Realising Classroom Differentiation and Inclusion with Tablets
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TABLIO-project
Tables for classroom differentiation and inclusion
Erasmus+ Key Action 2: Cooperation for innovation (2016-1-BE02-KA201-017311)

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1 Introduction

This eBook contains the intellectual outputs of the European Erasmus+ project called TABLIO (2016-1-BE02-KA201-017311). The Tablio-project aims to strengthen teachers and school in realising classroom differentiation and inclusion by the means of tablets and other mobile devices. All outputs were developed in the period 2017 - 2019 in close cooperation with teachers, schools, teachers educators and student-teachers in Europe.

The following organisations were part of the project consortium:

- PXL University of Applied Sciences and Arts, Belgium (lead partner)
- Institut za Napredno Upravljanje Komunikacij, Slovenia
- Istanbul University, Turkey
- iXperium Expertise center Learning with ICT, Netherlands
- Tell Consult, Netherlands
- North-West Regional College, Northern-Ireland
- CESIE, Italy

This eBook contains 3 chapters. Chapter 1 describes the design toolkit for classroom differentiation and inclusion by means of tablets. Chapter 2 describes existing practices in European classroom, gathered early 2017. Chapter 3 describes the results of a design-based research approach in several European schools. All outputs can be found on the website http://tablio.eu as well. Besides English, the outputs are described in Dutch, Slovenian, Italian and Turkish.

2 Methodology

In 2017 all partners of the project performed a desk-research on classroom differentiation and inclusion. In addition, focusgroups were organised in each partner country on the topic of classroom differentiation with mobile devices in particular.

All findings were discussed by the team members and combined in chapter 1: the design framework. The design framework consists of:

- a central concept map that visualizes the pedagogical construct of ‘differentiation’. We systematically describe each part of the concept map in the text;
- a list of pedagogical design principles for classroom differentiation with tablets and other mobile devices;
- a list of technical principles for classroom differentiation with tablets and other mobile devices;
- a list of apps that were used throughout the effectuation of the project;
- a template for the description and evaluation of practices;
- a grid to situate practices within the framework;
- an extended academic substantiation.

In the schoolyear 2016-2017 we launched an open call for good practices on differentiation and inclusion in the participating countries: Italy, Northern-Ireland, Belgium, Slovenia, Turkey and Netherlands. The project partners were explicitly looking for schools and teachers that were already doing educational tablet implementation for differentiation and inclusion purposes.
Candidates were contacted by the project workers and a semi-structural interview was held, either face-to-face, either via Skype. We used the following set of questions for the interview:

**CONTEXT ANALYSIS**

1) How would you describe your school and class context in general? How would you describe the class atmosphere, the class culture?
2) What is your school’s grouping strategy? Would you describe your class as a homogeneous or a heterogeneous (mixed) classroom? Explain your answer please.
3) Please describe the infrastructure of your classroom (availability of tablets, number of tablets, projectors, wifi, classroom furniture,...).
4) Please tell me something about the pedagogical vision of your school.

**DESCRIPTION OF THE PRACTICE**

5) So, you use the tablet for classroom differentiation? Could you explain your practice in general?
6) Is the class group kept together, or are some students temporarily in another classroom or under supervision of another teacher?

**CONTENT-differentiation**

7) What types of learning materials, ICT-tools or apps do you use in this practice? (How) Is the tablet involved?
8) Do all students have to use the same learning materials, or is there any differentiation involved?

**PROCESS-differentiation**

9) What teaching methods do you use to realize the classroom differentiation? (How) Is the tablet involved?
10) How does guidance and coaching take place? (How) Is the tablet involved here?
11) How is feedback delivered to the students? (formative assessment) Do all students get the same type and quantity of feedback? (How) Is the tablet involved here?
12) Do the formative assessment influence the choice of the teaching technique?

**PRODUCT-differentiation**

13) How do you evaluate if students reach the learning objectives? (How) Is the tablet involved?
14) Do some students get another evaluation method, or do all students get the same?
15) Does the differentiation lead to more study success for all students?
16) Is there a link between the formative assessment and the summative assessment?
17) What do (would) you do if a student doesn’t reach the learning outcomes of this lesson?

**STUDENT-characteristics**

18) What student-characteristics do you (better) address with this differentiation approach?
19) What stakeholders are involved in this differentiation practice?

**REFLECTION UPON THE PRACTICE**

20) Is it feasible, easy to do this differentiation with tablets into daily classroom practice?
21) What would you like to change to make the practice even better?

After the interview, the practice was described by the project worker. Subsequently, the practice was sent to the interviewee in order to have a first review on correctness and gaps. Then the practice was analysed by the project worker, using the analysis framework. Via a review round among the project workers, other experts were able to screen the practices as well.

This process led to a set of good practices, described in Chapter 2. These practices differ since some are more situated on the meso-level, others are more situated on the classroom level, some describe more technical aspects, other more educational aspects.

In Chapter 3 we report upon our newly developed learning arrangements of classroom differentiation with tablets. These practices are the result of a design based research with teacher design teams (TDT) in several European schools. A TDT can be considered as a mini-community of practice with minimum two teachers teaching the same subject-matter. These teachers are accompanied by other teachers,
experts, etc. A specific design challenge is central to a TDT (Handelzalts, 2009) and the main goal is to collaborate, redefine teaching and implement new teaching techniques in order to improve teaching and learning. The central method (heuristics) is the ADDIE-model (Branch, 2009), with the steps Analysis, Design, Development, Implement, Evaluate following each other in an iterative order. The starting point of a TDT is a practical problem, resulting from the teachers’ practice. We call this the ‘design challenge’. The next step consists of the Design, in other words the making of a blueprint of a possible solution. The next step is the Development of the solution for the problem combining innovative existing technology on tablet and instructional approaches into new learning scenarios and accompanying learning material. In the next step, the (first/second/third) Implementation is done into the classroom practices. Finally, the new learning scenario is Evaluated in relation to the Design-challenge.

In order to get the full contextual perspective of the practice, we combine several elements in the reporting:

- the several design-steps;
- the class context (pedagogical, infrastructural,...) and the starting position of the pupils;
- the learning objectives;
- the main didactical approach (methods, learning phases,...), technology involved and the way of using it (hardware and software), the content (essential knowledge, skills) , the carriers of context (could link to the technology);
- the specific didactical approach on differentiation and inclusion;
- the guidance provided (teacher-learner interaction);
- the collaboration and interactions in classroom;
- social aspects;
- evaluation and impact on the learning process;
- reflection, impact on the teaching process.

References:

CHAPTER 1
Design Framework
1 Concept Map

On the next page, you can find the visualisation of the concept map. This concept map represents the theoretical substantiation of the Tablio-project.
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2 Theoretical foundation of the concept map

2.1 Definition

“Differentiation” aims for the inclusion of all students, for a higher motivation to learn and to participate in life-long learning and for achieving learning outcomes more efficiently. On a more general level, the objectives of differentiation are self-realisation and self-actualisation on both the cognitive, emotional and social level and the striving for harmonious and pluralistic citizens for society and humanity. For these reasons, differentiation should be considered as a necessary aspect of all education.

Differentiation can be considered to be qualitative when it meets the following characteristics: proactive, goal-oriented, structured, varied and transparent. Qualitative differentiation also requires cooperation from stakeholders on both the micro-level (classroom-level), meso-level (school-level) and macro-level (policy-level).

Differentiation can appear in two main types: organisational differentiation and educational differentiation.

- **Organisational differentiation (also: structural differentiation)** can be operationalised in various ways: the grouping strategy of the classroom, individualized programs for special needs, extra-curricular acceleration programs and remedial programs.

- **Educational differentiation (also: classroom differentiation)** happens within the context of the classroom. It can be more learner oriented when it focuses on differences in student’s readiness, interests and learning profile. It can also be more teacher oriented when it focuses on content-differentiation, process-differentiation and/or product-differentiation. There as a mutually influence of teacher oriented and learner oriented differentiation techniques.

Differentiation may appear to be very complex and unreachable goal, but this is a misconception: differentiation is above all a feasible and achievable educational approach.
2.2 Aims of differentiation

The aim from differentiation is to create a learning environment which encourages students to engage their abilities to the greatest extent possible, including taking risk and building knowledge and skills in what they perceive as a safe, flexible environment. Differentiated instruction is important for all students, not only those who have specific learning needs or disabilities.

Differentiation aims for:

- **Inclusion**: teachers adapting teaching methodologies to students’ needs favour the inclusion of each student into the learning and teaching process. According to Leicester (2008), school practices are inclusive when they cover a broad range of schooling experiences and succeed in helping children with diverse backgrounds and abilities to be effective learners.

- **Motivation to learn**: the purpose of differentiated instruction should be to bring each student to learning and to enhance ‘the learning match’ between the students and the curriculum. Thus, teachers should develop products that reflect students’ capability to facilitate learning for students of different readiness levels and with different interests and learning profiles; all features that can affect the construction procedure of new competences.

- **Life-long learning**: the positive outcomes of differentiation strategies will encourage learners to participate in learning activities during their entire professional career and private life.

- **Achieving learning outcomes (effectiveness)**: differentiated and inclusive pedagogy is directly linked to effective learning as it aims at connecting to the individual’s learning profile and finding teaching styles through which they can learn more effectively and gain maximum benefit. According to Crawford (2008), the key to effective differentiation is to adjust the curricular components of content, teaching strategies and assessment continuously in response to adolescents’ interests, readiness levels and learning profiles, in order to encourage the development of a classroom of full inclusion. In a differentiated classroom students are active at their learning: they take responsibility for their learning process. This will lead to a higher ownership of learning and will increase the chances of achieving the
learning outcomes. Learning outcomes could also become richer and more diverse as students get more openness (e.g. open-ended problem tasks) in the learning process.

- **Efficiency:** in a differentiated educational context, chances are more likely that students spend time to learning tasks that match their zone of proximal development. Less time is wasted to learning tasks that are either too difficult, too easy or that aren’t adapted to their learning profile. Using ICT-devices (e.g. the tablet) can also increase the efficiency as learning progress can be shared and monitored automatically.

- **Self-realisation:** by introducing differentiation, teachers could facilitate opportunities for talented students to produce a product that reflects their potential.

- **Self-actualisation:** differentiated instruction helps in maximizing students’ opportunities for personal learning and growth. Teachers should differentiate education in order to encourage the development of the whole person: a mean to teach students differently, to take them out of the classroom and into society.

- **Harmonious and pluralistic citizens for society and humanity:** differentiation aims at having a learning environment that provides confidence to students to enhance their capabilities and building knowledge and talent in a flexible, safe environment. It should encourage independence and ensuring student performance and overall wellbeing to grow as responsible and active citizens in their society.

### 2.3 Characteristics

#### CHARACTERISTICS

- **Pro-active**
- **Necessary**
- **Goal-oriented**
- **Feasible**
- **Varied**
- **Structured**
- **Transparent**

**DIFFERENTIATION**

What are the key characteristics for effective and efficient differentiation?

- **Pro-active:** Teachers will have to learn how to develop a classroom routine and not to ignore variance in students’ readiness, interest and learning profile. Such routines may be defined as differentiating curriculum and instruction. It is a pedagogical, not organizational approach, in which teachers proactively modify curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of
students to maximize the learning opportunity for each student in a classroom. (Tomlinson, Brighton, Hertberg, Callahan, Moon, Birmijoin, Conover & Reynolds, 2013). The reactive approach would be that a teacher plans one lesson for the whole classroom and adapts his approach when a problem arises. This is not desirable.

- **Goal-oriented:** in a differentiated educational context the learning goals are central to the learning and teaching. A discussion can rise whether all students should acquire the same learning goals. For regular education, this would certainly be the case. Only in specific cases of inclusive education, it may be possible that some students aren’t required to achieve all goals.

- **Varied:** key to differentiation is the aspect of variety. This can be teacher-driven what would mean that the teacher varies in his educational offer of learning tasks and objects. Variation can also be student-driven when the educational context stimulates autonomy and ownership of the student. The student has the freedom to choose which learning tasks or learning objects he chooses to accomplish the learning outcomes.

- **Transparent:** transparency should be offered in terms of learning objectives and outcomes. A rubric is an interesting way to give transparency to the student. The students should have a clear image of the expectancies at the very beginning of the learning process. In more open ended learning processes, the student may have the opportunity to formulate the learning outcomes themselves. This should also be discussed transparently. Another aspect of transparency in differentiation is that teachers dare to express the differentiation process openly in the classroom. All students should be aware of the differentiation techniques and should take it for granted as well.

- **Structured:** the method of the differentiation should be clear to all persons involved.

- **Feasable:** Though teachers support the idea of inclusive classroom via differentiation, they tend to resist to adapting materials, planning lessons for individuals, changing evaluation procedures and instructional practices, make long-range plans or adapt scoring and grading criteria (Tomlinson, et al. 2003). Although there may be a learning process involved for the teacher, we believe differentiation to be feasible, especially when using tablets in the educational differentiation process.

- **Necessary:** for realizing truly inclusive classrooms with respect to everyone’s learning needs and talents.
2.4 Stakeholders

In order to make differentiation a structural, pro-active, systemically integrated aspect of education, stakeholders on three levels should invest energy in it and cooperate with each other.

- **Macro-level**: European, national and regional policy makers should emphasize the aspect of differentiation in their educational policy documents (e.g. national curricula). School inspectors and teacher educators can be an important vehicle for transferring this policy into local schools and classrooms.

- **Meso-level**: school policies should incorporate and explicit the need for differentiation. Intra- and inter-school collaboration and exchange between teachers on differentiation should be promoted.

- **Micro-level**: not only the teacher and the student, but also other classroom assistants and most importantly the parents should be engaged in the process of differentiation. This starts with informing each stakeholders but can evolve to participation and negotiation.
2.5 Organisational differentiation

Organisational or structural differentiation covers the differentiation actions on a school level or a program level (curricular level). It can be implemented in four main ways.

1) Individualized programs for special needs:
Special education is the practice of educating students with special educational needs in a way that addresses their individual differences and needs. Ideally, this process involves the individually planned and systematically monitored arrangement of teaching procedures, adapted equipment and materials, and accessible settings. These interventions are designed to help individuals with special needs achieve a higher level of personal self-sufficiency and success in school and in their community that may not be available if the student were only given access to a typical classroom education. Common special needs include learning disabilities, communication disorders, emotional and behavioural disorders, physical disabilities, and developmental disabilities. Students with these kinds of special needs are likely to benefit from additional educational services such as different approaches to teaching, the use of technology, a specifically adapted teaching area, or a resource room. Teachers who provide special education services in schools must be certified to do so and will focus on his strengths as well as his challenges. The services and supports they receive may differ. It’s all about individualization. What is important is giving kids the resources they need to make progress in school. Usually special needs students are removed from their regular classroom and taught in another setting.
2) **Remedial programs:**
Remedial programs (also known as developmental education, basic skills education, compensatory education, preparatory education, and academic upgrading) are designed to close the gap between what a student knows and what he’s expected to know. It is usually used to build basic skills and designed for any students, with or without special needs. They often target reading or math weaknesses and can help them catch up their peers. In many cases, students are removed from their regular classroom and taught in another setting.

Not all programs are effective. An effective remedial program is taught by a professional teacher with special training. Programs need to be implemented in small groups. The idea is to get more individual attention than is possible in a large class.

3) **Extra-curricular acceleration programs:**
Extracurricular programs are educational activities not falling within the scope of the regular curriculum. They are voluntary and could be organized at school or not. These types of activities include sports, music, arts, academic clubs and many other after-school activities.

Extracurricular activities have many positive effects on students. They help them gain new skills, learn to socialize, gain leadership ability and learn more about their own interests. At the same time participation in after-school activities is linked with better academic performance and higher self-esteem of students.

Many extracurricular activities, such as the school newspaper, photography, and drama, can lead to careers. Extracurricular activities also help to form the student’s profile for consideration in college or job admissions.

4) **Grouping strategies:**
School systems have developed different ways to manage the diversity of the student population. They select and group students into education levels, grade levels, different schools, programs, and different groups within schools on various ways.

Grouping strategies on organizational level include **vertical stratification (by age)**, and **horizontal stratification (between and within schools or programs)**.

- **Vertical stratification** of students is a result of development. As student populations grew in size and diversity, schooling was increasingly differentiated “vertically”. This vertical stratification resulted in the creation of different grades and education levels.

- **Horizontal stratification** on organizational level means adapting curricula to different groups of students, based on their ability. There are two main types of horizontal stratification:
  - **Between schools**: separating students into different schools based on ability, often involving a division into academic/general and vocational schools; often referred as “tracking”.
  - **Within schools**: when providing different curriculum standards to different groups of pupils based on their ability; different ability groups can be placed in different classroom or in the same classroom; ability groups are typically implemented to teach core subjects; remedial groups and special needs program are also a case of such differentiation; also referred as “streaming”.

The rationale behind using these differentiating mechanisms is to homogenize the student population so that its educational needs can be met more effectively. But there is some concern that horizontal
stratification replicates existing social and economic inequities, as socio-economically disadvantaged students tend to be disproportionately grouped into low achieving groups.

**Homogenous student groups** are result of differentiation. Homogenous grouping began as a response to traditional classrooms, in which a single teacher is responsible for a number of pupils who are typically diverse in terms of their levels of educational attainment, language proficiency, cultural background, and other characteristics. However various studies have showed that this practice does not contribute to overall school success. Researches on readiness have showed that homogeneous grouping may have positive effects on students with good overall study results, but at the same time it has negative effects on students with lower overall study results. Various studies have demonstrated that homogeneous groups increase the differences in performance among pupils, and it does not improve their overall performance. In homogeneous classrooms, low achievers learn less because they spend less time on instructional activities, the material and content they are exposed to is less challenging, instruction is of lower quality and the pace of instruction slower. Finally, horizontal stratification on school level limits the opportunities for upward mobility between groups and reduces students’ satisfaction with their group placement. It is highly likely that children belonging to vulnerable groups will be assigned to low-achieving groups, and this contributes to students being segregated, categorized, stigmatized, and socially stratified. The same is true for children with disabilities, whose attainment levels may decline even further.

**Heterogeneous groups** or mixtures in educational settings are groups that include students with a wide variety of instructional levels. Heterogeneous groups stem from the education precept that a positive interdependence can arise from students with varied learning levels working together and helping each other to reach an instructional goal.

For students of lesser abilities, there is usually an advantage in being included in a heterogeneous group rather than homogenous group. They don’t have the risk of being stigmatized as part of a less-able group. A heterogeneous group gives advanced students a chance to be a mentor to their peers. All members of the group may interact more to help each other understand the concepts being taught.

Which teaching strategies teachers choose to use seems to relate to the implicit or explicit learning goals they have for their classroom as a whole. From a ‘theoretical’ point of view teachers can strive for **convergence or divergence**.

- Teachers aiming at *convergence* are mainly focusing on reaching a minimum performance level with all of their students, which implies they might have to dedicate additional time and effort to the low achieving children in order for them to reach that minimum performance level, even when this goes at the expense of the high ability children, who by consequence receive less attention.
- Teachers aiming at *divergence* mainly focus on helping all children to reach their highest potential, equally dividing attention between students with lower and higher ability. In practice though, most teachers will combine convergent and divergent goals and will try to reach a minimum performance level with the low ability students, while also offering high ability children the opportunity to extend their knowledge without proceeding (too much) ahead of their peers in the classroom.
The potential convergent or divergent effects of varying differentiation strategies are not fully clear, as research shows mixed results, and therefore it is difficult for teachers to make explicit decisions on when to use which differentiation strategy, for what goal.

The effect of differentiation is considered to be divergent when the effect size is largest for high ability students and convergent when the effect size is largest for low ability students.

*Divergent thinking* is the process to create several unique solutions intending to solve a problem. The process of divergent thinking is spontaneous and free-flowing, unlike convergent thinking, which is systematic and logical. When using convergent thinking, we use logical steps in order to choose the single best solution. By using divergent thinking, instead of only choosing among appointed options, we search for new options. Convergent thinking stands firmly on logic and less on creativity, while divergent thinking is mostly based on creativity. We use divergent thinking mostly in open-ended problems that creativity is a fundamental part.

*Convergent thinking* is the opposite of divergent thinking. Convergent thinking is the process of finding a single best solution to a problem that we are trying to solve. Many tests that are used in schools, such as multiple-choice tests, spelling tests, math quizzes, and standardized tests, are measures of convergent thinking.
2.6 Educational differentiation - Learner Oriented

From a learner oriented point of view, there are three categories of student characteristics that can be taken into account.

1. **Student's readiness**: Student readiness or initial situation is the knowledge or skill level that individual learners have already mastered with respect to a topic or task that is planned for them to be engaged with (they are supposed / about to address?). Differentiation of curriculum and instruction as a response to student readiness: Individual learns in his or her zone of proximal development. Teacher has to be there for support and help students to become independent thinkers and problem solvers. Instruction must be in advanced, challenges at the proper level of difficulty.

2. **Student's interests**: Tasks that are interesting to students increase their motivation to deal with it, they are more productive, creative, persistent and autonomous. Rather than “How can I motivate students?” a teacher should think about “What motivates this particular student and how do I design work that is responsive to these motivations?”

3. **Student's learning profile**: The term learning profile refers to a student’s preferred mode of learning that can be affected by a number of factors, including intelligence preference, gender, and culture. Learners at primary, middle, and high school levels achieve better when instruction matches their preference.

*Important note: learning styles are not an advised way to differentiate between students since they fail to challenge the students to use different ways of learning and don’t lead to higher learning outcomes (De Bruyckere, Kirschner & Hulshof, 2015).*
2.7 Educational differentiation - Teacher oriented - Content differentiation

Content differentiation is concerned with:
- providing students with information through a variety of sensory inputs e.g. audio, visual etc.;
- providing students with a variety access points to information and considers how they access the information and what they need to learn;
- assessment that directly influences instruction.

Content differentiation can include:
- variation in texts;
- accelerated coverage of material;
- assorted supplementary materials;
- varied visual information;
- independent study;
- tiered assignments -based on pre-assessments.
2.8 Educational differentiation - Teacher oriented - Process differentiation

To differentiate by process, teachers use sense-making activities with students to enable comprehension of content. Differentiation by process involves giving students opportunities to explore key concepts. It gives them the chance to come to grips with the material they’ve been learning, to play with it, twist it, experiment with it, and test it.

Process differentiation can take place according to each of the student characteristics mentioned before (readiness, interest, learning profile)

One way to differentiate by process is by using flexible grouping of students. Flexible grouping is a range of grouping students together. This can be as a whole class, a small group, or with a partner. Flexible grouping creates temporary groups that can last an hour, a week, or even a month. It’s not permanent, but it is a temporary way for students to work together in a variety of ways and configurations depending upon activity and learning outcomes.

In differentiated instruction, teachers should ensure that their students have multiple options for taking in information and making sense of concepts.

Educators should take the time to:

- get to know their students and understand who they are as individuals;
- invite them to be active participants of their learning process;
- offer various methods through which modify curriculum components;
- increase the possibility for students’ success.
2.9 Educational differentiation - Teacher oriented - Product differentiation

In order to evaluate your students’ development better and clearly, alternative assessment techniques should be used, in addition to traditional assessment techniques. An alternative assessment is a student-centered approach and it concentrates on the level of the utilization of learning and abilities to actual life, taking the individual characteristics of the students into consideration. As traditional assessment just considers the practices in the intellectual zone, the alternative approach watches the improvements in emotional and psychomotor practices. Portfolio, project, performance assignments, concept maps, structured grids, descriptive branched trees, word association, self-evaluation and peer evaluation are accepted as the tools of alternative assessment and evaluation. Alternative assessment is more functional in defining the students individual needs, changes and differences.
3 Pedagogical design principles on classroom differentiation and inclusion with tablets

3.1 General design principles

1. Differentiation should be a pro-active teaching procedure.
2. Many stakeholders should be involved in order to differentiate successfully.
3. Being student-centred and being aware of the many differences in the group are considered a significant influencer in achieving inclusion of all students.
4. Differentiation is more about the quality of the differentiation than the quantity.
5. Differentiation provides multiple approaches to content, process and product.
6. Differentiation is not a static, but rather an organic, dynamic process.

3.2 Design principles related to content differentiation

1. It is advisable to use a varied set of learning materials.
2. It is advisable to use a set of meaningful and authentic learning materials.
3. Teachers may consider using student-generated content as learning materials for other students or classes.
4. Teachers could include options to branch to more complex content.

3.3 Design principles related to process differentiation

1. Teachers may formulate high expectations, may expect a serious effort and should support students where needed.
2. Designing and providing differentiated tasks should go hand-in-hand with a coaching attitude of the teacher.
3. The teacher should be in favour of peer learning.
4. Different grouping techniques might be used variously: by interest, divergent, convergent,...
5. Consider building variation into your educational method; aligned with grouping strategies and learning contracts.
6. Consider building variation into the learning environment: the school and classroom environment, real-life environments and virtual environments.
7. Assessments might be developed from a growth mindset.
8. Students should be stimulated to assess themselves and their peers.
9. Try to give quick and concrete feedback to students and therefore integrate ICT-tools as a smart catalyst.
10. Giving feedback is a specific skill. It is important to train the students to give qualitative feedback and feedforward to other students.
3.4 Design principles related to **product differentiation**

1. Consider using alternative assessment-techniques in addition to traditional assessment-techniques in order to adapt more to individual needs, changes and differences.
2. Try to enable your students to use higher level thinking skills.
3. Evaluation rubrics with clearly described expectancy levels should be used.
4. The teacher should give variety and openness in creating the outcomes and the final product in order to help students express themselves better, and better addresses students with different characters, needs, levels and preferences.
5. Teachers should use summative assessment to decide on learning outcomes.
6. Teachers should use formative assessment to monitor the progress and give feedback to your students.
7. Logistics and materials may be provided to help students preparing their products efficiently.

3.5 Design principles related to differentiation on student’s characteristics

1. Try to formulate high expectations for students and be confident in learners’ achievements.
2. Aim to challenge students and provide different levels of learning materials to challenge them.
3. Consider involving students in the process of differentiation, e.g. group choice.
4. One should routinely use consistent and meaningful assessment to get a good view of students’ readiness, interests and meta-cognitive abilities.
5. Be aware of differences between students based on special needs, gender, culture, linguistic preferences, strengths and weaknesses; confidence; self-awareness; self-efficacy. (inclusion)
6. Learning styles are not an advisable way to differentiate between students since they fail to challenge the students to use different ways of learning and don’t lead to higher learning outcomes.
7. Try to take advantage of the availability of ICT-tools for assessment to enable easy and fast (self-)assessment of students.
4 The SPACIER-principles - Technical design principles on classroom differentiation and inclusion with tablets

The following principles are intended to highlight the importance of creating SPACE i.e. room for manoeuvre, both for the teacher and learner to facilitate differentiated learning. Therefore, the SPACIER-principles should guide educators who plan to implement differentiated learning using the vehicle of mobile devices.

4.1 Design principles related to security (S)

1. The use of mobile devices for differentiated learning should comply with the policies, legalities, guidelines, protocols and structures that are aimed at protecting the health and well-being of both the learner and the educator.
2. Students (and teachers) should be media literate and should receive training in this area if required.
3. Permissions from parents for internet access and online user profiles, especially in primary education.
4. Participating in a learning process using tablets should be safe for the student.
5. If the use of individual mobile devices are permitted, coach students in their understanding on how other mobile devices and operating systems function (also for social learning activities).
6. In a tablet-school using school tablets, there has to be a clear policy on privacy, security and storing/deleting user-content.

4.2 Design principles related to plurality (P)

1. It is suggested to apply a multi-platform approach and use apps that function platform independently.

4.3 Design principles related to apps (A)

1. Taking account of app availability and access, the choice of the right app for learning should be influenced by the differentiated needs of the learners’ and less by the personal learning preference of the teacher.
2. Apps that give insights into user-progress are interesting, especially when it comes to classroom differentiation and inclusion.
3. Apps that work well on all devices are suggested.
4. The possibility to access the app with the computer is an advantage for the teacher.
5. Apps should be contemporary: they have to be developed to the latest Operating Systems. When an app is getting outdated, teachers should consider to change. A flexible attitude towards the choice of the app is therefore suggested.
6. Try to make use of free apps first. If they don’t meet the differentiation needs, consider to choose a paying app. Be aware of ‘hidden’ payments and advertising when you choose for free apps. Also be aware that free apps can disappear suddenly.

7. Make use of interdisciplinary apps: you don’t have to use many apps to have a satisfying tablet-experience. Make a good choice because teachers and students will get confused when there are too many options.

4.4 Design principles related to cohesiveness (C)

1. It is suggested that a group of teachers come together to decide what are common educational needs and adapt the apps that will be used to that (app suite). A ‘line of apps’ could be an interesting approach in order to have alignment within a grade and across grades.

2. Schools should consider balancing ‘strict guidelines for tablet use’ and ‘full freedom for each teacher’.

3. It is suggested to have a learning technologist / champion in a school using tablets. This person monitors and revises the apps that are used, takes care of the devices and gives support to the teachers.

4. A fully charged tablet-battery in the morning is necessary for an effective tablet-experience. There should be a clear school policy on battery charging. In a BYOD-school students and teachers have to charge their tablet at home or in lockers with charging stations. In a tablet-school with school tablets, a staff member needs to charge and manage all tablets. Classrooms in which tablets are used, need to have enough charging stations.

4.5 Design principles related to infrastructure (I)

1. The introduction of mobile technologies for differentiated learning should be supported by an infrastructure that is Reliable and Robust. Learners and educators should be able to share work from their mobile device through mirroring/casting.

2. You would only have a good tablet experience when you have a consistent Wi-Fi-network with high bandwidth.

4.6 Design principles related to economy (E)

1. Economy of scale: this includes choosing apps or infrastructure that reflect the micro-economy present in the school. Where possible the use of free apps or student owned devices taking account of the security principle, above, should be explored. Potential costs must be weighed against intended learning outcomes.

4.7 Design principles related to restrictions (R)

1. Students and teachers should take account of the restrictions associated with individual mobile devices such as screen size, memory to save apps and outputs such as images and infrastructural limitations e.g. bandwidth, availability of Wi-Fi etc.
2. Be conscious about apps with access codes. In primary education and VET it might be difficult when students have to login with a private account and password to an app or a platform. It’s easier to work with direct links or QR-codes to give students immediate access.
3. Consider to make clear statements about what student may and may not do with the tablet, during classes, but also in between classes.
5 List of apps

This list gives an overview of all apps that were used throughout the Tablio-project. We’d like to emphasize the importance of the pedagogical usage of the app. A good app can be used in a wrong way. Please have a look at the good practices if you want to get insight in how the apps were used in the Tablio-project.

- **3DVista**: is an offline (pay to use) software that can be used to create tours using 360-degrees pictures.
- **Actionbound**: is an app for mobile learning with multimedia guides and interactive treasure hunts for smartphones and tablets.
- **Airserver**: This is a tool that is used to allow mobile devices to be mirrored onto another device, such as a PC. This is especially useful when the PC is connected to an interactive whiteboard, so what is on a teacher’s or student’s device (tablet or smartphone) will be visible to the entire class.
- **Answergarden**: is a minimalistic feedback tool. It can be used in the classroom as an educational tool or at work as a creative brainstorming tool. Students can post it in a tweet or can embed it on your website or blog to use it as a poll or guestbook.
- **AWW - A Web Whiteboard**: an online whiteboard for co-creation, collaboration and information sharing.
- **Beebot**: is a small child friendly robot that can be programmed using the buttons on top of the robot. The robot is used in combination with a mat (bought or own design) that has a grid design containing text, images or numbers in certain cells. The assignment for students can then for example be to have the robot visit all the cells with numbers in sequence. It’s name technically is incorrect because it looks more like a wasp than a bee.
- **Book creator**: is a simple way to make your own beautiful eBooks, right on your iPad.
- **Classdojo**: allows you to build classroom communities with parents and students and to share learning progress.
- **Classkick**: is a free digital formative assessment tool that allows teachers to create lessons and assignments that students work through on their devices at their own pace. Teachers can observe student progress in real time and provide immediate feedback.
- **CMAP**: It empowers users to construct, navigate, share and criticize knowledge models represented as concept maps.
- **Edmodo**: Italian digital classroom. It involves students, teachers and families in the learning process. It can be integrated with Google Apps and Microsoft OneNote & Office. Functions: creation of groups, assignment of homework, tests and quiz.
- **Edpuzzle**: Edpuzzle is an easy-to-use platform allowing you to engage every student, one video at a time. The power of videos through simple editing tools and dazzling student data. The process is simple - find a video, add questions and assign it to your class. Watch as they progress and hold them accountable on their learning journey.
- **Edulastic**: the tool for interactive formative assessment. Create customized next-generation assessments with items from publishers or from your own curriculum. Choose from Drag & Drop, Sentence response, Graphing and more than 40 other technology-enhanced question types.
- **Fidenia**: Italian "social learning" dedicated to create virtual classes, share resources, create multimedia content, assign tests and dialogue virtually between teachers, students and families. Functions: e-learning; calendar; communication school-families; chat; tests and evaluations; sharing of contents, resources; e-books; school notice board; creation of groups and courses.
- **Flipgrid**: is a tool (online or app) that allows teachers to create "grids" of short discussion-style questions that students respond to through recorded videos. Each grid is effectively a message board where teachers can pose a question and their students can post 90-second video responses that appear in a tiled "grid" display.
- **Geogebra**: Free online app: get graphing, geometry, algebra, 3D, statistics, probability.
- **HP-reveal**: a tool to create your own AR en share it (formerly Aurasma).
- **iTunesU**: Virtual class for iPads, with homework delivery, integrated vote register and private discussions, Find out how easy it is to hold classes, assign grades to homework and stay in touch with students, all directly from your iPad.
- **Kahoot**: is a game-based learning and trivia platform used in classrooms, offices and social settings. Sign up to create, play and share engaging quizzes on any topic.
- **Mentimeter**: This is an app that allows teachers to create resources that seek feedback from students. There are a lot of options for the format of the questions and presentation feedback, such as single words, phrases, word clouds. The free version allows a small number of questions. Mentimeter is good for getting feedback, before, during and after class.
- **Minecraft**: is a game-based learning platform with standards-aligned content across K12 subjects and special features designed for classroom use. Through project-based lessons, students build critical 21st century skills like collaboration, creative problem solving and digital citizenship.
- **mymaths.co.uk**: This is a paid-for resource that is excellent for teaching maths, from basic level to seat.
- **Nearpod**: This is an app that allows teachers to create classroom learning materials, such as presentations, that allow a mix of types of resources. For example one can upload existing standalone resources, such as a PowerPoint, then add “slides” created in Nearpod. These slides can present text, pictures, hyperlinks, questions that require responses from students. Depending on the version the overall Nearpod presentation can be set to allow students to progress through the screens themselves, alternatively the teacher controls this.
- **Nedbox**: is an innovative online platform for learning Dutch.
- **Padlet**: Make beautiful boards, documents, and webpages that are easy to read and fun to contribute to. Choose a premade template or go bold with a blank slate. Invite collaborators to add content, comment, like and make edits in real-time. Add photos, documents, web links, video, and music to make the text come alive. Share your Padlet with classmates and colleagues, friends and family, kittens and Kanye West.
- **QR-codes** (generators & scanners) are a type of barcode that you can scan with your mobile device. The QR-code guides the user to specific information pages on the internet.
- **Quiver**: QuiverVision are world leading Augmented Reality specialists with a focus on cutting edge colour technology, providing high quality engaging experiences for all ages for some of the most recognisable brands in the world. ‘Quiver’ is available on iOS, Android and Amazon.
- **Quizlet**: is the easiest way to practice and master what you’re learning. Create your own flashcards and study sets or choose from millions created by other students — it’s up to you.
More than 30 million students study with Quizlet each month because it’s the leading education and flashcard app that makes studying languages, history, vocab and science simple and effective. You can create and manage Quizlet classes as well.

- **Roundme**: is an online service that allows you to publish tours using 360-degrees pictures. The tours can be shared online and viewed both in browser or on mobile viewers.
- **Scratch Jr.**: is a version of the Scratch environment aimed at young children (5-7 years old). It uses the same block like programming environment to enable children to program stories. It has a simple interface and works on tablets (iPad / Android) while the “full” Scratch version did not work on those devices yet (until version 3).
- **Scratch**: is a free online block based programming environment developed by the MIT Media Lab. The name is derived from the “scratching” technique used by DJs to remix songs. Projects created on the Scratch website also can be remixed: you can create your own copy and extend or modify the blocks (code).
- **Seesaw**: Seesaw is a student-driven digital portfolio. Teachers can empower students to create, reflect, share, and collaborate. Students “show what they know” using photos, videos, drawings, text, PDFs, and links. It’s simple to get student work in one place and share with families, and nothing is shared without teacher approval.
- **Showme**: is an online community which contains loads of multimediial lessons on different subjects. Users can also contribute to the community by using the Showme-software.
- **Simple Minds**: Allow you to organize your ideas exactly how you want it: Multiple Mind Maps on one page; Horizontal, Vertical, Top-down and List Auto layout, perfect for brainstorming; Virtually unlimited page size of elements.
- **Socrative**: is an app for fun and effective classroom engagement. Get instant insight into student learning with easy-to-create quizzes, polls, exit tickets and more! Check out the features below to choose the Socrative account that’s right for you.
- **Sutori**: is a digital learning tool for the classroom. It enables teachers and students to create interactive timelines and stories through a simple and intuitive interface. Adding images, videos, audio files is done in a few clicks while embedding quiz questions and a commenting system add further interactivity and engagement.
- **Symbaloo learning path**: allows you to make lessons and distribute them to your students. It is possible to track their learning progress.
- **TeachVR**: is a virtual reality platform aimed at education. Like other services, it enables you to publish tours based on 360-degrees pictures. TeachVR enables the teacher to control the VR experience of a whole group or class by guiding them through the tour.
- **Thinglink**: is a kind of photo editor tool that provides users with the ability to turn any image into an interactive graphic. You can create multiple “hot spots” on specific parts of an image and turn that image into a multimedia launcher. You can include video, record audio or provide a link to any website with the click of a button.
- **Timeline 3D**: is a simple to use tool to create multimediial timelines.
- **Toontastic**: is a 3D creative storytelling app that empowers kids to draw, animate, narrate, and record their own cartoons on their tablet, phone or Chromebook.
- **Weschool**: Italian virtual classroom (free). Teachers can share resources, create multimedia content, assign tests and dialogue virtually with students.
- **Zanichelli periodic table // PTable**: For Italian chemistry teachers. It is a useful tool for approaching the study of chemistry. The table is interactive: each element is accompanied by
all its data and a card that highlights its presence and use in Biology, Earth Sciences, Astronomy and History.
6 Evaluation sheet for practices
**Evaluation sheet for practices of classroom differentiation with tablets**

For more information on the Tablio-project or for access to more documentation on classroom differentiation with tablets, visit [www.tablio.eu](http://www.tablio.eu)

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7 Tablio Grid
8 Theoretical foundation of the concept map – Extended academic version

8.1 Definition

In the most general description, differentiation can be defined as taking into account differences between students in the educational practice in order to maximize each student’s chances to obtain the learning objectives.

In educational literature, we see several definitions on differentiation. Via some of these definitions we want to illustrate the different description levels and accents of the authors:

- Chandler (2015) uses a very general definition of differentiated curricula: “Modified courses of study designed to make the schools more responsive to the educational needs of learners”.

- Tomlinson (2015) emphasises the research-aspect of differentiated instruction: “Differentiated instruction is a research-based model of classroom practice intended to support teachers in developing curriculum and instruction likely to maximize the capacity of a diverse group of learners. The ultimate aim of the model is to support maximum feasible heterogeneity in classrooms that provide equity of access to excellence for the broadest possible range of learners.”

- Morgan (2014) gives more details about the type of differences and also addresses the need for learner agency: “Differentiated instruction is a way of recognizing and teaching according to different student talents and learning styles. That strategy includes consideration of different needs, stresses student responsibility, flexible grouping and choices. Using this kind of instruction, all students should be successful.”

The Tablio-definition of differentiation and the related concept map was created by combining desk research on the topic of differentiation (including the previously mentioned authors), focusgroups with teachers and teacher trainers and discussions with the international Tablio-project team in February 2017. The Tablio-definition and concept map give both a grip as inspiration to teachers and school leaders to organize the continuous process of differentiation in their classrooms and schools. The Tablio-definition and concept map are also a guide to evaluating practices on both the classroom-level as the school level when it comes to differentiating with tablets. We aimed to develop a very complete definition of the concept ‘differentiation’.
The Tablio-definition of differentiation:

“Differentiation” aims for the inclusion of all students, for a higher motivation to learn and to participate in life-long learning and for achieving learning outcomes more efficiently. On a more general level, the objectives of differentiation are self-realisation and self-actualisation on both the cognitive, emotional and social level and the striving for harmonious and pluralistic citizens for society and humanity. For these reasons, differentiation should be considered as a necessary aspect of all education.

Differentiation can be considered to be qualitative when it meets the following characteristics: proactive, goal-oriented, structured, varied and transparent. Qualitative differentiation also requires cooperation from stakeholders on both the micro-level (classroom-level), meso-level (school-level) and macro-level (policy-level).

Differentiation can appear in two main types: organisational differentiation and educational differentiation.

Organisational differentiation (also: structural differentiation) can be operationalised in various ways: the grouping strategy of the classroom, individualized programs for special needs, extracurricular acceleration programs and remedial programs.

Educational differentiation (also: classroom differentiation) happens within the context of the classroom. It can be more learner oriented when it focuses on differences in student’s readiness, interests and learning profile. It can also be more teacher oriented when it focuses on content-differentiation, process-differentiation and/or product-differentiation. There as a mutually influence of teacher oriented and learner oriented differentiation techniques.

Differentiation may appear to be very complex and unreach goal, but this is a misconception: differentiation is above all a feasible and achievable educational approach.

We synthesised this definition into six general design principles on differentiation:

1. Differentiation has to be a pro-active teaching procedure.
2. Involve many stakeholders in order to differentiate successfully.
3. Be student-centred and be aware of the many differences in the group in order to achieve inclusion of all students.
4. Differentiation is more about quality than quantity.
5. Differentiation provides multiple approaches to content, process and product.
6. Differentiation is an organic process.

The continuation of this article focuses on the several parts of this definition.
8.2 Aims of differentiation

The aim from differentiation is to create a learning environment which encourages students to engage their abilities to the greatest extent possible, including taking risk and building knowledge and skills in what they perceive as a safe, flexible environment. Differentiated instruction is important for all students, not only those who have specific learning needs or disabilities.

Differentiation aims for:

- **Inclusion:** teachers adapting teaching methodologies to students’ needs favour the inclusion of each student into the learning and teaching process. According to Leicester (2008), school practices are inclusive when they cover a broad range of schooling experiences and succeed in helping children with diverse backgrounds and abilities to be effective learners.

- **Motivation to learn:** the purpose of differentiated instruction should be to bring each student to learning and to enhance ‘the learning match’ between the students and the curriculum. Thus, teachers should develop products that reflect students’ capability to facilitate learning for students of different readiness levels and with different interests and learning profiles; all features that can affect the construction procedure of new competences.

- **Life-long learning:** the positive outcomes of differentiation strategies will encourage learners to participate in learning activities during their entire professional career and private life.

- **Achieving learning outcomes (effectiveness):** differentiated and inclusive pedagogy is directly linked to effective learning as it aims at connecting to the individual’s learning profile and finding teaching styles through which they can learn more effectively and gain maximum benefit. According to Crawford (2008), the key to effective differentiation is to adjust the curricular components of content, teaching strategies and assessment continuously in response to adolescents’ interests, readiness levels and learning profiles, in order to encourage the development of a classroom of full inclusion. In a differentiated classroom students are active at their learning: they take responsibility for their learning process. This will lead to a higher ownership of learning and will increase the chances of achieving the
learning outcomes. Learning outcomes could also become richer and more diverse as students get more openness (ag. open-ended problem tasks) in the learning process.

- **Efficiency:** in a differentiated educational context, chances are more likely that students spend time to learning tasks that match their zone of proximal development. Less time is wasted to learning tasks that are either too difficult, too easy or that aren’t adapted to their learning profile. Using ICT-devices (eg. the tablet) can also increase the efficiency as learning progress can be shared and monitored automatically.

- **Self-realisation:** by introducing differentiation, teachers could facilitate opportunities for talented students to produce a product that reflects their potential.

- **Self-actualisation:** differentiated instruction helps in maximizing students’ opportunities for personal learning and growth. Teachers should differentiate education in order to encourage the development of the whole person: a mean to teach students differently, to take them out of the classroom and into society.

- **Harmonious and pluralistic citizens for society and humanity:** differentiation aims at having a learning environment that provides confidence to students to enhance their capabilities and building knowledge and talent in a flexible, safe environment. It should encourage independence and ensuring student performance and overall wellbeing to grow as responsible and active citizens in their society.

According to Anderson, Klassen & Georgiou (2007) the key role of teachers in “giving birth to and maintaining a truly inclusive classroom is unquestionable, but such an important mission also requires that suitable, effective and barrier-free educational means should be included”. In this project we will argue and illustrate that a tablet is an educational means that answers these criteria.

### 8.3 Characteristics

![Characteristics Diagram]

What are the key characteristics for effective and efficient differentiation?
− Pro-active: Teachers will have to learn how to develop a classroom routine and not to ignore variance in students’ readiness, interest and learning profile. Such routines may be defined as differentiating curriculum and instruction. It is a pedagogical, not organizational approach, in which teachers proactively modify curricula, teaching methods, resources, learning activities, and student products to address the diverse needs of individual students and small groups of students to maximize the learning opportunity for each student in a classroom. (Tomlinson, Brighton, Hertberg, Callahan, Moon, Birmijoin, Conover & Reynolds, 2013). The reactive approach would be that a teacher plans one lesson for the whole classroom and adapts his approach when a problem arises. This is not desirable.

− Goal-oriented: in a differentiated educational context the learning goals are central to the learning and teaching. A discussion can rise whether all students should acquire the same learning goals. For regular education, this would certainly be the case. Only in specific cases of inclusive education, it may be possible that some students aren’t required to achieve all goals.

− Varied: key to differentiation is the aspect of variety. This can be teacher-driven what would mean that the teacher varies in his educational offer of learning tasks and objects. Variation can also be student-driven when the educational context stimulates autonomy and ownership of the student. The student has the freedom to choose which learning tasks or learning objects he chooses to accomplish the learning outcomes.

− Transparent: transparency should be offered in terms of learning objectives and outcomes. A rubric is an interesting way to give transparency to the student. The students should have a clear image of the expectancies at the very beginning of the learning process. In more open ended learning processes, the student may have the opportunity to formulate the learning outcomes themselves. This should also be discussed transparently. Another aspect of transparency in differentiation is that teachers dare to express the differentiation process openly in the classroom. All students should be aware of the differentiation techniques and should take it for granted as well.

− Structured: the method of the differentiation should be clear to all persons involved.

− Feasible: Though teachers support the idea of inclusive classroom via differentiation, they tend to resist to adapting materials, planning lessons for individuals, changing evaluation procedures and instructional practices, make long-range plans or adapt scoring and grading criteria (Tomlinson, et al. 2003). Although there may be a learning process involved for the teacher, we believe differentiation to be feasible, especially when using tablets in the educational differentiation process.

− Necessary: for realizing truly inclusive classrooms with respect to everyone’s learning needs and talents.
8.4 Stakeholders

In order to make differentiation a structural, pro-active, systemically integrated aspect of education, stakeholders on three levels should invest energy in it and cooperate with each other.

- **Macro-level**: European, national and regional policy makers should emphasize the aspect of differentiation in their educational policy documents (e.g., national curricula). School inspectors and teacher educators can be an important vehicle for transferring this policy into local schools and classrooms.

- **Meso-level**: School policies should incorporate and explicit the need for differentiation. Intra- and inter-school collaboration and exchange between teachers on differentiation should be promoted.

- **Micro-level**: not only the teacher and the student, but also other classroom assistants and most importantly the parents should be engaged in the process of differentiation. This starts with informing each stakeholders but can evolve to participation and negotiation.
8.5 Organisational differentiation

Organisational or structural differentiation covers the differentiation actions on a school level or a program level (curricular level). It can be implemented in four main ways.

5) Individualized programs for special needs:
Special education is the practice of educating students with special educational needs in a way that addresses their individual differences and needs. Ideally, this process involves the individually planned and systematically monitored arrangement of teaching procedures, adapted equipment and materials, and accessible settings. These interventions are designed to help individuals with special needs achieve a higher level of personal self-sufficiency and success in school and in their community that may not be available if the student were only given access to a typical classroom education. Common special needs include learning disabilities, communication disorders, emotional and behavioural disorders, physical disabilities, and developmental disabilities. Students with these kinds of special needs are likely to benefit from additional educational services such as different approaches to teaching, the use of technology, a specifically adapted teaching area, or a resource room. Teachers who provide special education services in schools must be certified to do so and will focus on his strengths as well as his challenges. The services and supports they receive may differ. It's all about individualization. What is important is giving kids the resources they need to make progress in school. Usually special needs students are removed from their regular classroom and taught in another setting.

6) Remedial programs:
Remedial programs (also known as developmental education, basic skills education, compensatory education, preparatory education, and academic upgrading) are designed to close the gap between what a student knows and what he’s expected to know. It is usually used to build basic skills and designed for any students, with or without special needs. They often target reading or math weaknesses and can help them catch up their peers. In many cases, students are removed from their regular classroom and taught in another setting.

Not all programs are effective. An effective remedial program is taught by a professional teacher with special training. Programs need to be implemented in small groups. The idea is to get more individual attention than is possible in a large class.

7) **Extra-curricular acceleration programs:**
Extra-curricular programs are educational activities not falling within the scope of the regular curriculum. They are voluntary and could be organized at school or not. These types of activities include sports, music, arts, academic clubs and many other after-school activities. Extra-curricular activities have many positive effects on students. They help them gain new skills, learn to socialize, gain leadership ability and learn more about their own interests. At the same time participation in after-school activities is linked with better academic performance and higher self-esteem of students.

Many extra-curricular activities, such as the school newspaper, photography, and drama, can lead to careers. Extra-curricular activities also help to form the student’s profile for consideration in college or job admissions.

8) **Grouping strategies:**
School systems have developed different ways to manage the diversity of the student population. They select and group students into education levels, grade levels, different schools, programs, and different groups within schools on various ways. Grouping strategies on organizational level include *vertical stratification (by age)*, and *horizontal stratification (between and within schools or programs)* (OECD, 2016).

- **Vertical stratification** of students is a result of development. As student populations grew in size and diversity, schooling was increasingly differentiated “vertically”. This vertical stratification resulted in the creation of different grades and education levels.
- **Horizontal stratification** on organizational level means adapting curricula to different groups of students, based on their ability. There are two main types of horizontal stratification:
  - *Between schools:* separating students into different schools based on ability, often involving a division into academic/general and vocational schools; often referred as “tracking”.
  - *Within schools:* when providing different curriculum standards to different groups of pupils based on their ability; different ability groups can be placed in different classroom or in the same classroom; ability groups are typically implemented to teach core subjects; remedial groups and special needs program are also a case of such differentiation; also referred as “streaming” (Flecha, 2015).

The rationale behind using these differentiating mechanisms is to homogenize the student population so that its educational needs can be met more effectively. But there is some concern that horizontal
stratification replicates existing social and economic inequities, as socio-economically disadvantaged students tend to be disproportionally grouped into low achieving groups.

**Homogenous student groups** are result of differentiation. Homogenous grouping began as a response to traditional classrooms, in which a single teacher is responsible for a number of pupils who are typically diverse in terms of their levels of educational attainment, language proficiency, cultural background, and other characteristics. However various studies have showed that this practice does not contribute to overall school success. Researches on readiness have showed that homogeneous grouping may have positive effects on students with good overall study results, but at the same time it has negative effects on students with lower overall study results. Various studies have demonstrated that homogeneous groups increase the differences in performance among pupils, and it does not improve their overall performance. In homogeneous classrooms, low achievers learn less because they spend less time on instructional activities, the material and content they are exposed to is less challenging, instruction is of lower quality and the pace of instruction slower. Finally, horizontal stratification on school level limits the opportunities for upward mobility between groups and reduces students’ satisfaction with their group placement. It is highly likely that children belonging to vulnerable groups will be assigned to low-achieving groups, and this contributes to students being segregated, categorized, stigmatized, and socially stratified. The same is true for children with disabilities, whose attainment levels may decline even further (Flecha, 2015).

**Heterogeneous groups** or mixtures in educational settings are groups that include students with a wide variety of instructional levels. Heterogeneous groups stem from the education precept that a positive interdependence can arise from students with varied learning levels working together and helping each other to reach an instructional goal.

For students of lesser abilities, there is usually an advantage in being included in a heterogeneous group rather than homogenous group. They don't have the risk of being stigmatized as part of a less-able group. A heterogeneous group gives advanced students a chance to be a mentor to their peers. All members of the group may interact more to help each other understand the concepts being taught (Flecha, 2015).

Which teaching strategies teachers choose to use seems to relate to the implicit or explicit learning goals they have for their classroom as a whole. From a ‘theoretical’ point of view teachers can strive for **convergence or divergence**.

- Teachers aiming at **convergence** are mainly focusing on reaching a minimum performance level with all of their students, which implies they might have to dedicate additional time and effort to the low achieving children in order for them to reach that minimum performance level, even when this goes at the expense of the high ability children, who by consequence receive less attention.

- Teachers aiming at **divergence** mainly focus on helping all children to reach their highest potential, equally dividing attention between students with lower and higher ability. In practice though, most teachers will combine convergent and divergent goals and will try to reach a minimum performance level with the low ability students, while also offering high ability children the opportunity to extend their knowledge without proceeding (too much) ahead of their peers in the classroom.
The potential convergent or divergent effects of varying differentiation strategies are not fully clear, as research shows mixed results, and therefore it is difficult for teachers to make explicit decisions on when to use which differentiation strategy, for what goal (Deunk, Doolaard, Smale-Jacobse & Bosker, 2015). The effect of differentiation is considered to be divergent when the effect size is largest for high ability students and convergent when the effect size is largest for low ability students.

**Divergent thinking** is the process to create several unique solutions intending to solve a problem. The process of divergent thinking is spontaneous and free-flowing, unlike convergent thinking, which is systematic and logical. When using convergent thinking, we use logical steps in order to choose the single best solution. By using divergent thinking, instead of only choosing among appointed options, we search for new options. Convergent thinking stands firmly on logic and less on creativity, while divergent thinking is mostly based on creativity. We use divergent thinking mostly in open-ended problems that creativity is a fundamental part.

**Convergent thinking** is the opposite of divergent thinking. Convergent thinking is the process of finding a single best solution to a problem that we are trying to solve. Many tests that are used in schools, such as multiple-choice tests, spelling tests, math quizzes, and standardized tests, are measures of convergent thinking.

### 8.6 Educational differentiation - Learner Oriented

From a learner oriented point of view, there are three categories of student characteristics that can be taken into account.

1. **Student's readiness**: Student readiness or initial situation is the knowledge or skill level that individual learners have already mastered with respect to a topic or task that is planned for them to be engaged with (they are supposed / about to address?). Differentiation of curriculum and instruction as a response to student readiness: Individual learns in his or her zone of proximal development. Teacher has to be there for support and help students to become independent.
thinkers and problem solvers. Instruction must be in advanced, challenges at the proper level of difficulty.

5. **Student’s interests:** Tasks that are interesting to students increase their motivation to deal with it, they are more productive, creative, persistent and autonomous. Rather than “How can I motivate students?” a teacher should think about “What motivates this particular student and how do I design work that is responsive to these motivations?”

6. **Student’s learning profile:** The term learning profile refers to a student’s preferred mode of learning that can be affected by a number of factors, including intelligence preference, gender, and culture. Learners at primary, middle, and high school levels achieve better when instruction matches their preference.

*Important note: learning styles are not an advised way to differentiate between students since they fail to challenge the students to use different ways of learning and don’t lead to higher learning outcomes (De Bruyckere, Kirschner & Hulshof, 2015).*

8.7 Educational differentiation - Teacher oriented - Content differentiation

Content differentiation is concerned with:

- providing students with information through a variety of sensory inputs e.g. audio, visual etc.;
• providing students with a variety access points to information and considers how they access the information and what they need to learn;
• assessment that directly influences instruction.

Content differentiation can include:
• variation in texts;
• accelerated coverage of material;
• assorted supplementary materials;
• varied visual information;
• independent study;
• tiered assignments -based on pre-assessments.

As technology has evolved, the identification of different learning methods associated with the use of technology has also changed. One such method that has influenced education is that of Mobile Learning (M-Learning). Laouris and Eteokleous (2005) proposed a more meaningful definition of M-Learning i.e. learning that took place using a mobile technology device, was needed given the proliferation and ownership of mobile technology. An opportunity to investigate M-Learning and the correlations that may exist between this pedagogy’s ability to facilitate differentiated learning and differentiated assessment has not been fully explored. Facilitating responsiveness to the learner’s needs brings with it the opportunity to facilitate a curriculum that adapts and is individualised to the needs of the learner. The creation of a curriculum that is individualised can be connected with the concept of differentiation where the differing skills and diverse needs of students’ are accounted for in what has been termed ‘instructional differentiation’ Mills et al. (2014). It is both E-learning and M-Learning’s ability to facilitate learning across various contexts and geographies that affords the opportunity for a personalised curriculum. However, M-Learning brings with it the opportunity to allow learners’ to take ownership of their learning and individualise this according to their needs at a time and place that suits their lifestyle as Song et al. (2012) indicate. However, even the concept of M-Learning has not given rise to the consideration of both instructional differentiation and differentiated assessment. Therefore, the ecology between learners’ and technology within education and the impact that one may have upon the other in relation to learning and both instructional differentiation and differentiated assessment is an area that requires investigation.

Currently, we have assessed that a number of gaps in the research are present and an opportunity exists to explore these gaps in more detail. For instance, no congruence has been found in relation to the role of M-learning in current teaching and learning practices. This includes investigating how M-learning can be exploited to facilitate a personalised education for students’. The affordances’ presented by the technology associated with M-Learning are such that a variety of sensory inputs and outputs can be communicated and created. Therefore, exploring not only the proliferation of mobile technology within education but also how this technology is currently being used by both students’ and lecturers’ would offer insight into learning behaviours and patterns.
8.8 Educational differentiation - Teacher oriented - Process differentiation

To differentiate by process, teachers use sense-making activities with students to enable comprehension of content. Differentiation by process involves giving students opportunities to explore key concepts. It gives them the chance to come to grips with the material they’ve been learning, to play with it, twist it, experiment with it, and test it.

Process differentiation can take place according to each of the student characteristics mentioned before (readiness, interest, learning profile)

One way to differentiate by process is by using flexible grouping of students. Flexible grouping is a range of grouping students together. This can be as a whole class, a small group, or with a partner. Flexible grouping creates temporary groups that can last an hour, a week, or even a month. It’s not permanent, but it is a temporary way for students to work together in a variety of ways and configurations depending upon activity and learning outcomes.

In differentiated instruction, teachers should ensure that their students have multiple options for taking in information and making sense of concepts.

Educators should take the time to:

- get to know their students and understand who they are as individuals;
- invite them to be active participants of their learning process;
8.9 Educational differentiation - Teacher oriented - Product differentiation

In order to evaluate your students’ development better and clearly, alternative assessment techniques should be used, in addition to traditional assessment techniques. An alternative assessment is a student-centered approach and it concentrates on the level of the utilization of learning and abilities to actual life, taking the individual characteristics of the students into consideration. As traditional assessment just considers the practices in the intellectual zone, the alternative approach watches the improvements in emotional and psychomotor practices. Portfolio, project, performance assignments, concept maps, structured grids, descriptive branched trees, word association, self-evaluation and peer evaluation are accepted as the tools of alternative assessment and evaluation. Alternative assessment is more functional in defining the students individual needs, changes and differences.

Alternative instruments urge students to make up their minds on basic and complex issues, not at all like the traditional tools. While students give short answers, or select one of the numerous decisions in traditional instruments, with alternative assessment they frame and make answers from their own points of view on genuine living, and they introduce their answers in various ways. While traditional methods by and large evaluate remembered learning, alternative instruments attempt to uncover the perception and achievement of learners. In this specific situation, alternative assessment instruments

- offer various methods through which modify curriculum components;
- increase the possibility for students’ success.
have an integral element for learners with various learning styles and they give other options to the assessment of these learners (Llewellyn, 2003).

What are some possibilities of alternative assessment techniques?

− **Self-assessment:** self-assessment is an assessment type which brings students into the assessment process by letting them evaluate and score themselves. Thus, it is assumed that students take responsibility for their development and they begin to internalize standards which increase autonomy (Hart, 1994)

− **Rubrics:** a rubric is a useful evaluation approach to judge the quality of a product or performance which includes related criteria and ratings based on those criteria. Rubrics enable descriptive informative and holistic characterization of students’ work (Van-Tassel Baska, 2003).

− **Peer-assessment:** peer-assessment is an arrangement in which individuals consider the amount, level, value, worth, quality, or success of the products or outcomes of learning of peers of similar status. However, if obtaining helpful feedback is needed, students must have a clear understanding of what they are to look for in their peers’ work. The instructor must explain expectations clearly to them before they begin (Topping, 1998).

− **Reflection paper:** reflections are pieces of writing that require students to articulate and review the process and/or products. They allow students time and space to analyse their achievement in relation to the class standards, evaluate their final products and determine growth as well as needs. Reflection papers, a critical component of the process/product, are vital tools in the learning process, for through reflection students learn to scrutinize their own performance, come to terms with what went wrong as well as what went well, contemplate strategies to enhance their success in future work and take responsibility for their learning. It is the job of the instructor to create and foster an effective reflection milieu (L. Fernsten & J. Fernsten, 2005).

− **Portfolio:** portfolios represent a form of authentic assessment. It is defined as “systematic collections by both students and teachers [that] can serve as the basis to examine effort, improvement, processes, and achievement as well as to meet accountability demands usually achieved by more formal testing procedures.” (Tierney, Carter, & Desi, 1991, p. 41).

− **Learning Logs/Diaries:** a learning log is a particular format which connotes a running commentary in writing format. A learning log is not meant to be a polished piece of writing that is rewritten through many drafts. It is an opportunity for learners to communicate their ideas and to clarify, refine, and consolidate their thinking (McIntosh and Draper 1997).

− **Projects:** the interdisciplinary projects constitute innovative assessment method aimed at helping students cope with real-world problems. The project-based method involves both theoretical and practical aspects and has the potential to make assessment explicit and meaningful to students. Project-based assessment thus enhances higher order cognitive skills, including the ability to perform data analysis, problem solving, and decision-making, and develops the students’ sense of responsibility for their physical and human environment (Dori & Tal, 2000).

− **Diagnostic Branched Tree (DBT):** DBT is an alternative assessment tools that can be used to identify what students have learned or what they have not accomplished in a given subject. Students are asked to select the right choice among true and false statements in an order from basic statements through complexed statements with more details. A branched tree is usually made up of 8 or 16 selected statements (Çelen, 2014).

− **Fishbone Technique:** fishbone chart diagram aims to specify the reasons of matters happen in a clear manner by indicating the relationship between qualitative attributes and their related factors. The problem is shown on the main bone and the causes of the problem are indicated on its main branches, respectively. This tool enables to prioritize actions considerably and can be effective in increasing creativity and to activating group thinking (Yazdani & Tavakkoli-Moghaddam, 2012).
− **Word association test (WAT):** this is a reliable technique used as a procedure for measuring number, direction and strengths of connections. WAT requires responses that are not restricted to any specific category or class of words. In tests of discrete word association, each participant is asked to produce only a single associate to each word, while in tests of continuous association, the stimulus word or the list of stimulus words is presented to the respondents only once and they are asked to give as many associations as they can in a pre-specified period of time (Kostova & Radoynovska, 2010).

− **Structured grids:** structural grid is one of the alternative assessment-evaluation techniques. A structured grid is a technique when a group of answers, elicited from a set of questions, are distributed to a numbered nine or twelve boxed table, and that students have to choose the options that logically order as well as find options that produce the correct answers to the questions. The most important feature of this approach is the measurement of meaningful learning, the lack of sight of partial information, and the fact that it is a diagnostic tool that reveals the deficiencies and inaccuracies of the student's cognitive structure (Bahar, Öztürk ve Ateş, 2002).

− **Mindmapping:** mindmapping can be defined as non-linear representations of ideas and their relationships. Mind maps comprise a network of connected and related concepts. However, in mind mapping, any idea can be connected to any other. Free-form, spontaneous thinking is required when creating a mind map, and the aim of mind mapping is to find creative associations between ideas. Thus, mind maps are principally association maps (Buzan and Buzan, 2000). It is different from concept map which only allows allows students to understand the relationships between concepts since mind-maps are for imagining and exploring new associations (Davies, 2011).

Higher level thinking skills aka 21st Century skills which are analytical, practical and creative thinking skills. These skills aim to equip students with the competencies necessary to reason about social affairs in a rapidly changing world and necessary to immerse in new information, display mental flexibility, innovation, complex problem-solving abilities, and productive collaborations with others. Teachers should enable students to use higher level thinking skills. We can distinguish several higher level thinking skills:

− **Creative thinking skills:** creativity can be defined as the production of work that is both novel (i.e., original, unexpected), of high quality, and appropriate to the task at hand (Kaufman & Sternberg, 2010).

− **Critical thinking skills:** critical thinking can be defined as reasonable and reflective thinking that is focused on what to believe or do (Ennis, 1987). In terms of this definition critical thinking skills are analysing and evaluating data, building explanations from evidence, engaging with scientific questions.

− **Practical thinking skills:** practical thinking skills mean to apply critical and/or creative abilities successfully to everyday, pragmatic situations (Sternberg, 2003).

We want to underline the importance of rubrics for realizing educational differentiation on the product-level. Rubrics describe simple criteria that identify whether or not the characteristic is present or absent, and also have some judgments regarding the qualities of the characteristics. The measurement scales in rubrics describe the characteristics of each point on the scale. The highest quality work generally receives more point values.

Teachers should detail the expectations for performance in the task description (and in the rubric). They should explicitly delineate the dimensions along which and how student performance will be evaluated and should clearly express the levels of performance quality (Renzulli & Callahan, 2008). One of the critical characteristics of rubrics is to engage the student throughout the entire process. In this way, students understand the goals for learning, the particular characteristics
needed for high-quality work, the types of samples that will best showcase these characteristics and their progress, how to reflect on their best work and themselves as learners, and how to communicate their progress to others. The use of rubrics becomes even stronger, when it’s also offered in a visual and/or auditory way, besides the textual way.

Another important element in product differentiation, is using variety in creating the outcomes and the final products. This helps students to express themselves better and reach the students with different characters, needs, levels and preferences.

- **Tangible products**: tangible products are the products that can usually, or to some degree, be directly experienced—seen, touched, smelled, or tasted, as well as tested (Levitt, 1981). We refer to the ‘content differentiation’-section to get ideas on the various types of tangible products.

- **Daily problems**: the concept of daily problem emphasizes the use and application of information (content) and thinking processes in an integrated, inductive, and a real-problem-oriented manner. The role of the student is being a first-hand inquirer instead of just a learner (Renzulli, 2005).

- **Open ended problems / Non-routine Problems**: open-ended or non-routine problems are the ones which require high-level thinking and problem solving, and put an emphasis on the process the student uses to come to an answer rather than on whether or not the student can quickly find the right answer.

It is important to integrate formative assessment in the learning process, in order to monitor progress and give feedback to your student. Qualitative and immediate feedback have an important positive impact on the learning progress (Hattie & Timperley, 2007). Summative assessments are obviously also in important source of information on students’ progress. Teacher should consider the possibility of ‘extra points’ for students that want to accelerate. It’s also possible to ask and discuss with students what grade they want to achieve.

### 8.10 Bibliography


REALISING CLASSROOM DIFFERENTIATION AND INCLUSION WITH TABLETS

CHAPTER 2

Good practices from European classrooms
The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.
1 Adapting to different learning profiles with Classkick

Age Group: 13-18 years old / Level: Classroom / Subject: Social sciences

1.1 Country of origin

Belgium

1.2 Educational analysis

1.3 Description

Angelica Spikic, Céline Lowette, Ilse Klingeleers, Lucinda Luyts, Nadine Houbrechts and Thomas Eerdekens are teachers in secondary education. They all have a bachelor degree ‘teacher for secondary education’ and teach the subject PAV (project general subjects), but at the same time they are taking the PAV training, which is part of the teacher training at PXL. In this context, they made a digital paper about organ donation under the supervision of lector Hanne Rosius (PXL Education).

At the time of designing the package, the group focused on the initial situation in Angelica Spikic’ class. This was also the first class in which the package was used. Angelica is a PAV teacher in the second grade in vocational education. Her students specialise in sales. Vocational education classes are often very heterogeneous, and so is Angelica’s. Some of her students take her class because of the adapted level, some of them choose to be there because they are genuinely interested in sales as a profession, still others ‘descend to it’ because of (a variety of) learning difficulties or because their native language is a foreign language. Angelica’s school is situated in the centre of Brussels. Due to its metropolitan context, the classes are very heterogeneous as far as cultural background and language are concerned.

The students in Angelica’s class are not familiar with using tablets in the classroom. The school has a number of tablets at the students’ disposal and a reliable WiFi- network. The classroom is big enough to allow the students to work actively.
A student working with Classkick

The package that has been developed aims to adapt to the above mentioned differences between students and uses the Classkick app (http://classkick.com). This device-independent tool (in the example the app was used on iPads) offers the students a number of assignments. The students work on these assignments in the classroom under the teacher’s supervision. They can decide for themselves what order they complete the assignments in and how much time they want to spend on each one of them. Each assignment is offered in different varieties and students can make their own choices (content-differentiation), so they can work through the basic assignment at their own pace. The app facilitates the teacher’s supervision. Angelica can keep an eye on her students’ progress all the time. In the app, she can see which student is working on which assignment, which assignments have been finished and what the quality of the assignment is (cf. display matrix).

With this information, she can decide which students need her assistance and which don’t. Classkick also offers students the possibility to take initiative and ask for Angelica’s help. They can virtually raise their hand to ask a question or to make clear they want feedback for an assignment (cf. the orange hands in the screenshot). Being able to virtually raise their hands, is an advantage for more introvert students because it lowers the threshold (process-differentiation).
Angelica can offer help via Classkick itself by sending a message that immediately appears on the student’s tablet. Naturally, the teacher can still offer face-to-face support too. It all depends on the type of question or the need for assistance from the student. The app also enables stronger students to give feedback. They can react to questions in the system that have anonymously been asked by fellow-students. In Angelica’s class this functionality was deactivated because her students couldn’t handle it yet.

Moreover, by means of a sticker system teachers can easily inform students when they are doing well, or give them a small hint (e.g. : ‘Fantastic!’ , ‘Read and approved’, ‘You forgot something’. Take a good look at the assignment!’, ...) This is a quick and easy way positive endorsement.

With the Classkick-app, assignments and feedback can be offered in different ways : with text, with sounds of visually. In the designed package, an audio version can be added to a written text. The student can then choose whether he reads the assignment or listens to it. This can be an advantage for dyslexic students or students with visual impairments (process– differentiation).
A spoken version is added to written instructions

Additionally, the app offers the possibility to import content in different ways. The possibility to integrate other tools (e.g. BookWidgets [http://www.bookwidgets.com], Thinglink [www.thinglink.com], EdPuzzle [http://www.edpuzzle.com], Padlet [http://padlet.com], etc.) through the hyperlink function, facilitates the realisation of the UDL-principle (*universal design for learning*) and adapt to the variety of learning preferences of students. By means of an example, links were made to the online tool Mentimeter [http://www.mentimeter.com], where students can give their opinion and look at the results of the class group in a bar chart. (students’ learning profile)
Also can students decides for themselves how they finish complete an assignment: the answer can be written, spoken, drawn, visualised by means of a picture or a video, or a combination of both. The images below give an idea of how one question can be answered in different ways. Thanks to this, the app facilitates easy adaptation to different learning profiles (student’s learning profile).

The package was tested in Angelica’s class first. Afterwards, it was also actively used in other classes. According to the teachers, the lessons in Classkick help students to make their own decisions without complicated organisational structures. They see it as an advantage to have an overview of the group’s questions at all times, so they can timely adjust and endorse. The combination of question-driven feedback and the possibility for teachers to decide for themselves whether students need feedback or not, seems to work. The application appears to adapt well to various learning methods and language obstacles, and it lowers the threshold for introvert students. Finally, the teachers emphasize that the app is very user-friendly.

Students in all classes easily started working with the app. This means that it is also fit for students who are not used to working with tablets in the classroom. Students particularly appreciate the variation of activities and materials that can be integrated in Classkick. The feedback and the stickers are motivating and introvert students are not afraid to virtually raise their hands.
Students from Angelica’s class working with Classkick

You can take a closer look at the package ‘Real heroes donate’ (Dutch version) and try it out on www.classkick.com or in the Classkick app. Log in as a student with code JXU YZE.
2 Use of tablets and online journal (digital portfolio) for easier formative assessment of pupils and improving inclusion of children

Age Group: 6-12 years old / Level: School / Subject: Languages

2.1 Country of origin
Slovenia

2.2 Educational analysis

2.3 Description
In order to achieve differentiation and inclusion in the classroom, focusing on pupils is essential. One of the best methods for regular monitoring of pupils’ progress is formative assessment, since it allows them to set their own learning objectives and advance in line with their abilities, with the help of clear and thorough teacher’s feedback. Monitoring pupils’ progress can be much easier and transparent with the help of tablets.

The Osnovna šola Rače primary school from Slovenia, in collaboration with the National Education Institute Slovenia, is performing an innovation project “Using tablets and online journal in primary school” for the third consecutive year. With the project they wish:

• to modernize educational practice at the school,
• to encourage motivation for work among pupils and guide them towards adopting new, different useful (digital) skills,
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- to test the usefulness of a tablet and online journal for performing formative monitoring and influence the improvement of inclusion.

Project leader Ksenija Pečnik, an English teacher, says that through their practice, tablets together with digital portfolios, which are a basis for the feedback, proved to be an excellent tool for formative assessment. “For performing formative assessment, the pupils must know what they are going to study and then set the goals they wish to achieve themselves. This is done without tablets. The tablets however have a leading role in creating various products.”

The pupils create diversely comprehensive and complex products by using tablets and various applications, such as:
- posters
  (PicCollage – [http://pic-collage.com](http://pic-collage.com))
- mindmaps
  (Mindomo - [http://mindomo.com](http://mindomo.com))
- comics
  ([http://ComicStripCreator.org](http://ComicStripCreator.org)
  [http://pizap.com](http://pizap.com), Photo Talks –
  [http://fueneco.com/photo-talks](http://fueneco.com/photo-talks))
- movies/videos (Viva Video, Slideshow Maker)
- sound recordings
- letters
- word clouds (Word Cloud, Word Art)
- interactive stories (Draw My Story, ThingLink)
- presentations (Prezi – [http://prezi.com](http://prezi.com))
- talking images
- picture stories
- etc.

The teacher determines a specific theme, content emphasis and the application (which is chosen with regard to content, purpose and goal), and gives oral and written instruction that apply to
everyone, while the pupils decide how extensive and in-depth their final product is going to be. Criteria which affects the final grade is created together with the pupils.
The criteria are then written on the whiteboard (how many images, slides, etc. the product must include, how much new vocabulary it should contain, which grammatical structures it should cover, while the text must be spelled properly as the pupils have access to an online dictionary, etc). All instructions and criteria are also available to pupils at all time on the school’s special website, while the teacher is also reachable for any additional explanations by e-mail.

The pupils can work individually, in pairs, with the help of the teacher or in a group. Those who cannot create a product in specific application can also use another application and create a different type of product (for example, a photograph instead of a video; if someone stutters they do not have to record a speech but can only describe the theme). In their work, pupils can use the internet, e-dictionary, maps, etc. "We must understand that every child has their own strong and weak points. By using tablets, which are a popular accessory among pupils, they work and learn with a greater enthusiasm, and in a manner that suits them.”
Each pupil creates a digital portfolio at the beginning of a school year with the help of a Google account in the Padlet application, where he stores products created during the learning process. With the help of a digital portfolio the teacher then monitors progress and achieved goals of every pupil through the entire school year, and can provide regular feedback and comments about his products, so he can improve them. Pupils mostly receive oral feedback and if they wish, also via e-mail. In case of e-quizzes (Kahoot – [http://kahoot.com](http://kahoot.com), Socrative – [http://www.socrative.com](http://www.socrative.com)), which are used primarily for evaluation of reading comprehension, the pupils receive feedback via tablets.

Moreover, the teacher’s role in this kind of work is limited to guiding and coordination of learning. This is namely research-based and collaboration learning, which stimulates creativity and critical thinking of pupils. The lesson is more dynamic, since it is co-designed by the pupils with their suggestions and Country of original problem solutions. Independent and creative problem solving motivates them, allows independent development and teaches them to be persistent. The teacher influences the entire educational process and individual actions, and at the same time makes the pupil a center of the process, while he is there to offer constant professional support.

“It is very important that the pupils collaborate with each other. Someone is good in technology and someone is good in languages, and they complement one another. We noticed that Roma are very skillful with mobile phones and are much more successful in such work. At the same time, they collaborate with generally more successful pupils who are not as skillful with tablets,” Pečnik describes influence of this type of work on inclusion of pupils in the classroom.
and also everyone who love to play since they perceive such type of work as a game. “At the same time, this type of work is appropriate for auditory, visual and kinesthetic types of learners, since we can use tablet to engage all types. I also see the advantage of such dynamic work for motorically restless pupils. Unfortunately, this type of work is less suitable for static pupils who prefer routine and do not like change. It also confuses those with suspicion for autism and very slow learners,” says Pečnik.

Ksenija Pečnik teaches English from 6th to 9th grade at the school. In the 8th and 9th grade they are performing streamed classes, while the 6th and 7th grades are heterogeneous. The 24 tablets at the school were purchases with the help of a sponsor, a local company, while the teachers borrow them from each other. In each classroom there is a Wi-Fi internet, a portable computer, an interactive board, a projector and a big touch screen. Each year the project leader, English teacher Ksenija Pečnik, also prepares a course on the topic, however still only a few teachers use tablets in class.
3 Each pupil a different profile  

*Age Group: 13-18 years old / Level: School*

### 3.1 Country of origin

Netherlands

### 3.2 Educational analysis

**Educational differentiation**

- **Learner oriented**
  - Readiness
  - Interest
  - Profile
- **Teacher oriented**
  - Content
  - Process
  - Product

**Structural differentiation**

- **Macro**
- **Meso**
- **Micro**

**Differentiation level**

- **Good practice**
  - Each pupil a different profile

#### Good practice

<table>
<thead>
<tr>
<th>Learner oriented</th>
<th>Teacher oriented</th>
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### 3.3 Description

Every pupil is unique and has a right to an educational concept that addresses his or her personal needs. Candea College in Duiven (Netherlands) really aspires a tailor-made approach. The school is data driven and uses the RTTI-programme (reproduction, training, transfer, insight) in order to plot the cognitive profile of a pupil on basis of which the learning track (pre-vocational, vwo) can be determined. Learning is the starting point, not teaching. They want to abandon the traditional classroom model by starting to use adaptive learning. They want to work with a core curriculum in the morning and a free choice part in the afternoon. In order to achieve that, a culture change for the teachers is needed such as a focus on learning goals.

A number of teachers are using mobile phones for e.g. Kahoot (quiz software) in order to get an insight in how much the pupils master the learning content. Learning analytics give a good overview of the development of pupils. The learning content that the educational publishers offer vary a lot: sometimes the paper content is translated into a pdf-file, but the school is really looking for adaptive materials.

Currently they are experimenting with Learnbeat, ITS learning as a digital learning and working environment, and with an electronic learning environment (ELO) that is connected with SOMtoday.
Advantages according to the school are: digital tests can facilitate the teachers. However, learning goals are the primary goal for the school, on the basis of which pupils can get more adequate feedback. Digital licenses (costs) are a limiting factor. There are cheaper materials available (secondary education content), where teachers can compose their own methods, but teachers are sceptical to that. Often there are also no tests available.

The school uses digipacks that are connected with educational publishers. In the pre-vocational secondary school they use the total packages where they can choose which parts they want to use. In vwo (the higher levels) this is more complicated (costs) because of the large number of subjects. There are several experiments though (e.g. with virtual reality) and the school supports that (with budget).

The agreement is that teachers differentiate mainly in the “roof tile” classes. Learning materials are being put in the ITS learning environment, so that pupils can always start working. Within this environment there is deepening, enrichment, additional exercise material. Presumably, the class is divided into groups (thus not full personalization), also because of the homogeneous classes in secondary education (in The Netherlands).

More and more teachers are testing formatively, the school now wants to map and promote that. Some (more innovative) teachers also develop their own learning materials. With permission of the school these teachers abolish report figures and use formative tests instead. Pupils thus receive individual feedback. Further cultural change is necessary within the school in order to spread such initiatives further than only a pilot phase.

The teacher’s role will change. In the future Candea wants to start using tablets to make more information available to parents. Parents will receive updates about attendance, learning analytics and extra information given by the teachers.

The regular mentor meetings will be abolished as well, they will now be more on-demand. A possible disadvantage of this system can be that pupils no longer have to meet a clear deadline (“the report”). Here lies a role for the mentor who has to coach to pupils. Currently there is 1 mentor hour per week, from 2018 there will be 1 hour per day. Teachers only have an overview of the pupils’ progress in their own subject and the mentor has the total overview.

One of the biggest challenges will be to adapt to the students’ needs. Each pupil with have a different profile after the formative assessment. Intrinsic motivated pupils will thrive more. Other types of pupils will need more coaching.

Another issue the school faces is vandalism in the use of schools’ devices. Candea has experimented with Bring Your Own Device but did not continue with that because not every pupil would have access to the same software/learning resources.
4 Educational Informatics Network (EBA)
Age Group: all / Level: Policy

4.1 Country of origin
Turkey

4.2 Educational analysis

4.3 Description
Gate to the future of education, Educational Informatics Network is an online social educational platform led by The General Directorate of Innovation and Educational Technologies.

The purpose of the platform is to enable the integration of technology into education by using information technology tools and supporting efficient use of material. EBA has been created to offer suitable, reliable and right content and is still being developed.

While many digital source designed by MEB and educational companies volunteering to share contents are published on EBA, students and teachers will also have the opportunity to offer the content they create. Therefore, there will be a pool of source which will be open to anyone keen on learning.

This will also open educational doors to everyone and provide a basis for carrying education outside the buildings. So is to say that it will be an integral part of the educational life. It will enable students to be self-determining and self-learning individuals. Besides, once students are united under EBA, they will be cooperating and involved in the team work with peers all over Turkey.

It will be easier to move from teacher-centred education to student-centred education. As a result, it will facilitate for the establishment of a country raising individuals who don’t have parrot fashion and who filter and search for well-prepared sources, interpret information and create new information out of the current one.

Moreover, parents will be able to monitor and follow the quality of education provided to their children on EBA thereby contributing to the improvement and quality of education and have a bigger role than previous one. Now, we will be responsible for the education as a society, our contributions will grow and we will have to opportunity to shape our own future.
Having these above-mentioned characteristics, EBA is a candidate for offering opportunity for education contributed equally, to our students and the world in a broader sense, which is the main purpose of FATIH Project in Education. Covering all shareholders of education, EBA will grow, become stronger and develop thanks to all your contribution.

**EBA COURSES**

**For Teachers,**

It is designed for teachers to collaborate with their colleagues and share educational materials with students. Teachers can participate in discussions created by them or other teachers, share educational materials, assign tasks to students and follow tasks individually or oncoming events. They can also contribute to content pool with the contents they have created with content creation tools provided by EBA.

**For Students,**

It is designed so that students can study more effectively and get better results. They can work collaboratively with their peers and teachers, communicate with them and share educational materials on EBA Course. Also students can follow the tasks assigned to them by their teachers and study any subject anytime. They can continue sharing at school, participate in voting on EBA and attend to events. Most importantly students can continue learning outside school.

**CONTENT MODULES**

**News Module**

Designed for the purpose that good works created by teachers and students can be seen and heard by anyone and can be an example for better works. All kinds of activities and newsworthy activities are added here and published after being checked by EBA community mechanism.

A small wall calendar can be accepted as newsworthy as well as a cultural success. Students’ success in sports, degrees gained from competitions, projects that schools got involved in... Shortly, every work done by you are newsworthy and worth-seeing.

**Video Module**

This module in Educational Informatics Network is designed for you to find educational videos that you can play in your class, in one place. In this module which contains videos supporting individual and collective learning in the fields such as course assistance, personal development, documents, cartoons, consultancy, professional training, you can find videos to use in from chemistry to mathematics and from languages to primary school life sciences. Moreover, videos to show on special days, videos created within social responsibility projects and documents to enrich your courses can be found here as well.

Thanks to this module which will be enriched with the videos sent by teachers and students, various videos will be created and learning will be a fun activity over time.

**Image Module**

Photographs chosen from the archive of General Directorate of Innovation and Educational Technologies are now on EBA image module to help you enrich the material you use. Planned to become a visual history of education with contribution of teachers over time, this module will contain
maps, graphs, animations and simulations prepared for your use. You will be able to enrich the imagery of your course, enable student grasp the topic easier with these materials you can use in your courses. Also, it will serve as a photograph archive that you can suggest as a reliable source for the students’ assignments.

Audio Module

In this module, you can download audio-based course assistance, personal development, history and culture programs, audio books, foreign language listening passages on your tablets or music players. You can find audio books, educational radio programs, samples from our music archive to listen to while walking, exercising, traveling on subway, bus, etc. Also, you can upload here audio files that you’ve created.

Book Module

It is designed so that you can download course books as e-books (PDF) to your tablets or interactive boards. Also you can share e-books that you find useful on this module. Students will be able to access their books on their tablets without need to carry them.

Magazine Module

You can access educational, cultural and scientific magazines here. Moreover you can share the ones you own or find useful.

Document Module

You can find any documents on guidance, tests, planning materials and etc. on this module which you can upload your own documents. You can also contribute by leaving constructive comments as well as uploading documents.

CONTEST MODULE

It is the module where you can find information and exhibitions of old contests. Also you can find general information and information about participation here.

APPLICATION MODULE

In this module, you can find individual learning contents, contents supplied by leading educational content companies, associations, ministries and NGOs. Also there is a part called “For Teachers” where teachers can access free portals.

EBA Document Module

It is an application where teachers and students can store and share documents such as presentations, images, audio files, videos, etc.

e-Course Module

It is a module where you can access acquisition and evaluation tests. It is also the platform where complementary courses are managed.
EBA Store

Store for application which comes installed on tablets distributed within FATIH Project in Education. You will be able to download and update applications with EBA Store. This store containing study aids such as enriched e-books, magazines, dictionaries, calculators, educational and instructive games, audio stories is growing and its content is being enriched day by day.
5 Interactive lessons to enhance motivation and participation

Age Group: 6-12 years old / Level: Classroom / Subject: STEM

5.1 Country of origin

Italy

5.2 Educational analysis

5.3 Description

Mr. Risiglione teaches mathematics and science in primary education at the Istituto Comprensivo “Giovanni XXIII” (Acireale, Catania). He has been using the tablet for classroom differentiation since recent years and, through it, has seen the competences and the involvement of his students increasing.

He works in a school paying attention to the needs and attitudes of its students and aiming at the inclusion of each student into the learning path. In the last years, it has been improving ICT facilities by providing each classroom with tablets, interactive whiteboards, PCs and Wi-Fi connection.

He has created a virtual class on ITunesU where he and the students can share learning material and communicate also outside the classroom. Through the app, he can provide feedback to the students for their homework and answer to their requests of clarification and/or their doubts.

He has also prepared a science mid-term evaluation that has been uploaded on the app and he has corrected students’ work through it.

Along with the virtual class, the teacher uses the tablet also in classroom in his daily didactic, in particular in Mathematics. The main app used is GeoGebra2.
The main reason why he started to use this app has been to involve students who were not able to do the exercises in the traditional way and showed a lack of interest towards the subject. By using the tablet and this app as well as others, these students got more confident with the subject and the exercises. In some cases, students with more difficulties became tutor of the others on how to use the app. Thus, the app has proven to be an effective tool to involve and motivate students who are not really familiar or interested in the subject.

Before using the app, he explains to the students what the app is about, how to use it and the methodology that will be used during the lesson. In this phase, he uses the interactive whiteboard in order to show to students also some examples of exercises.

Then, the class is divided in “islands”, namely group of 4-5 students divided according to readiness level, interests, attitudes, etc. on the basis of the activity or topic. Usually, for GeoGebra exercises the teacher tries to mix students with more skills in the subject and students with difficulties in doing the exercises.

The classes are heterogeneous and all students follow the same lesson. According to the kind of disability, the student is also followed by a support teacher who stays in the classroom. Even students with more serious cognitive disabilities (e.g., autism) remain in class and do the activities with the other students.

For instance, in a class, there is an autistic student who is also visually impaired. The support teacher facilitates his interaction with the other students and he can work on a bigger tablet that ease its view.

Some students, as in the aforementioned case of autism, do different activities and exercises, but always aiming at favouring their learning and interaction with other students is always guaranteed as they are also part of the “islands” and tutored by their peers.

As far as regards, science lesson, the teacher uses an interactive periodic table where students can learn easier about elements and their reactions.
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By clicking on one of the elements, students can look at examples of how the element is used. For instance, if the student clicks on thallium, the app explains that this element is often used for herbicides, insecticides and rat poison.

Students can also do interactive exercises to memorise the elements on the table. For instance, they have to match the name of the element with the symbol.

On the lower left corner, there are three circles with the number of attempts done, correct answers and their percentage.
The teacher shows the table and the exercise to be done on the interactive whiteboard and then each student can do the exercise on his/her tablet.

The composition of the “islands” can be changed according to the topic of the lesson and the kind of exercises. Moreover, students can move from an “island” to another if they think they need the support of another student in better understanding the topic and the exercise.

Through the use of tablets, students are more motivated in learning, in particular in geometry, which many students were considering boring and difficult. The interactive characteristic of the tablet enhanced their interest and eased the performance of the exercise.

The main students’ characteristics that have been addressed through these practices have been: motivation, team work, skills in the subject.
6 St Connors Primary School, Omagh

Age Group: 6-12 years old / Level: School / Subject: Arts & Cultures

6.1 Country of origin
Northern Ireland

6.2 Educational analysis

6.3 Description

KEY FINDINGS
- If you provide opportunities for differentiation you automatically introduce inclusion.
- Students’ prior knowledge and experience with tablets often exceeds curriculum demands.
- The use of technology is designed to increase knowledge regarding is subject area.
- Before leaving primary school all students are required to achieve level IV in the curriculum competency framework for ICT.
- Five E’s: Explore, Express, Exchange, Exhibit and Evaluate.

CURRENT SITUATION
The application of C2k network infrastructure is used in conjunction with an initiative from iTeach. A key set of competencies are required as part of CEA guidelines that include the five E’s. These are, explore, express, exchange, exhibit and evaluate. Software such as scratch, puppet and iMovie are used to improve literacy and ICT skills. Additionally, students are encouraged to use audio files, audacity or pictures and text to explore a topic.

ACHIEVING DIFFERENTIATION AND INCLUSION
Differentiation is applied less in Key stage I where old laptops and one iPad are used for students to play with rather than being actively taught how to use them. The approach is meant to be one that is an introduction to technology rather than formal education about it. Differentiation and inclusion can mean different things and this largely depends upon the resources there are available as well as peer training.
According to the curriculum students must have achieved a level IV stage in competency were the use of ICT is concerned. Ideally, before progressing to secondary school they would have achieved a level V.

Using tablet technology for inclusion is straightforward however differentiation is much more difficult. Time to plan for differentiation is a barrier. Additionally, apps that are used within the classroom as part of tablet technology are not often created with the curriculum in mind. This is reflective of the 'personalization' of technology for human use as a tool to enhance educational experience as Darling – Hammond (2014) indicates.

iPads are more interesting and user-friendly. There is a conflict between tablet technology and the system/infrastructure that we use to monitor students progression as part of the curriculum i.e. C2k. Additionally, using tablet technology can often take some time to setup. The majority of children find iPads are easier to use and it is becoming the norm to do so. However, it can be slow to introduce in the classroom i.e. passing the iPad around, ensuring everybody is logged in and using the correct count et cetera.

If you provide opportunities for differentiation you automatically introduce inclusion.

THE WAY FORWARD

Time, planning and resources are required in order to be very successful. This includes more human resources and more technical support. Further, opportunities for staff development in relation to the use of tablet technology would be useful. The use of tablet technology can be high risk and that if there is no planning can be chaotic. However, when there is clear planning that can be a high reward.

FILLING GAPS

Prior experience often exceeds the curriculum competencies. Children will often come to class with a very strong knowledge of how to use tablet technology. This supports the notion of 'poly-contextuality' and that informal learning, using technological devices, can operate in tandem with formal learning (Thorpe and Jones, 2014).

There is an inherent risk with app purchases and that they may not be suitable for the requirement of the curriculum. The use of external professionals such as those from AMMA has been very useful and has helped to integrate the use of tablet technology into your classrooms.

The advantages of tablets are that they help to increase literacy skills as well as listening skills. These are primarily conducted via apps such as puppet pals and telegamma that enable students’ to develop core competencies and communication. The use of tablets produces a number of ICT skills however these are seen as secondary to the improvement of English, mathematics or an understanding of history. This is reflective of what Conole (2011, P. 397,401) termed as the 'functionality' of technology to achieve greater learning outcomes.

One teacher in particular uses QR codes in their teaching. Here, a series of questions would be provided for students in relation to an historical event for example the sinking of the Titanic. Students will then be given QR codes that allow them to express an idea surrounding a question. For example, the QR code may indicate a yes or no response. The teacher will ask the students questions and using a tablet gather the responses from the QR codes that the students are using and then collate the responses on the interactive whiteboard. Additionally, the use of green screen for films and music production is also present.
Technology has advanced and the changes very quickly and is very easy to be overloaded by the changes that happen. Additionally technology, given that it advances so quickly, can become outdated quickly and the use of technology often depends on the vision of the school for its students.

Students will also use iPads to collaborate with other schools. For example, when working on a project in primary seven students will (using interactive whiteboard and tablets) collaborate with other students and other primary schools in Northern Ireland. These communication exchanges form part of developing knowledge in relation to historical or cultural areas from the curriculum. Students will express their ideas to each other using the tablets to reduce the communicative distance.

Reference list


7 Speaking exercises for reluctant speakers

Age Group: 6-12 years old / Level: Classroom / Subject: Languages – Arts & Cultures

7.1 Country of origin

Belgium

7.2 Educational analysis

7.3 Description

Education in Flanders recently adopted the M-decree. This decree encourages students from special education to switch to standard education. Students with autism, for instance, thus find their way to standard education more quickly than before. They then participate in all educational activities, possibly with some extra support from a GON-attendant. Nevertheless, a number of assignments are not at all obvious for these students. Part of the students with autism for instance, find it very hard to speak in front of a classroom and make eye contact with their fellow-students. (student’s learning profile)

This good practice shows how the use of a tablet can lower the threshold in a speaking exercise. Hanne Rosius attended to a student with autism in standard education. When her pupil was in the third year of primary school, he had to give his first talk in front of the classroom. The assignment was to read a book, make a creative book review and present it to the class. Having to do this, implied more than one threshold for this pupil: he didn’t like reading, he didn’t like to be creative in the traditional sense of the word and he never talked in the classroom. He did like tablets, however. (student’s interests) Together with his GON-attendant and the class teacher, they investigated whether working with a tablet could be a solution to successfully fulfil the task. (product-differentiation). The school disposed of a case with 10 tablets.

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1 GON means ‘integrated education’. GON-attendants support students with specific educational needs in standard education.
The student read the book ‘the BFG’ by Roald Dahl. In the book, the giant catches dreams and keeps them in his cave to blow them into children’s rooms later on. During the GON-session, it was decided to paint the rack full of jars with dreams. The student used a tablet to record parts of his presentation, upfront, at home, in his familiar environment. He found it very reassuring to be able to record his presentation as many times as necessary, until he was satisfied with the result. Via the ‘green screen’ app by ‘do ink’, he chose an appropriate background for the video. He found it very interesting to see how the app worked, which encouraged him to go on. Afterwards, with the ‘arasma’ app, the videos were put behind the different jars in the picture as augmented reality. The student did all of this autonomously. In this application, his strength in the field of tablet use compensated for his inferior speaking skills.

At the time of the presentation, the pupil briefly introduced his work. The share of ‘live’ speaking in front of the classroom was thus limited to a couple of sentences. Subsequently, he distributed the tablets and the pupils could scan his painting, listen to different parts of his presentation and watch them. His fellow-pupils were impressed by the application’s creativity and surprised with the ‘augmented reality’. That’s why they reacted to the presentation positively and the pupil could experience a feeling of success. This opened the way to other assignments.
Naturally, the fear to speak in front of a group doesn’t only occur (and not always either) with pupils with autism. The example above inspired Ulrike Custers, a teacher in secondary education, to develop a similar application for newcomers with a foreign mother tongue in her classes. As a result of the refugee crisis, a large number of students who don’t speak or understand any Dutch enter Flemish schools. They get separate OKAN-education the first year in order to learn Dutch (individualized program) before they switch to standard education. For these students, it is not at all obvious to speak in front of a classroom either. Convinced that the reason why students are afraid to speak in front of a group doesn’t matter, Hanne and Ulrike decided to investigate whether recording speaking activities with a tablet could help newcomers with a foreign mother tongue to speak more freely. From this perspective, the application doesn’t only adapt to the differences in interests and profile between students, but also to their speaking skills. (student’s readiness).

Ulrike gives her class a short speaking exercise on a weekly basis. Students must choose a current event and talk about it in front of the classroom, based on the W-questions (who, what, where, when, why). About 6 times a year, this standard exercise is replaced by a speaking exercise with a tablet. Ulrike uses a variety of apps that offer the possibility to add words to an image or to an animation. An important condition when choosing the apps is the possibility for students to record again and again, until they are satisfied with the wording and articulation of their message. This also encourages giving feedback and adapting to it. Ulrike has a range of apps from which the students can choose: Tellagami, ShowMe, AdobeSpark, Aurasma, Fotobabble, Morfo and Book Creator.
The different apps provide the students with sufficient variation and teachers can offer a selection of choices (student’s interest). All the apps are used in a way to sufficiently support and encourage the student’s speaking skills. The exercises are tackled with the OVUR-strategy (note from the translator ‘OPER : orientation, preparation, execution, reflection’), since this is an important part of the curriculum and students are familiar with it.

- **Orientation**: this step is about the conceptualisation of the speaking exercise. Students choose a subject and brainstorm or look up what they want to tell about it. They can write this down in key words, gather images, ....
- **Preparation**: in this step, students think about the wording of their message. They choose the right words and build correct sentences to clearly communicate their message. It is important to foresee a feedback round, as that is the perfect opportunity to enrich the student’s vocabulary, taking into account his or her specific educational needs.
- **Execution**: the students record their message by means of the app. This can be done in the classroom, in a separate room or at home. It is important for the students to feel safe enough to speak. For students with a foreign mother tongue, feedback starts playing a key role now. They can listen to the first recording with the teacher or with fellow-students and find out where it needs to be modified. In the second recording, students try to integrate this feedback.
- **Reflection**: the final product is being listened to in the classroom. Students try to map what they have learnt and what they should pay attention to next time.

This procedure is used by all students, not only the ones with a foreign mother tongue. Some students can handle OVUR (OPER) independently, others need support in one or some of the steps.

Together with Alessandro Voets (teacher in training), Ulrike developed an instruction file to guide the students through a speaking exercise. They can use this file for every exercise they make.
Ik, de nieuwe Staf Wouters? (nieuwslaezer)

Hoewel ik te werk?

Step 1: Ophalen — Wat wil ik vertellen?

Zie de hoekjes open en kies een interessant artikel voor je keuze uit:
- Van millones of is je beker op de hoogte zijn?

Opgelost:
- Artikel is:
  - "Boer De Bruijn ziet Manchester City naar Nizwa in deze Champions League
  - "Boer en burgemeester van beker
  - Feest uit Herentals aangevallen.

Zo maakt u nu uw keus en lees de te kiezen artikelen voor u als persoon, maar houdt u uiteraard geen enkele recente zaken. Je betaalt dus artikel met anti-demonstratie van JEDEN DE.

Nu het feitelijk van het artikel vind ik de volgende woorden uit het artikel belangrijk om het verhaal te kunnen vertellen:

Wie?

Hoe?

Wat?

Waarom?

Waar?

Supportive instruction file for speaking activities
It immediately became clear that this application has a number of assets. First of all, there are few technical thresholds. The students all get a tablet, and handle it with care. The new device motivates them, the well-being in the classroom is high. The students want to test everything. They easily find their way with the user-friendly apps. Since Ulrike uses free apps, the duration of a video is limited. The advantage to that is that students need to communicate the core message briefly and to the point and thus have enough time to focus on language issues. In a standard speaking exercise, students often speak more without communicating content. A lot of students find it reassuring that the app offers the opportunity to record several times. The final product looks cool and students are often proud of the result. The tablet supports the students’ language practice. The apps improve learning efficiency and have students pay more attention to articulation. After a while, students spontaneously started to ask for feedback when they needed it. One of the students with a foreign mother tongue often had the teacher listen to her first recording. She then asked for specific feedback which she tried to apply in a second recording. This application permits stronger students to work autonomously, so the teacher can invest more time in students with a foreign mother tongue. Stronger students that have finished earlier, can help giving feedback on the articulation (pronunciation) of other students.

A number of things also drew Ulrike’s attention. Some of the students lose themselves in their enthusiasm for the tablet and the apps. They spend too much time exploring the different possibilities the app offers and therefor pay less attention to the assignment itself. Other students do take the assignment seriously and use the app and the tablet only as a tool for the speaking exercise. Together with the discrepancies in level, this leads to larger variations in pace in a class group. Using a timer is a solution for these differences. Some students are also worried about what will happen with the recordings. They don’t want them to appear on social media. That’s why Ulrike also integrates a lesson about media wisdom and netiquette in this application.
8 Achieving greater interest and pupils’ success in mathematics with the help of tablets and differentiated assignments, marked by complexity

Age Group: 6-12 years old / Level: Classroom / Subject: STEM

8.1 Country of origin
Slovenia

8.2 Educational analysis

8.3 Description

For many pupils’ mathematics causes frustration and anxiety, and a lot of them perceive the subject as a needless burden. However, learning and understanding mathematics is anything but that, because it is vital for individual’s overall development in today’s complexed society. Not only does it build logical and critical thinking, it also helps to interpret the world and solve problems. By understanding mathematics, pupils strengthen their analytical skills and comprehension, as well as manage social inclusion.

Therefore, it is important to impart a positive attitude towards mathematics to individuals at the very beginning of their educational path. And it is the teacher who has a great role in doing so. A teacher can present the subject as something practical and necessary in life, and at the same time allow all pupils to succeed with a well-thought-out learning process. Studies show that a negative attitude towards mathematics is largely influenced primarily by abstractness of the subject and fear of failure, which derives from belief that special skills are needed to master this subject, which not all people have.

The mathematics and computer science teacher at the Osnovna šola Ivana Kavčiča primary school from Izlake, Slovenia, Iztok Ostrožnik, uses tablets in teaching mathematics with the purpose of increasing motivation for learning among the pupils, while at the same time encourages pupils’ independence and desire to explore through the use of tablets. “Pupils often use mobile phones in
their free time. Why not direct their enthusiasm towards using these devices in learning? The pupils much rather solve calculations on their tablets than writing in notebooks. They are more active with a tablet computer, they do more research...,” says Ostrožnik.

The school owns 11 tablet computers, which are used in mathematics to teach new learning contents, for researching, repetition and reinforcement. Work with tablets is individual (when reinforcing and knowledge testing), and in pairs or trios when the teacher is introducing new learning content or when the children are researching it individually.

The teacher uses tablets as a device for enabling differentiation. He mostly uses the applications Nearpod, GeoGebra and QuickGraph. The teacher also uses online services such as QR codes, Kliker, e-textbooks, calculator, World Wide Web, Power Point and thematic tools that contain formulas.

New learning content is introduced from easier to more demanding facts, and the process is stopped earlier for some pupils than for others. In doing researching, repetition and reinforcement, all the pupils receive same learning materials, but reach different levels of difficulty. Every material they receive includes assignments, which are marked with a level of difficulty. “In particular, I believe it is important that the pupils receive same learning materials, since that is the only way for them to be treated equally,” he adds. “Assignments are arranged according to difficulty, I mostly prepare them myself, and form them into QR codes so the pupils can scan the code they want.”
While solving mathematical problems on tablets, for the most part the teacher is only mentoring. If any of the pupils encounter a problem, the teacher helps and guides them. For such pupils the content and time for introduction of it is adjusted, while the feedback is very important in doing so. Certain learning materials allow giving comments immediately, otherwise the teacher gives feedback to each pupil individually during or after the assignment. Remedial classes are available to pupils who do not achieve goals, the classes are conducted once a week, while the teacher is also available in his free hours when the pupils can see him individually. Additional learning assistance is available to pupils in afternoons as well.

According to Ostrožnik, this learning approach has a positive impact on pupils who have trouble achieving goals (for those the content and time of its introduction is adjusted), as well as on those who are gifted and have no difficulties in achieving goals. “The fact is that pupils are more motivated for work because of differentiated assignments and have, because they are using tablets and other interactive means, greater interest in mathematics in general”.

References:
- presentation at the Sirlkt 2016 conference (http://www.zrss.si/digitalnaknjiznica/zbornik-sirikt2016/files/assets/basic-html/index.html#317)
- video of a lesson (https://video.arnes.si/portal/asset.zul?id=D2YIAFNaSgVTetZRbjqAX6N)
9 iPad Classes Sint-Ursula

Age Group: 13-18 years old / Level: School

9.1 Country of origin

Netherlands

9.2 Educational analysis

9.3 Description

Mark van de Mortel works at the Sint Ursula school. Sint Ursula is a rural school for secondary education in the Netherlands, located in Horn, a small village situated between the “cities” Roermond and Weert. The culture at the school is very relaxed. A lot of the teacher staff is from the local region, some have gone to school here themselves. Students often know the teachers from the local village, social gatherings, sport clubs etc. Crime etc. is not really an issue at school.

Students are also mainly from the local villages, there are hardly minorities or immigrants at the school. That is not by choice or design, it simply it the result of the location.

Due to the Synthesis group (see below) ever more students from outside the region attend the school. Traditionally, our vision was defined by three words: Care, Prepare, Appeal. Although the words are no longer a part of the vision statement, it is still the basis of our pedagogical vision. There is an extensive care structure, for example via the Synthesis group, the school is open for children that are in need for some extra care. We strive to prepare students as good as possible for their future. We spent extensive time on career coaching, deanship etc. And we try to make school as appealing as possible by providing modern, up-to-date education to our students.

When students enter the school, the first get assigned to groups for their first year (the “brugklas”) based on the advice provided by the primary school. By law the secondary school has to follow that advice. There are five different group types during that first year:

1. VMBO-T (lower general secondary education)
2. VMBO-T / HAVO (higher general secondary education)
3. HAVO / VWO (pre-university education)
4. VWO+ (pre-university education plus)
5. The Synthesis group

After that first year, they are split into:

1. VMBO-T (lower general secondary education)
2. HAVO (higher general secondary education)
3. VWO (pre-university education)
4. VWO+ (pre-university education plus)

The Synthesis group is a special needs group of 10 to 12 students in year 1 and year 2 (in the future possibly also in year 3) mainly for pupils with an autism spectrum disorder (but not exclusively, also for other special educational needs). The goal of the group is to have the students integrate in the regular groups within those first two years.

All students (at all levels) can choose to be assigned to either an “iPad class” or a “paper book class” depending on their own preferences.

Teachers can choose the teach in an iPad class or a paper book based class. This also means that the teachers for the iPad classes are there by choice and interested in the pedagogical use.

All this accounts for a lot of organizational challenges, but the school manages. It has become business as usual, it is maintainable and we’re still expanding with steady pace (no big bang).

The school was built in 1974 and that is noticeable in the design (small classrooms). In some areas, like the Studyzone, there has been redesign to cater for the new pedagogical vision. Another example is combining two classrooms into one bigger, different use of color and furniture in existing rooms.

The ict infrastructure in the school is modern. Currently there are 12 groups that use the iPad for 1-on-1 education. The other 45 groups still use paper books. As of June 2017 the school is officially an Apple Distinguished School. There are only two other schools like that in the Netherlands.

There are about 300 iPads in use, the Studyzone (library) has an additional 60 iPads for lending by students and 15 Windows laptops. Teachers also use Macbooks. But the school has no intention of becoming an exclusively Apple oriented school. Almost every classroom has got a fixed (Windows) pc, a data projector and/or smartboard. In those rooms, Airserver is used to enable streaming of iPad screens to the data projector. The school is looking at experimenting using Chromebooks in the Studyzone since they expect the maintenance costs to be lower than the Windows laptops.

The school renewed and improved the school wide Wifi network two years ago to support the increased use.

Our differentiation practice is firmly grounded. Stakeholders involved in our differentiation practice are:

- The board
- Parent/teacher board etc.
- Parents
- Organizations, sports clubs, companies in the local areas
- City hall
To understand our use of tablets, you need to distinguish between the regular iPad classes and the Synthesis group:

**Regular iPad classes**
In the regular iPad classes we try to cater for differences in students as much as possible right from the start by providing motivational education and new technology. Passiveness by students was one of the main criticisms by teachers before.
Using the tablet, we’re able to get the outside world into the school. Teachers create own material (videos, interactive books), use existing apps, and can provide students with more tailormade education. Students use the iPad as one of the tools to create reports and other class reports (although they usually can choose to use other means than the iPad). In the regular iPad classes, the students are always together in the same group. They move from classroom to classroom between courses.

**Synthesis group**
The students in the Synthesis class use the iPad in a different way. There, the teacher provides them with a set of apps and a set of learning material at their own level. There activating the students isn’t the main purpose, but differentiation on level is. Structure, working according to plan is important there. This would have been much more difficult without the iPads.
In the Synthesis class, the students have a fixed classroom and a single teacher (except when needed for specific courses).
An exception is made when a student takes part in a regular class for one of more courses, then that student goes to the classroom where the other students also are. This makes it very visible for all students how a student from the Synthesis class step by step works on full integration in the regular classes. The other students know that and in general these students are easily accepted in the group.

Teachers use a diverse set of pedagogical teaching methods. To support those methods, they use both material created by publishers and material that the create themselves.
The also use apps on the ipad, but the focus is on the pedagogy of the teacher, not the apps.
When there is teacher centered instruction, they all use the same material. Often, when doing project, assignments or reports students can choose the way they do that (on the iPad, using tools that the choose or using paper or other materials).

A teacher can also use the “app dice” where a student throws a dice which then determines the tool he/she needs to use.

In the Synthesis class, the amount of choice is purposely kept low (distraction) and is teacher structured.

We use iCoaches (students from higher years that support the juniors) during the mentor hours with regards to technical problems / use of the iPad.

For homework planning, overview of class roster, study planner, we use “Magister” a system used by a majority of Dutch schools for secondary education. This system isn’t optimized for use on the iPad. Students also use the “1-view calendar”. It is available in paper based version and an iPad version. This enables them to do scheduling.
The analysis and comparison of the iPad class and the paper book class shows differences, in concentration and focus on the task at hand. The students appear to be more enthusiastic (even when the end of the year approaches), but that is not clearly visible in the statistical results. A pilot with formative assessment is planned for next year. This also involves training for teachers and reduction of the number of summative assessments.

There is also a plan to start to use digital portfolio’s, or in case of physical education: sportfolio’s. However, besides these initiatives, formative assessment hasn’t been a main focus point yet so the formative assessment does not influence the choice of the teaching technique yet. Working with learning objectives is also an area where we want to improve. At the moment the content for a course is leading. We haven’t noticed btw that new teachers, even the ones fresh out of school, are used to learning objectives. So even there, training is needed.

The evaluation method is the same for all students. There has been a pilot where students could choose the method used for a test (MC or open ended questions), that wasn’t large scale yet, but is something we want to follow up on.

A challenge is the needed time (money) to do that. The school is located in an area with a decreasing number of potential students (up to -30% by 2020). Budget is linked to number of students which leads to new challenges.

Use of IT for remote teaching is still in its early stages, although it is used for individual students that cannot attend school for a period of time using a system called “Klassemaatje” provided by “KlasseContact”, an initiative of a big Dutch telecomprovider. But this is also an area where we see possibilities.
10 Motivating towards learning through conceptual maps

Age Group: 6-12 years old / Level: Classroom

10.1 Country of origin

Italy

10.2 Educational analysis

![Educational differentiation diagram]

Good practice

Learning through conceptual maps

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10.3 Description

The interviewee works in the Istituto Comprensivo “Giovanni XXIII” (Acireale, Catania), which is a resource for the area where it is located because of the lack of aggregative and associative centres for young people except the parish community.

The institute believes that the school is a community of continuous and comprehensive learning where the overall wellbeing of the student should be guaranteed. It is really active on counteracting early school leaving at different levels: material, intellectual and motivational. This is the reason why the school promotes the use of alternative teaching techniques including the use of tablet and other ICT devices.

In the class where the interviewee teaches, there are 6 students with learning disabilities and 2 with other kind of disabilities. The use of the tablet as a teaching tool born from the need to actively include these students during lessons and it has proven effective in doing it. It allowed to increase their attention and motivation to the didactic through group researches and development and creation of learning material.

The first step has been the realisation of a virtual class on Google Classroom where the students can share material, upload the learning material developed as part of their tasks, ask to the teacher further clarification and feedback, receive further learning material from the teacher.
Each student has a google account and access to the platform.

Due to the peculiarities of each student and the different cognitive styles, each lesson is made up of different moments:

- Overview of the topic to be addressed
- Projection of images, documentaries or movies
- Group work: elaboration of a particular aspect of the topic suggested by the teacher
- Exchange of information among the different groups to have a complete framework on the topic

Also the learning objectives are set according to the student’s characteristics, attitudes and readiness levels.

The class is divided into 5 groups with 4-5 students each. Each group has a student, called tutor, helping and supporting students with difficulties both in using the iPad and in the comprehension of the lesson. Everything is done under teacher’s surveillance who moves around the class during the whole lesson. In this way, she can monitor students’ work and their participation to the activities. Furthermore, the interaction between teacher and students is facilitated and eased in setting different from the traditional one (frontal lesson).

Lessons are performed through the use of different apps, in particular the ones to create conceptual maps.

According to the interviewee, the most effective app to favour the students’ inclusion is Super Mappe (http://www.supermappe.it/). It allows to create conceptual maps by using different kind of sources (e.g., e-books, PDF files, websites, videos, documents, notes) in the same page where the map is being built.

The app could be used both in the tablets and in the interactive whiteboard.

Another app that the teacher uses is Popplet Lite which can be used on iPads.

The conceptual maps are developed and realised within the groups but also autonomously. They have been proven to be a very useful way to memorise concepts and to learn in a more intuitive way by combining written tests with images or short videos.

Along with the conceptual maps, the teacher also uses Quick Video, an app to create videos on an easier way. Usually, each group is assigned with a topic to be addressed during following lessons. Groups can also create a video to be showed in class in order to explain the relevant topic to the other students.

All the works realised in class are then uploaded on the shared Padlet of the school in order to be available for other students and for future lessons.
As per teaching techniques, also the evaluation methods differ. Students can be evaluated through class discussions, written elaborations, multiple choices tests and group work. Except class discussions, all the other evaluation are done also through the iPad and the teacher can correct them directly from the platform.

Since the beginning, students have been improving their abilities in learning different kind of topics, but more than that their motivation and interest has increased. The playful side of these teaching techniques has eased the learning path of involved students as well as teacher’s work.
11 Eglinton Primary School

Age Group: 6-12 years old / Level: Classroom / Subject: Languages – STEM

11.1 Country of origin
Northern Ireland

11.2 Educational analysis

![Educational differentiation diagram]

11.3 Description

**CONTEXT ANALYSIS**
The school Eglinton Primary School (Co Londonderry, Northern-Ireland) is a medium-sized (218 pupils) village primary school. The class of teacher Ms Mc Kendry is a mixed ability group, aged 6 to 7 years. The class culture/atmosphere is one where all the pupils are focussed on doing well and progressing, with generally strong support from parents.
There is no grouping strategy across the whole class or curriculum, but for reading and maths, the pupils are grouped based on ability in that respective area of the curriculum. The grouping is actioned by table, with pupils of similar reading level working from a table with other pupils of similar ability.

Devices available throughout the 7-class school are:
- 32 Chromebooks
- 10 iPad Airs, for youngest classes, out of a total of 30 across the school population of 218 pupils

Every classroom has a touch-based interactive whiteboard, which is used extensively. There is Wi-Fi throughout the school.
Furniture is a cluster of desks arranged in squares, with eight places set at each cluster. Pupils spend time at different clusters for different tasks, not always sitting beside the same classmates.

The pedagogical vision of the course is simply to assist every pupil to achieve the target set across Northern-Ireland for pupils in the same school age grouping, but also to achieve their personal best.

**DESCRIPTION OF THE PRACTICE**
There are two ways that mobile devices are used for learning:
• A bought-in accelerated reading, called Accelerated Reading, programme, and
• in progressing through the ICT curriculum laid down for all Northern Ireland primary schools.

Accelerated Reading:

a) pupils are initially assessed in teacher planners to identify more able children (MAC). These work on stretching reading and vocabulary skills.
b) the pupil reads a text to suit their ability, chosen by the teacher, following pupil assessment by See-saw tool to assess reading level
c) Use an Accelerated Reading app to, by question (10 off) and answer, gauge level of comprehension the pupil has of the book, thereby gauging progress in reading
d) Then selects next books at appropriate level for the pupil to select to read
e) Process is recycled.

If the pupil’s progress is good then they are stretched, if less than expected they keep reading at same level or get additional support.

This accelerated programme has brought definitive benefits. The school had 33% of pupils underachieving in reading. Over 2 years of the accelerated programme, this has shrunk to 12% underachieving.
The system also allows parents to connect to see what their child is doing, what book(s) they are reading and how they are progressing.
The school has delivers a Using ICT (UICT) curriculum that is mandatory across all Northern Ireland primary schools. UICT has a well-defined specification of tasks to be achieved and progressive levels of achievement. Mrs McKendry uses mobile devices to allow the pupils to work with a degree of independence through well-defined tasks that will allow achievement of tasks. The structure for the work to be completed and the support resources mean that able pupils can, when finished initial tasks, progress onto additional tasks that stretch them individually. There is a target to achieve the UICT curriculum at level two by the end of year 3. If a pupil in Mrs Mc Kendry’s year 2 can progress to Level 2 in year 2 then this will be facilitated, though the availability of the mobile devices and the support and guidance of Mrs McKendry.

Children who do not reach the expected levels in reading are put into a “boost” group that gets together once a week. In this group, there is a focus on their specific area of difficulty and different strategies are used to help them. The class teacher takes this group for 1 hour to focus on progressing the difficulties, whilst the rest of the class join a class taken by another teacher to work on with tasks allocated to them.

**CONTENT-differentiation**
The learning materials are a mix of procured, bought or obtained from central public-funded support agencies, and developed by Mrs McKendry. The mobile devices are available for individual pupils to work though defined tasks at specific time slots in the class timetable.
For both elements that demonstrate support for differentiation there are learning materials to meet pupil needs. For accelerated reading, there are materials to stretch the more able pupils, as well as material to provide additional support for the less able.

As referenced in the second example cited above, differentiation is achieved by differentiated outcomes developed over creative tasks. These tasks are part of the UICT curriculum. This curriculum has many elements and levels, spanning over the 7 years of primary school. The structure of the programme is clearly laid out by Mrs Mc Kendry, with tasks cross-referenced to the specification of the UICT curriculum, in her role as ICT coordinator. This make it easy for teachers and pupils throughout the school to continue approaching additional, higher end tasks when they have finished a previous task.

Thus, the more able pupil is challenged to achieve more by stretching themselves, through undertaking tasks that have scope for more than one level of outcome or final product. As part of the learning, the pupils who complete the higher-level ICT tasks share their completed work with classmates, thus developing communication skills, whilst adding the knowledge of their peers.

ICT lends itself to a wide range of additional skill development, including higher-end resource development using tools for working with text and audio-visual digital assets.

**PROCESS-differentiation**

To achieve process differentiation more complex tasks are issued, to stretch the MACs, with some specific but limited explanation first. The tasks are selected such that they facilitate a wide scope for developing practical skills without a significant element of teacher intervention. For the teacher, the ease of ability to set further challenging tasks for the MACs is built into the prepared task specifications. These are available on the school-wide network in advance of actual need, easing the transition by a pupil from the standard task set to the whole class to further task for a MAC.

For accelerated reading guidance and coaching are undertaken part by device and part by teacher. The device gauges progression in reading and signposts next steps. Where there is some difficulty in doing the actual work the teacher will intervene. For pronunciation, teaching is through linguistic phonetics and where that doesn’t work a key words approach is used.

In the case of the UICT work, there is demonstration by the teacher, with practice on the mobile devices the means by which pupils get to develop skills, by creating digital content to a specification.

In both cases assessment is clearly built in to the work. The accelerated reading work produces a clear indication of progression through the end of book test and subsequent scoring. There is a target score of 85% for each test, with achievement of this score being specifically noted, supported by recommendation for progression to a more challenging next book.

Appropriateness of teaching technique is determined by the learning outcomes. So, for example, in the case of a LO that is focusing on developing a skill, the teaching technique will involve explanation and demonstration. Other type of learning outcome will also be the main influencing factor in determining the teaching technique.
PRODUCT-differentiation
Achievement of the learning objectives are clearly evaluated by:

- For accelerated reading the end of book test score and recommendation of progression to a more challenging book
- For UICT, further practical tasks issued, assessed and cross-referenced

Evaluation method is the same for all pupils.

There is greater success for the MACs as they gain a higher level of reading ability. The school reading capability has gained overall over a period of 2 years, from being 33% below the national reading ability on average to being 12% behind. The relative progress of MACs, average pupils and low achievers has improved. Whilst there are no specific metrics for the MACs their accelerated progression contributes to the school’s overall improvement.

STUDENT-characteristics
The pupil’s readiness, interests and learning profile are all addressed with the differential approach, both with the accelerated reading and ICT work. In both kinds of activity, they clearly must show progression at one level before they can progress onto further levels. Reading progression is based on understanding vocabulary.

ICT exercises allow the pupil to typically have a little demonstration before getting down to actually applying skills. At times some supportive intervention is required by the teacher, but often the pupils are able to work out for themselves how to apply software functions without extensive tuition or demonstration.

For both types of activity, the pupil’s interests help to motivate. They can pick books of a suitable level from a selection, based on the genre of stories they prefer. For the ICT work they are typically given a brief to use advanced functions to create some digital content, the subject matter of which the teacher strives to reflect the interests of the pupils.

The key shareholders are: teachers, Principal, ICT Coordinator, parents (they can log onto the Accelerated Reading system and see the reading progress of their child), classroom assistants, central educational support organisation (setting the UICT framework in conjunction with schools).
12 Listening activities at the student’s pace

Age Group: 13-18 years old / Level: Classroom / Subject: Languages

12.1 Country of origin
Belgium

12.2 Educational analysis

12.3 Description

Listening represents an important part of communicational skills, in native language as well as in foreign language education. While listening activities are a piece of cake for one student, they can be a really obstacle for another one. The conventional approach organises listening activities on class group level and each student hears an excerpt as often as any other student. Stronger students then have to listen to an excerpt twice, while they don’t really need it. For other students, hearing it twice might not be enough and they might succeed if they could hear it one more time. Another category of students might only need to listen to some of the excerpts for a second time. (student’s readiness). This good practice responds to this problem by giving the students the opportunity to listen to the excerpts in a flexible way (process – differentiation).

Sarah Awouters is a teacher in the 7th year of vocational education. Her group is very heterogeneous. Students who spent their entire secondary school career in vocational education, have never had any English lessons. Other students coming from general or technical education, have had a couple of English lessons a week for a couple of years. (student’s readiness)

To adapt to these differences, Sarah uses the EDPuzzle app (http://edpuzzle.com). EDPuzzle is a free, device-independent tool that can be used to shorten videos and provide them with sound recordings, open questions, multiple choice questions and comments. After the teacher has edited the video, he or she creates a virtual class in EDPuzzle and adds the edited video to that class.

Subsequently, a class code is generated. When the students open the EDPuzzle app, they can log in with this code and watch or listen to the edited video and answer the questions. EDPuzzle offers the possibility to click ‘watch again’ after every question to watch the last excerpt once more before
answering the question. This makes it easy for students to determine their own pace. (student’s readiness and profile)

Video with questions in EDPuzzle

Via the app, the teacher gets a structured overview of the students’ scores, the answers they gave and the number of times they watched a certain excerpt. He or she can evaluate the answers to the open questions and give comments. Afterwards, when the students log in again, they can see their scores and the feedback the teacher gave them.
Immediate feedback for multiple choice questions

Via a simple colour system the teacher can quickly assess which students have inadequate, sufficient or very strong scores. This offers the opportunity to proactively adapt to the differences between students during the next class.

Overview of the students’ performance for the teacher

Sarah testifies: ‘I mainly use it for English-spoken video excerpts which I use as listening activities. The questions vary from open to multiple choice questions. I always check how many times a student watched a certain excerpt before he or she found the right answer. Afterwards, the exercise is discussed orally and we jointly try to find out what exactly caused the student trouble.’ Students sometimes need some encouragement to watch an excerpt twice, but when they do, they find the right answer. Sarah’s students like the fact that they get the opportunity to watch excerpts several times. The more they watch it, the more they learn, which makes it a win-win situation for both students and teacher.
Sarah applies her way of working to her evaluation. ‘Because the school still works with a –to my opinion- outdated system of written exams on class group level for English, I wanted to focus on all skills by introducing an oral exam. Before the exam, students had to watch an episode of National Discovery via EDpuzzle about the future of trains or a news flash about the scandals in which Hilary Clinton was involved. They could choose the subject that interested them most. After watching one of these episodes, they had to choose a corresponding text and read it in preparation of the oral exam.’ (learner orientated classroom differentiation, student’s readiness and interests).

Sarah says : ‘There was one big advantage to this. Based on the results in EDpuzzle, I could deduct which questions they found hard and how many times they watched certain scenes before finding the right answer. I used this information to determine the questions for the oral exam after which the text was linked to this episode.’ (teacher orientated classroom differentiation)

Written reflections afterwards show that students had really enjoyed this way of studying before an exam and that they had found it really interesting.

Sarah finds the app very user-friendly, for teachers as well as for students. Sarah’s approach does require, of course, that each student has access to the app and that headphones are available for listening.

The idea to work with EDpuzzle to practice listening skills was shared via the mooc by Tablio (www.mooctablo.be). Teachers from different educational levels and different studying areas picked up the example and applied it in their classes. The examples below prove that the described application is transferable.

Nathalie Van Gossum integrated listening skills in her social education classes and taught a lesson about the search for a job. This way, students trained their listening skills at their own level, but at the same time found out some interesting information about looking for a job.
Nathalie also uses EDpuzzle to tackle shortcomings when it comes down to numeracy skills. She has a couple of students with arithmetical problems. Those who haven’t quite understood the explanation during class, can take another look at the instruction that was given during the lesson afterwards. Thanks to some additional questions, students can independently practice the material at home or in the classroom.

Olga Kooistra made an application for pre-schoolers. She recorded a video in which she read from a picture book. The children get to hear a question and have to choose the right answer by clicking the right picture. This application has been developed to improve listening comprehension and enrich the children’s vocabulary. You do need a few tablets in the classroom to put this application into practice. Some of the pre-schoolers might choose to make this exercise in a corner of the classroom. Moreover, this is a perfect way to coach pupils with language deficiencies.
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A visual listening activity for pre-schoolers
13 Learning through experience with the help of virtual reality

Age Group: 6-12 years old / Level: Classroom / Subject: STEM

13.1 Country of origin
Slovenia

13.2 Educational analysis

13.3 Description
The use of virtual reality in teaching has numerous benefits for pupils. Not only is learning through experience more effective than learning by reading, hearing or seeing, this type of learning also influences pupils’ enthusiasm, active participation in class and encourages their further curiosity and thirst for knowledge.

In terms of differentiation, using virtual reality is a welcoming different way to present learning content that allows teachers to address various types of learners, while experiencing learning content with all senses also influences the improved understanding of the learning content.

Virtual reality is a form of computer simulation which creates perception of presence in an artificial environment. It’s most important features are that a user can see, hear and feel the environment, as if actually being physically present. However, the user is not only present in the environment, but active as well. By moving his body and limbs he can reach into the “environment” in which he is “present”, he can get acquainted with it and understand it better. Virtual reality creates an authentic insight into content it is demonstrating; while at the same time encourages motivation, which is essential in acquiring knowledge and recognizing that we are learning for life.
At the primary school Osnovna šola Pod goro from Slovenske Konjice, Slovenia, teachers report of positive experiences after using virtual reality in class. Dominik Trstenjak, the teacher of optional computer science class, who is also responsible for helping other teachers at the school in using virtual reality technology in the classroom, says that the school decided to invest in virtual reality technology predominantly because they wanted to increase motivation among pupils to participate in class, and also ensure better visualization of the learning content and provide wider insight in it in comparison to textbooks and other teaching accessories. “Each pupil experiences the same thing differently, their interpretations are not the same. Virtual technology allows them to explore outside limited areas, determined by textbook, pictures, etc.”

Virtual reality is mostly used in higher grades, namely in geography, history, chemistry and biology. They use the Google Expeditions software, virtual glasses and tablets or pupils’ mobile phones which must be powerful enough. Pupils and the teacher have an application installed on their tablets or mobile phones that allows control over the entire class, which means that everyone is looking at the same content, while the teacher determines the exact location to which the pupils must pay attention at a certain moment. That is how the teacher controls the entire class over his tablet and guides them through the content. “It is important that the teacher is well prepared before using virtual reality.”
The Google Expeditions software offers 5 to 10 different virtual tours for each individual theme, which are supported with prepared questions of various difficulties. The questions and assignments are in fact divided into three categories: basic, medium and difficult. Thus, the software helps us in differentiating. We want each pupil to achieve their highest possible level according to their capabilities, and by using virtual reality we can make this work easier and more enjoyable for them,” says Trstenjak.

Adapting the content to different profiles of pupils is the greatest challenge for the teachers. “The teachers often adapt to pupils with learning disabilities, special needs, foreigners, etc., while we frequently forget about the gifted pupils who actually need the same amount of our attention, or even more. And the very use of virtual reality allows us to offer additional or complementary content to all pupils, regardless of differences between them, so they can all adopt the learning content”, stresses Trstenjak.
Instructions prepared by the teachers can be differentiated or same for all pupils. That depends on the teacher and the content he is presenting. Virtual reality content is same for all pupils, and it is the assignments that are differentiated. All is already prepared in the software, however, in English. So, the teacher can prepare handouts or worksheets in Slovenian before the class according to software instructions. Pupils cannot see the questions, they only see picture, while the teacher or the administrator has access into the whole content (questions and picture) and thus controls the entire class.

The key to virtual reality’s success in class is, according to Trstenjak, especially in interesting and useful contents, which enable pupil’s 360-degree insight into the learning content, due to which he is actively involved in the content, making it easier for him to imagine and memorize the learning content.

The school also strives for their teachers to educate themselves individually, follow the trends and participate in various interesting project that contribute to higher quality and interesting teaching.
14 Using technology to enrich lessons in order to boost students’ learning motivation, freedom of choice and self guidance

Age Group: 6-12 years old / Level: Classroom / Subject: Languages – STEM

14.1 Country of origin

Netherlands

14.2 Educational analysis

Good practice
Boost motivation, freedom of choice and self guidance

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14.3 Description

Femke has been teaching 6th grade at primary school Klein Heyendaal in Nijmegen (NL) for 17 years. In her class children feel safe and at liberty to discuss anything with her and each other as long as it is done respectfully.

In 2014 Femke wrote a proposal to Samsung’s innovation fund for education. The main objective was differentiation. She wanted to enrich her lessons with technology in order to be able to adapt more to children’s learning needs and to stimulate their learning motivation. Samsung accepted her proposal and donated 32 tablets to the school. In addition Samsung provided some teacher training and digital content partners.
Students in the higher grades of Klein Heyendaal are used to working in a three-week-planning. All students get a scheme containing both obligated and optional tasks. Femke and her students started looking for opportunities to use technology to enrich existing tasks and started collecting successful examples of 'tech-enriched' learning interventions:

- After an instruction, the children have a choice whether they want to proceed to their workbook exercises or if they would rather use their tablet. For instance geography: some children work in their workbook, others make a summary or wordcloud, others create a ‘Kahoot’-quiz for their fellow students, others design an online newspaper or clipboard about the subject. The fact that students can collaborate, continue working from home, share and enrich with multimedia are some of the advantages I see in working online.

- Several apps are used to train for instance multiplication and spelling. (Bloon, Squla, tafeltrainer, WIG, 6000Woorden)

- Padlet, an online clipboard tool, is often used. Mainly to share online recourses with or between students. (http://nl.padlet.com/femkebosmans)

- Students suggested to using Minecraft in the classroom. After two students presented the opportunities of Minecraft to me, I agreed to use Minecraft worlds in arts (creating creative structures) and for instance geography (try designing a building to fit the climate and surroundings of the Northpole, or South Africa, and how are they different?)

- Students often use Youtube to search for instructional videos. For instance ‘how to draw...’-videos

- studiocode.org is used to teach the students some programming basics

- I moderate a Yurls page (http://groep8kh.yurls.net) to share resources and other educational materials with my students
The three-weeks-tasks get personalized, based on test results. Children who know their multiplications don’t have to practise these as often as others. This task becomes optional for them. At the beginning of a new three-week-period the students mark which tasks are obligated for them and which ones are optional.

In Femke’s opinion, freedom of choice, stimulating the students’ feeling of autonomy is very important. The students have to learn how to plan their tasks and choose how to process them. Femke tries to give her students insight in the learning objectives, so they can check for themselves if they succeed. This kind of self guidance is also a very important skill they need when advancing to secondary education.

Sometimes a student can’t handle the freedom of choice. Sometimes I will not notice this until they fail at a test. In processing the next chapter/lesson, this student will be asked to use his workbook.

Other iCoaches and teachers often ask Femke how she does it. Where does she find the time to prepare all of these tech-enriched lessons? She states that she gets a lot of energy out of experimenting and her students’ enthusiasm. Preparing is very time-consuming. She tries to document good practises and save successful interventions, so she can use them again next year. Femke also stimulates students to create lessons for their classmates.
15 Biology Cell

Subject: STEM

15.1 Country of origin

Turkey

15.2 Educational analysis

15.3 Description

The application is a simulation that describes 3 different cell types. Generally, all cell types are explained, then each cell is shown one by one the tissues they possess and their names are taught.
In addition, students can place organelles into the cell by dragging and dropping to consolidate what the student has learned. The organelles and the tissues appear both sequential and mixed to students.
16 North-West Regional College, Derry

Age Group: 13-18 years old / Level: School

16.1 Country of origin
Northern Ireland

16.2 Educational analysis

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Good practice

16.3 Description
Coordinator of Nat Dip Health & Social Care, North West Regional College, Derry, N Ireland

CONTEXT ANALYSIS
The institution is a Further Education college and the teacher is Caroline Mc Keever,. The class is a mixed ability group who have come from a variety of school backgrounds, grammar schools that use formal selection tests and secondary schools that do not use any form of selection.

The class culture/atmosphere is one where all the students are either fairly focussed or very focussed on doing well and progressing on to university or a higher level course at the same college.

There is no grouping strategy as such but there is a range of abilities in the class grouping. Entry to the course is based on a minimum educational achievement, at least 5 GCSEs or a pass at the level 2 version of the course.

There is Wi-Fi throughout the College. Every teaching space has an interactive whiteboard. Desks for most lessons are laid out in a traditional format of rows. However, there is one room used by the teacher, C403, where there is a deliberate effort to have an active learning environment that focuses on the use of iPads. Furniture in that room is less traditional, brighter, modular and moveable. This is to facilitate configurations that enable groups of various sizes to be formed and furniture easily moved to suit various sizes of groups.

The room concerned has an iPad caddy located there permanently. The teacher uses this frequently, to give the students developmental work to do. That is, where they develop some electronic content
that forms part of an assessment. Content varies, but includes: mind maps, image, audio and video material.

In every lesson, irrespective of which room she is using, Caroline gets the students to do some work with their smartphones. Very often, this is simply providing feedback or doing quizzes. Tools used include Mentimeter and Kahoot. Caroline also encourages the students to take brief notes using their smartphones and for producing content for assessment. This content may be in various formats, text, images and audio being most common.

The pedagogical vision of the course is simply to assist every student achieve their best, not simply teach to Pass grades in assignments, but to let all students get as high a grade as they can.

The course awarding body requires assignments to be designed to allow clearly specified levels of work developed for achievement of Pass, Merit and Distinction. Students are typically advised by their teachers of what they ought to be seeking to achieve and supported in working for that grade.

DESCRIPTION OF THE PRACTICE
The tablets are used in multiple ways in class for learning:

- Access to learning content from the Moodle learning platform. The content consists of basic material for everybody, along with additional content for those who are capable of going further. Additional content is labelled by the grade it aims to address, i.e. Merit or Distinction. The additional content can be in the format of:
  - Lecturer developed material
  - Links to ready-made online content that is bought in
  - Links to websites
  - Used by students for working on assignments, such as
    - Researching a topic for the assessment
    - Writing up or developing presentations
    - Developing podcasts or videos.

The class group is kept together at all times, except where there is group work.

CONTENT-differentiation
There are a number of different sources of learning materials used. Teachers typically create the basic materials, using Microsoft Office tools. Caroline often uses a set of iPads with her students and they may develop content using iOS app such as Keynote or Explain Everything.

As referenced in question five above differentiation is through assessment, with students given the choice to address assessment criteria for pass, plus optional additional criteria for Merit and Distinction. These criteria appear of the course specification. Supplementary learning content is typically provided and identified as such. The additional criteria and content is not simply additional content but more challenging tasks that will provide the opportunity to exhibit a deeper understanding of the subject.

PROCESS-differentiation
Teaching methods used are Direct Instruction plus facilitator of deeper, independent learning through presenting more challenging assessment criteria. Caroline uses a significant degree of flipped class to
get her students to cover learning content. This allows her to address topics in a more significant way in class. Students need to have access to some technology outside class. This can be achieved in most cases by the student’s personal or family devices. In extreme cases, it may require the student to use publically available equipment, for example in the College’s Learning Resource Centre.

The tablet/mobile device is involved by:
- Providing access to the material, by tablet in class
- Providing access to the teacher for guidance on developmental work, using tablet in class or smartphone away from class.

Guidance takes many forms, including:
- Course Facebook account, for peer support and direct support form Caroline
- Discussion forums on the course Moodle
- FAQs in limited cases.

Feedback comes in a number of formats, mixed by design, for reasons of variety and suitability for students. It may be:
- Individual feedback on returned assignments
- Audio feedback
- Screencast feedback
- Face-to-face oral.

Audio and screencasts are created on tablet or smartphone and generally accessed by students on personal smartphones.

**PRODUCT-differentiation**
Various tools, quizzes, online discussions, mind maps. Smartphones and iPads used for quizzes.

All get the same, although Caroline is very flexible in some cases as to what format students provide the evidence, e.g. if someone wishes to provide evidence in an electronic format that they choose then that is fine, so long as the learning is evidenced.

Absolutely, for those who have the ability and drive to achieve as high as they can. The mobile devices are key here as they provide the ease of access to technology and to a range of formats for evidencing learning.

Sometimes there is a link between formative and summative. This is often used to break down bigger chunks of work into more manageable pieces.

There is typically additional content that is made available for students to access.

**STUDENT-characteristics**
It addresses students who have high motivation and self-created targets. The tablets give them easy access to learn more, outside class, and to evidence learning.

The Head of Department is a key driver in the advances made by Caroline, by setting a direction for the Department that places a significance in effective use of technology. The College has an overall
aim to have technology used effectively. Inspectors, who visit the College every year, ask to see examples of effective use of technology, causing an impetus for innovation, coming from the Principal down through all levels of management.
17 Getting a better overview of all students with the interactive class photo

Age Group: 6-18 years old / Level: Classroom / Subject: Languages – STEM

17.1 Country of origin
Belgium

17.2 Educational analysis

Educational differentiation

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17.3 Description

Adapting to differences between students in a proactive way, doesn’t only require for the teacher to be well aware of the capacities and performance of his students (learning status), but also of their interests and learning profile. This good practice facilitates gaining insight in the diversity of a class group. (pro – active, structured, learner orientated classroom differentiation)

The teacher takes a picture of the class with the tablet. The Thinglink app, an app to annotate pictures and videos, turns the picture into an interactive one. A pointer is put on every student. This pointer gives access to more information about the student, e.g. to his or her personal wall in Padlet. The student is personally involved in the completion of his own information. He or she can systematically add personal information, assignments, logbooks, reflections and so on, to his or her wall.

Below you can find an example of a class photo, with for each student a pointer, which leads to their personal Padlet wall. On this wall, students gather information about their reading profile and interests: do they enjoy reading, or not at all? What arguments do they have not to read? What subjects are they interested in? … Based on the information on the Padlets, teachers and fellow-students help them to look for a book that matches their reading profile. This enables the teacher to encourage everyone to enjoy reading. (student’s interests and learning profile)
Thinglink 'Choose a book for someone else'

The development of this application was initiated in the Tablio project. It was then passed on to teachers in primary and secondary schools (via www.mooctablio.be). That’s how the application was adapted to and tested in different educational levels, in different forms and with different subjects. Teachers often added their own touch to the application. Let’s read about some interesting variations.

Maria Helsen tested the application in primary school. She took her pupils to talent classes and had them write their own talents in Thinglink. After the talent classes, they could add the talents they had...
discovered. In this case, it was the teacher herself who completed the Thinglink, after having consulted the student. All that was needed to realise this application was a tablet. (student’s readiness)

Another teacher who tested the application in primary school was Stefanie Dirix. Her pupils in the second form had to pick someone they didn’t often play with. They had to get to know each other and add their favourite spot at school, their favourite book, their hobbies, and so on, to their picture. In Stefanie’s class, several tablets were available, so the pupils added the information themselves. Stefanie testifies: ‘I thought it would be difficult in the second form, but it was not at all! I had to explain it only once, and they all got it!’ Thanks to this application, Stefanie’s pupils got to know each other better, but as a teacher she also gained more insight into her pupils’ (sometimes hidden) talents, interests and preferences. Stefanie uses this information during her classes. (student’s interests and readiness).
Viki Schroyen designed an application for secondary school. She used the interactive class photo in her practical class ‘agriculture’ (vocational education, area of horse-riding). Viki tried to spark her students’ interest by aligning with their interest in their own horse. She started with a practical assignment that was closely related to daily live in a horse farm. She made her students register the clinical parameters they are taught during her ‘agriculture’ class (e.g. temperature, pulse, respiration) on a picture of their own horse (student’s interests). All pictures were gathered and shared by means of a class photo in Thinglink. Viki’s experience: “The students were very proud of their walls and they had a tangible proof of what we practiced.”
Agriculture practice

Alessandro Voets uses the application in the second grade of secondary school, specialised in sales. In the subject PAV (Project General Subjects) students are being taught about a variety of social subjects. Alessandro uses Thinglink to gain insight in his students’ experience with these subjects. They regularly post texts or pictures related to them. One of the subjects, for instance, is traffic. To find out about the students’ knowledge and the different traffic situations they get into while getting to school, students have to visualise their personal traffic situation on their Padlet wall. Alessandro can then refer to students’ examples during class or students can take a closer look at their own situation. (students’ interests). The texts his students post give him an idea of their strengths and weaknesses in the area of written communication, which is also an important part of the subject PAV (student’s readiness). It is Alessandro’s experience that students find it very encouraging when the teacher knows how the issues discussed in class, are integrated in their lives. On the other hand, for students in vocational education it is not at all obvious to do school-work at home (student’s learning profile).
18 Encouraging pupils’ social skills, inclusion and taking responsibility for studying with the help of the project “Pupil of the month” and the Class Dojo application

Age Group: 6-12 years old / Level: Classroom / Subject: Languages – Social Sciences - Arts & Cultures - STEM

18.1 Country of origin

Slovenia

18.2 Educational analysis

18.3 Description

School is not only a place where children learn to read, write and do mathematics. It is also a place where they learn the essential social skills for successful and happy life. Developed social skills enable pupils to establish and maintain positive relationships with others, which consequently influences their behavior in school, acceptance by peers, teachers and adults, their self-image, as well as their studying, effort in class, joy of going to school and ultimately, their overall educational success.

Petra Matkovič, an English teacher at the primary school Osnovna šola Vide Pregarc from Ljubljana, Slovenia, has as a class teacher thought a lot about how to additionally motivate pupils to study at home as well as to work and participate in class: “Today’s generations of pupils do not perceive lessons and teaching in the same way as they used to. Teachers must invest a lot more work to motivate the pupils and for them to take responsibility for their studying and work.” There are a lot of foreigners in her classes, who come from various linguistic and cultural backgrounds (Bosnia and Herzegovina, Albania, Syria), as well as pupils from poor socio-economic conditions and pupils with special needs, who really need the extra motivation.
For this purpose, the teacher started implementing a class project in the class where she is a class teacher, called the Pupil of the month, with support of the Class Dojo application with which she has very positive experience. Aim of the project is to encourage positive behavior in pupils, taking responsibilities for independent learning and healthy competition. The project is designed in such a way that pupils set the goals they want to achieve in the beginning of a school year. Then they gain and lose points each day, depending on their behavior and participation in class. The Class Dojo application functions as a tool for creating a competition system in the class.

Goals that the pupils set for themselves each year afresh are related to various social skills, which are important for successful work and positive atmosphere in the classroom. For example, the main goals set by the pupils in Markovič’s class were: improving educational success, doing homework and bringing school supplies to class regularly, and mutual collaboration and offering assistance in the classroom. Then they created several competition categories with the teacher and entered them in the application. These were divided into positive and negative. The pupils gained points with positive categories (eg. regularly bringing homework and school supplies, participation in class, assisting classmates, …), and lose points in negative categories (eg. disturbing lessons, forgetting homework and school supplies …). The pupils collaborated with each other and gained points by doing so. They could also download various assignments from the application and do them at home, and gain additional points. Additionally, the teacher evaluated the class as a whole, so that the pupils could see at any time how they are doing as a class. Through competition the pupils were (unknowingly) encouraging each other for mutual progress.

“I guided the pupils in the way that they thought by themselves on which areas of learning and social skills they wish to improve. The pupils first chose their avatar or image in the application, which represented them. We evaluated their activity in class and entered points in the application under my supervision. At the end of each month I selected a pupil of the month with the help of the application, who then received a special recognition,” says Matkovič.

The teacher also informed the parents about the project using
an online application, and obtained their consent for implementation of the activity. The teacher installed the free Class Dojo application, which is available for Android and Apple devices applications, on her computer. She also used the application in class meetings as a tool for developing social skills, teaching how to learn and unconscious learning of a foreign language. Short videos in English (how to study, how to handle defeats, how to learn from mistakes, etc.), which she plays for the pupils from the application in fact serve as a basis for the class discussion.

The Pupil of the month contest begins each month anew, so that all the pupils always have same chances of winning. It is important that both more and less successful pupils have same chances of winning, which is ensured by a diverse selection of evaluation categories. Among less successful pupils are often foreigners, pupils of ethnic minorities, pupils from poor socio-economic conditions and pupils with special needs, which means the Pupil of the month project has a positive influence on the inclusion of all pupils in the class. Matković believes that the simple display of information and language of the application, which is partially in English, partially in Slovenian, also plays an important role. Using the application thus encourages the pupils to directly learn a foreign language (English) as well as the native language (Slovenian), mainly helping foreigners to integrate into the class and broader school environment, as well as helping them in communication with others. In addition, the use of a tablet computer motivates pupils to participate in the project and achieve the set goals.

“I am using the Class Dojo application for the third school year, and the results are extremely positive. Most of the pupils in my class have achieved the set goals within the categories we created together. By setting their own goals and recognizing the areas of learning they have to improve, they took responsibility for their studying and positively influenced the dynamic of relationships in the class as well. The Pupil of the month project, supported by the ICT, has served as an encouragement and motivation for achieving the set goals. The final evaluation in the class has revealed that the pupils need such encouragement and want to continue competing in the coming school year,” emphasizes the teacher, who expanded the competition for a pupil of the month to few other classes in this school year, especially those less successful in learning and discipline. She is also planning a competition between individual classes, which could additionally encourage and motivate the pupils to achieve the set goals and the success of a class as a whole.
19 The teacher is still leading, not the system

Age Group: 6-12 years old / Level: Classroom / Subject: Languages – STEM

19.1 Country of origin

Netherlands

19.2 Educational analysis

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- Good practice: The teacher is still leading, not the system

19.3 Description

After working with Snappet for about 4 years, the teachers of Jenaplanschool De Keg in Venray (Netherlands) are increasingly re-evaluating its use. Snappet is good, but less child-oriented than they would wish, it is less capable of catering for the exact individual level of a student, learning activities “outside of the screen” aren’t supported by the system. The school does provide offline learning activities to complete the activities for the students, but the Snappet timeline can’t take them into account.

De Keg is a Jenaplan school based on the teaching concept conceived and founded by the German pedagogue Peter Petersen. They adhere to 20 Jenaplan principles (see: https://www.dekeg.nl/page/89953 - in Dutch). #1 principle is “every person/child is unique”.

The school aims to focus on shared discovery, tries to focus not on age groups, but on the development of the child. They aim to be as demand-driven as possible.

The school groups its students into family groups (“stamgroepen”), so groups by design are mixed. For math, a teacher usually has students from a specific group, but when needed students from other groups join the class for specific topics. It is flexible, because it enables us to provide students with support on their level, but also is complex in organization.
This good practice is focused on the use of Snappet (https://nl.snappet.org/), an adaptive learning platform, which in this case is used for math and spelling. De Keg uses Snappet at school level and coordinate its use on that level. The school doesn’t use Snappet to replace the book, but as a mean to add options for students to get additional practice at the needed level, after the instruction by the teacher. Students are able to use Snappet to practice different topics and subjects while providing the teacher with a real-time dashboard with data about progress (learning analytics).

A limitation of Snappet is the fact that it only is focused on using the screen as a way to practice. There is no integrated option to combine different types of exercises, like hands-on activities. When students work on a tablet, they learn differently. And while the results are positive for math, they are not for reading. Apparently working from a tablet trains the brain differently than when students work from paper. The results when the tablet is used drop in combination with reading in those cases.

To contrast the use of Snappet: for the subject “Orientation on the World” (WO), the school works project based, not based on a single method provided by a publisher. Here, students have much more options to choose different topics, methods of presenting or producing the results. But without the strong points that Snappet has for practice.

For math and language skills the teacher uses the Snappet dashboard to get an idea of how every student is doing. Based on the analytics, the teacher can choose to provide the student with extra learning materials. Because Snappet has integrated the learning objectives, the teacher can use formative feedback to keep the student on track.

The Snappet system only provides limited feedback (correct / incorrect, recently you can get a score). Because the teacher knows the student, he can usually understand the limited feedback and if needed discuss it with the student. There is the risk that the dashboard is leading for the teacher. It’s something that a teacher, using it, needs to keep in mind. In the end the teacher and not the system should be leading.

In general, learning objectives in primary education are formulated in very broad terms. For WO the school has formulated clear learning objectives and evaluation moments (no tests!) to determine if students reach them. Examples are projects / presentations / events.

Twice a year, the students receive a report. The school doesn’t score on a 0 – 10 base for tests but uses reports with the knowledge areas. They do use indications for Unsatisfactory, Just satisfactory, Average, Good, Excellent ( O / M / V / RV / G) . This is the same for WO, math, reading. The feedback and info provided by Snappet is part of the info used to fill in the report book. The overview that the teacher has over how the student works is even more important.

The school is investigating the possibility of adaptive testing. Testing currently is age related, but this is not always considered that to be fair towards the student. Sometimes they just haven’t mastered the material yet. Also the school is considering how to give better feedback to the students, offer more personalisation in strategies and learning paths and give more insight in learning goals.
20  Favouring learning by creating videos

Age Group: 13-18 years old / Level: Classroom – School / Subject: STEM

20.1 Country of origin

Italy

20.2 Educational analysis

Educational differentiation

<table>
<thead>
<tr>
<th>Learner oriented</th>
<th>Teacher oriented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readiness</td>
<td>Content</td>
</tr>
<tr>
<td>Interest</td>
<td>Process</td>
</tr>
<tr>
<td>Profile</td>
<td>Product</td>
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</tbody>
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Differentiation level

- Macro
- Meso
- Micro

Good practice: Favouring learning by creating videos

- • • • • • • • •

20.3 Description

The interviewee is working in the Istituto Comprensivo “Giovanni XXIII” (Acireale, Catania) located in the suburbs of the city and with a high rate of students coming from disadvantaged background and at risk of early school leaving. This is why the school is always innovating its didactics in order to be more appealing for children and young people.

All classes are heterogeneous, thus including students with disabilities and special needs, and the school always tries to create balanced classes.

Recently, the school has been focusing on the enhancement of students’ responsibility. In doing this, they adopt teaching methodologies used by the “Senza Zaino” (trans. without backpack) network. For instance, on the classrooms’ doors there is a two-side cartoon with one side green and the other red. When a student goes to the toilet, he/she turns the cartoon on the red side so the others know that someone is outside and they cannot go to the toilet and they should wait the other student to come back. In this way, they do not have to ask permission to go to the toilet anymore.

Each classroom has an interactive whiteboard that can be connected to students’ and teachers’ tablets, smartphones and laptops. In two classrooms, there are iPads, while in the others there are other kinds of tablet.

On the basis of the pedagogical vision of the school, namely promoting the inclusion of each student, the teacher uses the tablet in all her lessons for differentiation strategies and to favour inclusion.

The teacher works in early primary education (11-13 years) and she teaches mathematics and science. In mathematics, she usually uses GeoGebra for geometry as she finds it a useful tool to study mathematics while enjoying it because of the interactive exercises.

In science, she uses videos both downloaded from the web and created by students. The first ones are used by the teacher to explain the topic of the lesson. As far as regards the videos realised by the
students, usually the class is divided in groups and each group works on the same topic or on different aspects of the same topic, then there is an exchange in plenary. The teaching technique is mainly based on the “flipped classroom” theory, in which students are the main actors of their learning path.

Students are divided according to different indicators on the basis of the topic addressed during the lesson. They might be divided according to students’ readiness level, interests, attitudes, etc. The main idea behind it is to favour peer learning and to let more “advanced” students be tutor of the ones with difficulties in the subject and/or a specific topic.

For instance, when studying the human body, the class is divided into groups to analyse an aspect of the topic and to re-elaborate it through a video.

Along with the video, in particular in the developing phase, they are encouraged to create a conceptual map in order to have a clearer idea both of the topic and of how to structure the video. They can use different Apps to do it. According to the teacher experience, these tools have been proven effective in memorising the topic as well as in enhancing students’ interest. Thus, students are encouraged to use these Apps for all the lessons. The conceptual map can be done in different ways. For instance, the students with more difficulties in writing or using words can use photos or images instead of text in developing their maps.

The apps used to do these videos are usually Quick Video (https://quik.gopro.com) and IMovie (http://apple.com/imovie).

The videos are designed, developed and realised by the students, always under the teacher’s surveillance. Through the videos, they should explain to fellow students the topic addressed: this favours not only active participation by students, but also peer learning.

The videos are uploaded on the virtual class allowing the teacher to provide immediate feedback. The virtual class is also used to correct homework and to favour exchange of learning material among students themselves.

The videos are then uploaded on the school Padlet (http://padlet.com) and made available for all the students of the school and for other teachers who like to use them as learning material.

All the students are connected through tablets as well as smartphones both to the virtual class and Padlet. Students are always under supervision of teachers and support teachers, but they have been answering positively to the possibility of using alternative methodologies during lessons and having more autonomy.

The videos are considered part of the formative assessment and they allow students to be evaluated also through alternative methods than the traditional ones, which usually include only oral and written examinations. Moreover, at the end of each lesson, students do exercises (e.g., didactic “games”, reports, conceptual maps, etc.) that can allow the teacher to understand if the learning objective of that lesson has been reached by all the students and at what degree.

For the evaluation, different methodologies can be used:

- Written tests (e.g., reports, multiple choice questionnaire, etc.)
- Videos
- Drawings
- Collection of picture
- Etc.
This allows to evaluate the readiness level of each student and to understand where they stand in the comprehension of a topic. All the evaluation methods mentioned are usually performed through tablets, notwithstanding the national standards and set methodologies for evaluation that have to be respected by the teacher.

Through the use of tablets and other ICT devices, students have increased their motivation towards learning, their abilities in working in group and communication skills.
21 Science and Art Center (BİLSEM) Group Assessment Test

Age Group: 6-12 years old / Level: Classroom / Subject: Social Sciences – Arts & Cultures - STEM

21.1 Country of origin

Turkey

21.2 Educational analysis

21.3 Description

BİLSEMs are public, educational institutions that attract the attention of Gifted and Talented students. These centers serve under the Ministry of National Education General Directorate of Special Education Guidance and Counseling Services. GT students are accepted to BİLSEMs by a three-step assessment system. In the first step, primary class teachers make observations and use rating scales to determine their potentially GT students. At this step, all the primary school students (1st, 2nd, 3rd, and 4th-year students) around the country are scanned via the use of an “observation form” to refer students for further testing. In the second step, selected students take group intelligence tests. Finally, based on the results of this test, at the final stage, successful students take the individual intelligence test (Weschler Intelligence Scale for Children – WISC-R). The students identified as GT and selected for BİLSEMs receive project-based training in line with their interests and needs at times outside of their formal education. The individual intelligence test has been transformed for application on tablets. All the students who are to be assessed are given tablets and the students are expected to do the tasks on the tablets.

Talented and gifted students are tested for their ability in music, arts and sciences. The GT students readiness for special education is tested. Based on their ability and interest, they are given non-formal education to further their abilities. The students are transferred to individualized programs outside the regular school.

There is a group assessment test with the tablet. The tasks require drag and drop type of answers. They get screened via the test to orient to extra-curricular classrooms.
The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.
22 Didactic “games” through Kahoot!

Age Group: 6-12 years old / Level: Classroom

22.1 Country of origin

Italy

22.2 Educational analysis

22.3 Description

The interviewee teaches in an early secondary school (11-13 years) in the city centre of Palermo, next to many disadvantaged areas of the city. Thus, most of the students do not have the support of their families in their educational path because of different reasons: cultural background, socio-economic issues, job related commitments, etc.

Unfortunately, the ICT equipment of the school (which has 10 classes) is not adequate for the number of students: only 8 tablets and a wick Wi-Fi connection.

Notwithstanding these difficulties, the interviewed teacher is trying to use tablets for differentiation strategies and to increase students’ motivation towards learning.

The tablet is used to involve students who cannot buy text books and who are not motivated in participating to didactic activities.

The main activities performed through tablets are: researches in class, realisation of videos, didactic “games” in class.

Videos are usually developed by students who are divided in groups, to analyse and study a topic. This technique is based on the “flipped classroom” methodology. Thus, students are the main actors of the lesson and through the videos they are sharing what they have learnt with the others.

The main app used to do the exercises is Kahoot! (http://kahoot.com), a platform where it is possible to create or use already existing didactic “games”. It allows the students to learn while playing and being more interactive and active in the learning process.

The app has proven effective not only in increasing motivation and interest in learning, but also in increasing students’ learning success.
The exercises are done in group. Students take part to a challenge among teams. The challenge allows students to exchange opinions and students with less competences on the subject or with difficulties in learning feel less intimidated in asking further clarifications or in making mistakes.

The use of these didactic “games” is helping the teacher in promoting the inclusion of each student. When using the tablet, students with special needs, learning disabilities and difficulties in understanding a topic find it easier to learn, while they are not able to completely follow a traditional lesson (namely, the teacher explaining a topic and the students listening at it).

Thus, the main student-characteristics addressed through the use of Kahoot! are motivation and ability to work in group, collaborate among each other.

Kahoot! can be used also as a tool to evaluate how much the students have achieved their learning goals without using only the traditional methods. This allows students with learning disabilities to feel more included in the class and less different form fellow students.

The interviewee would like to use the tablet on a more regular way in the future starting from the success obtained through the use of this app.
23  St. Canice’s Primary School

Age Group: 6-12 years old / Level: Classroom / Subject: Languages – STEM

23.1 Country of origin
Northern Ireland

23.2 Educational analysis

![Educational differentiation diagram]

23.3 Description

CONTEXT ANALYSIS
The school is a small, (120 pupils) primary school. The class is a mixed ability group of 30 pupils, aged 9 to 11 years, compromising years 6 and 7. The class culture/atmosphere is one where all the pupils are focussed on fully participating in school and class activities and achieving to the best of their ability.

There is not what one would recognise as a grouping strategy. Children from years 6 and 7 are taught in the same room by Ms Diamond. The teacher allocates pupils seating positions by putting together pupils that she has identified as being comfortable working together. Often, but not always, this means that friends will with together.

The technical resources available across the school are:
- 25 low-cost 3-year old Asus tablets
- 18 iPads, 15 of which are stored centrally and used as a collection when required
- 2 laptops for pupils with learning difficulties.

The mobile devices are used to access electronic learning materials and tools that are web-based, that is what would traditionally be considered as apps for tablets are not used. All schools in Northern Ireland are connected to a regional network for primary and secondary level schools, called C2K. This is a managed service that provides networked access to a wide range of electronic resources and documentation across all Northern Ireland’s primary and secondary level schools.

Classroom furniture is laid out in a U shape, so that every pupil is facing the teacher and is able to see each classmate’s face.
The pedagogical vision of the school is that each child should be given every opportunity to learn to the best of their individual ability.

**DESCRIPTION OF THE PRACTICE**

The mobile devices are used for learning in an immersive way. That is, for every developmental activity undertaken throughout the school day, some mobile device is used for the children to undertake tasks that form part of the Northern Ireland curriculum at the appropriate level.

The teacher uses Google Classroom to release in a timely way each activity that the pupils are expected to complete. This involves some instructional material explaining the subject theory, then a task or set of tasks that allow the pupils to create something to put the theory into practice. Build into each task are opportunities to take the level of development somewhat beyond what is needed by the regional curriculum target for that level of pupil.

If a pupil completes the standard task well inside the given time then they are stretched by having the opportunity to undertake a further task. From Google Classroom they will be able to access some instructional material if necessary for the further task. In the cases of pupils who do not reach the expected standard then the teacher will provide additional instruction for them.

Availability of the mobile devices provides a significant level of access for pupils to:

- Instructions from the teacher, in text and audio;
- Additional task specifications, if required;
- Additional support materials, if required;
- Access to the World Wide Web to allow pupils to acquire information and digital assets (images, videos) to be used for task development;
- Software tools to build electronic materials for evidence, including tools for creating still images, audio and moving images;
- Tools for collaborating with classmates and pupils from twinned schools, including demonstrating content developed;
- Audio feedback from the teacher.

The teacher is able to do live checking from her device on how each individual is progressing, to some extent.

**CONTENT-differentiation**

The learning materials are a mix of procured, bought or obtained from central public-funded support agencies, and developed by Ms Diamond. Two of the core tools are Accelerated Reading, bought-in for reading, and MyMaths, bought-in. The latter has a very wide range of mathematical content, with:

- instructional material, including interactive demonstrations;
- associated exercises;
- the ability to give “homework”, something that is used in class time to allow fast learning pupils to attempt mathematical examples beyond that expected from their cohort.

MyMaths-content covers a very wide spectrum of the mathematics curriculum, up to age 18.
The mobile devices are available for individual pupils to work though defined tasks at specific time slots in the class timetable.

**PROCESS-differentiation**
Teaching is very much pupil-centred with a variety of methods employed. New topics are introduced using Direct Instruction and demonstration. Learning materials are made available to pupils through Google Classroom, with presentations and exemplars displayed on an interactive board but also shown on a mobile device shared between 2 pupils.

Depending on the topic that is being covered, inquiry-based learning plays a major role in a significant proportion of the curriculum. Inquiry and related task development is almost entirely based on use of the mobile devices available.

Differentiation is achieved in a number of different ways, depending on the subject matter. For much of the curriculum, which uses inquiry-based approaches, tasks can be extended in complexity, either by suggestion of the teacher or the pupil. For example, Adopt a Pet, a task that incorporates many elements of the curriculum, including maths, will have a large element of inquiry along with some direct instruction. The latter will contextualise the task and give some initial mathematical background.

The task itself will involve working out all the elements involved, including the costs of procuring and keeping the chosen pet. The pupil will develop a piece of work that will outline all the considerations for keeping the pet. For differentiation, if a pupil is a gifted child, the teacher may pick an exotic pet, such as a meerkat. This will require the pupil to consider a range of elements that are different to a more traditional pet, such as a dog or cat. For example, import costs, quarantine costs, specialist housing. The pupils will have to work out initially that all these extra factors are needed and calculate costs.

There are extensive support materials on the network for the pupil to access, some available from the regional curriculum support service, other created by Ms Diamond. In the case of some bought-in services, such as the web-based My Maths, there is a significant provision of ready-made instructional and practice materials.

Ms Diamond intervenes where individual pupils are experiencing difficulty with specific learning content and undertakes one-to-one or small group additional support. This may involve allocating further practice sessions that use the mobile devices.

Ms Diamond makes audio comments on pupils’ work. This commentary is attached to each piece of work and is available to each pupil through their individual account.

Individuals are encouraged to review each piece of work completed and submitted and consider What Went Well (WWW), to pick up on the positive aspects of the experience and work produced. They are also routinely required to consider Even Better If (EBI), to specifically address what they could have done in a task to improve on it. The individual WWWs and EBIs are shared with the rest of the class, so that all pupils can learn from their peers.
The key shareholders are; teachers, Principal, parents, classroom assistants, central educational support organisation (setting the UICT framework in conjunction with schools).
REALISING CLASSROOM DIFFERENTIATION AND INCLUSION WITH TABLETS

CHAPTER 3

Good practices

Resulting from Teacher Design Teams in European Schools
1 Topicality? Just Imagine! Vocational Students with a Hunger for Topicality

Age Group: 13-18 years old / Level: Classroom / Subject: Social Sciences

1.1 Country of origin
Belgium

1.2 Educational analysis

1.3 Description

Introduction
Vocational students, enthusiasm and topicality combined? Impossible according to clichés. What students they can choose the topical items focused on in class? What if we provide tailor-made support for them? It was the challenge of one of the Teacher Design Teams of the Tablio Project of the PXL University College. It led to the multimedial topicality project ‘Actualiteit? Beeld je in!’ (‘Topicality? Just Imagine!’).
Tablio
The topicality project has been developed in context of the Tablio research project of the PXL (Hasselt). Tablio is a practical research project into the constructive use of tablets in education. The research project started in 2012. After developing, testing and finetuning a number of ready-to-use tablet implementations it became clear that tablets have a lot of potential to tackle the students’ differences in learning. The main focus of the project shifted to personalised learning and differentiation. Tablio developed a didactical frame, analysing available good practices and zooming in on hiatuses. The expertise and good practices were shared by a MOOC (MOOC stands for Massive Open Online Course: an online course with open registration. The Personalised Learning with Tablets MOOC took place between January and March 2017. Good practices were spread through the MOOC which are being used in the work field. The material is still available on the website www.mooctablio.be). In 2017 Tablio started an international cooperation in view of an Erasmus+ project. This cooperation composed two Teacher Team Designs in six European countries. The Teacher Design Team enables researchers, teachers and teacher-training students to work together on a specific need of a particular school.

The Teacher Design Team of the ‘Topicality? Just imagine in!’ project consists of Hanne Rosius (Project General Subjects course didactic and researcher at PXL in Hasselt), Axelle Bollen (student Bachelor Secondary Education at PXL), and Myriam Bortels (Project General Subjects teacher at HAST School). Teacher-training students Eef Vanderstraeten, Alexander Kalebka (PXL), and teacher Mieke Magchiels (HAST School) helped with the testing and refining.

The subject Project General Subjects has a thematical approach. However, teachers noticed the difference in students’ enthusiasm for certain themes. The Project General Subjects curriculum mainly dictates functional skills. The openness of the curriculum leads to a broad scope to choose subjects in order to be combined with functional skills. It is possible, in theory, to let students participate in the choice of course subjects. Teachers however doubt whether students possess enough self-guiding skills to take their learning into their own hands. Nevertheless, independence is the main focus in the Project General Subjects third two-year cycle curriculum.
The original research question was ‘Can we give student more autonomy in the Project General Subjects curriculum as to choose the subjects in order to motivate them. Can tablets promote autonomy-aided learning?’

The design was based on the ABC-model: a theory to improve autonomy-aided learning. Three pillars are the foundation of the ABC-model: autonomy, connectiveness and skills. This article will illustrate the ‘Topicality? Just Imagine!’ project by zooming in on these characteristics.

**Autonomy: starting from strong images leading to topicality**

The Teacher Design Team choose to focus on topicality in order to explore the research question. Topicality is an important subject in the Project General Subjects curriculum. Moreover, it provides legion of opportunities to imbed choice possibilities. The ABC-model even states that the students’ autonomy will be improved by providing a wide range of learning materials for the student to choose from. The Teacher Design Team chose to use strong topical pictures as a stimulant for topicality. A strong image is interesting since it invokes a certain emotion. However, without getting the whole story immediately.

Students are image-driven. Strong photos can invoke students’ questions and therefore interest. Curiosity motivates the students to learn more about the story and thus also the topicality it links to. Figure 3, for example, is a strong image of a calm mother holding her crying infant while faced with
armed authorities. A student may be curious and therefore motivated to learn about the refuge crisis in Honduras.

The Teacher Design Team quickly learned that there are more than enough strong images available about topical themes. Most of the vocational students however do not use the channels that provide these images such as quality newspapers or magazines. The Teacher Design Team chose hence to collect the images and post them on their Instagram account (see figure 5). Instagram is a popular app which a lot of the students use. Students can follow the project’s account and will be confronted with and made curious by news items even after school has ended.

Since not all the students have Instagram and since physical presence of pictures in the class is an advantage; the photos will be present in the classroom on a photo display. Students can ‘shop’ in the
Students choose photos from the photo display.

**Skill: from photo to story**

A photo is worth a thousand words. After all, every photo holds a topical story. Once students have chosen a photo, they have to look for the deeper story. They should recreate the story and make a video out of it. This should contain the answers to the (W-)questions that function as a reference for these assignments:

- Why did I choose this picture?
- What did I think it was about?
- What is it actually about?

An introduction class provides the students a good foundation to start from. During this class the Teacher Design Teams introduce their picture choice.
Looking for the story behind the picture is not that easy for every student. They have to feel skilled enough to tackle the assignment. In order to achieve this; the topicality display also contains guide cards with QR-codes. These codes lead to websites or apps to help the student work the app, with the search, or with the language. The foundation for this are the so-called OVUR-steps: orientation, preparation, execution and reflection. Step-by-step guidance cards are added to the display.

- **Orientation**: Students conceptualise their assignment. On the back of their picture are keywords to help them get started (see figure 9). These keywords can be used to look up online. Furthermore, students who need extra help can scratch off the patches covering QR-codes (see figure 10). These codes lead to easily accessible sources providing more information on the picture.
- **Preparation:** Students write down their text and look for extra pictures to clarify their story. To motivate their choice, they can use a vocabulary Padlet (see figure 11). Manuals for finding pictures and references for speaking are available for struggling students.
- **Execution:** Students record their story in the app Adobe Spark. This enables the student to tell the story using multiple pictures. Afterwards, the movie should be uploaded in Flipgrid. A tutorial video for both apps is available; the photo display contains a QR-code linking to it. Only students who need the extra help use this video.
- **Reflection:** Students get feedback from their teacher and peers. From this feedback they can derive points for improvement for the next video.

*Keywords on the pictures’ back.*

*Tailor-made guidance covered underneath a scratch patch.*
Providing different guidance cards helps to tackle the differences in students’ status. This improves the feeling of being skilled and thus helps each student to work independently within the project.

**Students looking for the story behind the picture.**

**Spark Video and Flipgrid**

Students make a video using the app Spark Video after researching the story. This app focuses on animated videos with text or voice-over. Existing pictures can be uploaded and combined into a video with effects, animation and spoken voice-over. Items can be imported from the camera on the smartphone or tablet, or from Lightroom, Google Photos or Facebook. Spark Video is perfectly suited for digital storytelling and fits wonderfully in the project ‘Topicality? Just imagine!’
The students reconstruct the story behind their picture by combining images (cards, important people, places ...) in Adobe Voice and recording the explanation. They can choose to only record their voice or to film themselves while telling.

All of the students’ videos made in Adobe Voice should be collected on one canvas in the app Flipgrid. This is an interesting tool to engage students and formatively evaluate them. The idea is simple: a teacher poses a short, written question. Students can answer with a video of which the teacher decides the length. All videos are combined in a type of grid. This is visually and stimulates the students to see the answers of the peers.
The tool, online or app, is quite easy. After registration, grids and questions can be created. The free account allows grids to be made. These grids function as digital classrooms in which questions can be posed. The number of questions and responses (namely students’ videos) is unlimited. Different evaluation criteria can be linked to each grid. In addition, every student or teacher can respond to a video with a video.

Every question generates a URL or QR-code for students to react directly. Teachers can secure the question with a password or choose to moderate the videos before publishing.

It is even simpler for students: they do not need an account. They can click the link, log in using the code, click the plus sign, provide access to microphone and webcam and take a webcam picture as identification. Afterwards they can listen repeatedly to the recording. When satisfied they can submit their video message.

By collecting the project’s videos in Flipgrid students can take a look at each other’s work and derive more topical information about different topical items.

**Connectivity: sharing stories and feedforward**

To provide the students a feeling of connectivity, they will have coaching conversations. All students work on a video during the first two classes thus to get to know the assignment with guidance. They work on the second photo without more help.

The Flipgrid evaluation system is used to provide feedback on the following criteria:

- motivation of the picture choice,
- story behind the picture,
- language,
- work ethic,
- creativity.

These criteria are explained on an evaluation card hanging on the picture display.
The teacher fills in the evaluation system. It focusses on the good parts and formulates a point of improvement for the next photo.

The Flipgrid app enables to react on other people’s video with a video immediately posted underneath the original video in the shape of a small point to click on. The Teacher Design Team chose to use the video response function for peer assessment. Students give each other a concrete top (what went well) and a hint (what can be better next time). Consequently, students can grow in summarizing topical items. The top and hint system protects the safe assessing atmosphere.
Findings
The HAST School’s students were asked to help reflect on the quality of the ‘Topicality? Just Imagine!’ project during the test period.

Teachers and students are enthusiastic about the working method. Students especially appreciate the room for their own interest. They experience the pictures as being stimulating and have no problem with finding a photo that interests them. Some students even look for extra images for the project. In addition, students acknowledge the usefulness of the wide range of aids for language, search process and apps. They also like the choice whether to use the extra guides or not. They feel encouraged and skilled enough to tackle the assignment. Furthermore, both the students as the teachers believe the apps to be user-friendly. Students learned quickly how to use the app. No practical problems came up. The testing phase also led to points of improvement. The students helped the Teacher Design Team to discover these.
The project’s points of improvement according by students after first testing.

Students often had difficulties with giving feedback to their peers. Especially finding the right words to tell their peers clearly and respectfully how to improve. The Teacher Design Team thus added an extra guide card with QR-code to the picture display. This code leads to a Padlet with clear-cut criteria and sentences for both tops and hints (see figure).
Next, students perceived the project’s scope as being too wide and needed a synthesis action plan to look back at. This was added as well.

Lastly, students were worried about their e-privacy, especially who could see their videos. They pay great importance to a safe digital environment. The new European privacy legislation of 25 May 2018 also forced the Teacher Design Team to keep this in mind. The GDPR (General Data Protection Regulation) handles the storing and securing of personal data of European citizens. Thus, including the students. The used platforms were hence secured with codes to ensure the content to be only seen in classroom context.

The future
The result was received well by students and teachers. The project based on the ABC-approach turns vocational students into students eager to learn and skilled to do this autonomously. Both the HAST School as PXL will imbed the design in their curriculum. The design will be shared further during a Tablio bootcamp and workshops during the PXL Congress. For further development, check the Tablio Facebook page, #Tablio or @RosiusHanne on Twitter.
2 A Digital Reading Portfolio: Illustrate your Learning, Reading and Growing yourself!

Age Group: 6-12 years old / Level: Classroom / Subject: Languages

2.1 Country of origin
Belgium

2.2 Educational analysis

![Educational differentiation diagram]

2.3 Description

Introduction
Let start by stating the cliché: society is changing. The digital era requires children to be taught 21st century skills. Skills such as self-regulation, teamwork and media wisdom should be imbedded at the start of in the curriculum. Moreover, education needs to differentiate more and evaluate differently. Cliché and useful ideas, but nothing new. However cliché it may be, accomplishing it seems not that easy. How can you achieve this for primary school pupils? How do you manage this as a teacher (or was it as a coach)? How do you ensure that these ‘new’ educational ideas are imbedded functionally in the curriculum as to enrich pupils’ learning process without getting stuck after only a few successful classes? This article zooms in on the use of a digital reading portfolio. In this portfolio, students from first to sixth grade collect their work on reading. They can show their learning process themselves. They are challenged to critically but constructively assess both their work as their peers’ which learns them to grow even more.

The article starts by outlining the Tablio project from which the application is derived. Next, it focusses on the use of a digital portfolio. Further on will be zoomed in on reading and how reading fits into the digital portfolio. Then will be looked at self-evaluation and self-regulation by means of the reading portfolio. Finally, good practices will be illustrated. Every paragraph will refer to 21st century skills and the development areas from the ZILL curriculum. The transfer to the curriculum itself is proven to be a piece of cake.
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**Tablio**

The topicality project has been developed in context of the Tablio research project of the PXL (Hasselt). Tablio is a practical research project into the constructive use of tablets in education. The research project started in 2012. After developing, testing and finetuning a number of ready-to-use tablet implementations it became clear that tablets have a lot of potential to tackle the students’ differences in learning. The main focus of the project shifted to personalised learning and differentiation. Tablio developed a didactical frame, analysing available good practices and zooming in on hiatuses. The expertise and good practices were shared by a MOOC. In 2017 Tablio started an international cooperation in view of an Erasmus+ project. This cooperation composed two Teacher Team Designs in six European countries. The Teacher Design Team enables researchers, teachers and teacher-training students to work together on a specific need of a particular school. One of the PXL’s Teacher Design Teams came across the need to develop a functioning digital portfolio that facilitates pupils to visualise their own learning process.

The teacher design team focused on the digital reading portfolio consists of Hanne Rosius (Project General Subjects course didact and researcher at PXL in Hasselt), Ann Jacobs (teacher, staff member and IT coordinator at primary school Klimop in Gent), Nele Tillemans (6th grade teacher at primary school De Mozaïek in Brugge) and Tommy Gyseberghs (1st grade teacher at primary school Catharina in Hasselt). The PXL’s teacher-training students were frequently involved in the development. The teachers of the Teacher Design Team work often with tablets and use the tool Seesaw for creating the digital portfolio. The research question of the Teacher Design Team is the following ‘Can Seesaw be used to let students practice their reading meanwhile illustrating their learning growth?’

The team’s objectives are the following:

- stimulating pupils’ motivation to read and parents’ involvement in reading;
- visualising personal growth in reading for all students, parents and teachers;
- providing tailor-made feedback, remediation or challenges in line with the proven learning growth;
- stimulating students to take their learning process in their own hand and illustrate it in the portfolio.

**Seesaw: a ‘media-apt’ digital portfolio system**

Since pupils are expected to take their learning in their own hands, they should be taught how early on. A portfolio can help students to take on more responsibility for their own learning. They collect meaningful tasks and products in a portfolio to illustrate their learning. Thus, visualising their learning process. They can have a look at earlier work, become aware of their learning growth and set new objectives (Castelijns & Kenter, 2009).

Digital tools can be handy to create and organise a portfolio. The Teacher Design Team chose Seesaw: a device independent portfolio system for (younger) pupils. It can be used on any type of tablet, smartphone or computer. Even Seesaw’s free version provides multiple opportunities for collecting work and giving feedback. The functions of the paid version are legion: even more possibilities for assessment and exchange within the school.
Seesaw collects digital or photographed analogue works of each pupil. This can vary from photos, videos, audio, documents, notes, hyperlinks, or a combination of aforementioned. These products can all be created in the app itself. Pupils do not need extra apps or tools. They easily find their way thanks to clear symbols. Pupils can, moreover, post products in Seesaw made in other tools.

Using Seesaw this way stimulates pupils’ media literacy. Both media wisdom, media proficiency as media literacy are domains in the ZILL curriculum. For media wisdom, the curriculum states two objectives: positively and enthusiastically implementing media, and being prepared to show and use their own and their peers’ media talent while learning and playing (objective MEmw1). Media proficiency has the following objectives: to develop digital audio-visual skills, to experiment with audio-visual media and their possibilities while recording or playing content, and to make use of simple audio-visual media tools to record, edit, cut and play (objective Meva2). For media literacy, students should experience and illustrate the function and value of media in their daily life, and they should experience the role media plays in their daily life (objective Mege5).
Pupils can post their work in their portfolio without needing help. They can take initiative to post things themselves. Teachers can prepare activities as well and post them on Seesaw. These are not standardly provided by the application. Teachers have to come up with activities themselves in line with the class and individual pupils. Pupils can then react on the activities by posting notes, drawings, photos, videos, audio, hyperlinks, documents or a combination thereof. For example, for technical reading the teacher can post a text for pupils to read out loud. To stimulate reading comprehension, a teacher can upload a text for pupils to mark the key words. For enjoyed reading, students can make an advertisement for their favourite book by making a collage. They can even read a segment of the book expressively.

Seesaw activities comprise a structured step-by-step plan in which text is supported by symbols. Audio instructions for the step-by-step plan can be an extra help for starting readers. A teacher can add an example or a template for the pupils to complete.
Woordjes leggen

Leg vier woordjes.
1. Tik op het groene plusteken 🔄.
2. Neem een foto van je vier woordjes 📸.
3. Tik op het potloodje 🆒.
4. Tik op het microfoontje 🎤.
5. Teken een cirkel om je woordje en lees het luidop voor.
6. Tik op het groene vinkje ✅.

Instructions for a Seesaw activity.
After pupils have uploaded a product, others can respond by clicking ‘like’, by writing a response or by uploading a spoken message.

Teachers create a virtual class in Seesaw by adding all the pupils. When clicking on their name, teachers can take a look at that pupil’s work. Parents can be invited to look at their child’s work. The portfolio is private for the rest. Seesaw generates an access code for pupils to log in during class. This code expires after one hour. Once pupils are logged in, they can start using the portfolio. This seems unpractical at first, but it reassures the pupils’ e-privacy. Pupils must learn that a portfolio is a learning instrument and that other pupils’ uploaded products should not be looked at and commented from home. The enclosed system helps pupils to learn netiquette in a safe environment. Maybe one pupil’s response on another’s work is inappropriate or a pupil posts work using someone else’s name. The problems can be tackled inside the classroom. Pupils can make up for their mistake without the outside world looking over their shoulder. The experiences teach them how to behave on the internet. They can even make a list of which online behaviour is appropriate and which is not. This is a crucial social skill for pupils learning and living online. This is also an objective in the ZILL curriculum: well considered and careful use of media, being aware that communication by media entails complying to certain rules and agreements (objective MEmw3).
Reading in the digital portfolio

Learning to read is so fundamental in our society it can almost be interpreted as a human right. Literacy is crucial for almost every course. Even more, it is a crucial condition for participating in our society. Therefore, the Teacher Design Team chose to create a reading portfolio. The primary education curriculum includes four types of reading. The teacher design team chose to design activities in Seesaw to ensure that all of the reading types are addressed in a varied and multimedial way.

- **Technical reading**: Reading written language aloud. Thus, the transfer of the alphabetical crypt to spoken language. Using Seesaw, pupils can upload a photograph of some text and an audio file of them reading the text out loud.

  ![Technical reading activity.](image1)

- **Comprehensive reading**: Giving meaning to the text read. Obviously, this is connected to technical reading. In the following example pupils summarize the text visually by creating a collage.

  ![Comprehensive reading activity.](image2)
Enjoyed reading: The joy a reader gets from reading. This is also called reading enjoyment or reading promotion. To improve the positive attitude towards reading, pupils can take a picture of their favourite reading spot. They show a book they like and tell their peers why. Afterwards they can take a look at the book choice of their fellow pupils.

Expressive reading: The art of reciting a text. The pupil has to be able both to decode as to comprehend the text. For example, pupils can make a video in which they read a cartoon while doing voices.

Visualising the learning
All activities are compiled by age and are in line with the ZILL’s reading learning-teaching trajectory from ages 6 to 12. Every activity in the collection is illustrated by an example or template and a pupil’s upload.
All the collected activities will be drawn up as following:

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Type of activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toon wat je bijleerde!</td>
<td>Complete the grid by adding text.</td>
</tr>
</tbody>
</table>
For example

<table>
<thead>
<tr>
<th>Welke tekst las je?</th>
<th>Wat was het belangrijkste in de tekst?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vuilisbelten in Afrika</td>
<td>Dat onze oude computers en TV's naar Afrika gaan. Dat is niet gezond en slecht voor de natuur.</td>
</tr>
<tr>
<td>Wat vond je het meest interessant?</td>
<td>Waar zou je meer over willen weten?</td>
</tr>
<tr>
<td>Dat ze nog chique dingen maken van onze oude dingen.</td>
<td>Hoe oud de kinderen zijn die er werken.</td>
</tr>
</tbody>
</table>

Seesaw grid activity.

Curriculum objectives
- Being introduced to reading strategies by modelling: linking to foreknowledge on the subjects, looking back and reading over, checking the comprehension ... (ages 2,5 to 12).
- Learning how to process complex and non-lingual messages adjusted to their interest, daily life and reading level (ages 6 to 9).
- Using reading strategies on initiative of and with help from their teacher: making an outline of the message, checking the comprehension, summarizing ... (ages 6 to 9).
- Processing complex and non-lingual messages adjusted to their interest, daily life and reading level (ages 9 to 12).
- Classifying, connecting or summarizing information (from stories or informative texts retrieved from children's literature, schoolbooks and other media.

Explanation
Pupils use the grid to mark the title and summarize the text in one line. They formulate why they liked the text' information and what they do not know after reading it. These four reading strategies are applied before, during and after the reading. Obviously, the questions can be adapted to focus on other strategies.

Since (comprehensive) reading is crucial for other courses, activities focusing on this skill will be integrated. For example, by combining comprehensive reading and programming in Minecraft.

Growth thanks to the digital portfolio
A portfolio is the ideal instrument for pupils to focus on their learning process. A critical view on their own work to derive strength and points of improvement out of it for both themselves and their peers are crucial 21st century skills. After implementing Seesaw linked to ZILL the Teacher Design Team discovered that the portfolio visualises the learning process of pupils. However, pupils need extra
guidance for self-evaluation and self-reflection. These skills take time to acquire and this process needs to be supported by methods. This led to the conclusion that extra research is needed on how to stimulate and guide this process in Seesaw.

Seesaw provides legion evaluation tools for self-evaluation and peer evaluation. One option is liking products by clicking on the heart. Liking is in itself showing appreciation. Nevertheless, it lacks constructive feedback for the pupil to grow. Combing liking with another evaluation option is better. Young pupils can use the heart to indicate that the task was completed in a correct manner. It is an easy step for pupils of the 1st grade to reflect on their own work and their peers’. The comment option, on the other hand, allows pupils to write down constructive feedback or even record it. Giving the advantage that the assessment or feedback is enclosed under the product. Finally, pupils can add items to their portfolio. They can post photos, videos or notes of their assessment or feedback. The main advantage is the visual approach. However, these elements will be uploaded next to the other assessments instead of underneath the product on which the feedback is given. Obviously, this is no problem when giving a temporary evaluation for multiple assignments over a longer period of time.

Pupils need clear criteria or objectives to complete a useful self-evaluation in Seesaw. This teaches them to assess their performance. In addition, pupils need to have acquired a sufficient vocabulary to formulate tips or points of improvement. The Teacher Design Team developed a couple of methods for this, ranging from simple to more complex. The first tools focus on self-evaluation. Over time self-reflection will be added.

Following examples illustrate this approach. A first example is the medal method. Young children post a photo of themselves posing with a medal when they have mastered a certain skill. The medals function as evaluation criteria, easy for young children. They can not only get a medal for reading ability but also for attitude. Namely, a pupil making less progress can get a medal for practicing on a regular base and proving this in his portfolio.

*Self-evaluation using the medal method.*
The next example uses evaluation matrixes for children. The matrix provides pupils the criteria on which they can assess themselves and their peers. Each criterium can be scored. A template of this evaluation matrix can be added to Seesaw as a template for pupils to fill in. Even more, they can record an extra explanation of their scores.

Self-evaluation by using a matrix.

The last example is the speech bubble method. Expressing constructive feedback is not always that easy for children. They often feel that something went good or not, but they cannot come up with the right words. Choosing the right feedback from a collection of speech bubbles is a great help for them. The teacher provides the speech bubbles in the back of the class or hanging from the wall. Pupils then make a picture with both a yellow and a blue speech bubble. The former states points of improvement, the latter states a strength. Pupils can use this for both self-evaluation as peer evaluation.

Peer evaluation using speech bubbles
By focussing extra on self-evaluation, the Teacher Design Team improves the pupils’ ownership of their learning process. Pupils learn to implement media to assess themselves and others constructively while focussing on growth. The ZILL classifies these competences in the development area ‘moral compass’. This comprises both identity and resilience. Objective Ikid2 concerning identity entails the following: having a positive and realistic self-image; being aware and accepting that people have different talents, options and limitations; discovering how people handle these limitations; knowing and respecting their own limitations; being aware of their own possibilities and limitations and exploring and developing these; enjoying their own growth and development; experiencing the support of others; having a nuanced image of their own strength, characteristics and possibilities; realizing how people differ in talents, possibilities and limitations; realizing how they are different and alike other people; reflecting on their own possibilities and limitations and learning from it; communicating about their own possibilities and limitations. For resilience, the ZILL contains the following objectives: believing with hope and trusting their own living, learning and development power; being aware of their own vulnerability and learning to cope with it; discovering that characteristics and possibilities are not fixed and how they can be developed; seeing possibilities in the limitations; experiencing how people motivate and support one another to grow; allowing others to support and motivate them; experiencing how they can support and motivate others; discovering the importance of people being inner free (Ikvk2).

**Findings**

The Teacher Design Team has focused on the digital reading portfolio’s design since September 2017. The activity collection has been thoroughly tested and will be refined and completed during the rest of the school year. The self-evaluation system has been developed and will be tested during the following months. The team perceives Seesaw and the activities as an easy tool to differentiate. For example, it is easy to choose who needs to read what text without constantly having to copy. Using the recording function on a regular base gives the opportunity for teachers, parents and other care providers (individual counsellors for pupils with extra needs, speech therapists …) to listen along and provide feedback. The feedback is extra helpful since the pupil can listen over and over to the recording with the feedback in mind. Parents are likewise enthusiastic: they can follow their child’s progress easily thanks to the Seesaw app. Moreover, they can make recordings with their child and show this to the teacher.

Tommy Gysenbergs states: ‘I use Seesaw mostly for parents to get to know what letters their children should know and how fluently they can read. The dialogue with the parents resulting from this is the greatest advantage. For example, when I state that a pupil should be reading a little more fluently, parents offer to practice more or explain why the reading is not going so well. I now have valuable conversations which I would not have had without the portfolio since I would not have been able to show parents the reading process in the class.’ Experience shows that parents who find it difficult to come to school, find their way to Seesaw and like their child’s work. Obviously, teachers must be aware that not all of the parents have devices to consult Seesaw.

The advantage of Seesaw activities is that the pupils are constantly being compared to themselves. The focus shifted to the learning process: did I improve? Pupils learn to take a look at themselves on a visual and active way. This is considered to be of great convenience.
Nevertheless, the team is aware of the importance of good preconditions. Sufficient devices and a good functioning network are crucial to be able to work. Ideally at least one tablet per six children is available for them to smoothly upload their materials. The activity choice for each pupil needs to be made with great care. Selection is important as well to ensure the manageability of the product that must be checked.

The future
The Teacher Design Teams will keep on developing, testing and refining the activities and methods stimulating self-evaluation during the schoolyear 2017-2018. Thus, to spread an easy-to-use and enriching concept during a bootcamp for teachers. This will be organised by the research centre of the PXL University College. For further development, check the Tablio Facebook page, #Tablio or @RosiusHanne on Twitter.

References


Bio
Hanne Rosius is course lecturer and Project General Subjects course didactic at the PXL University College, department Education. Furthermore, she works as researcher for the Tablio E+ project.
3 Learning geometry through Geogebra

Age group: 13-18 years old / Level: School / Subject: STEM

3.1 Country of origin

Italy

3.2 Educational analysis

3.3 Description

Introduction

The first Teacher Design Team (TDT) has been organised at Istituto Comprensivo “Giovanni XXIII” placed in Acireale (Italy). It is a school comprehending classes from early childhood until lower secondary education. The school is composed of 8 buildings placed in different places, some of the not really close to the city centre. The school is thus working in different socio-cultural contexts.

The educational and learning offer of the school is based on the analysis of the socio-cultural contest in which the school operates in order to guarantee the wellbeing and learning success of its students. Indeed, the institute believes that the school is a community of continuous and comprehensive learning where the overall wellbeing of the student should be guaranteed. It is really active on counteracting early school leaving at different levels: material, intellectual and motivational. This is the reason why the school promotes the use of alternative teaching techniques including the use of tablet and other ICT devices.

Although the school works in different social and cultural contexts, one of the main aims of the school is to tackle early school leaving and to promote the inclusion of all its students in the learning path. In some areas in which the school operates, along with the parish community, it is the only aggregation centre: thus, it often organises afternoon activities in order to give its students a place where to express themselves and grow by developing their sense of belonging to a broader community and their active participation in their learning and personal growth.

In its work, the school tries to involve as many educational agencies as possible to value people, environment and financial resources of the central government, local authorities and European community. The aim is to involve as many actors as possible in the promotion of new educational methodologies and to tackle the early school leaving and involve as many students as possible in the learning path.
The lower secondary education classes have at their disposals tablets that have been used in these years by teachers and students to foster the inclusion of learners with special needs. The use of tablets and Apps has proven an effective methodology to foster the inclusion of these students as well as students with disability or the ones who were not enough motivated in studying.

**The Teacher Design Team (TDT) work**

The TDT was made up of:

- 1 teacher with a coordinating role within the school. Precisely, she is a *funzione strumentale*, namely teachers supporting the school leader in the organisation and monitoring of activities in given areas. In this case, the teacher involved is supporting in the activities related to the inclusion of students with disability and special learning needs.
- 2 teachers of science and mathematics.
- 1 support teacher, who is a temporary staff and is in the process of becoming a permanent teacher.

The teachers involved were working in lower secondary classes. They all have experience in working with students with disability and/or special learning needs. The majority of them (3 out of 4) have already tested the use of tablets during their lessons and would like to improve their skills in using mobile devices and Apps to create inclusive learning environments.

The group collaborated with TABLIO project and CESIE for the school year 2017-2018 (from September 2017 to June 2018).

The first meeting with the group has been focused on analysing the challenges that teachers wanted to address in their daily work in class. The starting point has been the analysis of the major difficulties they meet in their teaching and which difficulties have students in following the lesson. The reflection has been focused on Mathematics and Science as the teachers involved in the TDT are teaching these subjects.

Teachers pointed out that the first experiments of lessons with the use of tablet have been successful and students are more motivated in studying mathematics. Teachers would like to further develop the use of tablet (e.g., through new Apps) and to develop tools to evaluate progress made by student. The group identified the following challenges:

- One of the major difficulties that students have in the field of mathematics and science is geometry. The use of tablets and Apps (e.g., GeoGebra) in class has positively impact on the students’ competences in solving geometrical problems and on their motivation in following the lesson. In particular, it has proven an effective methodology with students with special needs.
- Need to involve a student with autism during lessons and to create shared moments with the other students.
- Improving the evaluation of the results achieved with the use of tablets and ICT tools. It would be very important to keep track of students’ achievement.

Some remarks from teachers’ experience were:

- Students need **alternative ways to learn mathematics** because it will allow them to be more motivated and learn in an easier way
- Student with autism needs a **support in learning mathematics** because it will allow him to follow lessons with the other classmates
– Teachers need to **develop tools** that will allow them to **evaluate** and keep track of the progress achieved by students through the use of tablet because it will allow them to further improve their work.

According to the context analysis conducted by the teachers and the identified challenges, the TDT started working in class with 20 students from the 3rd year (last year) of the lower secondary school. The aims were:
- Improve students’ motivation in learning mathematics
- Actively involve the student with autism in regular lessons
- Provide 1:1 feedback to students and allow them to see their progresses

Some first ideas on how to address design challenges have been addressed and teachers came up with some possible solution for the design phase:
- To create an on-line portfolio that will allow students to upload the exercises done and their homework and receive feedbacks from teachers. The portfolio will allow teachers to evaluate the progress done by students.
- The student with autism will also have his portfolio and will participate, when possible, to the exercises done by the other students in groups with the monitoring of the support teacher.

The **second meeting** has been conducted almost a month after the first one and teachers during that period have been invited to think about possible solutions for the design challenges. The main idea has been the development of an on-line portfolio to keep track of the students’ results and interact with them online.

The **third meeting** has been conducted a month after the second one and teachers during that period have been invited to start developing activities in class with students combining innovative existing technology on tablet and instructional approaches into new learning scenarios and accompanying learning materials.

They tested the Geogebra App with students during math and geometry lessons. Students also did exercises and evaluation test in open spaces where they have tools and instruments (e.g. the Cartesian plane) dedicated to scientific subjects, so they were able to combine applied approaches, exercises with the use of Apps and tablets.
2 Exercises with the Geogebra App

Outdoor Cartesian plane exercises
By using the tablet and this App as well as others, these students got more confident with the subject and the exercises. In some cases, students with more difficulties became tutor of the others on how to use the App.

The fourth meeting has been conducted almost a month after the third one and teachers during that period worked with students implementing the innovative learning arrangements. In particular, students have been invited to continue working with Tablets for 2 months (April-May) both in class and at home (for those who could use the connection at home) using different tools and programs.
The main purpose of the activities was to use iTunes U to share homework and exercises among students and with teachers.

Assigned Activities:

- To use and study Geometry through the Cartesian Plane (with “Geogebra”)
- To realize a conceptual map with Simple Minds on a specific science topic (tissue)
– To answer questions on the Nervous System (open answers)

Pupils sent the teacher (on the ITunes U platform) the exercises of sciences using the application Pages (text process). Both the exercises of geometry (realized with Geogebra) and the conceptual map made with Simple Minds were sent as images and screenshots.

Example of Conceptual Map realization using App (Simple Minds) and Digital devices
Example of an online test for students

DOMANDE
1) Cosa si intende in biologia per tessuto?
   In biologia per tessuto si intende una struttura di cellule specializzate che svolgono la stessa
   funzione.
2) Quali sono i principali tipi di tessuto?
   I principali tipi di tessuto sono: il tessuto connettivo, il tessuto nervoso, il tessuto epiteliale e
tessuto muscolare.
3) Descrivi il tessuto nervoso, connettivo, epiteliale e muscolare.
   -TESSUTO NERVOSO è formato da neuroni che hanno la capacità di ricevere e trasmettere segnali
elettrici.
   -TESSUTO CONNETTIVO forma le strutture di sostegno del nostro corpo, può essere di vari tipi a
quanto tessuto fanno parte anche il sangue e la lenta.
   -TESSUTO EPITELIALE protegge il corpo e i singoli organi un esempio di epitelio l’epidermide
strato superficiale della nostra pelle.
   -TESSUTO MUSCOLARE è formato da fibre che permettono tutti i movimenti volontari e
involontari del corpo.
Teachers, after introducing the subject of the lesson/exercises (using the interactive whiteboard), uploaded and sent the students specific tasks, exercises and deadlines through the ITunes U virtual class. The support teacher assisted the student with autism during the implementation period (connection to the virtual class, typing and, in general, the realization of the various activities and exercises).

**Methodology and group strategies**
Students, included the pupil with autism, were grouped in islands of 4/5 members collaborating actively in laboratory classes. The formation of the groups depended on the kind of activities, subjects, students’ inclinations and always guaranteed cooperation and socialization among students because the groups have been mixed several times.

**Timing**
The virtual class has been tested from April 2018 (IPad delivery) until May 2018 (IPad return).
- Activities assigned for home had a limited time of 7 days.
- Activities assigned in class had a maximum time of two hours.
Evaluation methodology
- Individual (1-1) online revision between teacher and student
- Collective revision in class (the teacher shows all the correct exercises to the class through the interactive whiteboard).

Conclusions
The work of the TDT followed the ADDIE-method in an iterative process where Analysis, Design, Development, Implementation and Evaluation (optimisation of the design) go hand-in-hand. Each new pedagogical arrangement has been designed following the design-principles, described following the design-templates and evaluated following the evaluation-criteria. Teachers were also interviewed, documents and tools were analysed, class observations were done and video reports were made. At the beginning of the TDT work have been set with teachers clear goals and objectives; the monitoring process covered all the implementing period (from analysis to evaluation) and at the end teachers were able to demonstrate that all the fixed objectives and expected results were reached. Indeed, the activities realized in class have been very useful for both the TDT and students.

The TDT reached the following results:
- Increased use of Tablet and Digital devices in class.
- Developed tools to evaluate progress made by students.
- Involvement of students with disabilities and/or learning difficulties in regular lessons.
- Alternative teaching and learning methodologies used in class.
- Improved students’ motivation and participation in class.
- Online portfolio/virtual classes tested and used in class (Fidenia, ITunes U).

At the end of the school year, teachers and students filled out an evaluation form, provided by the TABLIO team, in order to investigate the effect/impact of the activities as well as teachers’ and students’ satisfaction at different levels. The TDT underlines the great result of the activities in terms of differentiation and inclusion in class, especially for the student with the autism spectrum disorder: students with lower learning problems helps those who need particular support (peer support and tutoring among students). The student with autism show a big interest in working and studying with Tablets and a high level of participation and inclusion in class. The use of tablets in class had also a great impact on students’ motivation, inclusion and participation. They showed a great interest in studying with tablets and differentiating their learning process at school.
4 Innovative approaches for learning Science and Literature at school

Age group: 13-18 years old / Level: School / Subject: STEM and Languages

4.1 Country of origin

Italy

4.2 Educational analysis

4.3 Description

Introduction

The second Teacher Design Team (TDT) has been organized at the Istituto Superiore “Duca Abruzzi-Libero Grassi”, placed in Palermo. The school begins its institutional journey on 1st September 2013, following the sizing of the Institute Surveyor and Tourism "Duca Abruzzi" and the Commercial Technical Institute "Libero Grassi ".

Currently the school is divided into two buildings:
- the "Duca Abruzzi" located in via Fazio 1;
- the "Libero Grassi", located in Viale del Fante 70/c.

Based on the Reorganization of Technical Institutes and High Schools (DPR No. 88 and 89 of March 15th 2010) the Institute has activated the following fields of study:
- Scientific high school (Traditional address; Applied Sciences address),
- Technical address - Administration, Finance and Marketing,
- Tourism,
- Technical address - Construction, Environment and Territory.

The main goal of the school is to train people who:
- are open to the cultural and economic reality in which we live, ready and competent to intervene on it and contribute concretely to its development;
- are aware of the European dimension of their cultural growth process and social skills and have the skills to access all development opportunities personal and professional at international level;
have built a mental attitude mutual aid, solidarity, integration, mutual understanding, respect, tolerance and dialogue.

The school, therefore, offers a context in which learning and learning needs can be answered, inspired from the principles of inclusive education.

Attention to the individual that characterizes the didactic and training approach of our Institute is essential for students with disabilities, with disorders specific learning needs or with special educational needs.

**The Teacher Design Team (TDT) work**

The TDT was made up of:
- 1 teacher of Science
- 1 teacher of Mathematics (expert in digital didactics and e-learning)
- 1 teacher of History and Literature

All the TDT members are working in High secondary School and they involved the same students of the 4B LS-Scientific High School class, in which they intervened, starting from their learning and inclusion needs/problems.

The group collaborated with TABLIO project and CESIE starting from 2017 and for the school year 2018-2019 (from September to December 2018).

The **first meeting** with the group has been focused on analysing the challenges that teachers wanted to address in their daily work in class. The starting point has been the analysis of the major difficulties they meet in their teaching and which difficulties have students in following the lessons. The reflection started from the class contexts and has been focused on Mathematics, Science, Economics and Valuation as the teachers involved in the TDT are teaching these subjects.

Teachers pointed out that the first experiments of lessons using software online or app have been successful, and students were more motivated in studying that subjects (e.g. Chemistry). Teachers wanted to develop the usage of tablet (e.g., through new Apps and software online) and to develop tools to evaluate progress made by student.

The group identified the following challenges:
- Inclusion of a foreign student with linguistic obstacles (oral production, written production, comprehension) and relationship problems.
- Inclusion of a student with a difficult family background and learning obstacles.
- Need to stress on group-class cohesion.
- Need to involve students that are lacking of constructive learning methodologies.
- Evaluation of the class results using tablets and ICT tools.

Some remarks from teachers’ experience were:
- Students need alternative ways to learn mathematics, literature, history and science because it will allow them to be more motivated and learn in an easier way.
- Students with linguistic and socio-cultural problems need a **learning support** because it will allow them to follow lessons and be included with the rest of the class.
- Teachers need to **test new approaches and tools** in class with tablet in order to increase students’ participation and achieve better results.

According to the context analysis conducted by the teachers and the identified challenges, the TDT started working in class with 20 students (7 girls and 13 boys) attending the 4B LS-Scientific High School class. The class group is, on the whole, compact and close-knit, interested in the didactical activities and supported by a good method of study. Participation in the various activities is adequate and does
not require particular recalls. There are no extreme disciplinary problems, but emerges the need to consolidate the method of study that, for some students, is still mnemonic and not very autonomous. One foreign student presents some linguistic problems in terms of comprehension and inclusion in class.

The aims were:

− Improve students’ motivation in learning mathematics, literature, history and science.
− Actively involve the student with linguistic obstacles in regular lessons.
− Develop an atmosphere of cooperation among students.
− Create a stronger cohesion.
− Establish a friendly competition among students.
− Improve learning motivation.

Some first ideas on how to address design challenges have been addressed and teachers came up with some possible resources and solutions for the design phase:

- To work with students through laboratory methodology/approaches/techniques.
- To improve active participation in class and at home through tutoring and mentoring support.
- To facilitate students’ learning development through ICT resources (tablet, online platforms -> e.g. Edmodo weschool, online software -> e.g. Socrative and apps ->e.g. Kahoot!, Quizlet, Cmap).

The TDT group met the Project Manager on September 2018 for a second meeting after the beginning of the school year. During this meeting, they were invited to think about possible solutions for the identified challenges and to share the outcomes of the reflections on possible solutions.

The third meeting has been organized a month after the second one and teachers during that period have been invited to start developing activities in class with students combining innovative existing technology on tablet and instructional approaches into new learning scenarios and accompanying learning materials.

From November 2018 the TDT group started the implementation of the activities with the students in classroom, within the 4 following pedagogical arrangements.

1st pedagogical arrangement: New approaches to Science

Kahoot!

Through training in groups of 4/5 people, students start preparing different Kahoot! on the chemical nomenclature and they share them with the rest of the class, on order to assess different levels of complexity.

Moreover, through this platform, the students had the chance to do the quizzes created by the teacher with Kahoot!.
Specific Apps

“Acidi, ioni e sali inorganici” (Acids, ions and inorganic salts)
The app named “Acidi, ioni e sali inorganici” (Acids, ions and inorganic salts) has been used for the review of the names and formulas of all of the most important inorganic acids, polyatomic ions and the relative salts. After the installation of the app on the tablets supplied to the school by CESIE, it has been used for a quick review through group work.

Socrative
Socrative is a web platform that allows to create online quizzes, tests and surveys. It can be used on any tablet, Smartphone, computer and laptop. The teacher accesses Socrative through his/her account, creates the tests and gives it to the students. From their devices, the students log in with their account and do the test prepared by the teacher. The teacher can follow the ongoing work of the students on his/her device and get the results in real time, and in graphical form. You can find different kind of questions: multiple choices questions, true-or-false questions or with short open answers.

The test was prepared by the teacher with the support of different images. This function is very useful because most of the test involved the recognition of animal tissues and their description: this action requires clear and colourful images.

Students had the possibility to use their smartphones, tablets or their PCs. The timing of the test was established by the teacher who could have decided to stop it at any time. The students were always very concentrated, more than when they do traditional tests. They did not tend to distract because the questions can be given in random order as well as the answers. At the end of the test, for each student, the software processed a pdf file with the automatically correct questions and answers.
For the questions with open answers, the teacher proceeded with the traditional correction. Then, the final data are reported by the teacher on a spreadsheet to get the students’ marks. At the end, all the material is sent to the students through the virtual classroom and after having uploaded their marks on the school's platform, ARGO.

**EDMODO**

Edmodo is a social network designed to interact with the class outside the school walls. Called the “School’s FACEBOOK”, it offers the teacher the possibility to create tests for the class, to post videotutorial or general information.

Through this platform, the teacher creates a "group" (which usually has the name of the class) and invites the students through a shared a password. Within the group, the communication can be “many-to-many” (the teacher with everybody or a student with everybody) or “discreet”, between teacher and student. The students already knew the platform so the teacher created a sub-group named TABLIO.

The Edmodo platform was used for the exchange of educational material. In this case, through a link students can access to an online test on the nomenclature of inorganic compounds, or to a solved and commented exercises. Also, the platform was useful for the administration of short training tests to test the students’ educational improvements.

Specifically, the test was created with some exercises related to the calculation of oxidation numbers. The students’ answers were sent to the teacher through the EDMODO platform. Then, the teacher sent the correct tests with some comments to the students, whom could reply through a chat. At the end, the teacher created individual assessments.

**EDPUZZLE**

EdPuzzle is a free platform that allows to create multimedia lessons using videos as learning tools. With Edpuzzle you can search and select a video on multiple specialized websites (YouTube, Vimeo, Khan Academy, National Geographic ...) or upload your own, cut the portion you are interested in, add an audio, insert a voice annotation upon a specific part of the video, to propose different kind of quizzes in some points of the video and to give the edited video to the students.

For this class, was chosen a video from YouTube where was explained the nomenclature of the ternary salts. Through EdPuzzle, the teacher created short questions to put in some points of the video, indicated with green placeholders.

At the end, the students had the opportunity to evaluate their answers and to review them watching the video. The link to the video was shared with the class using the Edmodo platform.

**2nd pedagogical arrangement: The project “Billy e la scuola” (Billy and the School)**

The project aimed at creating a virtual exchange of literature and reading knowledge between the Facebook group “Billy, il vizio di leggere” (formed by readers) and the students of the class 4B LS. Starting from the suggestion of a book, the group members and students have read the same text for a month. During this period, they had four online meetings in which they could talk together trying to come up with useful elements for the understanding of the plot. The students were able to interact with a group of readers.

The books have been suggested by the members of the Facebook group and selected by the students. At the end of the project, students had the opportunity to write a small article about their experience, which has been published into the local journal "La Repubblica-Palermo".
The selected book of the project was “Il bambino che disegnava parole”, a romance about dyslexia. Students had the possibility to communicate both with the Facebook group members and with the author of the book.

This kind of interactive activity was very useful and stimulating for students who could share their opinions about the thematic of the book with adults. On the other hand, adults had the chance to think about their approach to the thematic and to understand better students’ needs.

Thanks to this project, the use of smartphone and social networks has been promoted during regular lessons in class. Paper and virtual words were mixed with the aim to promote the social networks as didactical tools for the involvement and inclusion of all the students. They worked in mixed groups to overcome any kind of barrier (linguistic, mental, etc.).

The teacher is trying to continue this learning approach, organising virtual meeting on Skype with students and journalists/authors.

**Liber Liber**

In addition to this activity, the class has been studying history (in particular history of law) using the platform Liber Liber (www.liberliber.it) where students and teachers can download Books, Audiobooks, Music and Videos.

The members of the class have a mini library in their smartphones, where they have been reading and studying different books, Classics, texts and resources.

Some materials read: *Dei delitti e delle pene* - Cesare Beccaria; *Viaggio in Italia* - W. Goethe; Universal Declaration of Human Rights; Constitutions.

**3rd pedagogical arrangement: The project “Nei panni dell’altro”**

The project “Nei panni dell’altro” saw the participation of the students in a theatrical workshop run by the director Preziosa Salatino. The methodology used by the workshop called “the theater of the oppressed” has a strong pedagogical value.

The students of the class 4BLS used their smartphones to interview professors, students and family members about the immigration topic. Once in the classroom, in a circle time setting, they placed a
speaker in the middle of the circle, with all their devices connected via Bluetooth. Everyone has listened to the interviews recorded and at the end they opened up a debate about the results.

The mentioned records have been shared on a WhatsApp group from where the students together with the teacher will select the soundtrack for a theatrical show that will be broadcast at school in February.

![Students working on a project](image)

**Students work within the project "Nei panni dell’altro"**

**4th pedagogical arrangement: The project “MOODLE”**

The project involves the use of MOODLE, an e-learning platform built up by the Institute, which can be activated from the Institute's homepage or directly on the website of the teacher. The platform aims at:

- the review of the topics managed in classroom for all the students
- the study of the topics treated in class for absent pupils
- Training tests
- “Flipped classroom” activities

The pictures below show an example of this last activity. Through their devices (tablet or smartphone), the students analyse the materials prepared by the teacher in the classroom or at home and they take notes about their doubts. Once in the classroom, the teacher clarifies and does exercises, individually and/or in groups with the students.
Methodology and group strategies
Students mainly worked in groups collaborating actively in classes. The formation of the groups was based on the kind of activities, subjects, students’ inclinations and always guaranteed cooperation and socialization among students because the groups have been mixed several times.

Timing
The class has been involved in the activities of the project from September 2018 until December 2018, during the first trimester of the school year 2018-2019.

Evaluation methodology
- Individual (1-1) online revision between teacher and student.
- Collective revision in class (the teacher shows all the correct exercises to the class through the interactive whiteboard).

Conclusions
The work of the TDT followed the ADDIE-method in an interactive process where Analysis, Design, Development, Implementation and Evaluation (optimisation of the design) go hand-in-hand. Each new pedagogical arrangement has been designed following the design principles, described following the design-templates and evaluated following the evaluation criteria. Teachers were also interviewed, documents and tools were analysed, class observations were done and video reports were made. At the beginning of the TDT work have been set with teachers clear goals and objectives. The monitoring process covered all the implementing period (from analysis to evaluation) and at the end teachers were able to demonstrate that all the fixed objectives and expected results were reached. Indeed, the activities realized in class have been very useful for both the TDT and students.
The TDT reached the following results:

- Increased use of tablet and digital devices in class.
- Developed tools to evaluate progress made by students.
- Involvement of students with linguistic and socio-cultural obstacles and/or learning difficulties in regular lessons.
- Alternative teaching and learning methodologies used in class.
- Improved students’ motivation and participation in class.
- Virtual classes/apps tested and used in class.
- Learning improvement on scientific subjects through the use of the apps as: *Kahoot!*, *EDMODO* and *Socrative*.
- Improvement in text comprehension through the participation of the students at the project "*Billy e la scuola*" (*Billy and the school*)
- Improvement in the study of history and history of law through the *Liber Liber* platform.

At the end of the school year, teachers and students filled out an evaluation form, provided by the TABLIO team, in order to investigate the effect/impact of the activities as well as teachers’ and students’ satisfaction at different levels. The TDT underlines the great result of the activities in terms of differentiation and inclusion in class.

According to the responses of the questionnaires made by the students, they were satisfied with the activities performed with the tablet and other devices in the classroom, and they believe that this project has brought good results for their educational path.

Furthermore, this project has implemented the inclusion of those students with learning difficulties and encouraged greater collaboration among classmates. The activity that was most followed and appreciated from the students was the use of "*Kahoot!*".

Generally, they showed a great interest in studying with tablets and differentiating their learning process at school.
5 Mobile Devices for Literacy & Maths Education

Age Group: 13-18 years old / Level: Classroom / Subject: Languages & STEM

5.1 Country of origin

Northern-Ireland (UK)

5.2 Educational analysis

![Educational differentiation diagram]

5.3 Description

**Introduction**

This text describes the use of a Teacher Design Team (TDT) to explore the application of mobile devices in assisting teaching and learning at North West Regional College (NWRC), in Derry, Northern Ireland. The College has five main campuses, spread across one city and two towns. There are a large number of out-centres, often community centres, spread out across the north west of Northern Ireland, where part-time courses are delivered, during the day and in evenings.

NWRC is a College of Further and Higher Education. This means that it provides courses for:

- students aged 14-16 from local secondary schools, and
- full-time and part-time students aged 16 and over doing courses from level 1 to level 6 (degree).

In recent years the College’s enrolment numbers have averaged 3400 full-time and 14000 part-time students. This includes groups of students who attend from local secondary schools, typically aged between fourteen and sixteen, who undertake what are essentially introductions to vocational areas that the schools do not offer.

The College’s students come from a very wide range of educational backgrounds and pursue a wide range of subjects at a range of levels. Many courses are vocational, aiming at specific employment routes. Other courses aim to lead to further study, with a lot of the students going straight from the College to university.

Where a student enters a course without having GCSE passes in English and Mathematics, the government requires the College to enrol them on Essential Skills Literacy and Numeracy respectively.
The students are required to gain Passes at level 2 in these, which is equivalent to GCSE Grade Cs (pass). This can be quite a challenge, given that they were not able to achieve this level after five years at secondary school.

The College has been supporting learning through technology since approximately 2001. This has meant that over the years all full-time and part-time courses have course materials and some exercise made available to learners from an online platform (LMS).

Over the past five years NWRC has had an increasing focus on use of mobile devices. Initially this involved making Wi-Fi available outside classes, for students to access the LMS or Web. Over the past three years use of mobiles has extended to use during classroom sessions, to:

- add variety to classroom activities
- engage learners, including those who are too shy to orally participate, also those who may be somewhat disinterested
- take advantage of some excellent apps that are available for tablets and smartphones, and
- provide more opportunities for students to progress at their own pace.

Access to mobile devices initially came from the College’s provision of a number of suites of iPads. There was a fear that encouraging students to use their own smartphones in class opened the potential of misuse, with possible unknown taking of photographs and subsequent potential for bullying.

Over the past one or two years many staff are more comfortable to have students use their own smartphones in class. This has happened due to a realisation that planned and managed use can greatly add to the vibrancy of classroom sessions and that protocols established and agreed with students allows expectation of disciplined and effective use of mobile technologies as a normal element of classroom activity.

**Elements of the Case Study**

The study and solution was based on a group of students, many of whom were required to complete a numeracy/Mathematics unit, with a significant overlap of the group also required to complete a literacy/English unit. The target was “how might we improve achievement of learning outcomes in performance in GH’s Literacy (English) and Numeracy (Mathematics) classes by increasing engagement of all learners”.

There are many challenges with teaching this class, the most significant being:

- there is a wide range of abilities, so preparing a single collection of work for them to do is difficult as specific class notes and practice exercises needs to suit the spectrum of ability, motivation and behaviour
- getting the class as a group to pay attention is difficult.

GH manages his class by:

- as much as possible having desks arranged in a circle, so he can have constant ability to scan faces so he can keep their attention, and the focus on him. He will ask questions, selecting a student at random. This means that they have to keep attention as they are aware the he may ask a question suddenly, and
- using a wireless mouse so that the IT display can be manipulated without him having to get up from his seat.
Additional Contextual Information
In the Derry area there is a declining demographic in the numbers of young people from which the College would typically draw students. As schools and the College are funded based on numbers of individual students, this has meant over recent years local schools have been working very hard at keeping their pupils after compulsory attendance age. A consequence of this is that in some course areas the College has an increasing challenge in attracting students.

The Teacher Design Team (TDT)
The TDT consisted of:
- GH – the teacher. He is very experienced in teaching Mathematics and English, with a particular expertise in working with groups who have low levels of achievement in Literacy and Numeracy, variants of Maths and English
- EOS – leads support for teacher excellence/education, with a particular responsibility for each year’s new teachers, providing a structured training course for them, along with one-to-one mentoring, and a developer/deliverer of recognised qualifications in innovation in teaching
- MP – local project manager, learning technologist
- SC – learning technologist.

The TDT
MP was required, sometime after the TDT had been working, to take over the role of learning technologist as SC became unavailable over a prolonged period. MP had a background in learning technology, and had significant knowledge of the project, so was able to undertake the project activities.
As the project progressed there were inputs from a group of new teachers, with whom EOS and MP worked on a regular basis. This was a group of staff who were undertaking a College course for newly appointed teachers.

**The Solutions**

Planning for the solution to the issues relevant to this case study took consideration of both pedagogical and technical design principles. In particular, consideration was given to:

- Awareness of differences in the group and the need to be student-centred defined the solution
- The learning materials used were varied, given the varied differences in the group
- This included branching to more complex content to challenge the more able
- The task design reflected the coaching approach of the teacher, who sought to help the students to be better at managing their time, deal with adversity and work with their classmates for mutual benefit time
- Feedback was aimed generally to be quick and precise, to provide encouragement and direction
- Depending on the tasks given, GH aimed to have opportunities for product differentiation to create the possibility for some to stretch their performances
- There was a real effort to use the widely different characteristics of the students to design the specifics for activities that each would undertake.
- The SPACIER principles were adapted as a guide to the way that tools and technologies were selected and applied to the solution, including:
  - Using commonly available, modern apps, that can run on the widest range of technical platforms/devices
  - Apps tended to be free, or have free versions (might not have all the functions of the paid for options)
  - Whilst all students involved did have their own smartphone, the College supplied pre-charged tablets, with relevant apps installed, so that reliability of working during the class session was guaranteed
  - Guidelines were given about protocol for use of tablets, so that for example, when issuing instructions on what to do, students had the tablets face-down on the desk, so were listening to GH and not distracted by the tablets.

The TDT meetings at the outset focussed on identifying the issues for the target group of students. GH explained in detail who the members of the class were, their learning backgrounds and some of the challenges he experienced in working with them.

At the next meeting MP and SC did some demonstrations of tools that they believed should be considered. These aimed to:

- Provide learning materials in a range of formats, allowing mixed media and having opportunities for interactivity
- Allow for progress through the material to be either teacher or student-paced, so that the able could go on ahead, and others that needed more time could get that time
- Provide sufficient practice exercises, of increasing difficulty, so that those who were able to complete exercises quickly would have enough examples to do so they were challenged. Also, simply that they were kept busy and consequently kept interested in the classroom task
- Allow discreet responses to questions posed
- Allow presentation from seated positions, for a student who had a significant aversion to standing up and presenting.
The TDT decided that there would be very valuable opportunities to do some work with the literacy and numeracy elements. The two groups are not completely the same, but there most of the students involved were in the same.

**Literacy Solutions**

A total of two class sessions were designed to cover literacy classes, focussing on the production of formal letters and basics of punctuation and capitalisation. Following the meetings to investigate the nature of issues in delivering literacy classes to the group of students, the tools and resources identified below were part of the solution.

Before getting into the specific formal lessons, on two occasions the students were given the tablets in class to:

- Get familiar with connecting to the WiFi, and
- To try out the mirroring tool, which was AirServer.

**The student group**

These preparations were done so that when the time came to do the actual lessons, achievement of the learning objectives wouldn’t be hindered on inability to use the technical resources, so the focus was completely on the curriculum issues.

For a lesson on basic punctuation there were a number of pre-prepared digital learning resources and individual ad hoc or pre-prepared questions/activities; a basic version for the class and some amended materials for individuals. The learning resources were bought in by the College and had some modifications, which were done with Articulate Storyline.

The group decided to use Nearpod as the delivery platform as it:

- Allows a lesson to be constructed where resources can be used in a linear manner, but
- Facilitates the inclusion of either additional materials to stretch those who are capable of the basics, and
- Allows one to add supplementary material for those who are having difficulty with basic content.

Nearpod means that students have the lesson’s digital contents to be delivered to a device (tablet) they are in possession of. This has a number of advantages, in particular that the attention of the student can be held as, by careful design of activities, the teacher can intersperse subject matter with activities. For example, in dealing with commas, G was able to show examples of where they should
be used, and some incorrect use. He then followed up with activities where the students had example sentences and to indicate where commas should be placed.

Using the Gold account, which we did for a period, meant that the content could be both student and teacher driven. In the case of the latter, the teacher manages progress of the lesson. The value of the former is that students can decide when to move through the learning materials and activities, allowing them to move at their own pace.

G’s lessons were designed where he had some materials that involved him leading, followed by other resources where the student moved through materials at their own pace. During these elements he moved through the class checking if people had any issues with which they wanted help. This also allowed him to gauge where he needed to address elements of the content that was covered.

Nearpod also allowed the teacher to add, in an ad hoc manner, real-time created questions or activities. An example would be that there when there was some confusion about an example given, G added, in real-time, another similar example, just to see if the students were able to handle an unexpected issue or query about part of the teaching material as it was being delivered, the teacher can straight away send an additional question/activity to the students, via Nearpod and appearing on the tablets, requiring students to consider the issue and provide an answer. The answer could be given orally, or if desired sent back electronically.

We also found that Nearpod allows discretion when responses are made by students, you (the teacher) can chose to show the identity of responders, or keep that undisclosed.

The learning materials added to Nearpod consisted of:

a) a Learning Object, available online here, covering Capitals, commas and full stops, sample screens in figs 1, 2 and 3 below.
b) 8 pieces of exercise material, created by the teacher GH as simple Nearpod slides, where the students had to suggest placement of punctuation

c) 2 of the examples were concerned with the use of capitals. Students were asked to volunteer display of their responses from their tablet, through Nearpod

d) Where questions are asked by a Nearpod function, there is the facility that allows the teacher to decide whether or not to share the individual response with the class see image below.
The second literacy example was a class that dealt with writing letters. The resources used here were delivered through Nearpod, and consisted of:

- A short video from BBC Skillwise, see fig 4 below
- A series of samples from GH, displayed on tablets using Nearpod and discussed
- A quiz from BBC Skillwise, on format of elements of letters, with 3 levels of quiz to allow those who found the task easy to attempt more challenging examples.

![fig 4](bbc.co.uk/skillwise/topic/writing-a-letter)
The students finished up by having to write a letter on their tablet, based on an instruction provided by GH, and were given the option to display it to the class. This was done using AirServer, which provides casting, also known as device mirroring, where a device's screen content is replicated on a PC, which, as it is connected to the classroom’s data projector, meant that the student’s tablet screen was shown to the class. Two students showed their work and explained the rationale for the letter structure and content that they had used.

**Numeracy Solution**

The numeracy example was an introduction to percentages. Similar to the Literacy examples this consisted of using Nearpod to create a lesson with digital resources, including:

- A short video about fractions that explains why they are important to everybody – from BBC Skillwise see fig 6 below
- Instructional material from www.MyMaths.co.uk, see fig 7 below
- 3 samples of practice calculations for GH to work out with the students
- Students to complete a series of practice questions, taken from MyMaths, using the Online Homework function. (this doesn’t mean the work has to be undertaken outside class, as a home work, rather the broader definition of homework applies, as in practice exercises one takes on one’s own).
The online homework is a way of allocating some pre-set practice exercises to a defined group of student users. The teacher allocated 2 separate homeworks exercises on percentages to the group, to be done in class. The instruction was to all complete the first exercise/homework, and if finished continued to the second one, with a hyperlink to it.

This meant that the able students had enough work to keep them busy. One of the strengths of MyMaths is that with the homeworks, there is the facility to set individualised work to suit student’s strength. Results of work completed are available by question and group of questions. (Mymaths has been around as an online mathematics teaching and learning resource PC-based, using Flash as one
of the underlying technologies. In recent years much of the content has been re-engineered so that it no longer needs Flash, so is usable on tablet devices.)

The students were given 20 minutes to complete the exercise(s). At the end of that time 60% of the student had finished homework 1, 27% hadn’t completed, and 18% had got half way through homework 2.

GH went over the homework 1 questions in class, asking the students to volunteer to explain the answers, or cast their solution to the group.

Having the tablets available in class allowed each student to:

- go through the work at their own pace
- show GH, and class colleagues if they wished, what they we working on, explain the steps to complete an example, getting valuable feedback, and affirmation when correct
- the ability to jump back to examples and theory if stuck with an example.

MyMaths Homework

![MyMaths Homework](image)

<table>
<thead>
<tr>
<th>Question</th>
<th>Mark</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 – Fraction and percentage equivalents</td>
<td>( \frac{3}{5} )</td>
<td>60%</td>
</tr>
<tr>
<td>Q2 – Comparing fractions and percentages</td>
<td>( \frac{7}{8} )</td>
<td>88%</td>
</tr>
<tr>
<td>Overall</td>
<td>( \frac{10}{13} )</td>
<td>77%</td>
</tr>
</tbody>
</table>

Click the Practice button if you want to try this homework task again.

Close the page if you are happy with your score.
6 Using problem based learning to develop coding skills and spatial awareness

Age Group: 6-12 years old / Level: Classroom / Subject: STEM

6.1 Country of origin
Northern-Ireland (UK)

6.2 Educational analysis

<table>
<thead>
<tr>
<th>Good practice</th>
<th>Coding skills and Spatial awareness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Educational differentiation</strong></td>
<td></td>
</tr>
<tr>
<td>Learner oriented</td>
<td>Teacher oriented</td>
</tr>
<tr>
<td>Readiness</td>
<td>Interest</td>
</tr>
<tr>
<td><strong>Structural differentiation</strong></td>
<td></td>
</tr>
<tr>
<td>Macro</td>
<td>Meso</td>
</tr>
</tbody>
</table>

6.3 Description

The School
St. Conor’s is a Catholic Maintained Primary School situated on the outskirts of Omagh. Pupils attending this vibrant and progressive school come from the neighbouring housing estates as well as others parts of Omagh, Killyclogher and surrounding areas.

Aims For The Pupils
St. Conor’s Primary School promotes high achievement and learning for life by working with children to:

- develop spiritually, socially, emotionally, physically and academically to the best of their ability.
- develop enquiring minds and a spirit of curiosity;
- become motivated, life-long learners;
- achieve high standards across the curriculum;
- be flexible and adaptable for the modern world;
- have high self-esteem and self-confidence-respecting themselves, others and the environment;
- be able to work both independently and collaboratively.

Mission Statement for the school:
We believe in St. Conor’s that each child will succeed through experiencing quality in:
– an ethos which fosters the spiritual, moral and religious growth of the children, based on the teachings of the Catholic Church.
– a broad and challenging curriculum;
– quality learning and teaching within an ethos of support, challenge and encouragement to succeed;
– a stimulating learning environment with a rich, varied and up-to-date range of learning resources;
– an enriching programme of extra-curricular activities and educational visits;
– learning partnerships between home, school and the wider community;
– a positive, disciplined environment with high expectations for both learning and behaviour.

The Team
– Mr Gary McCrory: Vice Principal; Primary School Teacher.
– Mr Kieran McCartney: Staff Tutor (The Open University); Lecturer (North West Regional College)
– Mrs Maeve McMahon: Primary School Teacher
– Mrs Rhona McCain: Primary School Teacher

The Research Question
How can students develop their skills in coding and spatial awareness?

Methodology
The group collaborated with TABLIO project and NWRC starting from 2017 and for the school year 2017-2018.

What is in the curriculum?
Prior to making any decisions regarding an intervention that would be used to enable the development of spatial awareness as well as develop coding skills the team decided to review the current curriculum. Part of this review involved exploring how developing spatial awareness and computer coding skills could be incorporated into the existing curricula.

As they move up the levels, pupils begin to solve more complex problems and/or create interactive programs, for example using embedded procedures in Logo or designing and creating a game using Scratch. This progression is outlined in the Northern Ireland Curriculum key stages 1 and 2, below.
Interactive Design

Based upon this curriculum, students who leave the primary school in year 7 should have accomplished Level for on the above curriculum and ideally Level 5.

An interactive Design was used where pupils enter instructions or commands to solve problems. At the lower levels, they control devices such as Bee-Bot and explore digital environments such as Logo and Scratch. The intention was that within lower levels of the school i.e. primary is 1, 2 and 3, students could use Bee-Bot to enable a mechanically operated device to traverse along a grid shaped map that was placed on the ground.

Students were asked to map out a route along a colour-coded strip. Following this, students would programme the bee-bot to follow the route that they had planned. Initially, the route was basic and involved moving between different colours on a straight line. However, as the activity progressed differentiation was facilitated by providing more complex maps that the students would get the Bee-Bot to traverse using more complex codes. In the following page a 1st draft of the lesson plan is outlined. Following this figure is 1 to 4 provide a pictorial diary of the progression students demonstrated when using the Bee-Bot to develop spatial awareness using coding in straight lines and then within a more complex topographical map.
**First Draft**

A 1st draft of the lesson plan is outlined, below. This was conducted with primary one children aged between 4 and 5 years of age.

**St Conor’s Primary School & Nursery Unit**

**Using ICT Planner – Summer 1**

<table>
<thead>
<tr>
<th>Year: 1</th>
<th>Task Title: N/A (if applicable)</th>
<th>ICT Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Level:</strong> working towards Level 1</td>
<td>Curricular Activities and T.S.P.C.</td>
<td></td>
</tr>
<tr>
<td><strong>Context/Topic:</strong></td>
<td>• Follow directions in relation to a task (MI)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Talk about what they are doing and what they have learned (SM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Show ability to memorise by recalling and restructuring experiences and stories (TPSDM)</td>
<td></td>
</tr>
</tbody>
</table>

**Using ICT Learning Opportunities**

**INTERACTIVE DESIGN**

- Introduce and familiarize the children with the Bee Bot- talk about and explore all the commands on his back- restrict him to backwards and forwards, with adult support. (WO)
- Programme Bee Bot to find topic related pictures. (WO)

**Explore**

- Switch Beebot on and off
- Make Beebot move forwards and backwards independently
- Clear Beebot memory

**Exchange**

- Begin to understand how ICT can be used to communicate

**Evaluate**

- Talk about work I completed using UICT, beginning to use relevant UICT language.

**Resources:**

- Old Mobile Phones
- Old laptops
- IWB
Evaluation Of The First Draft
A review of the 1st draft of the work that was focused upon primary is 1, 2 and 3 revealed that:

− Students awareness of coding and using technological devices exceeded that of the curriculum.
− The use of coding in combination with a strategy to enable spatial awareness using the bee-bot was viewed as a fun activity.

Second draft
A 2nd draft of the initial lesson was then prepared for primary 3 children. These children, aged between 6 and 7 years of age, used scratch Jr to code movements across a map. The map was contained within an iPad.
<table>
<thead>
<tr>
<th>Task Title: Animating with Scratch Junior Curricular Activities</th>
<th>ICT Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INTERACTIVE DESIGN</strong></td>
<td>Explore</td>
</tr>
<tr>
<td>Pupils will use Scratch Junior to make a sprite move in different directions and add a background</td>
<td>• Investigate, solve problems and make simple predictions</td>
</tr>
<tr>
<td>Pupils will be able to:</td>
<td>Express</td>
</tr>
<tr>
<td>• choose a suitable background relevant to the topic</td>
<td>• Create, develop, present and publish ideas responsibly using digital media source</td>
</tr>
<tr>
<td>• choose a sprite</td>
<td>Evaluate</td>
</tr>
<tr>
<td>• change the colour and size of the sprite</td>
<td>• talk about, review and make improvements to their work</td>
</tr>
<tr>
<td>• make the sprite move in different directions</td>
<td>Exhibit</td>
</tr>
<tr>
<td>• work with a partner to talk about how to improve their piece of work</td>
<td>• manage their saved work</td>
</tr>
<tr>
<td>• save their work</td>
<td></td>
</tr>
</tbody>
</table>

**Context/Topic:** T.S.P.C (SM) Talk about what they are doing and what they have learned

**Literacy**
- Talk about their work and what might happen when different codes are used

**WAU**
- Minibeasts

**Numeracy**
- Making predictions
- Problem solving
- Programming

**Resources:**
- iPads
- Scratch Junior App
Using Scratch Junior in Year 3

In Year 3 we can locate Scratch Junior on the ipad. When we open the application, we begin by discussing which would be an appropriate background for the topic we are working on in World Around Us, ie. ‘Minibeasts.’

We agree on and select a background that shows basic and is that were where a minibeasts habitat.
We browse through the different sprites that are available and choose one to begin with.

If the sprite we want to use is not there, we can draw and colour our own.
We are also able to change the size and colour of all existing sprites.

We can then insert the sprite(s) into our chosen background and adjust their size if necessary.
We are now ready to begin building a code for each sprite using the blocks. This will enable them to move in different directions and at different speeds.
Once we have finished the code for each sprite, we are ready to play our presentation. We have the opportunity to show it to our peers and talk about our work. We can edit and make improvements if we need to. When we are finished with our final piece, we can save it in our documents folder.

**Evaluation Of The Second Design**

Similarly, to the outcomes of the 1st design, the 2nd Design revealed that

- Students capabilities with the mobile devices exceeded that expected within the curriculum.
- Further, the link between coding within computers and developing spatial awareness was determined by the teachers and students to be a positive one.

**Conclusion**

In summary, an initial plan to introduce coding as a method to improve spatial awareness among primary one students revealed that students capabilities with the mobile devices exceeded that expected from the curriculum. Additionally, the use of a mobile device upon which students cognizance regarding spatial awareness and the science of coding proved to be successful.

A review of this success with in primary one students led to the creation of a 2nd lesson that was delivered to primary 3 children. This took account of the successes demonstrated at primary one and moved towards encouraging students to demonstrate an abstract understanding of spatial awareness and coding using a mobile device.
7 Motivating pupils for active participation in class and continuous work at nature science subjects

Age group: 6-12 years old & 13-18 years old / Level: Classroom / Subject: STEM

7.1 Country of origin

Slovenia

7.2 Educational analysis

7.3 Description

Primary school Miklavž na Dravskem polju is located in the suburbs of Slovenian second largest city Maribor and has four units: central school in the town of Miklavž na Dravskem polju, subsidiary school in the town of Dobrovce, childcare unit (kindergarten) in the town of Miklavž na Dravskem polju, and subsidiary of childcare unit in the town of Dobrovce.

In the school year 2017/18 the central school and the subsidiary schools were attended by 655 pupils aged from 6 to 15 years. The primary school program was carried out by 54 pedagogical workers.
The school offers a wide range of compulsory, additional and extracurricular activities in the form of supplementary and additional classes, various interest activities, expanded program, as well as extended stay and morning care. They also have special workshops for gifted pupils. At the same time, the school is collaborating with colleges and is a teaching school for future teachers.

Children with special needs are also enrolled in the regular primary school. Pupils with different deficiencies, obstacles and disabilities belong in this heterogenic group of children. For these pupils, the school provides additional professional help, carried out by a special needs teacher, pedagogues, two speech therapists and teachers. In the school year 2017/18, 33 pupils with placement orders attended the school. Pupils with deficiencies in individual areas of learnings, speech-language disorders, long-term sick pupils, physically impaired pupils, visually impaired pupils and pupils with autistic and emotional disorders, are going to the school. For each special needs pupil, an expert group at the school designs, monitors and evaluates the individualized education program. The school strives to establish an optimal learning environment for each individual pupil. Encouraging and maintaining pupil’s motivation for learning, providing diverse learning opportunities, developing strategies for independent, critical thinking, and living in a community. They emphasize the importance of project work and active learning, where the teachers become guides, mentors and moderators. They promote innovative and creative approaches to working with pupils, parents and colleagues, the use of modern communication and information means, and individualization and differentiation of educational work.

The school is generally technologically well equipped, with strong wi-fi, interactive boards, projectors and modern computer classroom. Nevertheless, there were only 5 available tablets at the school until recently. That is why the teachers of upper grades who wanted to use tablets in the classroom used smart phones and tablets of the pupils (BYOD system). However, the school came into conflict with interests of the parents, who did not support the idea of using smartphones during class. In the school year 2017/18, the school then additionally acquired 10 new tablets. 15 tablets are now available, which is still not enough for a school with more than 500 pupils, as teachers find it difficult to find free terms for using tablets in their classes. Also, 15 tablets do not allow individual work in classrooms with 24 pupils.

**Work of the teacher design team**
In the school year 2017/18, 3 teacher design teams (TDT) were established at the school.

The first teacher design team consisted of: a mathematics teacher, a technology teacher, a pedagogy student and a representative of the INUK Institute. The team met once a month. At the first meeting, the team analyzed challenges that natural science teachers face in their work at the school. The teachers noted that participation in class and continuous work of the pupils is important in natural science classes in particular. They were detecting lower learning success of pupils who do not do their homework, do not attend supplementary classes, and pupils who are cramming. At the same time, they noted that the pupils are not independent enough in their work and do not have skills of critical thinking, leaving them less efficient in the learning process.

The team thus set the following goals:

- to improve motivation in all pupils to participate in lessons,
- to encourage continuous work in all pupils,
- to encourage independence and critical thinking in pupils and, consequently, the effectiveness of learning.

With the help of design thinking methods and the ADDIE model, the team developed a variety of solutions for the set challenges, which the teachers also tested later in the classroom. Mathematics teacher Helena Jus Silić used tablets in the past only in the optional subject Mathematical Workshop with pre-developed mathematical applications for diversification of classes. These workshops are mainly attended by pupils interested in mathematics. She has not used tablets in regular mathematics lessons. When designing a solution for the set challenge, she kept in mind that a majority of pupils find mathematics, especially when it comes to content reinforcement, uninteresting or boring. That is why she decided to make content reinforcement in mathematics more fun, as she wanted to trigger pupils’ interest for learning mathematics and their active participation in content reinforcement.

The teacher thus had a lesson with tablets in an eighth grade with 15 pupils, where they reinforced the content of Pythagorean theorem. In this class, the pupils are especially unwilling to work. “The pupils can be very disrupting if left unmotivated. Except for certain individuals, they take the schoolwork leisurely. By including tablets, I wanted to determine if I can change their attitude towards learning mathematics,” says the teacher.
The teacher designed a lesson in the form of gamification. She prepared a treasure hunt for the pupils using QR codes and stations in the classroom. The lesson was very successful. “From first to last, the pupils were active for the entire lesson. If they were given the same tasks on worksheets or would solve them on the board, they probably would not have been interested. But in this lesson, all pupils, both weak and strong, actively participated and were motivated for work. Such form of work really captured their interest.”

The class was designed in such a way that the pupils were paired up and had to correctly solve the Pythagorean theorem. If their calculation was correct, the result guided them to a new station and new QR code with a new challenge or calculation. If the result was wrong, they had to go back and find the correct result.

Helena Jus Silić adds: “The pupils would have quit sooner if they would have to solve such calculations in regular class, but the game and use of tablets motivated them to persevere and work harder.”

Learning in the form of a treasure hunt with QR codes made otherwise everyday and compulsory subject matter interesting and motivated the pupils to solve even difficult tasks correctly, since the desire to scan a new QR code captured their interest.

And the teacher adds: “It would be even more interesting if the pupils actually received a prize at the end of the lesson, like in a real treasure hunt. I will definitely test that in the next school year.”

Teacher of technology Rok Ozmec has, while designing his solution, focused primarily on improving the pupils’ continuous work while encouraging their independence and critical thinking. He decided to integrate practical work in technique lessons with continuous, individual schoolwork at home and learning theory. The pupils mostly like to make various products in technology class but are not interested in the theory, even if it is directly related to the building process of individual products. In classes where he teaches technology (from 6. to 8. grade), he prepared various tasks for the pupils that were related to schoolwork which the pupils finished at home.
In the sixth grade, for example, the pupils made wood products in class, and then prepared a detailed description of the building process of a particular product, from planning to making the final product, at home using the Sutori application.

In the eighth grade, where they were reinforcing the content of paper materials, the pupils got homework where they had to design and make a quiz relating to the subject matter with the Sutori application. The quiz was then also uploaded to the Padlet Wall where the other pupils could solve it and commented on it.

The teacher says this kind of work certainly encourages pupils to work continuously and participate in the lesson. At the same time, he stresses that “the teachers themselves can learn a lot from the pupils who have shown great skills and independence in such homework.”
8 Improvement of pupils’ speaking skills in native and foreign languages

Age group: 6-12 years old & 13-18 years old / Level: Classroom / Subject: Languages

8.1 Country of origin

Slovenia

8.2 Educational analysis

Good practice
Speaking skills in native and foreign languages

8.3 Description

Primary school Miklavž na Dravskem polju is located in the suburbs of Slovenian second largest city Maribor and has four units: central school in the town of Miklavž na Dravskem polju, subsidiary school in the town of Dobrovce, childcare unit (kindergarten) in the town of Miklavž na Dravskem polju, and subsidiary of childcare unit in the town of Dobrovce.

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The school strives to establish an optimal learning environment for each individual pupil. Encouraging and maintaining pupil’s motivation for learning, providing diverse learning opportunities, developing strategies for independent, critical thinking, and living in a community. They emphasize the importance of project work and active learning, where the teachers become guides, mentors and moderators. They promote innovative and creative approaches to working with pupils, parents and colleagues, the use of modern communication and information means, and individualization and differentiation of educational work.

The school is generally technologically well equipped, with strong wi-fi, interactive boards, projectors and modern computer classroom. Nevertheless, there were only 5 available tablets at the school until recently. That is why the teachers of upper grades who wanted to use tablets in the classroom used smartphones and tablets of the pupils (BYOD system). However, the school came into conflict with interests of the parents, who did not support the idea of using smartphones during class. In the school year 2017/18, the school then additionally acquired 10 new tablets. 15 tablets are now available, which is still not enough for a school with more than 500 pupils, as teachers find it difficult to find free terms for using tablets in their classes. Also, 15 tablets do not allow individual work in classrooms with 24 pupils.

**WORK OF THE TEACHER DESIGN TEAM (TDT)**

In the school year 2017/18, 3 teacher design teams (TDT) were established at the school. The second teacher design team consisted of: two English teachers, a Slovene teacher, a student of English and a representative of the INUK Institute. The team met once a month.

At the first meeting, the team analyzed challenges that the teachers face during class. The teachers noted that the pupils’ communication skills are poorly developed, that they have problems expressing their thoughts, both in everyday life and in public performances, and consequently do not know how to collaborate well. At the same time, the curriculum focuses primarily on acquiring theoretical knowledge and less on acquiring practical speech experience. In oral presentations, some pupils suffer from stage fright due to lack of experience, and some are afraid of not performing well or getting a bad grade. Additional issue for some pupils is also a poor knowledge of native or foreign language. At the same time, the teachers noticed that pupils have problems with personal contact, are avoiding it,
and find it much easier to communicate through various ICT devices, because such form of communication is less personal.

The team thus set the following goals:

- gradual improvement of pupils’ speech abilities, both in daily communication and in oral presentations with the help of ICT,
- to integrate theory (grammar) with the use of it in speech communication, and providing the pupils with more opportunities for practicing one-way or multi-way communication in lessons of Slovene and English,
- to improve pupil collaboration.

The teachers wanted to improve general rhetoric in all pupils in both one-way as well as multi-way communication. They wanted to achieve comprehensive improvement of speech skills, which include improvement of vocabulary, sentence structure, pronunciation, non-verbal support, basic communication strategies, considering the rules of intercultural communication, and achieving smooth and spontaneous speech.

Within the TDT, the teachers developed a number of different solutions.

English teacher Špela Mesarič, who previously used tablets during lessons only for research and finding different sources online, focused mainly on improving pupils’ oral presentations through ICT.

The teacher decided to allow eight-graders who needed to give oral presentations to have an interactive presentation. The pupils who wanted to do so, were allowed to prepare an interactive presentation by themselves or with a partner at home using the Piccollage and Thinglink applications. They searched for photos online, made a collage from the photos using the Piccollage application, and then added different multimedia elements to the collage or the photograph in the Thinglink application, from additional photographs, own or downloaded video and audio recordings, to various textual description.

Theme of the oral presentation was My Dream City and followed a subject unit from the textbook, so the presentation had to include assimilated vocabulary from the subject unit.

Preparation for the interactive presentation helped the pupils to prepare for their assignments, while the interactive presentation at the same time provided weaker pupils with necessary support when giving the presentation and reduced stage fright of all the pupils.
The teacher said all pupils enjoyed such form of work. The pupils especially liked the theme of the oral presentation, because they could incorporate their imagination into the presentation, and freely choose the images and other materials as they liked. “Also, the presentation was useful for assimilation and reinforcement of new vocabulary, and encouraged pupils’ spontaneous speech in a foreign language,” adds the teacher.

The generation of eight-graders with which the teacher performed this activity is considered very vivacious and problematic. Nevertheless, “the pupils were actively involved in the activity, because they enjoy using tablets,” the teacher adds.

Teacher of Slovene Anita Babič focused mostly on encouraging daily one-way or multi-way communication and collaboration among pupils when designing her solution.

Before that, teacher Anita Babič used tablets or smartphones of the pupils occasionally in her classes, because there were not enough tablets at the school. Most often the pupils used phones and tablets to search for information, data, looking through headwords in the Slovene Literary Language Dictionary, preparing oral presentations or solving literary assignments here they searched for information about authors on the internet.

This time, she decided to use the Toontastic application, which is a storytelling application. She tested the activity in a 6. grade in which the pupils are very different from one another, especially in abilities, plus it is very difficult to motivate them for work.
Before performing the activity, the class discussed the Ugly Duckling fairytale that all the pupils know. They talked about different views on the fairytale, including the acceptance of difference. Then the pupils made their own story in the Toontastic application on the subject of acceptance of difference, where they had to consider the drama triangle and lend a voice to characters from the story. The pupils worked in smaller groups and needed to think about the content, form, subjects and conversations. They had 50 minutes to make the story. When they finished, they played the animated stories for their classmates and had a discussion about them. The pupils tried to analyze the stories, what they liked and how they could be improved.

The teacher says that the pupils were excited about such form of work. “They were very motivated and enjoyed working. Their creativity was also expressed when interpreting the stories and developing characters that appeared in the stories. Some stories were very good, especially in good pupils who put great effort into the content. I was also surprised by pupils who do not stand out but were very creative in the task.”

According to the teacher, this type of work primarily has a positive effect on pupils who otherwise have stage fright and issues with free speech and oral presentations. Lending a voice to animated characters and careful planning of speech and scripts allows all pupils a relaxed practice of various forms of communication.
9 AR Apps for Teaching English in Primary School

Age Group: 6-12 years old / Level: Classroom / Subject: Languages

9.1 Country of origin

Turkey

9.2 Educational analysis

9.3 Description

Teacher Design Team 1

TABLIO Project Istanbul team has prepared a Teacher Design Team consisting of 5 foreign language teachers, 2 pre-service teachers from Istanbul University - Cerrahpaşa, ELT department and 3 teacher trainers in Avrupa Koleji Innovation School. The teachers were all from the foreign languages department who taught from 1st to 4th grade. The TDT continued for 8 weeks on Fridays at 3.30 pm, the last day of school on every two week intervals. During the meetings first the pedagogical approach of TABLIO project was presented by the teacher trainers, then the concept map and the concept of differentiation was introduced. Next sessions included the school presentation and the context and needs of the schools as well as the curriculums that the school followed. Then the curriculums of the school for all grades was transformed for differentiation with tablets and many apps were matched to the learning outcomes. The school purchased 20 tablets in the meantime for the class use with the advice from the teacher trainers of TABLIO Project. Then the teachers were given time to design and differentiate their lessons. These lessons were evaluated with the help of the teacher trainers. However, as the school was sold to another investment group the teachers never had the chance to apply their lessons and report back on them. The teachers as well were scattered around other schools unfortunately. They all reported that they were eager to continue the work but all of them were in different schools and it was difficult to collect them back again in one place.
Teacher Design Team 2:
TABLIO Project Istanbul team prepared a Teacher Design Team consisting of 1 foreign language teacher, 2 pre-service teachers from Istanbul University - Cerrahpaşa, ELT department and 2 teacher trainers for Ümraniye Nurettin Topçu Primary School. The 2 teachers from this school were invited to the Faculty of Education at Istanbul University – Cerrahpaşa. The teachers were invited for 4 weeks and the previous TDT design was used. During the meetings first the pedagogical approach of TABLIO
A project was presented by the teacher trainers, then the concept map and the concept of differentiation was introduced. Next sessions included the school presentation and the context and needs of the schools as well as the centralized curriculum that the school followed. Then the curriculum of the school for 4th grade was transformed for differentiation with tablets and many apps were matched to the learning outcomes. The teachers preferred to create their own lesson plan that was in parallel with the centralized curriculum. Both teachers came up with their lesson plans and good practices in the end of the 1 month they had for application.

The school Ümraniye Nurettin Topçu Primary School was established in 2005 - 2006 Academic Year. In 2005, it was constructed as 1 manager room, 3 deputy director rooms, 24 classrooms, 3 science laboratories, 1 visual arts classroom, 1 computer technology class and 1 multi-purpose hall. However, the school has been transformed into primary school in the academic year of 2012-2013 and there are currently 1 manager room, 2 assistant manager rooms, 42 classrooms (private education and classroom for Syrian students), 2 guidance rooms and 1 multi-purpose hall. The school has 3 floors excluding basement and ground floor. The school was named as Dudullu Primary School and changed to Nurettin Topçu Primary School since December 2015. The school is a regular state school (full-time education from 8.50-14.20).

**AR for English Lessons**

The lesson was planned for the English class for 38 students from the class 4, section G. The “Countries and Nationalities” unit in the primary school English curriculum was the subject of the application and was planned for differentiation in process for warm up activity and pre-speaking phase.

**Challenges**

Report from the English Teacher Damla Eryilmaz Bahadir:

I planned activities with the tablets provided by the students. Since I couldn’t reach as many tablets as the number of students, I designed the activities as group work or as the activities of the teacher with his own tablet to differentiate a certain stage of the lesson.

I have applied the school’s wireless network password to tablets by collecting the tablets in advance to make the internet connection to the tablets. This took a lot of time and I couldn’t put the school’s internet password because of some insufficient technical equipment to some tablets or my lack of technical knowledge.

I have done my own tablet activity warm up. Activity in time, because the tablet’s own internet was completed without problems, but the lad pre-speaking event in the activity I planned for the tablet to be connected to the school's internet site was unable to open the desired website. Later I learned that this problem is not due to the lack of a strong internet connection since my school is not part of the FATIH project.

I tried to solve the internet problem by sharing the internet of my own tablet, but this time I could not connect more than 5 tablets. I spent a lot of time with these reasons. I changed my plan within the possibility of pulling 3 rows in front of the board and put the tablets connected to the internet in each order and tried to solve the students by taking groups. This took a lot of time because of the crowded class and I had to end the lesson far behind what I was planning.
Design
The teacher used “Quiver” for the “Warm up” and “Inigma” (Qr Code Reader) and “AnswerGarden” for the pre-speaking activity. The teacher has a computer and a projector in her class.

Implementation and Evaluation
The English teacher used a group work as she didn’t have enough tablets in her class. The students used the apps on their tablets to warm up for the class with flags and country names. They got awareness on the colours of the flags and what country they belong to. The students drew the flags and had Quiver transform them as Augmented reality.

Then the teacher organized an activity on the country names where the students had to scan the QR code and say the name of the country as a pre-speaking activity, then the students added their answer to the “AnswerGarden” to see the name of the country in writing.
The teacher observed the participation of the students and reported that all her students wanted to participate in the activities and that the motivation of her students increased initially.
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TDT Ümraniye Nurettin Topçu İlkokulu for Math Lesson
The lesson was planned for the English class for 39 students from the class 4, section G. The Primary school Math teacher Aysegul Rendeci Yumurtaci has prepared a lesson plan to differentiate her “Types of Fractions” unit, she used the tablets to differentiate the process and product.

Challenges
Math teacher Aysegul Rendeci Yumurtaci’s report on challenges and advantages of using tablets in her class:
Activities should not be started before the students and parents are informed about the virtual / digital environments. The programs required for the application should be pre-loaded on the tablets. Digital netiquette rules should be explained. Online activities should be prepared according to the students’ achievements. More than one event must be prepared for each learning outcome. The same activity pushes towards memorization.

- There are no smart boards in our class.
- No connection to Fatih project.
- At the same time, the connection of all tablets to the network of the school was not possible.
- Tablets can be connected with outside facility. An average of 4 students per tablet were assigned.
- Individual work could not be done in class (except Plickers).
- Some programs/apps should be updated from time to time, otherwise the running program can be installed in the class.
- The memory or versions of the tablets were inadequate.
- Because of the shortage of applications in the application, we focused on tablet applications usable without internet.
- Because of the shortage of the internet network, individual-purpose activities are usually given as homework (kahoot, learningapps).
- The teacher should prepare and experiment before the class.
- One error can take 40 minutes of the class.
- Changes should be made within the group. Sometimes, some students may become dominant in groups. The teacher should observe all the time.

Advantages

- The students and parents trust the teacher.
- The parents support the activities with preliminary information given about the applications.
- The students forget to go to the break when they are engaged with the tablet.
- Synergies occur in working groups.
- Applications without internet are suitable for small age students and group because they are closed to online dangers.
- A fast and different learning environment is formed.
- There is a transition from concrete to abstract.
- Mobile learning allows learning anywhere anytime.
- Activities are creating a permanent archive.
- Prepared activities can also be reached on students’ holidays.
- Studies affect visual intelligence.
- Activities suitable for creating student level groups open the way for learning. (difficult, easy, intermediate questions)
- There are activities suitable for individual and group work.
- At the end of the activities, the student expects an appreciation or a movement from his / her teacher.
- Foreign language vocabulary knowledge is increasing in applications (play, stop continue, upgrade, resume, fraction etc.)
- The virtual media are developing digital literacy.
- Students are aware of the fact that this type of work exists instead of just time-killing games that are empty and violent.
- Competitive spirit is developing.
- Students enjoy their own practice.
- They learn ways to enrich their homework.

**Design**

The teacher used many apps on her tablet to start the lesson and then to end the lesson, for example “Learningapps”, “kahoot”, “plickers”, “padlet”, “cram”, “quiver”, “tagul”, “toontastic”, “scratch”, “hp reveal”, “inigma”, “calmfash”, “canva”, “classDojo”, “Animoto”, “kligtag”.

**Implementation and Evaluation**

The teacher started her lesson by asking students to classify the types of fractions on their tablets on LearningApps and observed while the students did the activity in groups. Then she asked her students to answer questions about fractions with plickers app. Then she scanned her students answers and reflected on the screen, then she evaluated that 23 students answered correctly and so on.

**Conclusion**

Our TDT revealed many sides to the using tablets for differentiation in classrooms. We observed that the teachers appreciated the fact that their voice was valued in the design of an idea. However, due to unexpected events one of the TDTs had to be completed without an actual result. Although they had many resources and were really prepared to execute an in-class activity, the school closed down...
and the teachers had to be replaced. The second school, which was a state school with fewer resources and deficiency in many aspects could complete the tasks and succeeded after the TDT. All of the activities in this TDT have been successfully recorded on videos and thus reported. The teachers who undertook the activities created video reports as well as reports on their progress based on the TDT. Our experience came across challenges such as crowded classes, scarcity in resources and number of tablets per student, issues with reliable internet connection, the cost of apps, time consumption of the planning process and logistics for tablets. On the other hand, students enjoyed the lessons with tablets and their motivation increased, the teachers felt refreshed and reported positive attitude of the students.
10 Mobile Apps for Teaching Math in Primary School

Age Group: 6-12 years old / Level: Classroom / Subject: STEM

10.1 Country of origin

Turkey

10.2 Educational analysis

10.3 Description

Teacher Design Team

TABLIO Project Istanbul team prepared a Teacher Design Team consisting of 1 math teacher, 1 pre-service teachers from Istanbul University – Cerrahpaşa, and 2 teacher trainers for Ümraniye Nurettin Topçu Primary School. The teacher from this school was invited to the Faculty of Education at Istanbul University – Cerrahpaşa. The teacher was invited for 4 weeks and the previous TDT design was used. During the meetings first the pedagogical approach of TABLIO project was presented by the teacher trainers, then the concept map and the concept of differentiation was introduced. Next sessions included the school presentation and the context and needs of the schools as well as the centralized curriculum that the school followed. Then the curriculum of the school for 4th grade was transformed for differentiation with tablets and many apps were matched to the learning outcomes. The teachers preferred to create their own lesson plan that was in parallel with the centralized curriculum. The teacher came up with their lesson plans and good practices in the end of the 1 month they had for application.

The school Ümraniye Nurettin Topçu İlkokulu was established in 2005 - 2006 Academic Year. In 2005, it was constructed as 1 manager room, 3 deputy director rooms, 24 classrooms, 3 science laboratories, 1 visual arts classroom, 1 computer technology class and 1 multi-purpose hall. However, the school has been transformed into primary school in the academic year of 2012-2013 and there are currently 1 manager room, 2 assistant manager rooms, 42 classrooms (private education and classroom for Syrian students), 2 guidance rooms and 1 multi-purpose hall. The school has 3 floors excluding basement and
ground floor. The school was named as Dudullu Primary School and changed to Nurettin Topçu Primary School since December 2015. The school is a regular state school (full-time education from 8.50-14.20).

*Mobile Apps for Math Lesson*

The lesson was planned for the Math class for 39 students from the class 4, section G. The Primary school Math teacher Aysegul Rendeci Yumurtaci has prepared a lesson plan to differentiate her “Types of Fractions” unit, she used the tablets to differentiate the process and product.

*Challenges*
Math teacher Aysegul Rendeci Yumurtaci’s report on challenges and advantages of using tablets in her class:

- Activities should not be started before the students and parents are informed about the virtual / digital environments. The programs required for the application should be pre-loaded on the tablets. Digital netiquette rules should be explained. Online activities should be prepared according to the students’ achievements. More than one event must be prepared for each learning outcome. The same activity pushes towards memorization.
- There are no smart boards in our class.
- No connection to FATIH project.
- At the same time, the connection of all tablets to the network of the school was not possible.
- Tablets can be connected with outside facility. An average of 4 students per tablet were assigned.
- Individual work could not be done in class (except Plickers).
- Some programs/apps should be updated from time to time, otherwise the running program can be installed in the class.
- The memory or versions of the tablets were inadequate.
- Because of the shortage of applications in the application, we focused on tablet applications usable without internet.
- Because of the shortage of the internet network, individual-purpose activities are usually given as homework (kahoot, learningapps).
- The teacher should prepare and experiment before the class.
- One error can take 40 minutes of the class.
- Changes should be made within the group. Sometimes, some students may become dominant in groups. The teacher should observe all the time.

**Advantages**

- The students and parents trust the teacher.
- The parents support the activities with preliminary information given about the applications.
- The students forget to go to the break when they are engaged with the tablet.
- Synergies occur in working groups.
- Applications without internet are suitable for small age students and group because they are closed to online dangers.
- A fast and different learning environment is formed.
- There is a transition from concrete to abstract.
- Mobile learning allows learning anywhere anytime.
- Activities are creating a permanent archive.
- Prepared activities can also be reached on students’ holidays.
- Studies affect visual intelligence.
- Activities suitable for creating student level groups open the way for learning. (difficult, easy, intermediate questions)
- There are activities suitable for individual and group work.
- At the end of the activities, the student expects an appreciation or a movement from his / her teacher.
- Foreign language vocabulary knowledge is increasing in applications (play, stop continue, upgrade, resume, fraction etc.)
- The virtual media are developing digital literacy.
- Students are aware of the fact that this type of work exists instead of just time-killing games that are empty and violent.
- Competitive spirit is developing.
- Students enjoy their own practice.
- They learn ways to enrich their homework.

**Design**

The teacher used many apps on her tablet to start the lesson and then to end the lesson, for example “Learningapps”, “kahoot”, “plickers”, “padlet”, “cram”, “quiver”, “tagul”, “toontastic”, “scratch”, “hp reveal”, “inigma”, “calmfash”, “canva”, “classDojo”, “Animoto”, “kligtag”.

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had many resources and were really prepared to execute an in-class activity, the school closed down and the teachers had to be replaced. The second school, which was a state school with fewer resources and deficiency in many aspects could complete the tasks and succeeded after the TDT. All of the activities in this TDT have been successfully recorded on videos and thus reported. The teachers who undertook the activities created video reports as well as reports on their progress based on the TDT. Our experience came across challenges such as crowded classes, scarcity in resources and number of tablets per student, issues with reliable internet connection, the cost of apps, time consumption of the planning process and logistics for tablets. On the other hand, students enjoyed the lessons with tablets and their motivation increased, the teachers felt refreshed and reported positive attitude of the students.
11 Virtual Reality

Age Group: 13-18 years old / Level: Classroom / Subject: Arts & Culture

11.1 Country of origin
Netherlands

11.2 Educational analysis

11.3 Description

The schools
ROC De Leijgraaf
ROC De Leijgraaf is a school for vocational education in the Netherlands with campuses in Cuijk, Oss, Uden, Veghel and Boxmeer. De Leijgraaf has about 650 staff members and about 6,500 students in the domains Technology & Society, Economy & Business, Hospitality & Tourism and the Career Center.

Helicon MBO
Helicon MBO is a school for both vocational education and pre-vocational education in the Netherlands with campuses in Boxtel, Den Bosch, Eindhoven, Geldermalsen, Helmond, Nijmegen, Tilburg and Velp. Helicon has about 750 staff members and about 6,500 students in the domains Food, Environment, Agriculture and Horticulture, Green Living Environment, Flowers, Animals, Cities and People.

The Teacher Design Team
The teacher design team (TDT) consisted of 3 teachers from ROC De Leijgraaf and 2 teachers of Helicon MBO, supported by a media coach and a researcher/member of the Tablio project team. The team of teachers had different backgrounds and existing knowledge with regards to VR.
Phase 1: Design challenge
The TDT started by discussing about a joint design challenge for the team. There was agreement on the requirement that there is a need for more realistic forms of education. One way to do that is by visiting organizations/companies, but that is difficult to organize on a large scale. They expected that VR can help here by providing alternatives to the actual visits. So they formulated three hypothesis to test:

**Hypothesis:** The TDT sees VR as a way to provide students with safe environment to experience situations from their (future) working environment that would otherwise not have been possible.

The teachers also see VR as a required ict-skill for students, meaning that they think it’s important that students by graduation time at least have some hands-on experience using it. But students should also be able to form ideas and a vision with regards of the further development of VR.

A final shared question the teachers have it what it means to use / create a VR-tour\(^2\) as a didactical activity.

**Hypothesis:** The TDT believes that it is possible to provide teachers and students with the needed support materials to enable them to use VR (with some support of the iXperium) within their lessons and study.

**Hypothesis:** The TDT believes that the resulting learning materials can be used to provide teachers with means to provide differentiation and inclusion with mobile devices for their students.

Phase 2: collect information and analyse the challenge

*Level up the same level*

The members of the TDT had a different level of knowledge and experience with regards to VR and 360-degrees video/images. Some had already created VR based on 360-degrees video/images before, while other members were completely new to the topic. The members shared examples of previous products that they worked with or on and discussed them.

The media coach helped the members that were new to VR in trying out 360-degrees cameras and headsets. In this phase the TDT also setup a Facebook page for the TDT showcasing a GDPR friendly picture of the whole group active in VR.

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\(^2\) The teachers discussed what comprises a “VR-tour”. They agreed to distinguish between “VR-tour”, consisting of multiple linked 360-degrees images of videos and “VR- activity”, being a single image or video.
The members of the TDT studied current (mostly online) literature about VR. A previous TDT had recommended to use smartphones and (relatively) cheap headsets as a means for students to experience the VR tours. The main reason for that choice was that the experience was “good enough” for its purpose while it added the bonus of lowering the barrier for students to watch the VR-tours using their own or abundantly available hardware from the iXperium.

The TDT also experimented, with support of the media coach, with tools and online environments that can be used to develop VR-tours. They shared experiences, questions, challenges and literature found and read via their own blog (in Dutch).

They created a questionnaire for teachers and students asking them about previous experience with VR.

**Phase 3: Design requirements**

During this phase the TDT decided on the design requirements for the products they are developing. The requirements are based on a brainstorm with the team, advise from the literature, feedback from the presentations / sessions with students and teachers.

**Phase 4: design, experiment and test**

The TDT created three groups of experiments. A diary/logbook (in Dutch) has been kept of the activities within each of the experiments. The experiments are briefly described below.

**Manuals/Instructions**

To support students and staff during the experiments, the TDT created a number of instructions (in Dutch) related to:

- The use of the available 360-degrees camera (Ricoh Theta S and Theta V)
- The use of TeachVR platform (https://teach-vr.com/)
- The use of 3DVista application (https://www.3dvista.com/)  
- The use of the Roundme platform and apps (https://roundme.com/)

The instructions were tested during the experiments and where updated and improved based on the feedback that the TDT received while using them.

**Experiment 1 Historical Walking Tour Oss**

Two teachers worked, together with a group of students, on an external assignment for the city of Oss in the Netherlands (where De Leijgraaf is located). They build a historical walking tour where a VR tour with historic images is added to the real live walking tour. They created a VR tour where historic pictures are overlaid over the current situation.

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3 The results are available in Dutch
Experiment 2 Training organizations within the social care vocational training are being portrayed in 360 degrees
One teacher worked on an assignment as part of the social care vocational training: a 360-degrees tour of a number of social care organizations.
An example of a tour created using pictures and video can be viewed online:
http://vr.ixposs.nl/web/Hoeve/
The tour contains some text in Dutch but uses icons for the navigation.
Screenshots of the result:

![Image](image1)
![Image](image2)

Experiment 3 Helicon-tour, virtual tour through Helicon in Eindhoven and Tilburg.
The two teachers from Helicon did three experiments within Helicon: one experiment involving level 2 and 3 students in Eindhoven, one experiment involved level 2 students in Tilburg. The third experiment involved doing a training for teachers.
The pictures below show screenshots of the completed products.

![Image](image3)
![Image](image4)

See: https://roundme.com/tour/254385/view/752695 for an online example. There is some text in Dutch in the tour, but navigation uses icons.

Phase 5: Evaluate and share
The TDT designed and tested a number of lesson designs using 360-degrees pictures and video. They created instructions for the tools needed by students and teachers. The goal was to make the instructions so clear that students and teachers could even use them unassisted.
Where possible they shared their products online, for pictures and videos involving students this was a challenge.
The TDT presented in public about their preliminary results both during an external conference (the CvI conference for VAT schools in Leeuwarden) and during internal knowledge sharing meetings. It is not very common for teachers to present about work in progress. But for the process of working in a TDT it is considered very important. The TDT maintained a public Facebook page where they shared progress, pictures and news.

After completion of the work of the TDT, the results are being integrated in the regular trainings provided by the academies of both De Leijgraaf and Helicon MBO.

Lessons Learned
- It was remarkable how quickly and easy the “new” members of the TDT were able to get up to speed about VR. Having colleagues around that can show first-hand examples and having a media coach that can help getting the hang of the technology greatly increases the speed with which teachers can learn to become comfortable with the technology.
- The questionnaire from phase 1 showed that not just the teachers in the TDT saw the applications for the technology.
- During the TDT, the members were introduced to the concept of sharing early and sharing often. While teachers usually are reluctant to share their experiences while only just started with the development, the TDT was (successfully) challenged to already share during the process. The sessions provided feedback leading to (small) changes in the formulated design challenge and ideas for a new VR-platform (teachvr) that the TDT could use (and decided to use).
- Although the teachers were very clear on their requirements in phase 3, they did not commit to any pedagogy related requirements.
- Despite the efforts of the TDT to make the instructions as “simple” as possible, often other teachers and students required some additional support in using them.
- Students that did the learning activities as a voluntary choice were more intrinsically motivated for the assignments.

Looking back on the three hypothesis
The materials developed by the TDT needed to be fine-tuned and wasn’t always enough on its own, but it did succeed in providing students and teachers (at least for the most part) with the help they needed to get started using VR. The use of VR / 360-degrees images and videos by students does provide an additional option for them to express themselves. Not everyone will like it, but it is a good option for product-differentiation. It also provides a safe environment to experience situations from their (future) working environment.
12 Meaningful learning using technological devices

Age Group: 6-12 years old / Level: Classroom / Subject: Languages, Social Sciences, Arts & Culture, STEM

12.1 Country of origin

Netherlands

12.2 Educational analysis

The schools

Primary School De Driemaster

Primary school De Driemaster is a small rural school with one group of students per grade. The school's mission is to offer meaningful education in a meaningful context. In doing so, students respond to the individual development opportunities, and there is a lot of attention for student autonomy.

Primary School Het Kleurrijk

Primary school Het Kleurrijk is also a relatively small school. It is a community school (combination with other facilities such as out-of-school care). The school works with TOM (Tailor-made Team Education). From this working method the school works with units (groups 1-2, groups 3-4, groups 5-6, groups 7-8), whereby teachers from different classes within a unit work together a lot. The school uses combination classes (two consecutive grades together). The mission of Het Kleurrijk results in a lot of attention for providing a personalised meaningful learning environment.

Both schools have been working with technological devices for some time (Chromebooks in the upper years, tablets in the lower years). These are mainly used as a class or for working individually with drill and practice software. The teachers also see opportunities to use the devices to contribute to more meaningful education.
The Teacher Design Team (TDT)
The design team included two teachers, one year 8 teacher (age 12) from De Driemaster and one year 3/4 (age 6-7) and year 5/6 (age 8-9) from Het Kleurrijk. The TDT also included a teacher trainer, a media coach, an ict expert, a Tablio project member and someone to facilitate the design process.

The design challenge
Both teachers are convinced of the chances of using mobile devices in their school. They think they could be used in different and more meaningful ways than currently done. The teachers see the availability of the technological devices as an opportunity to enrich education and deepen learning: the devices could contribute to more meaningful learning. The teachers want to include their teams in the more meaningful use of the devices. They also want their colleagues to learn how to design meaningful learning activities/learning designs and thus approach education differently: not just by following the method, but by occasionally replacing part of the method with a more meaningful instructional format.

At Het Kleurrijk, disappointing student test results have led to a focus on improving mathematics instruction. The teachers think that applied arithmetic (arithmetic in practice/context, e.g. in workshops) could help in this process. There is also a lack of intrinsic motivation and independence among the students. Their attitude when working on assigned tasks is poor. The teachers believe the students’ problems with motivation and work attitude are one cause of the poor arithmetic results. Students also have a poor work attitude/motivation in relation to other subjects.

The TDT formulated the following design challenge:

How can I (re)design meaningful learning activities/learning designs in which students use technological devices in a meaningful way?

The TDT wanted to achieve the following objectives with our design:
1. We want to use meaningful learning designs with ICT to ensure that students are more involved in the subject, that they understand more clearly why they are learning something and that the learning outcomes improve.
2. We want to encourage our colleagues at school to design and implement meaningful learning designs with ICT for their students.

A potential product would be a set of developed meaningful learning designs with ICT that include various ICT applications. These learning designs would serve as examples and inspiration for the school team to use technological devices in different, more meaningful ways.
The timeline above shows how the TDT’s process unfolded. In total, eight sessions (blue) were held over one year. Between sessions, teachers were involved in designing, redesigning, implementing and evaluating learning designs (orange). The teachers were supported by worksheets/homework assignments.
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The TDT arrived at three essential characteristics of meaningful learning designs:

- Context/authentic/imaginable/corresponding with experience/practice
- Active learning/creating/making something
- Self-direction, freedom to choose approach (differentiation in instructional format).

Features the TDT does not think of as essential but would be nice to have:

- Differentiation according to level (this is related to self-direction)
  - Differentiation in difficulty of the activity
  - Differentiation in degree of guidance
- Activating prior knowledge (helps to put the activity in context)

The characteristics of differentiation can be found in the concept map on differentiation from the Tablio project (see tablio.eu). This concerns differentiation at the micro-level. Self-direction and freedom to choose the approach are about differentiation focused on the students’ learning profiles and interests. Learning level differentiation can be found in the concept map as differentiation aimed at the starting level. According to the abovementioned characteristics, meaningful learning designs may involve content differentiation (e.g. whether students can autonomously choose fields of interest, learning questions or difficulty levels), process differentiation (when choosing the approach and differentiation in degree of guidance), and/or product differentiation (if students can choose how they develop the product).

Use of ICT

The SAMR model from Puentedura (2009) distinguishes four levels of ICT use in a learning activity. These range from Substitution (ICT as a replacement for an outmoded learning activity, e.g. book behind glass) to Redefinition (redefining your education so it is impossible without ICT) (see Figure).

The TDT used this model to evaluate and improve the use of ICT in meaningful learning designs. In Session 3, the TDT compared several of the meaningful learning designs designed by the team. This comparison was based on these questions:

- What is the current level of ICT in this learning design?
- What can we change to reach a higher level of ICT use? And is this desirable in view of the objective of the learning design?

Based on the discussion of the learning designs using the SAMR model, the TDT concluded that the aim was for meaningful learning designs using ICT with added value. This does not necessarily mean that a higher level in the SAMR is better. The TDT wanted to create meaningful learning designs in which ICT makes an important contribution; not use ICT for the sake of using ICT.
The personalised learning scale
To evaluate the extent to which the learning designs to be designed contain elements of personalised learning, the TDT used the “personalised learning scale” (“Meetlat recht doen aan verschillen”) from iXperium/CoE can be used. This scale consists of several evaluation questions to assess the extent to which various aspects of personalised learning are used in a learning package and what the role of ICT is in this context.

Example of one of the developed learning designs

Title: Dream Room learning design (first design)
By Koen, year 8 teacher, De Driemaster

Description of the learning design
The goal of the learning design is was to do scale calculations. Children start by thinking about their “dream rooms”, and first make a rough sketch on paper. The rooms really comes to life when the children work out their sketches using an online site called Floorplanner.com. The interiors takes shape, the walls are coloured, and they see the extent to which their sketches are realistic: the walls and floor area are adjusted to the agreed dimensions (4 x 6 metres).

Children see their drawing in 2D, but they can also use the 3D function to enter their room. When a room is ready, the teacher prints it in 2D and 3D and the children use this printed image to determine the correct dimensions of everything in the room. This is essential because the next step is to make a physical model (crafts). We agreed on a scale (1:20) and the children start the preliminary work.
How does the teacher experience this learning design in the group?

The teacher experienced it as very positive and pleasant. Children were actively involved in all phases of the assignment. It was about scaling, and he made that clear to the children often by repeatedly asking if their initial sketch was correct or by having them think about how big something should be. The ICT part was used to bring their dream rooms to life. The children enjoyed designing the rooms, and it was up to me to check that the process was not just about having fun, but also to make sure they were really thinking about the surfaces: what would fit and what were the possibilities?

What did the students learn (according to the teacher)?

The teacher indicates that it is difficult to say whether this was a better way for the children to learn than just using regular books. What he saw was that the children were enormously engaged, and they really thought about all the learning questions. The children were not just doing sums but were deliberately working on the scale calculations. We also had a good class discussion about what the scale should be and what that means.

What were the students' reactions?

The children were very positive. They did not fully perceive that it was actually an arithmetic lesson, and they wished that arithmetic lessons would ‘always’ be like this.

Design-redesign

In the TDT, the teachers redesigned a number of the tried-and-tested learning designs. They did this based on their findings during the trials and based on the information collected during the exploring and collecting and establishing design requirements phases (see timeline). They used the established characteristics of meaningful learning designs, the SAMR model (see Section 2.2) and the personalised learning scale.

From evaluating the Dream Room learning design, the TDT concluded that – as expected – a meaningful learning design with technological devices increased student engagement. The students worked intensively and were inadvertently working on their numeracy. Afterwards, several students indicated that they learned more in the meaningful learning design than in a regular lesson, or that what they learned was easier to remember.

The components of the learning design seem to have contributed to these experiences. Due to the authentic context and the creation of their own dream room, students became more engaged and the usefulness of the calculations became clearer. Using ICT contributed to making the learning design even more meaningful or ‘more real’ (‘buying’ flooring and paint on a website, converting a 2D design into a 3D design in Floorplanner). The freedom of choice
that students had in performing the assignment (creating their own design, making their own choices in spending the budget) also led to greater engagement and motivation. Finally, the learning design considered individual differences (personalised learning) in various ways: the learning design was offered at two levels of difficulty, students were guided in accordance with their individual instructional needs and students could review the instructions at their own pace. This enabled the students to work at their own level.

**Design requirements for designing meaningful learning designs**
The TDT wants to share their design requirements with teachers that want to design their own learning designs:

**Learning objectives, alignment with curriculum/method**
The learning activities are in line with learning objectives of the curriculum/method. The approach in practice may deviate from the method; this is even encouraged!

**Characteristics of the learning design**
The learning design is meaningful. This means that the learning activity contains at least these elements:
- context/authentic/imaginable/in line with experience/practice
- active learning/creating/making something

The learning design can be made even more meaningful by:
- Activating prior knowledge (helps to put the activity in context)
- The product of the learning activity is actually used (e.g. by others) or is presented to others

**Form of differentiation**
- Students have self-direction/freedom of choice with regard to their approach in the learning design
- If possible, there are also other forms of self-direction or differentiation, e.g. regarding interests, level, time and place of learning, pace

**Grouping forms**
Collaborating, learning from and with each other

**Role of ICT**
- ICT provides added value to the learning design (the use of ICT adds something; it is more than just a replacement for paper teaching material)
- The hardware and software are easy for the students to use/learn

**Organisational aspects (duration, planning, preparation time)**
The learning design can replace regular lessons about the corresponding subject/learning objective. Sometimes extra time is required, such as time normally reserved for crafts, ICT or projects, or it can be part of the weekly task.

**The teacher’s role**
The teacher mainly has a supervisory role, but instruction can also be part of the learning design
Assessment of learning outcomes
Learning outcomes of meaningful learning designs can be assessed by, for instance, asking students to explain what they have learned. Suitable forms include presentations, portfolios or demonstrations of products the students created. Regular tests can also be used, since the learning designs are in line with the learning objectives from the curriculum.

The design team is in the process of creating a website with lesson descriptions of the developed learning designs, so teachers from the participating schools and beyond can use them.

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