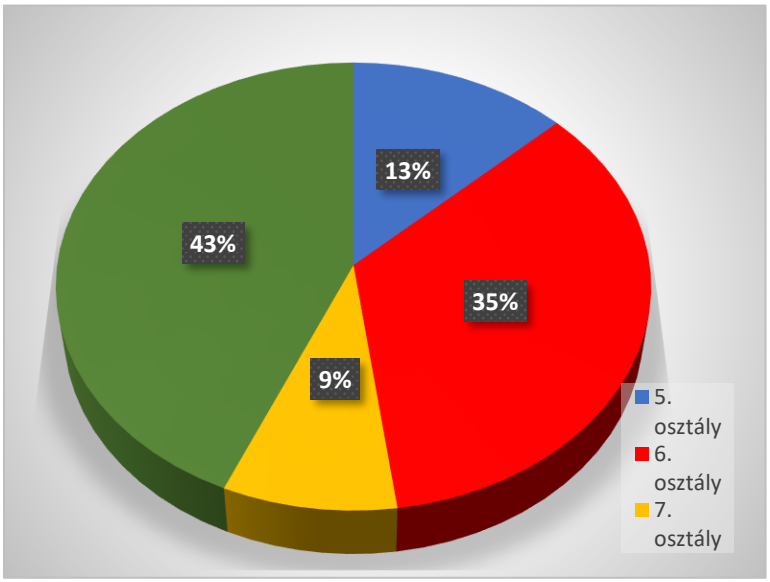
assembly practice-oriented approach, contains the methodology of the whole adaptation process, advice and subject-specific development suggestions for teachers.

The Methodological Adaptation Guide, after presenting the innovative pedagogical methodology, describes the methodology of the seven-step adaptation process. It then reviews the content and curriculum structures developed through the collaborative development work. During the adaptation process, 22 teachers developed content in 5 thematic groups in mathematics, reading comprehension, science and history. This joint work has resulted in a professionally high-quality, differentiating content springboard for each subject, which is the subject of the chapter on Thematic curricula and curriculum structures.

I. A GENERAL DESCRIPTION OF THE DEVELOPMENT OBJECTIVES AND METHODOLOGY USED

The number of teachers involved in the content development was 22, who jointly developed curricula in five thematic groups. The percentage distribution of contributors by subject was as follows: 8 in mathematics (33.3%, 2 groups), 6 in history (28.6%), 5 in reading comprehension (23.8%) and 3 in science (14.3%). The content was tested by the teachers with their own slides, and the number of pupils who were able to test the content was much higher than the 15 pupils who had been involved, with a total of 406 children.

Age breakdown of students participating in the pilot



1.1. General aims of the adaptation process

The aim of the Seven SMART Steps project is to adapt our previously developed SMART e-Maths, a digital methodology supporting differentiated teaching, to a wider range of upper primary schools. During the adaptation process, the teachers involved in the programme produced new educational content, for which we provided them with appropriate technical-methodological preparation and training. At the end of the process, the teachers involved became SMART mentors themselves, who presented the application and their experiences during the adaptation process to the local professional community.

We wanted to support the development of teachers' digital competences through the dissemination of digital pedagogical methodology and the Tanlet teaching tool to the wider professional community. As a result, we aimed to empower participating teachers to independently create digital learning materials that best match the educational objectives, interests and abilities of the learners. We aimed to develop a useful skill structure and approach that can be used in teaching in the long term. To this end, in a seven-step training course, teachers will develop digital learning materials using the https://tanlet.classyedu.eu platform, while acquiring new knowledge about ICT tools and their role in everyday teaching.

As a result of the Seven Smart Step adaptation process, several schools in three regions have been introduced to the innovative methodology. The number of teachers involved in the content development was 22, who worked together in five thematic groups to develop curricula with the support of the subject coordinators. The breakdown of teachers by subject was as follows: mathematics 8 (33.3%, 2 groups), history 6 (28.6%), Hungarian language and literature 5 (23.8%), science 3 (14.3%).

In preparation for the development of digital content, common curricular cross-curricula have been identified across the three regions, so that the content produced meets the requirements of all regions. The learning materials will help to prepare for the Hungarian secondary school entrance exams, the Felvidék 9th grade monitor and the Transylvanian 8th grade national assessment (aptitude) test.

The result of the joint work is a high-quality curriculum, prepared by practising teachers, with content aimed at the 8th grade exit level, tested in real school settings by teachers with their own students, 406 students in total. A total of 981 (327 Superunit) self-contained text tasks and 117 audiovisual explanations, i.e. 1098 tasks, were produced during the adaptation process.

1.2. Applied e-learning pedagogical methodology: ALA

Before describing the adaptation process and its results, it is necessary to briefly describe the application and methodology used as a basis for curriculum development.

Innovative methodology

At the heart of the innovative Smart e-Maths methodology, which focuses on differentiated instruction, is an adaptive algorithm for constructing individual learning pathways (ALA) that allows students to follow different learning paths according to their abilities and current knowledge. The ALA back-end application redesigns the learner's learning path at each step, depending on the path taken, i.e. where the learner goes next, whether he or she has solved the given task, moves up a level if the answer is correct, and moves down a level if the answer is incorrect. Students are challenged according to their current level of knowledge and can learn and progress at their own pace. Teachers use the system data to monitor students' progress and difficulties on an ongoing basis, so that they can support children when they are stuck.

Differentiating

The personalised learning process results in learners progressing at their own pace, according to their own abilities. We try to avoid the student experiencing constant failure, as well as boredom. A prerequisite for differentiation to work is that the curriculum is structured according to an arbitrary number of levels of difficulty, with easier tasks at the lower levels and more difficult ones at the higher levels. The student does not progress in a linear sequence of tasks, but in a system of tasks, structured according to levels of difficulty, with more tasks at each level.

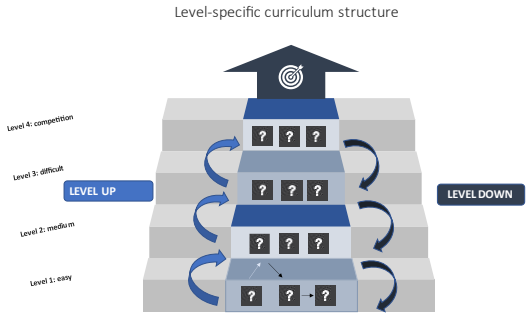
Individual catch-up, assistance

However, students are not left to their own devices in the learning process, the Superunit (Super Cell) is designed to help students who are stuck in the solution. The Superunit is made up of a basic task and its corresponding Helper Task(s) and Explanation(s). The idea is that if the student fails to solve the basic

task, he or she is given help in the form of a guiding question or information that the teacher would ask the child in the classroom. However, if they still fail, they will be given an explanation, including the correct solution, how to solve it and the necessary background knowledge.

Rise and fall

Depending on their results, learners move up or down the curriculum between levels of difficulty. Each level has at least three versions of each question type. In case the student successfully solves the problem, he/she can move on to a higher level. If the student fails the problem, he or she is dropped back to an easier level, in which case he or she is given one of the three problems that he or she has not encountered before. It is a matter of individual preference whether the difficult - medium - easy level change determines the movement through the course.



1.3. The seven-phase adaptation process: mentor training methodology

The training of the Seven Smart Steps adaptation process consisted of 7 steps, each step was organised around a technical and pedagogical training workshop, resulting in 7 sessions in total. The process provided extensive training in the use of the Tanlet application and the ICT tools essential for digital content development. In addition to digital competence development, teachers were also introduced to the methodology and approach to curriculum development. Each workshop was structured in two different units with different content. The first unit consisted of a whole-group technical workshop led by the professional coordinator. The theme is the transfer of general content development and technical skills. The second unit was the thematic workshops, which were divided into small groups by subject area and led by the thematic coordinator. In this part of the pho-training, the teachers' subject-related curricula were jointly developed. Each group was coordinated by a subject teacher who was responsible for guiding the development.

Pilot teaching - debugging: after each adaptation phase, the curriculum was tested, with the teachers who wrote the exercises trying out the content with their own students. During the pilot teaching, hidden errors were identified and the content of the curriculum was finalised on the basis of the findings.

The proposed steps for content development are:

Step 1: Digital pedagogy - Introduction to the world of modern digital education

The first introductory session focused on digital pedagogy, the logic of the innovative methodology and its application.

Content development and technical skills: introduction to the digital interface and the methodology used, basic functions of the digital teaching tool (registration, learner groups, learning paths, generating reporting data, etc.), introduction to key concepts for content development (folder, topic module, block, difficulty levels, game engines, task types).

Pedagogical objective: to develop a subject-specific thematic and methodological concept

Definition of the technical content and timetable for content development, methodology for curriculum development, subject-specific principles, structure, quantitative and formal criteria.

Step 2: The linear curriculum manuscript

Workshop 2 was about learning about the content development functions of the application and the technical and methodological basis for linear curriculum development. The creation of the linear curriculum consisted of two phases, the creation of the linear manuscript and the digitisation. The result is a curriculum that forms the basis for level-jumping tasks of increasing complexity.

Technical objective: to learn about the functionality, creation methods and characteristics of game engines, to create game tasks, pdf and video content. Learning about digital frameworks before digitalisation makes development work much more productive.

Pedagogical objective: to produce a manuscript of linear learning material

Preparation of an outline of the planned content in Word, based on the principles set out in the concept. The outline is then completed by assigning game engines to the tasks (Methodological outline).

Step 3: Digitisation

The digitisation process creates the electronic learning material, i.e. the individual tasks are integrated into game engines. A crucial aspect is the LMS in which the learning material will be played and the technological devices used by the students (computer, tablet, smartphone). It should be taken into account that the amount of information that can be contained on a page is limited, overcrowding should be avoided, attention should be paid to the length of the texts used, the font size, all visual aids, images and diagrams should be legible and clearly visible. In our case, the tasks must be assigned to game engines that meet these criteria in terms of both content and scope.

Technical objective: to prepare the digitisation of the analogue learning material.

Pedagogical objective: to harmonise the content and the game engines developed in order to achieve the educational objective, to further develop the logic of curriculum development and, if necessary, to modify the original concept.

Step 4: Developing differentiated, level-hopping curriculum with textual explanations

The fourth step consists of rethinking the subject matter in terms of the use of help questions and explanations, and finally developing a synoptic content built from superunits. The aim of the task block is to help students.

Technical topic.

Pedagogical objective: to reconceptualise the linear content in the light of the synoptic logic, to define methodologically justified supporting tasks and to develop textual explanations.

Step 5: Creating differentiated learning material with audio-visual explanations

Our preliminary experience has shown that students often skip over textual explanations, so that they do not contribute to their understanding. Our hypothesis is that video explanations can better capture students' interest, motivate them to learn more efficiently, increase the effectiveness of the explanations, contribute to the comprehension of the task and help them memorise the knowledge. During this phase, several technical preparation sessions were organised to familiarise the writers with the method of producing audiovisual explanations. As a result, all participants were able to produce audiovisual explanations independently.

Technical objective: demonstration of content development applications (Explain Everything Whiteboard, prezi.com, Microsoft Whiteboard), demonstration of additional software, how to make a screen recording (OBS studio), video uploading process, video editing software.

Pedagogical objective: joint reflection on the use of audiovisual explanations to supplement the lesson material. Development of methodologically justified criteria for video commentaries: content, format, quantity.

Step 6: Exchange professional experience. Finalising the differentiated curriculum package

After the curriculum development and final test teaching, a final evaluation of the joint work was carried out in the form of an exchange of experiences. The aim is to process and summarise pedagogical observations, good and useful practices. We intend to feed the relevant professional suggestions back into the further development of the tanlet.classyedu.eu platform and the game engines.

Technical objective.

Pedagogical objective: thematic discussion of the experiences, finalisation of the differentiated curriculum package. Correction of hidden errors that emerged during the test teaching, joint discussion of feedback, modification of the curriculum if necessary.

Step 7: Training SMART mentors to support the adaptation process

The final phase aims to prepare educators for dissemination of the application to the wider professional community. We believe that the teachers involved in the project are best placed to present the methodology in a credible way.

The most effective way to do this is for content educators to share their own experiences with colleagues open to digital education at a dissemination event in an institution not yet involved.

1.4 Basic system settings - planning the learning activity

Before the students are given the tasks, it is necessary to plan the activities, make essential system settings that determine progress in the learning material, such as the way the pathway is played (linear level jumper), the way the tasks are played (test-practice), the way tasks are played randomly or sequentially, replayability, difficulty of going up and down, etc.

- Set the route to public: in this case, not only group members but anyone can access and learn with the route. If you do not want this, do not make the learning material public.
- Choice of graphics: a different theme is recommended for each age group (Theme 1-2-3)
- Exercises and Supporting Exercises playback mode: test - practice
  The test setting should be used if you want to assess the student. When using the practice mode, the student cannot go any further in the task until he/she gives the correct solution.
- Path playback mode: linear-synchronous
  The linear course content should be used in linear playback mode, while the level-skipping content should be used in level-skipping playback mode, as this setting determines how students can use the content.
- Replayability
  If a pathway is replayable, it is only possible to replay the course content once.
- Number of repetitions: basic task, help task, explanation
  In SU, the number of repetitions depends on the number of times each type of task is given to the student. In the Superunit, it is compulsory to repeat the basic task once, but apart from that, you are free to decide how many times you want to repeat the units.
- Difficulty of ascending and descending
  The grey bar, Settings, can be pressed to enter the level settings:
  level jump difficulty and drop difficulty: can be easy (1 task), medium (2 tasks), difficult (task), which determines how many tasks the student changes level after.
- Play tasks randomly or in sequence
  This setting determines whether students receive tasks in sequence or randomly within a difficulty level.

II. THE THEMATIC CURRICULA AND CURRICULUM STRUCTURE

QUANTITATIVE RESULTS OF CONTENT DEVELOPMENT

During the adaptation process, initially 21 and eventually 22 teachers developed content in 5 thematic groups with the help of the coordinating teacher.

Aggregated data		Results by theme			
Content development dimensions	**Results**	**Math**	**Siences**	**History**	**Reading comprehension**
Time spent studying (hours:minutes)	619:26	432:02	33:21	110:28	42:39
Average percentage of results achieved	66,7%	61,75%	66,25%	66,3%	77,7%
Number of SU task units completed	327	119	57	90	61
Number of tasks completed (basic, supporting, explanatory)	981	357	171	270	183
Number of audiovisual explanations	117	54	15	24	24

Curriculum development data

As a result of the joint work, a differentiation toolbox was created for all subjects, containing a total of 327 Superunit units. The SU block consists of at least three independent tasks: a basic task, a help task and an explanation in text or video. Accordingly, the minimum number of self-contained tasks is 981, but sometimes a task unit may contain more than one of one type of task (e.g. a Help task), so the actual numbers are actually higher than this. However, about 20% of the Superunits contain tasks that use multiple screens (i.e. technically one task contains multiple task questions) to process closely related topics, which also implicitly increases the number of completed tasks.

Previous experience that students often did not read the text explanations inspired the concept of producing audiovisual explanations, whereby it was assumed that children would find videos more enjoyable and would therefore be more likely to watch them. During the project, teachers created a total of 117 audiovisual explanations using a wide variety of ICT tools and applications. These exercises were

first produced in text form and then replaced by videos in the final phase. Thus, 117 audiovisual explanations were added to the 981 stand-alone text tasks, making a total of 1098 tasks during the adaptation process.

The pedagogical documentation related to each curriculum development phase, as well as the content sample of the completed tasks, can be viewed as part of the IO2 intellectual product presentation. The full content is available on the app: https://tanlet.classyedu.eu.

2.1. History

The aim of the history curriculum development is: to deepen students' knowledge of Ancient Greece - Hellas through progressively more challenging tasks, and to develop learning, communication, mathematical-logical and digital competences related to the subject of history. The sub-themes identified are Mythology, Olympiads, Athens, Sparta, The Greco-Persian Wars, Alexander the Great.

According to the curriculum development concept, the tasks are designed in 5 levels of progressively increasing difficulty, moving from the easier tasks to the more complex ones. The levels have been adapted to the grade level, the curriculum aims at the end of grade 8. The lower levels tend to use simpler engines, the higher levels more complex ones. The development of historical competence as defined by the NAT has been used to determine the content of the levels of difficulty.

Criteria for difficulty levels

The content criteria of the curriculum are defined by the development of historical competences targeted by the NAT: development of competences and knowledge at all levels.

- Easy level: builds on learning competences - the aim is to search for and process historical information. e.g. Choose when was the first ancient Olympics?
- Intermediate level: builds on communication competences, processing historical sources. Aim: to develop reading comprehension - mainly through the use of reading comprehension engines (e.g. connect the concepts that are related based on the text.)
- Difficult level: based on mathematical and logical competence, the aim is to explain, formulate, highlight and draw conclusions. e.g. group the concepts, which ones refer to the Olympics and which ones do not.
- Advanced level. E.g. Choose which event did not belong to the pentathlon!
- Competition level: level of complex tasks: e.g. comparing ancient and modern Olympic events

2.2. Reading comprehension

The pedagogical aim of curriculum development is to develop reading and comprehension skills. To this end, a competence-developing text comprehension curriculum was developed, adapted to the text typology of the PISA assessments, focusing on the ability to put knowledge into practice, and consisting of a hierarchical structure of level-hopping tasks, i.e. tasks of different levels of difficulty.

Concept for text comprehension development

In the creation of the text comprehension level-jumping content, four levels of increasing difficulty were developed, aiming to ensure that students encounter all text types.

TYPES OF TEXT USED

- 1: Easy level, narrative, continuous text: an excerpt from the magic story of Palko Furulyás. Since the genre is familiar to the students, they have no problem working with fairy tales, so we chose a fairy tale as a warm-up.
- 2: Intermediate: descriptive continuous, informative texts: little caterpillars, big tricks
  The explanatory type of text describes the habits, life and characteristics of caterpillars.
- 3: Difficult level: practical, non-continuous text of the documentary type, which occurs in everyday life. Its form and subject matter may be different from textbook texts, making it difficult to interpret. The Moonlight Grove Adventure Park is a complex text consisting of a price list, a house rule and a map, so students may encounter several types of text.
- 4: Advanced level: As fiction is the highest level of reading comprehension, a novel extract has been chosen from the texts already used in the intermediate level entrance examinations in previous years, which can be found on the website of the Education Office. The aim is to give students an opportunity to encounter a passage from the novel The Flying Schoolbag by Tibor Gyurkovics, which is a common item in the advanced examinations.

LEVELS OF READING COMPREHENSION APPLIED

The texts were processed according to the levels of reading comprehension, with increasingly difficult series of questions at the sublevels. Each level contains several tasks of the same type of question, with the aim that if a student falls back to an easier level after having failed, he/she will not be given the same task again.

1. Concrete information retrieval: the level of literal reading, at this level, the search for information and data explicitly presented in the text (data, characters, place, time of the action, etc.)

2. literal comprehension: vocabulary development: finding meaning, pairing, logical grouping - anoponyms, synonyms, old-fashioned expressions, dialect words, idioms, fairy-tale turns, etc.

3. inference: at this level, it is no longer the explicit but the implicit, inferable content of the text that needs to be understood. The aim is to deduce something missing that is not explicitly stated in the text: to discover ideas, opinions, cause and effect relationships that are not expressed literally (authorial intent, pronouns, adverbs, missing words, interpretation of poetic language, the person of the narrator, conjunctions)

4. global cohesion: interpreting the text as a whole: no longer interpreting isolated bits of information, but seeing the text as a whole and recognising the context (assigning a key word to a paragraph, contextual link between text and title, etc.)

5. Linear cohesion: sequencing of events

6. interpretation, critical reading: this involves reading the text both literally and interpretatively. Evaluation of the text read, the credibility of the content, arguments. Interpret what is read (characterisation of characters, association of a proverb with the text, etc.)

2.3. Mathematics

Mathematics curriculum development aims to develop mathematical skills and numeracy, to extend mathematical knowledge, and text comprehension tasks are emphasised. We wanted to contribute to addressing the underachievement of pupils in mathematics education in general. The project has produced a curriculum content that helps to develop the mathematical knowledge and competences of pupils in grades 5-8.

The chosen topic is decimal fractions, as it is a permanent curriculum in all three countries, it touches on numeracy skills, but at the same time the fractions are easily adaptable to the application and fit well with the game engines.

Defined subthemes within decimal fractions:

1. local value,
2. a series of numbers,
3. rounding,
4. addition - subtraction,
5. multiplication by one,
6. dividing by one,
7. multiplication by decimals,
8. division by decimals,
9. text,
10. multiplication by powers

2.4. Natural sciences

In the field of science, curriculum development in biology and chemistry. In biology, the upper digestive tract (oral cavity, pharynx, oesophagus, stomach) and the human respiratory and respiratory system (anatomy, physiology and respiratory system of the lungs) were covered. These topics were chosen because they are part of the curriculum in all three countries and are an important part of our everyday lives. The upper part of the Digestive System is divided into three sub-topics: organisation, function and health. The sub-themes of the respiratory system are: anatomy, physiology and health sciences.

In Chemistry, Atomic Structure and Periodic Table were covered. The task covers 2 topics from the 7th grade curriculum, the two are closely related and are therefore covered in one curriculum structure. A thorough knowledge and understanding of atomic structure is a prerequisite for learning chemistry and is necessary for understanding and explaining chemical bonding, chemical reactions, formula and equation building. The data required for chemical calculations are also contained in the periodic table and therefore a thorough knowledge of the periodic table is essential for progression.

CONCLUDING THOUGHTS

In summary, the project's objectives were successfully achieved in all areas. During the adaptation process, teachers' curriculum development skills and digital competences have improved significantly. The joint work has resulted in a high quality, cross-curricular content aimed at the 8th grade exit level, which meets the requirements of all three regions. Overall, based on the pilot learning, both students and teachers perceived the use of the app as effective.

If you are interested in the Tanlet application and the methodology used, please visit the project website for more information: https://sevensmartsteps.hu/

The website also contains additional information and teaching resources under the Teachers' section, which provide a comprehensive overview of the pedagogical methodology and content development that support differentiation. The tutorial videos show the main functions of the digital teaching aid, from registration to content development. The Basic User Manual and the Advanced User Manual summarise the way to create learning materials and tasks, and the features of the application in a user-friendly way.

The use of the application and the completed course materials is free of charge. If you are interested in the application and would like to try it out, please register at the following link: https://tanlet.classyedu.eu.

You can also view our tutorials without registering at the following link: https://tanlet.classyedu.eu/app/ , and on Android devices by downloading the application https://play.google.com/store/apps/details... To log in, simply use the email address interregioforum@gmail.com and matematika password!

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