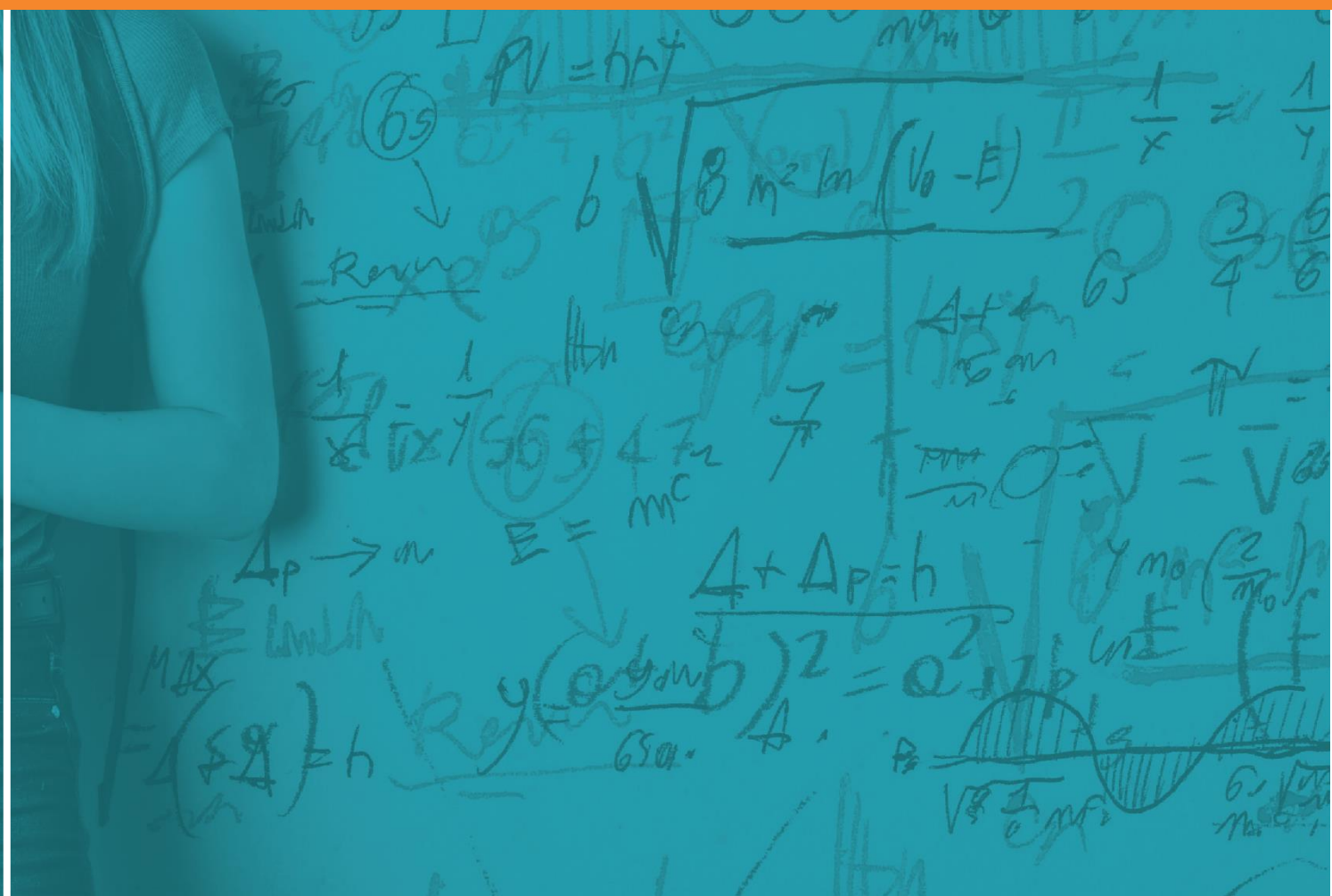


Guidelines for educators and stakeholders

First Official Version



This version of the *Guidelines for educators and stakeholders* is the first official draft and it was developed by the following partners of the Augmented Assessment consortium: European University of Cyprus, Aristotle University of Thessaloniki, Athens Lifelong Learning Institute, Polytechnic Institute of Porto, University of Helsinki, University of Pompeu Fabra.

Augmented Assessment 2021

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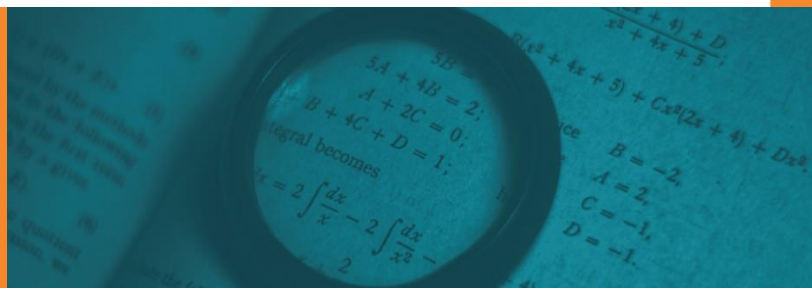
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Introduction and Background



THE PURPOSE OF THE PROJECT: AUGMENTED ASSESSMENT, A BRIDGE TO MIGRANTS' KNOWLEDGE

The AUGMENTED ASSESSMENT PROJECT aims to address the gap that exists in assessing newly arrived migrant students' prior knowledge in the fields of Science and Mathematics, by utilising augmented reality for assessment. This will be achieved by developing and piloting an innovative augmented toolkit in the form of an online library and a training course for teachers that will equip them with the necessary theoretical and practical knowledge for assessing newly arrived migrant students' prior knowledge.

Within the above aim, key topics in the context of the project are:

- inclusive education and learners' assessment
- newly arrived migrant students
- augmented reality (immersive technologies)

Each of these concepts is explained below.

Inclusion/Inclusive Education and the importance of assessment

Inclusive education is strongly linked with any child's human rights to a quality education (UNESCO, 2005). Though there are many definitions concerning inclusive education, for the purposes of the project the following is adopted:

Young people - no matter who they are - can learn together in the same school. This entails reaching out to all learners and

removing all barriers that could limit participation and achievement.¹

Students' assessment (formative and summative) constitutes an important and crucial part of inclusive education and aligns with UNESCO's policy (2017) on 'learning assessment: ensuring effective and relevant learning for all' (see [Education 2030, Sustainable Development Goal 4](#)). UNESCO (2017), defines learning assessment as an element for the broader evaluation of education by pointing out that it involves a plethora of methods and tools, utilised for the evaluation, measurement, and documentation of learning outcomes and learning progress. Learning assessment focuses on collecting information from a variety of sources on learners' knowledge and the ways they can deploy/exploit/tap into this knowledge.

Furthermore, assessment provides valuable information about the factors that facilitate learning (context & processes) as well as the factors that might obstruct learning. From a pedagogical perspective, learning assessment can contribute to gather information about learning practices and teaching, helping learners (and their teachers) to recognise areas of strength and areas requiring improvement (ibid). From this perspective, "*Learning assessment is therefore not an end in itself. Regardless of its purpose, scope, object or nature, it is conducted with the ultimate goal of improving equity and learning for individuals, communities and society*" (UNESCO, 2017, p.3). In other words, learners' assessment must reflect the principles of inclusive education, as stated above in the definition of inclusive education.

¹ <http://www.iiep.unesco.org/en/inclusive-education>

However, especially when the focus is on newly arrived migrants - as in the Augmented Assessment project - there are barriers to realise inclusive assessment. These barriers, involve, among other factors, monolingual students' assessments, in subjects not necessarily connected with language, as Science and Mathematics.

Students of migrant background and newly arrived migrants

Students of migrant background are defined as newly arrived/first generation, second generation or returning migrant children and young people. Their reasons for migration (e.g. economic or political) and their legal status may vary – they may be citizens, residents, asylum seekers, refugees, unaccompanied minors or irregular migrants. Their length of stay in the host country could be short- or long-term, and they may or may not have the right to participate in the formal education system of the host country. It is also important to note that they are not a homogeneous group. They have many and varied characteristics, such as their linguistic and cultural background and the socio-economic status of their families. However, they are all at risk of facing similar challenges in successfully integrating into the school environment and achieving their academic potential (Eurydice report, 2019).

The specific sub-group of the newly arrived migrants faces even more challenges, including the absence of any documentation of their prior learning. For these reasons, 23 education systems in Europe distinguish between newly arrived migrant students and other first-generation migrants or second-generation students who have been residing in the country and participating in the education system for some time. Some education systems also target new arrivals for specific support. According to recent data, in some education systems, the 'newly arrived' status is defined in terms of a specific timeframe calculated from the time of arrival at the host country (Belgium – Flemish and French Communities, Denmark, the Netherlands, Iceland and Norway). In

other systems, it is counted from their enrolment in the education system (Belgium – Flemish Community, France, Slovenia, Sweden, and the United Kingdom – England, Northern Ireland) (Eurydice report, 2019).

What's at stake? (wider challenges and specific challenges regarding newly arrived migrants' assessment)

What's at stake? (wider challenges and specific challenges regarding newly arrived migrants' assessment)

The assessment of prior skills and knowledge for newly arrived migrants usually focuses on language skills. There are some systems where competences in the language of the host country and/or prior learning of all newly arrived migrants are assessed at primary and lower secondary levels. These assessments are partly used to determine the school level and grade and partly for diagnosing learning support needs. With very few exceptions, European countries tend to assess only language skills. For example, in France, Cyprus and Switzerland, both language and cognitive skills are assessed. In France, prior learning is tested in the home language of the pupil in order to exclude distorting factors in the assessment that might be due to a lack of French language skills; nevertheless, French language skills are also tested (Eurydice report, 2019). According to a wealth of research evidence, students from migrant backgrounds face several challenges that may have a negative impact on their learning and development, and, consequently on the level of inclusion and equality within education systems. There are three types of challenges in migration and education:

[a] Challenges related to the migration process

The process of migration often results in significant changes in the lives of children and young people. They have to leave their previous lives behind and, upon arrival in the new country of residence, they may need to acquire a new language, adapt to new

rules and routines in schools as well as deal with unfamiliar experiences in the wider community (Hamilton, 2013). The impact of such significant life changes (in the academic literature also referred to as 'acculturation stressors') depends on individuals' inner strengths or vulnerabilities; and this affects migrant students' well-being and consequently their educational attainment (Hek, 2005; Transberg & Kond, 2017). Moreover, newly arrived migrants may face 'resettlement stressors' such as poor housing, financial hardship and lack of social support networks. Hostility within the host societies towards people from migrant backgrounds, whether they are newly arrived or long-term residents, can create barriers to building social bridges (ibid). For children and young people, the lack of secure attachments to peers as well as negative relationships with schoolteachers can contribute to feelings of isolation or rejection, which are in turn predictive of social, emotional, and behavioural problems, including a higher risk of early school leaving (Hamilton, 2013). Due to their limited or non-existent skills in the language of instruction, particularly when their previous education has also been limited, newly arrived children and young people may be enrolled into school grades that are significantly below their age and cognitive abilities. Any misdiagnoses could have a negative impact on a child's remaining school career.

[b] Challenges related student participation in education

According to research (Nilsson & Axelsson, 2013; Reakes, 2007), some of the most common barriers which migrant students face in the process of their educational integration in the host countries' systems are:

- lack of information in schools about the academic and non-academic background of migrant children as they arrive;
- inappropriate grade placement;

- language provision that is not adapted to the needs of students with a different mother tongue;
- teachers who are not trained and/or supported to teach in diverse classrooms.

These barriers have negative effects on migrant students' school performance and, later on their professional and social life.

[c] Challenges related to the general socio-economic and political context

In the case of newly arrived migrant children and their access to quality education in the host country, even though there are many initiatives and policies which promote the acquisition of essential language skills, and the provision of learning and social-emotional support, initial assessment of children's background knowledge and skills is not widely carried out and is rarely comprehensive in Europe. In the EU report "Integrating Students from Migrant Backgrounds into Schools in Europe" (2019), it is noted that "top-level criteria for assessing competences in the language of instruction and/or prior learning, which can promote consistency in the initial assessment of migrant students across all schools in the education system, exist in only 18 education systems in Europe" (pp.14-15).

Moreover, once these students access the education system, highest priority is given to the acquisition of host language skills, by providing them with either preparatory classes or additional language support classes, even though top-level regulations/recommendations stipulate that these classes should also cover other curriculum subjects in addition to the language of instruction (especially other core subjects such as mathematics, foreign languages, natural sciences, etc.). Several researchers across the world provide evidence and conclude that **monolingual policies and practices affect students'**

assessment, and that language proficiency appears to negatively affect students' performance in subjects such as Science and Mathematics, in which knowledge is not necessarily connected with the language, (Abedi, 2004; Abedi, Hofstetter & Lord, 2004; Butler, Bailey, Stevens, Huang & Lord, 2004; De Backer, Van Avermaet & Slembrouck, 2017; De Backer, Baele Van Avermaet & Slembrouck, 2019, De Backer, Slembrouck & Van Avermaet, 2019; Kopriva, Gabel & Kameron, 2011; Luykx et al., 2007; Noble, Risebery, Suarez, Warren & O' Connor; Penfield & Lee, 2010). There is strong evidence that even multilingual second-language learners' knowledge in Science and Mathematics is often underestimated when tests use the dominant language (Menken, 2010; Wright & Li, 2008).

Based on the above, it seems very likely that newly arrived migrants, who have extremely limited linguistic skills in the language of the host country, do not find the appropriate channels to communicate and express their knowledge to their teachers. Concerning teachers, according to the EU report "Integrating Students from Migrant Backgrounds into Schools in Europe" (2019, p.23), they are "at the forefront when it comes to supporting the integration of students from migrant backgrounds in schools". However, the research literature shows that teachers often feel unprepared and insecure when confronted in the same classroom with students from different cultural and linguistic backgrounds (Eurydice report, 2015; Sinkkonen & Kyttälä, 2014). This finding is confirmed by the fact that in 28 European education systems, teachers' lack of competences to work in diverse and multicultural classrooms is reported as a main policy challenge. In nearly half of the education systems in Europe it is reported that teachers need stronger competences to work with multicultural classrooms, and specific references are made about the lack

of skills to support newly arrived students either in preparatory/separate classes or in mainstream education. In a briefing paper published in September 2019, titled "Access to education for refugee and migrant children in Europe"², UNHCR, the UN Refugee Agency, UNICEF, the United Nations Children's Fund, and IOM, the International Organization for Migration, detail the obstacles children and adolescents born outside Europe face when trying to access education in Europe. One of the key obstacles is teachers' unpreparedness to work with refugee and migrant children.

If teachers and students had the opportunity to overcome that lack of communication, students' knowledge would be more accurately assessed by educational professionals, and they would be placed in a grade level that matches their actual competence level. Therefore, when this happens, students will be more motivated to participate in the everyday classroom life and the inclusion of the migrant students will be smoother and easier for both students and teachers. In the abovementioned framework, teachers seem to need new approaches and tools to build communication bridges to assess newly arrived (and other) migrants' knowledge and to include them in their everyday classroom life.

How Augmented Assessment offers a solution

The response of the project is an approach which promotes assessment for inclusion, combining:

- visual representations,
- multimodal assessment and
- immersive technologies

in the field of Science and Mathematics.

More specifically, the project will address the above challenge by combining the

² <https://reliefweb.int/report/world/access-education-refugee-and-migrant-children-europe-september-2019>

representational tradition of Mathematics and Science with the multimodality that characterises immersive technologies. On the one hand, research and practice in Science and Mathematics education emphasize the important role of visual representation in understanding and learning (Arcavi, 2003; Eilam & Ben-Peretz, 2012; Kozma, Chin, Russel & Marx, 2000; Noss, Healy & Hoyles, 1997; Schönborn & Bögeholz, 2013).

On the other hand, it is also emphasized that immersive technologies, such as **Augmented Reality** provide a variety of multimodal means that can address diverse students' needs, concerning different learning styles, motivation, gender, language, culture, disabilities (New London Group, 1996). "AR overlays digital information on top of the physical world to create an interactive space where users can explore, discover, interact, and learn" (Craig, 2013; cited in Walker, McMahon, D. Rosenblatt & Arner, 2017, p.2). More about the use of augmented reality in education can be found in the video "[How Augmented Reality Will Change Education Completely | Florian Radke | TEDxGateway](#)". Therefore, linking the power of visual representations within the fields of Science and Mathematics for learning and the power of AR could provide to teachers a solution in their attempt to communicate, include and assess the knowledge of newly arrived (and other) migrant students.

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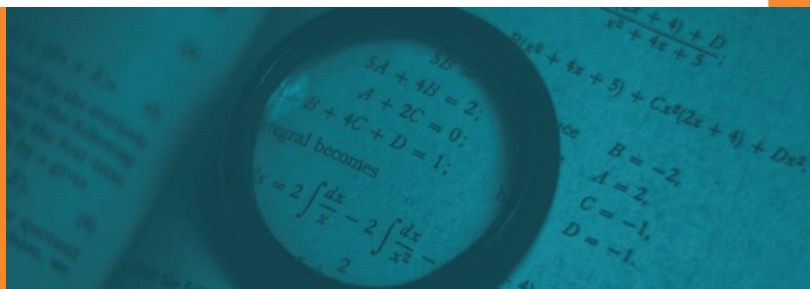
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Methodology



Framework and augmented material development

Creating a framework for assessing Science and Math knowledge

During the project's implementation, partners will create several augmented questions that teachers could use to assess their migrant students' existing knowledge in Science and Math. These augmented questions will be good examples for the teachers participating in the training, and useful resources for all teachers. Additionally, learning objects (3D models) created for these representations will be available to teachers participating in the training to use in order to develop their own representations. Although teachers during the training will create their own augmented questions based on their needs, the initial items created by the partners should be helpful for them.

A common foundation on the aspects of knowledge considered critical for the assessment of newly arrived and other migrants' knowledge in each grade is needed to meet teachers' needs in all the different educational systems of the participating countries in the project. For that purpose, each participating country will form a workgroup of experienced teachers who will propose and, along with the research teams, form the National Framework of Prerequisite Knowledge. That National Framework will include the aspects of prerequisite knowledge that they consider essential for assessing migrant students' knowledge for each grade. These National Frameworks will be compared. The leading partner (EUC) of this task will highlight the similarities and the differences between the National Frameworks. The

partners will make an effort to reach a consensus on their differences to agree to a Common Framework of Prerequisite Knowledge. This Common Framework will be the foundation upon which the assessment material will be developed.

Creating a workgroup of expert and experienced teachers

Each partner from the implementation countries (Greece, Cyprus, Portugal and Finland) participating in this work package will form a workgroup of researchers, scholars and at least five highly qualified or expert teachers of primary and secondary education. These teachers will be selected through an application and an interview process. The selection of teachers will be based on academic qualifications, teaching experience, previous experience with European projects, and their willingness and availability to participate in the project and to be members of the workgroup. The total number of participants in each workgroup will be 7-9 people. All the workgroups should have at least two primary education teachers (one with expertise in Math and one in Science) and four secondary education Science teachers (at least one with a major or expertise in Physics, one in Chemistry and one in Biology).

These workgroups will work along with the project's staff members to determine the prerequisite knowledge on their national level.

Determining the prerequisite knowledge on a national level

Each workgroup will determine the prerequisite knowledge for Science and

Mathematics at the national level. Scholars and researchers will collaborate with the teachers to highlight and determine the essential aspects of prerequisite knowledge for Science and Mathematics in 4th to 9th grade based on the national curriculum's goals and objectives. In some educational systems, the national curriculum overestimates the prerequisite knowledge needed by a student to be included in a grade; that is why the members of the workgroup are asked to use their national curriculum as a reference or base and to develop the aspects of the prerequisite knowledge based on their experience. The purpose of that process is for the Frameworks to be as close as it gets to real classroom conditions and the actual needs of the teachers who are called to include newly arrived and other migrants in their classrooms. Additionally, the teachers (members of the workgroups) are asked to keep in mind that these aspects of knowledge should be representable via multimedia.

During this stage, the workgroups should answer the following question:

- *Which are the most critical aspects of knowledge in Science and Mathematics that students should have to integrate into each grade and educational level?*

At the end of this stage, the workgroup should provide a list of the most critical aspects of the prerequisite knowledge in each national context following the quantitative indicators described below:

- Science in 4th to 6th grade: max. fifteen (15) aspects of knowledge for each grade, max. forty-five (45) in total
- Mathematics in 4th to 6th grade: max. fifteen (15) aspects of knowledge for each grade, max. forty-five (45) in total
- Science in 7th to 9th grade: max. twenty (20) for each subject (Physics, Chemistry, and Biology) for all grades, max. sixty (60) in total
- Mathematics in 7th to 9th grade: max. Twenty (20) aspects of knowledge for each grade, max. Sixty (60) in total.

Writing instructions will be formed to guide partners on the form of the aspects. The form will be based on the ABCD model for writing instructional objectives. The members of the workgroups will include three parts in the aspects, namely Audience ("students should be able to..."), Behavior (action verb and result) and Context (in what circumstances). Workgroups and staff members in each country will work together to finalize their National Framework. National Frameworks will be sent to the leading partner of the task.

Developing a common framework of prerequisite knowledge

The National Framework of prerequisite knowledge were compared to find similarities and differences between participating countries. Unfortunately, this comparison guided us to the conclusions that the differences between the participating countries are significant and a consensus will be very difficult to achieved. That conclusion is aligned with the existing knowledge about the European national educational systems.

Since the common framework' goal is to create a common place for and to represent the needs of all the partners, the consortium decided at the second PAT meeting, to re-examine and change the methodology of developing the common framework of prerequisite knowledge.

Based on the above-mentioned decision, Each partner will propose representative aspects from their National Framework, as follows:

- **Science 4th-6th:** Each country will propose 10 aspects from the National Framework to be included in the common framework, at least three from each grade (from all subjects)

- **Math 4th-6th:** Each country will propose 10 aspects from the National Framework to be included in the common framework, at least three from each grade
- **Science 7th-9th:** Each country will propose 15 aspects from the National Framework to be included in the common framework, at least five from each grade (from all subjects)
- **Math 7th-9th:** Each country will propose 15 aspects from the National Framework to be included in the common framework, at least five from each grade each partner will propose.

The coordinator of the task will combine the proposals to create the common framework of prerequisite knowledge.

That framework will include the following number of aspects:

- **Science 4th-6th:** 40 aspects, ten aspects from each country
- **Math 4th-6th:** 40 aspects, ten aspects from each country framework
- **Science 7th-9th:** 60 aspects, fifteen aspects from each country
- **Math 7th-9th:** 60 aspects, fifteen aspects from each country.

The coordinator will work on the format of the aspects to reach verbal consistency.

Creating assessment material

Partners and their workgroups will divide and undertake the creation of assessment material (verbal questions) based on the aspects of knowledge described in the framework. Items should have a form that could be represented via a multimedia story (e.g. image or video).

The partner and their workgroups will be responsible for creating assessment material for one of the specified grade/subject categories. Based on the PAT decisions, the following partners will undertake responsibility for each category:

- The University of Helsinki and the Finish workgroup are responsible for Science in 4th to 6th grade: forty-five (45) items.
- The European University of Cyprus and the Cypriot workgroup are responsible for Mathematics in 4th to 6th grade: forty-five (45) items.
- The Aristotle University of Thessaloniki and the Greek workgroup are responsible for Science in 7th to 9th grade: sixty (60) items in total, twenty (20) items for each subject (Physics, Chemistry, and Biology).
- The Polytechnic University of Porto and the Portuguese workgroup are responsible for Mathematics in 7th to 9th grade: sixty (60) items in total.

At the end of this stage, each partner will provide a pool of questions for the category of their responsibility. Partners will then be asked to review the pools of questions of the other partners. Next, each workgroup will use the feedback provided by the review to make proper adjustments. Finally, each partner will translate all 210 questions into their national languages.

These questions will be transformed into augmentations using 3D models or other multimedia in the project activity described next.

Pool of Augmented Questions

In this stage of the project, the augmentation of the assessment material and the creation of the Augmented Assessment Library will take place.

The pool of assessment material developed during the previous Work Package will become augmented via augmented reality applications. The workgroups will connect the items with multimedia (videos, pictures, etc.) that represent each assessment question. Pools of augmented assessment material (non-verbal) will be developed. A Library that will host the pools, the guidelines, the teachers' training course materials, the resources for creating augmented assessment

activities and other teaching material will be created. The prepared content will be uploaded to be used by partners and all relevant stakeholders, including schools and other educational institutions, during the lifetime of the project and well after its end.

Creating a pool of Augmented Questions

Each workgroup from those developed during the previous WP will be supported by a digital designer/ IT expert to create proper multimodal representations (videos, pictures, etc.) of the questions of their responsibility for **at least 50% of the verbal questions created based on the aspects proposed by each country**. When the representation of one item is ready, the question will become augmented using an augmented reality application and will be used to create a pool of augmented questions.

The remaining 50% of the verbal questions will remain available for augmentation by the teachers participating in the training (WP3).

Sharing the pools and review

When the pools of augmented assessment material (non-verbal questions and activities) are available, the workgroups will share their pool of responsibility for review with the other partners. Each partner and the workgroups will take the review into

consideration and make proper adjustments to the augmented material.

After this step, four pools of augmented assessment material will have been created as follows:

- Primary Education (4th-6th Grade)
 - o Mathematics
 - o Science
- Secondary Education (6th-7th Grade)
 - o Mathematics
 - o Science with three subject-pools as below:
 - Physics
 - Chemistry
 - Biology

At the end of this step, workgroups will upload both the pool of the verbal expression of the question and the pool of the non-verbal augmented items, with the instructions in their national language to the Augmented Assessment Library which will be developed as explained later in this document.

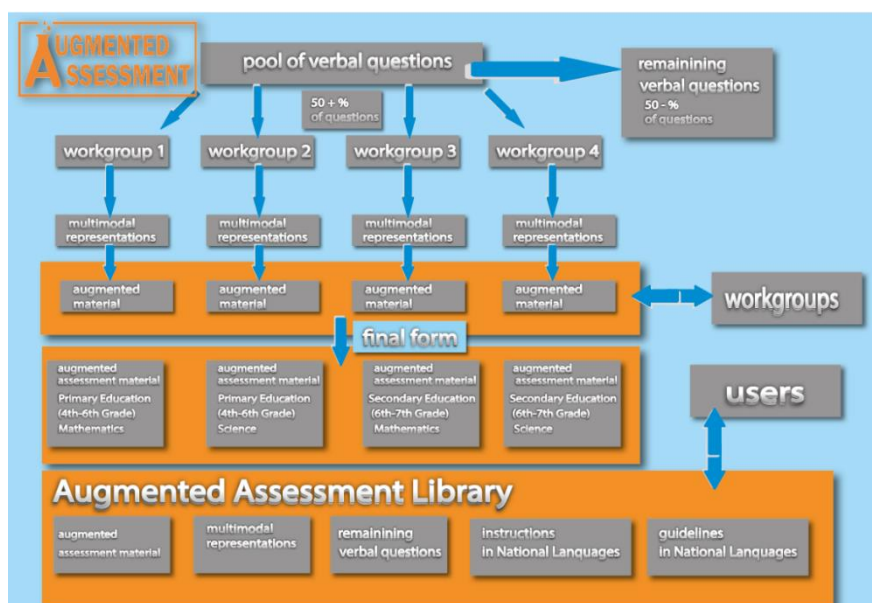


Figure 1: A schematic representation of the Augmented Assessment methodology

Teachers' training

Inclusive Science and Math education and the importance of assessment

The European educational landscape

Even though Europe faces the challenge of integration and inclusion of newly arrived and other migrants, it seems that monolingual policies that do not support integration and inclusion are reinforced in European education systems. Immigrant students' educational success is often determined by their host language skills (Pulinx, Agirdag & Van Avermaet, 2014) – even when language is not at the center of the subject (Menken, 2010; Luykx, Lee, Mahotiere, Lester, Hart, & Deaktor, 2007) – as is the case in many science, technology, engineering and mathematics (STEM) subjects. This unfair path begins at the arrival of migrant students, for in most European countries the diagnostic assessment of newly arrived migrants solely measures host language skills. As a result, these students may be placed at a grade that is not reflective of their age nor cognitive abilities. This can have negative consequences both on the students' motivation and their social ties. The lack of attachment to peers and negative relationships with teachers may lead to social emotional and behavioural issues (Hamilton, 2013), on top of potential and harmful stressors associated with acculturation and resettlement (Hek, 2005; Trasberg & Kond, 2017). Additionally, migrant students may face teachers that are untrained or unsupported to teach in diverse classrooms (Reakes, 2007; Nilsson & Axelsson, 2013) and language provisions that are not adept to the students' needs. According to Noorani, Baïdak, Krémó and Riiheläinen (2019), upon arrival of migrants, highest priority is given to the acquisition of host language skills. As a result, other curriculum subjects may be neglected. This leaves the students in an unfavourable position: lacking behind in both the host language skills, and other subjects.

These structural issues may play a role in the worrying statistics regarding immigrant students. For example, in multiple countries immigrant students perform worse than their non-immigrant peers, even after accounting for socio-economic background (OECD, 2019). Immigrant students are also over-represented among the early leavers from education and training in many European countries. (European Commission, 2014; Hippe & Jakubowski, 2018). To ensure equal opportunities of success for all students, we must address the structural inequalities at the beginning of the spiral – the diagnostic assessment of newly arrived migrant students.

The benefits of Augmented Assessment – Pedagogical perspectives

In this chapter we aim to shed light into the pedagogical theories and ideas that guide the development of the Augmented Assessment tool. In doing so, we hope it will become evident that such a tool will benefit, not only the newly arrived migrant students, but also teachers, other students, and the society at large.

Students' perspective

As was stated earlier, the focus on host language skills in diagnostic assessment can lead to the newly arrived migrant students' misplacement on grades that are not reflective of their cognitive, nor academic competences. As a result, students may experience negative task-related emotions. Ideally, the learning environment should encourage positive task-related emotions, as they have been associated with increased student engagement and motivation (Reeve, 2012). Engagement and motivation in turn have been associated with higher academic achievements (Sciarra & Seirup, 2008), while a lack of engagement and motivation has been linked with increased drop-out rates (Lehtonen, 2012). As we noted earlier,

statistics regarding immigrant students' academic achievements and drop-out rates are worrying. For this reason, improving newly arrived students' motivation is at the core of Augmented Assessment. According to the well-known motivation theory of self-determination (Ryan & Deci, 2002) people have three basic psychological needs that need to be fulfilled for them to feel motivated: Autonomy, competence, and relatedness. In the following paragraphs we explore these basic needs, and how Augmented Assessment can help fulfil them.

Firstly, to feel motivated, an individual needs to feel autonomous, in control of their life. Naturally, multiple factors restrict our autonomy on a daily basis. For newly arrived migrant students perhaps the most evident restriction on their autonomy is their host language fluency: Their ability to navigate their surroundings is dependent on the extent to which they can understand and express themselves in the dominant languages. Augmented Assessment aims to increase newly arrived migrant students' autonomy, by allowing students to explore sciences without the restrictions of language.

Secondly, to feel motivated, an individual needs to feel competent. This, according to Ryan and Deci (2002), means that we have an inherent desire to use our capacities and overcome challenges. Underestimating students' capabilities strips them of the opportunity to face challenges, while tasks too challenging deprive them from the joy of overcoming them. Vygotsky (1978) suggests that in fact the ideal state for learning is when the child is not quite able to complete the task at hand by themselves – but will be able to do so with the support of others. To create such a state, an accurate assessment of the student's abilities is crucial. Additionally, competence is also connected to autonomy in that our knowledge and beliefs of our competence may restrict our sense of autonomy – and vice versa. This is why Augmented Assessment aims to help newly

arrived migrant students with tasks appropriate to their skills, so they may feel as competent as they actually are.

Lastly, to feel motivated, an individual needs to feel relatedness; to have close emotional bonds and secure attachments with others. Upon migrating, students may largely be stripped of what is called social capital – the social links, shared values and understandings that allow for co-operation between people (Brian, 2007). Social capital (or the lack thereof) understandably factors into feelings of relatedness, even more so, when students do not yet share a language to communicate with their peers. It is thus essential to create tools such as Augmented Assessment, which allow for more versatile means of communication and cooperation.

To sum up, the focus on host language skills in diagnostic assessment can at worst prevent all three basic psychological needs of a migrant student from being fulfilled. Such a process is exemplified in Byars-Winston's (2014) study, where he notes that minority students may be affected by students' and teachers' perceptions of their abilities in the STEM field – as far as to cause them to internalise conflicted (and imagined) social identities of their minority group as inherently “bad for science”. This example demonstrates how external feedback may impact their beliefs of their own competence, which then causes them to underestimate their autonomy in the STEM field. But this internalised distinction between the minority and the majority groups and their competences can also reveal a lack of relatedness with the majority group. With Augmented Assessment we want to help newly arrived migrants feel autonomous, competent and related. Because fulfilling these needs is essential for motivation, which, in turn, is associated with high engagement, high achievements and low drop-out rates. And more importantly, because fulfilling these needs is beneficial for the students' psychological wellbeing (Orkibi & Ronen, 2017).

Teachers' perspectives

Augmented Assessment is a well-suited tool for teachers who wish to increase their students' motivation, not only because by targeting the three basic psychological needs it bridges some of the gaps caused by language barriers, but also because of its augmented reality features. In the following paragraphs we elaborate on how Augmented Assessment may benefit not only the newly arrived migrant students, but also their teachers, as well as the whole class.

Augmented reality applications have been found to improve collaborative learning, as they provide new ways of communication and cooperation (Diegmann, Schmidt-Kraepelin, Eynden & Basten, 2015). As we addressed earlier, diverse means of communication and cooperation between the students may help fulfil their basic psychological need of relatedness. But improved communication and cooperation between the migrant student and the teacher may also improve the student-teacher relationship. A positive student-teacher relationship has been associated with students' improved academic achievement, but also with a positive effect on behaviour, conditions and social relationships (e.g. Birch & Ladd, 1998; Hamre & Pianta, 2001). By providing new ways of communication and cooperation Augmented Assessment may spark changes that positively impact the atmosphere of the whole class.

Augmented reality is also unique in that it both allows for non-language-based learning, and learning in almost any given language, due to advanced translation programmes. This allows the student to utilise any languages they know, which also encourages additive multilingualism—the development of a new language while continuing to develop already known languages (Cenoz, 2013), but also translanguaging - or the use of varied skills in different languages. The visibility of additive multilingualism in the classroom is important, as it gives space for students'

diverse multilingual identities. According to Hermans (2001) "the self" is composed of multiple fractions which he calls I-positions. The newly migrated students might have several I-positions that are imposed on them in their new school, including for example "I – the immigrant" or "I – the speaker of my language". While we may not be able to prevent the formation of these I-positions, by normalising the use of multiple languages, Augmented Assessment may help to create positive connotations to these I-positions. A learning environment where students' diverse I-positions are accepted and appreciated benefits all students in class - as well as the teacher.

One of the additional benefits of the online library created for Augmented Assessment is that it allows for contributions from teachers around the world. This not only helps busy teachers in need of easy-to-use material, but it also creates a platform for potential dialogue with and input from a diverse cast of global teachers. This is important, as the STEM field has often been criticised for being eurocentric. We therefore believe that Augmented Assessment has a far-reaching potential for supporting the diversification of science education.

Despite the benefits of inclusive classrooms, it has been documented that teachers often feel unequipped to promote the inclusion of migrant students, both in regards to assessment and everyday practices (Manzoni & Rolfe, 2019). While Augmented Assessment predominantly focuses on the assessment of perquisite knowledge of newly arrived migrant students, with the contributions of teachers it has the possibility to develop into a tool that eases formative assessment and other everyday practices as well. But we acknowledge that it is important to not only create tools, but to also offer the necessary training for teachers to be able to use these tools, and to feel equipped to promote inclusion. For this reason, the Augmented

Assessment project also includes formal training and development for teachers.

Societal perspectives

We have outlined some of the various ways in which Augmented Assessment may help students, teachers and the STEM field. Augmented Assessment however also has the potential to spark large scale changes in many ways: Firstly, by allowing students to reach their best potential we may discover and empower talents, that we would have otherwise not been able to emerge identify and stimulate for the future. Secondly, by improving communication and understanding between people, we may improve social cohesion, which is in dire need in polarised societies. Thirdly, by creating structures that encourage language diversity, we may provide space for structures that allow for all kinds of diversity. And lastly, by creating a network of teachers from all around Europe and around the globe, we allow for diverse voices to be heard, not only in the classroom, but on the whole STEM-field.

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Design of the augmented assessment teacher training course

A main output of the project is the intercultural Augmented Assessment professional development course, which will target in-service mathematics and science teachers of upper primary and lower secondary school (ages 9-15). The course, which will be developed, pilot tested and delivered within the project lifetime, will take into account best practices in mathematics and science education, teacher education, and blended learning to promote the inclusion of newly arrived and other migrant children (aged 9-15) into mainstream mathematics and science classrooms. It will achieve this by equipping participating teachers with the knowledge and skills required to use the Augmented Assessment Library, augmented reality technologies and multimedia for the creation of inclusive formative and summative assessment approaches, and for the promotion of inclusive pedagogy that will enable migrant students to participate fully in their learning.

We next provide a brief overview of the Augmented Assessment professional development program design: course objectives, pedagogical and didactical approach, course content and structure.

Objectives of the Teacher- Training Course

The following objectives have been set regarding teachers' knowledge, skills and stances, during the training.

Knowledge

It is expected that upon completion of the training, teachers will be able to:

- (a) identify the theoretical ideas and pedagogical principles underpinning the utilization of formative and summative

assessment in the fields of Science and Mathematics to promote inclusive education

- (b) acknowledge the importance of multimodal/instructional representations in the fields of Science and Mathematics
- (c) explain the contribution of immersive technologies (Augmented Reality) to formative and summative assessment and draw connections between multimodal assessment and immersive technologies

Skills

It is expected that upon completion of the training, trainers will be able to:

- (a) create and adjust learning objects for representation by using user-friendly free graphic design software (eg. Vectr, Vecteezy, Inkscape)
- (b) use augmented reality applications such as Zapworks, ARtutor, Metaverse for summative and formative assessment
- (c) design augmented assessment material

Stances

It is expected that upon completion of the training, trainers will have developed:

- (a) a positive stance towards the utilization of immersive technologies for summative and formative assessment in the fields of Science and Mathematics
- (b) a positive stance towards the use of AR-supported formative and summative assessment for the inclusion of migrant students.

Course Pedagogical and Didactical Approach

The Augmented Assessment teacher professional development course design will be guided by the Technological Pedagogical Content Knowledge (TPACK), the influential conceptual framework proposed by Mishra and Koehler (2006) in response to the

absence of theory guiding the integration of technology into education. Building on Shulman's (1986) idea of Pedagogical Content Knowledge, TPACK emphasizes the importance of developing integrated and interdependent understanding of three primary forms of knowledge: technology, pedagogy, and content. The framework is based upon the premise that effective technology integration for pedagogy around specific subject matter requires developing understanding of the dynamic relationship between all three knowledge components. Following the main premises of the TPACK conceptual framework, the "Augmented Assessment" course will be designed to help teachers move beyond technocentric strategies that focus on the technology rather than the learning (Mishra & Koehler, 2006), and to promote their critical reflection on the educational use of AR and other technologies as tools for assessing and developing students' mathematical and scientific reasoning.

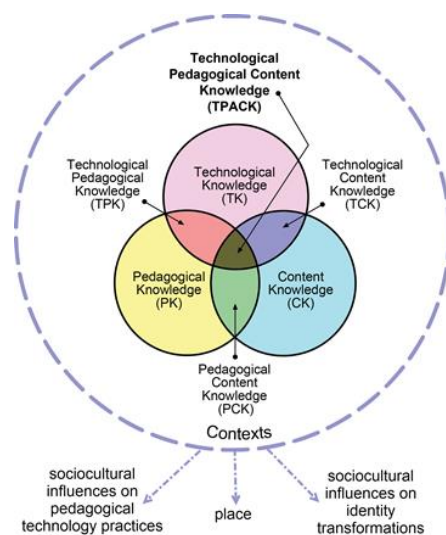


Figure 2: TPACK re-contextualized framework (Source of the initial TPACK image: <http://tpack.org/>)

The theoretical underpinnings of the professional development program are located within sociocultural theory. In Augmented Assessment, TPACK is perceived not as an individually acquired attribute, but

as an embodied phenomenon shaped by social, organizational, and cultural factors extending beyond individuals (Phillips, 2013) Corroborating with Phillips' re-contextualized TPACK framework (Phillips, 2006) illustrated in Figure XX, the basic TPACK model will be enriched with the addition of the components of Communities of Practice (Wegner, 1999), and school-based teacher development (McLaughlin & Talbert, 2006).

While the program will employ innovative augmented reality tools and resources to support educationally useful human-computer interactions, its focus will be on exploiting technology to support human-human interactions. The teacher training course will be designed to facilitate the creation of both local and online communities of practice by encouraging rapport, intercultural awareness, and sharing of experiences among participants.

A systemic approach to examining and extending teachers' TPACK of Augmented Assessment will be adopted, by putting emphasis on the socially mediated contexts in which teachers develop their TPACK. The Pilot Training and Implementation to be conducted in multiple schools in different partner countries will help to fill a serious gap in technology-enhanced learning research pointed out by Beavis, Muspratt and Thompson (2015) – the lack of research that accounts for the realities of school. Teachers will have the opportunity to assess whether the augmented assessment materials are indeed effective and successful for the assessment of their migrant students' prior knowledge in Science and Mathematics. Research in actual school settings will help to overcome researchers' and policymakers' tendency to overlook the difficult conditions under which most teachers and students are operating in schools when investigating innovative approaches based on 'state-of-the-

art' technologies like AR that will be exploited in the Augmented Assessment project.

Finally, the design of the professional development course will be based on key principles of adult education. Although there is no specific theory about learning in practice, several studies have been conducted over the past decades to investigate the ways in which adults develop the required knowledge and skills to effectively function in everyday life and in work situations. The main conclusions of these studies are the following (taken from Groenestijn, 2007):

- (i) Adults are free to learn; there is no compulsory education for adults
- (ii) Learning happens in a functional situation; there is a need for learning
- (iii) Learning in practice is characterized by learning through authentic materials
- (iv) Knowledge acquired in practice is almost always functional and applicable ('knowledge-as-a-tool' rather than 'knowledge-for-knowledge')
- (v) Every learning situation is a socio-culturally determined situation: Learning is an interactive and social act in which everybody takes part
- (vi) Learning in practice focuses on 'shared cognition', rather than on 'individual cognition'. In work settings, employees are often complementary to one another, asking questions, discussing the problems they meet, and jointly seeking solutions
- (vii) The way in which learning in practice takes place is often via showing - imitating - participating and applying: There is no need to create specific instructional settings.
- (viii) For learning in practice people construct or re-construct their own 'rules-of-thumb' and informal 'rules and laws' for managing actions, situations, materials and the environment in which they work.

Thus, to make training relevant and attractive for teachers, they should experience it as usable and applicable to their actual classrooms. Dunleavy and Dede (2014) underlined the need of teachers' preparation in using AR and the different pedagogical strategies that this task entails.

Drawing upon the relevant literature, the Augmented Assessment training will use adult appropriate teaching strategies. Rather than adopting a transmission-of-knowledge instructional model, the teacher training course will be designed to facilitate inquiry and problem-based learning. Educators participating in the course will be responsible for their own learning, facilitated by an environment rich in challenges and interactions. They will be trained in how to use Augmented Reality and multimedia to create their own augmented assessment material and use it to build communication bridges with newly arrived and other migrant students and to accurately assess their prior knowledge in science and mathematics. Particular emphasis will be put on drawing upon and extending teachers' workplace experiences. The teacher training will be followed by participants implementing the Augmented Assessment approach in their schools. We believe that this can help to further determine the actual educational potential of the Augmented Assessment approach.

Course Content and Structure

The Augmented Assessment Teacher training course will be made up of 6 modules covering the following topics (slight modifications are possible during the curriculum design and implementation phase):

- **Module 1 - Augmented Assessment:** Ways in which the augmentation of the assessment material supports the inclusive assessment of newly arrived and other migrants
- **Module 2 - Pedagogical Framework:** Students' knowledge in Math and Science,

Formative and Summative Assessment in Science and Mathematics Education, Multimodality and Augmented Reality as a means to inclusive assessment

- **Module 3 - The Augmented Assessment Library:** How to use the Augmented Assessment Library to assess newly arrived and other migrants' knowledge in Science and Mathematics to foster their inclusion
- **Module 4 – Creation of Augmented Assessment Material:** How teachers can create their own augmented assessment material based on their context needs – This module includes the guidelines for teachers to create augmented assessment items
- **Module 5 - Creative formative assessment:** How to take advantage of the Augmented Assessment results through creative assessment methods using AR and multimodality
- **Module 6 - Practical course task:** Self-assessment of learning outcomes and self-generation of the Augmented Assessment Certificate (interactive resource).

The curriculum and key contents of the professional development course will be developed in English and translated to all other partners' languages. All partners will participate in the development of the curriculum.

Once the curriculum and key contents of the teacher training course are developed, a Master Trainers' Training event, designed as a 3-day capacity building workshop for staff of participating organisations and expert teachers, will be held in Barcelona, at month XX. The aim of the event will be to assure, at the territorial level, an adequate level of knowledge and competences on the side of partners' staff and collaborating expert teachers to manage the testing phase with teachers and students. More importantly, the Master Trainers' Training event will aim at

creating among selected partners a common and shared understanding on the different aspects of the methodology, its main tools and dynamics.

The core national implementation teams from partners will attend the "Master Trainer" seminar. A total of twenty trainers (20) trainers will participate in the training from each of the partner countries:

- Greece- Athens (2 expert teachers, 2 people from project's staff team)
- Greece- Thessaloniki (2 expert teachers, 2 people from project's staff team)
- Cyprus (2 expert teachers, 2 people from project's staff team)
- Portugal (2 expert teachers, 2 people from project's staff team)
- Finland (2 expert teachers, 2 people from project's staff team).

Participants of the Master Trainers' Training event will be trained in the Augmented Assessment methodology, in how to use the Augmented Assessment Library to foster newly arrived and other migrants' inclusion through formative and summative assessment of their knowledge in science and mathematics, how to create augmented assessment content, and how to teach and share the project resources and methodology. The expected outcome of the event will be a pool of teachers and operators, working in partner organisations with reinforced abilities to become "trainers of trainers" in their respective territories. These professionals will lead the pilot testing of the blended training course for Augmented Assessment Teachers to take place in four partner countries (Greece, Cyprus, Portugal and Finland), undertaking the training of the group of teachers at their national level.

The course will be delivered using a "blended-learning" method, in order to offer teachers time flexibility, provide easy access to

additional content (articles, videos etc.), encourage communication, and develop a personal contact with the participants. At the beginning of the course, teachers in each country will attend a series of face-to-face seminars. Course participants will be familiarized with the project philosophy, objectives, and resources. More importantly, they will get the chance to meet and interact with one another, share issues and problems, as well as exploit the course facilitators' presence to ask questions about things they are unsure of. This initial in-person meeting will reinforce teacher online engagement (Kavanaugh et al., 2005) since it will mitigate the problem of trust and social presence online (Ardichvili et al., 2003). The seminars will consist of a combination of mini-workshops that will include AR-enhanced and hands-on activities in small groups (5-6 persons), presentations by experts, and discussions. Language of tuition will be the national language of each partner country.

The remainder of the course will be delivered online using the instructional content and services of the Augmented Assessment Library and of the course dedicated platform for teaching, support and coordination purposes. The site will offer access to various tools and resources, including the following:

- A Pedagogical Framework and Curriculum Definition: Layout of structure of different modules, phases, methodologies, learning outcomes for teachers; description of main topics to be treated
- Instructional Contents: A line of research-based curricular and instructional materials to be used during the professional development course
- Interactive resource for assignment of practical tasks, self-assessment of learning outcomes and generation of a certification
- E-learning material for teachers in each national setting

- Collaboration Tools for professional dialogue and support (e.g. discussion forums, chat rooms, etc.).

As already pointed out, a special emphasis of the Augmented Assessment course will be on building an online community for the exchange of ideas, content, tools, and didactic approaches among the European parent educators participating in the training. Throughout the course duration, teachers across partner countries will participate in online discussion forums, exchanging experiences, ideas, and educational resources.

At a final stage, teachers will undertake a teaching experiment. They will customize and expand upon the tools included in the Augmented Assessment Library, but will also create new augmented assessment materials, and apply them in a population of migrant students, especially the newly arrived ones. This application will be the "crash test" of the products already developed, both for the group of teachers who are going to apply them and for the groups of students who are going to receive this innovative educational approach.

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The Augmented Assessment Library

During the same period, the Augmented Assessment Library that will host the pools of the augmented questions will be created by the University of Pompeu Fabra.

The toolkit implementation will be based on the existing community platform LdShake (Hernández-Leo, Moreno, Chacón & Blat 2014), later extended as the Integrated Learning Design Environment (ILDE, Hernández-Leo et al., 2018), which provides a baseline for the necessary infrastructure. The platform will be adapted for the requirements of the Augmented Assessment project and will serve to host the augmented assessment material. The users will find the guidelines, instructions and resources for creating augmented assessment activities, teachers' training course materials, and the augmented questions itself on the platform. The platform will provide community features, which will enable, for example, adding comments and likes to shared materials.

The Augmented Assessment Library will be designed to have the following necessary preferences:

- a) Language (according to the partners' national language and English)

All the material (including guidelines, instructions, the augmented assessment material, etc.) will be displayed based on the language selection.

- b) Primary or Secondary Education

Only the augmented assessment material of the selected education level will be displayed based on this selection.

- c) Mathematics or Science

Users will choose if they are interested in Mathematics or Science and only the augmented assessment material of the selected subject will be displayed based on this selection.

- d) Selection of augmented items

Users will choose the items which are needed to assess their student(s)' knowledge. After the selection, the Library will export a pdf that includes the selected augmented questions. The Library will provide the teacher with the proper instructions about the use of the application that they must use to trigger the augmentations.

- e) Proposing your own augmented assessment material

Users will have the opportunity to upload their augmented assessment material using the Augmented Assessment Library. Their material will be included in the right pool with a sign that is created by the user.

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Implementation at schools

This phase of the project involves the practical implementation of all previously developed products and outcomes in real life settings, and the application of the project methodology to schools in the participating countries.

In summary, the implementation phase involves the following activities:

- Open Call for Schools

Project partners through an Open Call process will select five (5) schools per participating country in order to implement the project outputs. Among the basic criteria for this selection is the hosting of newly arrived migrant students in the relevant school communities.

- Selection of the Teachers

Once the five (5) schools have been selected in each national context, teachers belonging to their staff will be selected to participate in the pilot training on the use of the augmented assessment materials to their migrant students and on the creation of new materials.

- Pilot training

Training courses will be organized in the participating countries where the Augmented Assessment methodology will be piloted, in Greece, Cyprus, Portugal and Finland. At least 80 teachers from these partner countries will be trained in the project's methodology. The training will combine face to face meetings and online learning. During the training teachers of Mathematics and Science will be trained not only to use the previously developed materials, but also to create new augmented assessment materials to be applied in their classrooms, to suit the needs of their migrant students. Teachers will get acquainted with the process and they will be equipped with innovative means to evaluate, assess and therefore include migrant students

according to their level to the right grades of their schools, for Mathematics and Science.

Application of the augmented assessment materials

During the pilot training teachers will apply the materials to a group of around two hundred (200) students in each participating country, 30% of whom will be newly arrived migrant students, in order to check whether the materials are effective and successful for the assessment of migrant students' prior knowledge in Science and Mathematics. This application will be the "crash test" of the products already developed, both for the group of teachers who are going to apply them and for the groups of students who are going to experience this innovative educational approach.

These activities will be organized and implemented in the following manner.

Open Call for the participation of schools

Overview

Twenty (20) schools from each of the implementation countries, that is five (5) schools from Greece, Portugal, Cyprus and Finland, will be chosen in order to pilot the Augmented Assessment methodology. The schools targeted by this methodology are those that host a significant number of migrant students among their population, especially newly arrived ones.

The procedure for the selection of the pilot schools will entail an Open Call towards all interested schools in the participating countries. During this stage, the final criteria for the selection of the pilot schools will be developed. Through this process, twenty (20) schools – with large presence of newly arrived migrant students - interested and willing to participate in the project activities, will be selected as pilot schools for the implementation of the Augmented Assessment Methodology.

The Open Call

The Open Call for the participation of schools in the partner countries is key for the implementation of the project outputs and methodologies and a crucial factor for the success of the project. Therefore, it has to be carefully planned and executed in order to ensure that the participating schools will invest the time, the effort and the means required for the smooth implementation of the project until its very end.

For a successful and effective Open Call for schools, the following steps need to be considered and taken by each participating organization in their respective country context:

Identification of the target schools

Each partner will develop a list of the potential schools which would be suitable to participate in the project activities. The schools on the list will be contacted, informed and sensitized in order to promote, achieve and ensure their participation. The schools to be approached and contacted need to have the following characteristics:

1. Public or private schools and educational institutions which offer education classes for grades 4th to 6th and 7th to 9th. Therefore, no preschool institutions will be eligible to participate in the project, nor schools offering classes beyond the 9th grade. These schools should offer the national educational curriculum, which includes the subjects of Mathematics and Science (Physics, Chemistry, and Biology)
2. High concentration of migrant students, preferably newly arrived migrant students. High concentration means that at least 20% of their students belong to the group of migrants. Existence of other groups of disadvantaged learners in a school will also be a factor influencing the selection of schools to be contacted. On the other hand, the country of origin of migrant students, their gender, their host language competences and their level of integration in the host country

education system are not factors to be taken into consideration, so as to allow for any migrant student to benefit from the project activities and outcomes. M3. Schools which have a record of participation in previous pilot projects related to the population of migrant students. At this stage, these schools are preferred since they already have the experience with the practical aspects for the implementation of a European project and are acquainted with the process these projects usually follow. These schools will therefore have the experience of cooperation with different agencies targeted at the social integration of migrant populations. Schools with no previous such experience will also be included at a later stage, in case the development of a group of five (5) schools in each participating country has not been achieved.

4. Schools with an active community of teachers will also be included in this primary list. An active community of teachers will guarantee their active and continuous participation in the project activities and their commitment to be fully engaged in them, which not only involves the application of a set of activities and augmented assessment materials, but also the creation and development of new materials. These teachers need to be willing and enthusiastic to test new approaches and to go beyond their traditional role to provide standards-based instruction and guidance to students, assuming the role of co-creators and co-producers of new innovative tools. These teachers should be interested in the educational inclusion of their migrant students and sensitized towards this direction. A strong and effective school management team is also among the factors to be considered at this stage, since the activities involve the constant cooperation with the school management.

Project partners should develop this list based on relevant research among their networks of cooperation and on relevant research for

schools having participated in other similar European projects in the past. The schools which already have expressed their commitment to participate in the project, even at the proposal stage, providing the partnership with “Letters of Support” will also be included in the list. Likewise, the schools in which members of the national workgroups (WP1: Framework for assessing Science & Math knowledge and assessment material, Step 2) are employed is highly advisable and expected to be reached and encouraged to participate, as well.

Development of the Open Call.

A common Open Call process will be identified by project partners which will later be specified and amended to adapt to the specificities of each participating country. The issues to be considered for this process are the following:

Preparation of the application form for schools to participate in the project.

The application form for schools should be brief and easy to fill in. Some basic school information should be requested, such as the school level, the percentage of migrant students and/or students belonging to other disadvantaged social groups (for example, refugee, Roma and asylum-seeking students), the location of the school and the participation in previous similar projects. Some open-ended questions should also be included, in order to reveal the level of engagement the school is expected to show during the implementation of project activities. Questions such as “Why does the school want to participate in the project?” and “What benefits does the school expect to achieve through the participation in the project?” should highlight the level of preparedness of each school to embark in such initiative. Application forms should be addressed and filled in by the school director and/ or the relevant administrative body.

Text/ language

The Open Call should be developed in a brief and reader- friendly text targeted at the school leaders and directors as well as the community of teachers. The basic questions which need to be answered through this text are: who, what, how and why. The text of the call should therefore include:

- Who: Project identity. Basic project information (goal, partners, basic activities, expected results) should be included in the text.
- What: Identification of the project request. In this section of the call what is requested by each school should be explained and specified so that it is clear for all parties what is expected by them and how they can contribute in the application of the project
- Why: Reasons to participate. Clear and positive information to attract the potential schools into participating in the project should be included in the text. The Open Call text should inform, sensitize and encourage potential schools to participate, by pointing out the numerous benefits from this participation. These benefits could include the educational and social inclusion of their migrant students, the creation of an open and friendly school environment for all students, especially those threatened with exclusion and marginalization, and the development of skills and competences among the educational staff.
- How: The participation process. The Open Call should include precise information on the application process (or even the application itself), so that school directors fully understand what the application stage entails and how the applications will be reviewed and evaluated in order to conclude to the five schools which are going to participate in the project.

Finally, contact details of the project coordinator as well as the national partner

should conclude the Open Call, so that potential applicants know where to turn to in case of requests, questions and clarifications.

Means

After the finalization of the Open Call text in English and the project national languages, and after the necessary graphic design of the Call, according to the project identity, all relevant means should be considered and selected to achieve the widest possible coverage of the population of schools targeted by the Call. Each national partner will take the final decision on the means to implement to disseminate the Call, but the minimum means should include:

- uploading of the Call on the project site in English and in the partner languages
- sending of a newsletter in the national languages
- provision of a space in the project partners' official websites and social media, to direct to the project site and the application form
- development of social media posts directing all interested parties to the project site, the Open Call text and the application form
- pursuit of personal communication with school directors via telephone and emails
- participation and/or announcements in workshops, seminars and events which teachers, trainers, education stakeholders and policy makers attend and/or participate.

Depending on each partner's own means and preferred ways of dissemination, press releases, media announcements and flyers/posters can also be included in the ways to promote the Call and to reach as many potential schools as possible.

Duration

The Open Call and the application process should extend for at least three months, starting as early as possible. It is advisable that project partners start researching on the

potential schools early on so as to reach them as soon as the Open Call and the application form are available. Depending on the specificities of each participating country, the participation of schools could be a lengthy process involving request and acceptance by relevant educational authorities. Therefore, the sooner the process begins the better, for the avoidance of delays and postponements. The duration of the application process should be extended until at least five (5) participating schools are found, attracted and engaged in the project.

Results- Selection of schools

Each implementation team from each project partner will be responsible of receiving the applications from schools and managing the whole process. These teams will select the schools to participate in the project based on common criteria, which should include:

- the school's population of migrant/newly arrived migrant/ other disadvantaged students
- the willingness and commitment of the school to participate, as stated by the school director and/ or the educational staff
- the school's motivation to test new approaches for the benefit of their students
- the school's flexibility to include project activities in the usual school activities.
- the school's experience in European projects and in cooperating with external agents such as local authorities, educational authorities, parents' or citizens' associations, and NGOs.

Based on these criteria each implementation team will select five (5) schools to participate in the project, at a national level, therefore twenty (20) schools in total. A short list of three more schools will also be developed as runners-up in case some of the selected schools ceases to participate in the project at any point of its implementation.

Directors of the selected schools will be contacted to inform them on the selection of their schools and to mutually design the following steps to be taken for the next project phase, which is the pilot implementation of the project methodology.

Pilot phase

Selection of teachers in the participating schools

Once the five (5) schools have been selected in each national context, teachers belonging to their staff will be selected to participate in the pilot training on the use of the augmented assessment materials to their migrant students and on the creation of new materials.

The educational staff and the teachers of the selected schools will be informed about the project activities and especially the ones which involve their active participation and commitment, such as the application and the creation of augmented assessment materials for Mathematics and Science. These teachers will be informed through meetings and/or information materials sent via emails. They will be encouraged to apply to participate in the activities, by filling in a simple application form.

The selection criteria, set by the partnership and applied by each national implementation team should at least be the following:

Teachers in order to be selected should:

- teach on the 4th to 6th and to 7th to 9th grade in their school (i.e., teachers in either primary or secondary education)
- be teachers of Mathematics and/or Science (Physics, Chemistry, and Biology)
- have at least three years of experience in working with disadvantaged learners, especially newly arrived migrant students
- be able to communicate in English in order to comprehend and take advantage of any materials, assessments,

documents, reports and products produced by the partnership, in the framework of the project

- be willing to dedicate time and effort to implement and test new and innovative approaches and methodologies
- be available to participate in project activities, such as the pilot training sessions specifically targeting their group and the implementation and creation of augmented assessment materials.

Teachers will apply to participate in the project activities and once their applications are received, the selection process will commence. The national implementation teams in cooperation with the school directors from the relevant schools will form the selection committee which will review and evaluate the teachers' applications. The selection committee will organize interviews with the applicant teachers in order to make its final selection. Twenty (20) teachers from each national setting (eighty in total) will be selected to proceed with the project activities, while a list of ten (10) runner ups will also be developed in case some teachers fail to fully participate in the project.

Pilot training

Training courses will be organized in the participating countries where the Augmented Assessment methodology will be piloted, in Greece, Cyprus, Portugal and Finland.

At least 80 teachers from these partner countries will be trained in the project's methodology. The training will combine face to face meetings and online learning. During the training teachers of Mathematics and Science will be trained not only to use the previously developed materials, but also to create new augmented assessment materials to be applied in their classrooms, to suit the needs of their migrant students. Teachers will get acquainted with the process and they will be equipped with innovative means to evaluate, assess and therefore include

migrant students according to their level to the right grades of their schools, at least for the subjects of Mathematics and Science.

At least twenty (20) teachers from the four implementation countries (Greece, Cyprus, Finland and Portugal) will participate in the training course. The trainers who will undertake the training of teachers will be the ones who participated in the Master Training event of the previous WP ("Augmented Assessment Training Course for Master Trainers" to take place in Barcelona, Spain) while the educational materials to be used during these courses will be the ones already developed for the train-the-trainer event.

Teachers' training will last for thirty (30) hours by using blended learning with fifteen (15) hours face-2-face training and fifteen (15) hours online/ webinars. The e-learning material to be used for the online/ webinars learning is the material already developed by partners during the previous WP.

The webinars will refer to the use of software and augmented reality applications. For instance, for each augmented reality application that is going to be used in the project a short webinar will be prepared. These webinars will help participants to revisit the utilization of these applications after the F2F meetings. At present, the most popular free and user-friendly software in the area of designing is Inkscape, Vectr, and Vecteezy. Teachers could use one of them to create or adjust learning objects (useful learning objects for all disciplines designed by the workgroups in previous Work Packages will be provided to teachers) to design the representation they need for creating their material. Also, Blender, Movie Maker, PowerPoint, and other user-friendly software can be used to create videos. In the area of augmented reality, Zappar, ARTutor, Metaverse, ION, and other platforms are available for teachers to augment the material that they have already designed. The project implementation teams in

collaboration with the workgroups will agree to use one of them for designing, video making and a variety of them for augmentation (platforms like Metaverse and ION have different use from Zappar or ARTutor) in the whole project. During the training, teachers will be equipped with the necessary knowledge and skills to be able to use them. Therefore, though the training regarding the software and augmented reality applications will take place F2F at the same time webinars will offer to participants the opportunity to study these applications in more depth and experiment with the software and the augmented reality applications.

Concerning asynchronous e-learning, it will combine self-study of resources (webpages, blogs, academic and non-academic articles, the project's guidelines) available to teachers and teachers' participation in asynchronous discussions.

Finally, one of the most crucial aspects of the training is the teachers' preparation not only to use the 50% of the already developed augmented assessment questions but also to create their own augmented reality questions (the rest 50%). More specifically, the remaining 50% of the verbal questions created by the workgroups (WP1) will be available for augmentation to the teachers. Teachers in all partner countries will be able to use this 50% of the verbal questions or to create their own questions. However, the fact that these questions were formed to be appropriate for augmentation will facilitate teachers' work during the augmentation process. The new augmented assessment material will provide participating teachers with more augmented material and activities that can be used in the context of assessing new migrants' knowledge in Science and Mathematics.

Teachers piloting the Augmented Assessment approach and tools will develop their understanding about innovative forms of

summative and formative assessment by utilizing a variety of innovative digital means. They will be familiarized with ways in which the Augmented Assessment approach and tool can contribute in assessing newly arrived migrants' knowledge in Science and Mathematics and promoting inclusion for these students, while at the same time strengthening the development of a cluster of other key and transversal competencies..

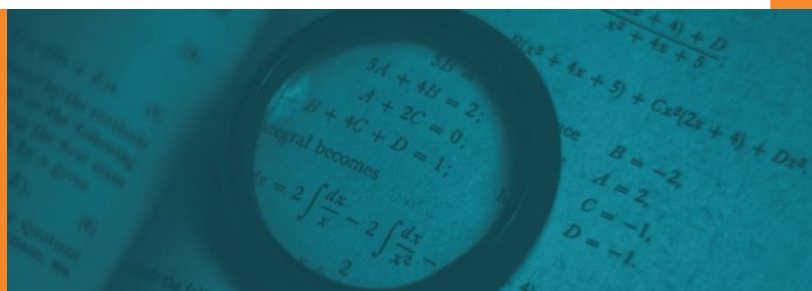
Application of the augmented assessment materials

During the pilot training teachers will apply the materials to a group of two hundred (200) students in each participating country in order to check whether the materials are effective and successful for the assessment of migrant students' prior knowledge in Science and Mathematics. This application will be the "crash test" of the products already developed, both for the group of teachers who are going to apply them and for the groups of students who are going to receive this innovative educational approach.

At least 30% of these students will be newly arrived migrant students. In most cases, classrooms do not consist only of newly arrived migrant students therefore the implementation will not only involve newly arrived migrant students but also students with a migrant background and students with diverse needs for promoting the inclusion of all children. This pilot assessment using augmented assessment materials will take place between Module 5 and Module 6 of the teacher pilot training as an essential part of it.

Teachers will be asked to keep records of all application activities and to reflect on any point or task of this process in order to provide valuable and usable results to the national project implementation teams and to the project partnership as a whole.

Evaluation and good practices or experiences



Transfer of Knowledge and follow-up

After the end of the pilot training of teachers and the application of the augmented assessment to migrant students (including newly arrived migrants and other disadvantaged groups of learners), the evaluation process will take place. Teachers' and students' views will be sought in an effort to evaluate the already developed materials and the whole learning and assessing process (including the guidelines, curriculum, training course, Augmented Assessment Library), so that the necessary amendments are made and the project's outputs are finalized, to be used by other interested parties. Especially for the augmented assessment material evaluation teachers will be asked to evaluate the augmented questions they used with their students between Module 5 – Module 6 using a proper evaluating rubric which will be designed by the project members as part of the training material. The rubric will involve several evaluating aspects such as appropriateness, usefulness, attractiveness, in what degree contributes to identifying students' knowledge in Math and/or Science.

Evaluation during implementation stage

During this stage the work previously developed will be practically tested through two basic activities:

- The training of teachers in the participating countries. Teachers of Mathematics and Science will be trained not only to use but also to create new augmented assessment materials, to suit the needs of their migrant students. Teachers will get acquainted with the process and they will be equipped with innovative means to evaluate,

assess and therefore include migrant students according to their level to the right grades of their schools, at least for the subjects of Mathematics and Science.

- The application of the augmented assessment materials in a population of migrant students, especially the newly arrived ones. This application will be the “crash test” of the products already developed, both for the group of teachers who are going to apply them and for the groups of students who are going to receive this innovative educational approach.

In all national contexts, emphasis will be given in testing the AUGMENTED ASSESSMENT project outputs in the regions with high concentrations of migrant population. All project partners have close cooperation with public primary and secondary public schools and they have the capacity to promote the project for implementation to very extensive school networks. This process will be facilitated since all major project outputs will be produced in the languages of the partners, apart from the English language. Specific public schools in partner countries have already declared their

interest and support to the project activities and have pointed out their willingness not only to apply this methodology to their own school environment but also to promote it to other schools in their area or country so that more migrant students are benefited and more schools become a positive learning environment which respects the different needs of different people.

Through the participation of schools in the project, the most critical group which will be

reached at the grass roots level is the group of newly arrived migrant students. Around eight hundred (800) students who have recently arrived in the participating countries are in the process of attending school classes or of being placed in certain grades will go through the process of assessing their skills and knowledge in Science and Mathematics, with the use of the augmented assessment materials. It is expected that the engaging, interactive and positive characteristics of these materials will receive positive feedback from these students. Finally, the materials will also be applied to other disadvantaged groups of learners, so that their efficiency and usability are checked.

Overall, four research designs will be used to evaluate the effectiveness of the Augmented Assessment Approach: evaluation, experiment, longitudinal and comparative cross-cultural designs, aimed at the teachers and students participating in the pilot phase.

Teacher survey-based evaluation

As mentioned, the teachers will be asked to evaluate the augmented questions they used with their students between Module 5 – Module 6 using a proper evaluating rubric aimed its appropriateness, usefulness, attractiveness, and ability to identify students' knowledge in Math and/or Science.

Student longitudinal survey-based evaluation regarding self-perceived intrinsic and extrinsic motivation towards Math and/or Science (profiling)

This stage is aimed at characterizing and evaluating the educational context in which the Augmented Content will be introduced, both before and after its application, to permit the detection of any changes in the intrinsic and extrinsic relationship of students with Math and/or Science. This stage will also serve to evaluate if students' motivation and predisposition towards Math and/or Science changes after the introduction of this type of content, thus revealing its potential to change the students' mindset, among self-perceived low achievers and high achievers. For this, the contextual questionnaires of the International Mathematics and Science Study (TIMSS) (Fishbein, Foy, & Yin, 2021) will be used and adapted, in order to include a specific section aimed at the student evaluation of the appropriateness, usefulness, attractiveness of the Augmented Assessment Content, on top of its regular contextual variables. The outputs of this stage of assessment will also serve as an input to the development of good practices (Case Studies) among the project partners.

Student performance-oriented experimental evaluation regarding Math and/or Science grades

The impact of the Augmented Assessment content on students' grades will also be

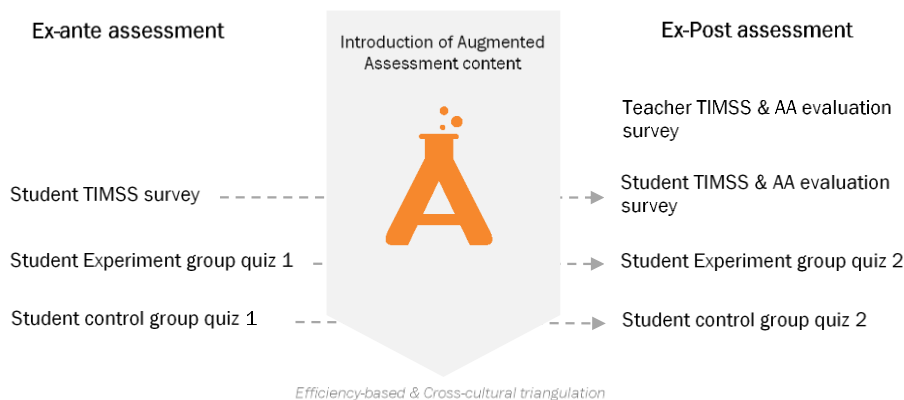


Figure 3: The proposed evaluation scheme

evaluated. Following an experimental methodology, an experimental group, and a control group will be setup in each country. In a first stage, a Math and/or Science quiz will be applied to both groups, according to the common framework of aspects of learning developed by the consortium. The students' grades are registered. After the implementation of the Augmented Assessment content among the experiment groups, the students answer the quiz a second time. This will allow to establish causality in the Augmented Assessment contents' ability to improve students' knowledge and grades (performance) regarding Math and/or Science, by comparing grades among the experiment and control groups (while considering students' profiles with data from the previous stage).

A final triangulation of all the data and information gathered during the above-mentioned stages will allow to identify trends in the students' and teachers' profiles, using contextual data, and on how they relate to Math and/or Science in general. This will provide a solid base for the evaluation the real impacts of the Augmented Assessment materials in, for instance, high achievers and low achievers, and other relevant dependent variables such as access to technology, overall feeling about school and learning, and social integration, which may impact learning and performance.

This final stage will also be aimed at a comparative cross-cultural analysis of impacts of the Augmented Assessment materials in each country/school, allowing local particularities to be considered in the overall assessment of impacts. This knowledge will be used to draft the good practices and recommendations for further implementation of the projects' methodology and outputs beyond its timeline.

Good Practices (Case studies)

The partnership will edit an E-Book with the title "Assessing newly arrived migrants'

knowledge in Science and Math using augmented teaching material". This output is critical in helping maximize the impact and results of the project. The aim of this output is the successful replication and scaling up of the Augmented Assessment project by describing it to the appropriate decision makers on both a national and a European level and the convincing of the end-users to adopt the proposed programme.

The E-Book will include all project products, outputs and findings so as to constitute a comprehensive guide book for further use and application of all interested parties. Collaborative work methodologies will be put into practice for the production of the E-Book.

The contents of the E-Book will at least include the following chapters:

- Augmented reality in education
- Newly arrived migrants and their educational inclusion
- The Augmented Assessment project approach
- The Augmented Assessment Library
- The trainings: Master Training. Pilot Training
- Experiences from the application of the approach (case studies)
- Recommendations

The case studies will provide real world in-context examples of the implementation of the project activities, and constitute a reference for other schools and countries to adopt the project's outputs and methodology.

References

Fishbein, B., Foy, P., & Yin, L. (2021). TIMSS 2019 User Guide for the International Database. Boston College, TIMSS & PIRLS International Study Center. Retrieved from <https://timssandpirls.bc.edu/timss2019/international-database/>