SeLFiE

STEAM educational approach and foreign language learning in Europe

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The ScienceL2 Toolkit:

STEAM and Second Language Learning in the real-life world

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The ScienceL2 Toolkit:

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1. Introduction to the toolkit

If you are browsing through or reading parts of this toolkit, you are probably a teacher, or an educator working in early years and/or primary education, searching for new ideas and inspiration to make learning for young children more engaging and meaningful. As a teacher of young children, you probably find yourself facing many challenges as you try to integrate different subject areas as well as cater for diverse learning needs. It is not easy to keep children interested and motivated in learning for long periods whilst also making it fun and enjoyable. In addition, as an educator in the European Union with its linguistic diversity across Europe, you also find yourself teaching a second language. Most importantly, the major challenge that you, like all teachers, face is that of ensuring that children develop their literacy, numeracy and scientific literacy as well as second language proficiency.

Teaching young children in the early years and primary education has, particularly in recent years, experienced a significant pedagogical shift. Whereas schooling has historically tended to be teacher-centred and compartmentalised subject teaching, it has now evolved into an education which is more child-centred, holistic and integrative in approach. The boundaries between the different subject areas have become blurred as learning follows the children's interests and different learning areas are integrated. In addition, innovative approaches which enhance European citizens' linguistic competencies are increasingly being promoted. For example, the Content and Integrated Language Learning (CLIL) approach for teaching a subject through students' non-native language is emerging as one such strong educational approach.

The SeLFiE toolkit presented here takes STEAM (Science, Technology, Engineering, Art and Mathematics) pedagogies and integrates them with second language learning approaches. The radically innovative potential of the SeLFiE model is its ability to integrate scientific language, which tends to be simpler and easier for students to understand than literature, with the rich everyday language and practical lexicon of the CLIL framework for students. This toolkit presents both the theoretical background of the pedagogies included in the SeLFiE model as well as provides practical examples of how teachers can implement such holistic learning experience. To reflect modern educational provision, the SeLFiE model proposes a project-based integrated approach through the use of stories which serve to bring together different curricular areas. It achieves engaging learning experiences through pedagogies such as inquiry-based learning and engineering design as the basis of many activities. The model proposed is

also illustrated through examples of good practice which teachers across Europe have implemented.

If you wish to explore our integrated SELFIE model of teaching, we advise you to first find some time to read through the theoretical section which explains the different pedagogical components. This section is written in an 'easy to read' and practical language style to help you, as educators, see the link between theory and your everyday school practice. In the second section of the document you will also find a number of examples of good practice which illustrate how the model proposed has been implemented by early years and primary educators. These teachers come from different European countries and show how it is possible to promote STEAM learning integrated with second language learning. If you are interested in reading about the different pedagogical aspects in greater depth, you will also find links to more theoretical and academic explanations. In case you have limited time to reach or prefer to listen, we have also produced videos where we explain the different theoretical and pedagogical aspects. These can be accessed at: https://project-selfie.eu/resources/selfie-toolkit/

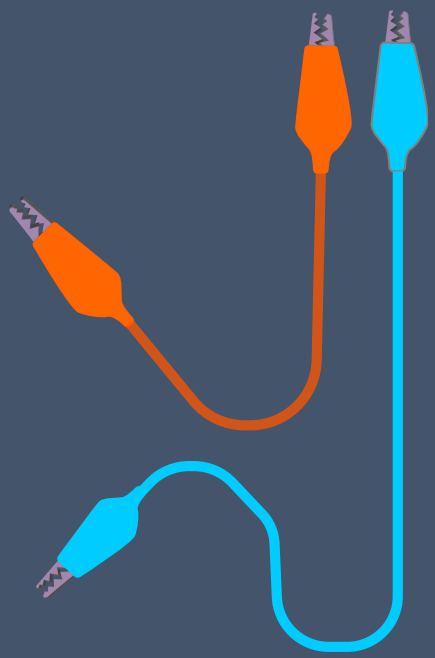
The SeLFiE team invites you to read through the toolkit and hopes that you will be inspired to try some of the examples of the teaching approaches which we provide. We strongly believe that many elements of this integrated approach will surely increase student motivation and make it fun to learn both STEAM and additional languages. We thus encourage you to make that extra effort to try these new approaches as we are sure that you will reap positive learning outcomes for your students.

The SeLFiE Team

2. The SeLFiE project and partnership

We would first like to introduce the project which led to the development of this toolkit as well as the team behind it. The project mainly aims to improve: bilingual early years and primary teachers´ competencies in applying STEAM pedagogies to promote second language learning; the overall STEAM and foreign language competence of early years and primary children across Europe.

The SeLFiE project promotes a holistic approach to the acquisition of second language competency (English, Spanish, French or any other second language in the first stage of education, depending on the country where one is teaching) through STEAM topics. It integrates a number of active pedagogies, mainly: the project-based learning approach **(PBL)**; inquiry-based learning (**IBL**); Engineering Design Process in Science Education **(EDP)**; and Content and integrated language learning **(CLIL)**. Story telling is also used to provide a context which links the different content areas, creating topic-based project work.



2.1. Project Outputs

The most important result of the project is a new method for teaching STEAM in a bilingual context (the SeLFiE Model). The project leads to the production of three Intellectual outputs: a Toolkit which presents the SeLFiE Model with a number of good practices in the fields of CLIL, IBSE and EDP; a series of activities with brief comments on the methodology, and complete teaching developed for different STEAM L2 contents; and a repository of educational materials which can be downloaded by anyone interested to apply the SeLFiE Model.

2.2. Partnership

The project is coordinated by the University of Burgos in partnership with: two Universities - the University of Malta (UM) (Malta) and the University of Granada (UGR), Spain; the International Trilingual School of Warsaw (ITSW), Poland; the Teacher Training and Educational Innovation Centre (CFIE) Burgos, Spain a public institution within the Education Regional Government in Spain which trains pre-school, primary and secondary teachers; and Kveloce I+D+I, a consultancy expert in the implementation of European Projects.

The partners have worked together, to develop the SeLFiE Model and collect examples of good practice from practising teachers across Europe. This toolkit is one of the outputs of the project. You can find more information about the project at the project website: https://project-selfie.eu/

3. Theoretical background to second language learning through STEAM

This section presents the theoretical background of the SeLFiE model. In order to help you understand better the key perspectives taken into consideration, it was considered important to first help you understand the meaning of key pedagogical approaches and concepts included. We thus feel that it would help you, as educators, to have a basic understanding of these aspects, such as what STEAM stands for, what key components make up the CLIL methodology, why integrated learning is considered important within the new approaches to learning; and the role that digital learning has gained in a technological society.

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3.1 STEAM subjects and pedagogies

Many of you are probably familiar with the term **STEM** education which stands for "**S**cience, **T**echnology, **E**ngineering and **M**athematics" where:

- **Science** refers to what knowledge about nature and it works;
- **Technology** refers to human-created innovation, change, or modification of the natural environment to satisfy perceived human needs or solve problems;
- **Engineering** refers to the systematic approach to designing objects, processes, and systems to meet human needs; and
- **Mathematics** refers to numbers, symbolic relationships, patterns, shapes, uncertainty and other mathematical reasoning (Yakman & Lee, 2012).

STEM has, in recent years, been replaced in education discourse by the term STEAM. The added 'A' to make up STEAM adds **A**rt to the learning process. Art incorporates different aspects, ranging from: languages including all kinds of communication such as Music; physical Arts which concretely exists in physical reality, in space and time such as painting, sculpture, or performance; liberal Arts(Social) Including; Education, History, Philosophy, Politics, Psychology, Sociology, Theology, Science Technology Society (STS) etc.; and Fine Arts such as such as painting, sculpture, photography, film, animation, illustration, printmaking or ceramics.

Many of you are probably questioning why Art has been included alongside traditional Science related subjects in STEM. Art involves the process of discovering and creating as well as finding innovative ways of solving problems, integrating principles or presenting information or conveying messages. For example, an architect uses engineering,

The roots of the shift from STEM to STEAM

The roots of the shift from STEM to STEAM in the education process can be traced to the United States where a national reform promoting STEAM in education and the curriculum was implemented to prepare students for the global economy of the 21st century (Yakman & Lee, 2012). The reform was a response to the advances of a more globalised world, where persons' employment histories have become more complex and dynamic.

mathematics, technology, and science, combined with artistic expression to create modern buildings and structures. In the case of young children, Art ensures that this facet of creativity and self-expression is also included in the curriculum.

The concept that school education prepared us to find lifetime employment which applied a few decades, no longer exists as our competences quickly become obsolete in the workplace. As workers need to make sure that they remain relevant in their current employment, or are seeking career advancements, they realise that they need more than just content knowledge. Today's workers, particularly in the scientific sector, find themselves also needing to possess other competences than possessing content and subject specific skills, these including among other things, competences such as: how to work in teams; how to innovate; to come up with creative solutions; be good communicators; present ideas and proposals in a manner which is attractive to the audience, as well as be able to express empathy towards others. In the case of those working in science related fields, this highlights the need for scientists and others in science related sectors to possess competences which can mainly be developed through the Arts.

A second justification for adopting a STEAM approach is that the science and technology sector also needs to attract diverse types of students, not only those who are attracted by the 'objective and detached' view of the subjects which is held by many, but also those students who consider themselves creative in the way they learn and express themselves. This thus makes Art also highly important in the preparation of future scientists who would benefit from the ability to be innovative and to come up with creative solutions. These competences are also important for those students not specialising in science as they would still need to interact with science related issues in their personal and social life as scientific citizens.

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The main objectives are to help students learn how to engage in experiential learning, take risks, and persist in problem-solving while also learning subject content. STEAM thus brings together five disciplines to create a holistic learning environment that encourages all student types to participate and contribute to the scientific and technological enterprise. The addition of Art to STEM to create STEAM thus incorporates creative thinking and applied arts in real situations, humanising STEM and transforming STEM learning from a disciplinary enterprise into an interdisciplinary one. The inclusion of Art also increases the importance of STEAM education as it promotes the infusion of art and design principles, concepts, and techniques into STEM learning (Liao, 2016).

The roots of the shift from STEM to STEAM

STEAM is a pedagogical approach which responds to these new challenges as it promotes learning that tackles Science, Technology, Engineering, the Arts and Mathematics by engaging students in inquiry, dialogue, and critical thinking.

STEAM involves educating the whole learner through curricula which are integrated and themed, and uses pedagogies such as inquiry, discovery or reality-based learning within a constructivist education (Barlex & Pitt, 2000).

STEAM endorses constructivism, which highlights that there is no single or best pedagogical approach, and focuses mainly on 'learning how to learn' rather 'learning what there is to learn'. Pedagogies such as inquiry also engage students directly into tackling specific questions and problems which are relevant to them, reflecting their interests or question posed directly by them.

Thus, instead of teaching disciplines independently, lessons tend to be project and inquiry based, with a focus on interdisciplinary learning. STEAM thus reflects better the way we work and problem solve in our daily lives, making it a distinct way of learning compared to traditional approaches. With STEAM we are teaching knowledge and skills in the way students will encounter them in the real world. It prepares students better for their future employment as well as citizens. In the SeLFiE project we go one step further, and incorporate second language learning within this integrated approach.

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Similar to all pedagogical approaches, however, STEAM also faces challenges in implementation.

Main challenges that teachers often face in their classes relate to difficulties in integrating different subject content simultaneously, and taking on a multidisciplinary education where teachers find themselves teaching content outside their comfort area or speciality (Sanchez & Cortes, 2019). Other challenges involves lack of time for collaborative planning and instruction, inadequate school structure and organization, difficulty in assessing STEAM achievements; and lack of resources.

(Shernoff et al., 2017)

Teachers also need support through: collaboration with colleagues, having a quality curriculum which allows an integrated approach to learning; support from learning officials and local administration, and more importantly, well-organized and frequently available professional learning opportunities (Margot & Kettle, 2019). These will probably also be the challenges which you will face as teachers in the SeLFiE approach. This is where toolkits like this one come in handy, particularly since it provides both the theoretical background as well as practical examples on how the SeLFiE model can be implemented in primary classes.

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3.2 Content and Language Integrated Learning (CLIL)

The past twenty years have seen a growing number of schools teaching a range of curricular subjects like science, music, physical education, etc. in a foreign or second language (L2). This type of immersive language teaching which involves children learning a school subject in a second language has a long history in countries like Canada or the United States, unlike Europe where the practice is more recent in Europe.

CLIL helps students develop their communicative competence in another language, and enables them to participate in social, personal, academic and professional activities at an international level. Studying in another language also enhances students' cultural awareness and expression alongside subject learning.

> Bilingual teaching and learning in Europe have increasingly incorporated methodologies that fall under the umbrella term of Content and Language Integrated Learning (CLIL).

While these objectives are reasonable and appear beneficial for learners, it is, however, important to acknowledge that the effects of bilingual education varies between countries and from one school to another. There are a large number of factors such as student age, available resources, and teachers' proficiency in the foreign language as well as their familiarity with CLIL methodological principles which need to be taken into consideration first. A number of studies indicate that CLIL promotes L2 proficiency without any significant negative effect on the students' competence in their mother tongue. However, it is important to take into account that young learners may face more challenges in terms of academic performance, motivation or intellectual helplessness due to their still developing language proficiency.

The CLIL methodology involves the integration of a series of common principles and practices into teaching programmes known as the 4 Cs.

These include:

- **Content:** refers to the curricular content of the specific subjects taught. Subject learning is the same for both CLIL and non-CLIL classes. The teaching and learning process in either case is intended to provide learners with key competences and core skills required to understand subject-specific concepts, and to complete a wide variety of subject-related tasks which are potentially transferable to real-life scenarios;

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- **Communication:** Another major component is that of communication, and the different opportunities and challenges that may arise when dealing with content matter in the L2. Essentially, this means that subject teachers need to provide adequate support to ensure that learners are able to understand, interact, produce and mediate in subject-related scenarios through the medium of the foreign language;
- **Cognition:** While dealing with content in the L2, learners are expected to engage with tasks and activities which challenge them cognitively. While lower-order thinking skills such as memory and understanding have a role in learning, students also need to engage in higher-order thinking skills, such as analysis, evaluation and creativity;
- **Culture:** The CLIL approach also places importance on cultural elements. This focus essentially entails making the most of the unique situation in which students use learning content through another language in order to help them become aware of, understand and express a variety of cultural realities. It is important to note that this component does not relate exclusively to the target culture but also involves the appreciation and expression of one's own cultural identity. This is particularly important when working in a language that is different from one's mother tongue.

In addition to these considerations, of course, CLIL also endorses other general educational principles such as **scaffolding, meaningful and authentic task-based-learning, strategy development and learner autonomy**, all of which also need to be incorporated into the learning contexts.

These principles, however, often take on different roles when dealing with content subjects and also integrate principles commonly associated with language teaching and learning, such as the need for comprehensible input, comprehensible output, negotiation of meaning, and diverse encounters with the language of the subject area through a variety of formats.

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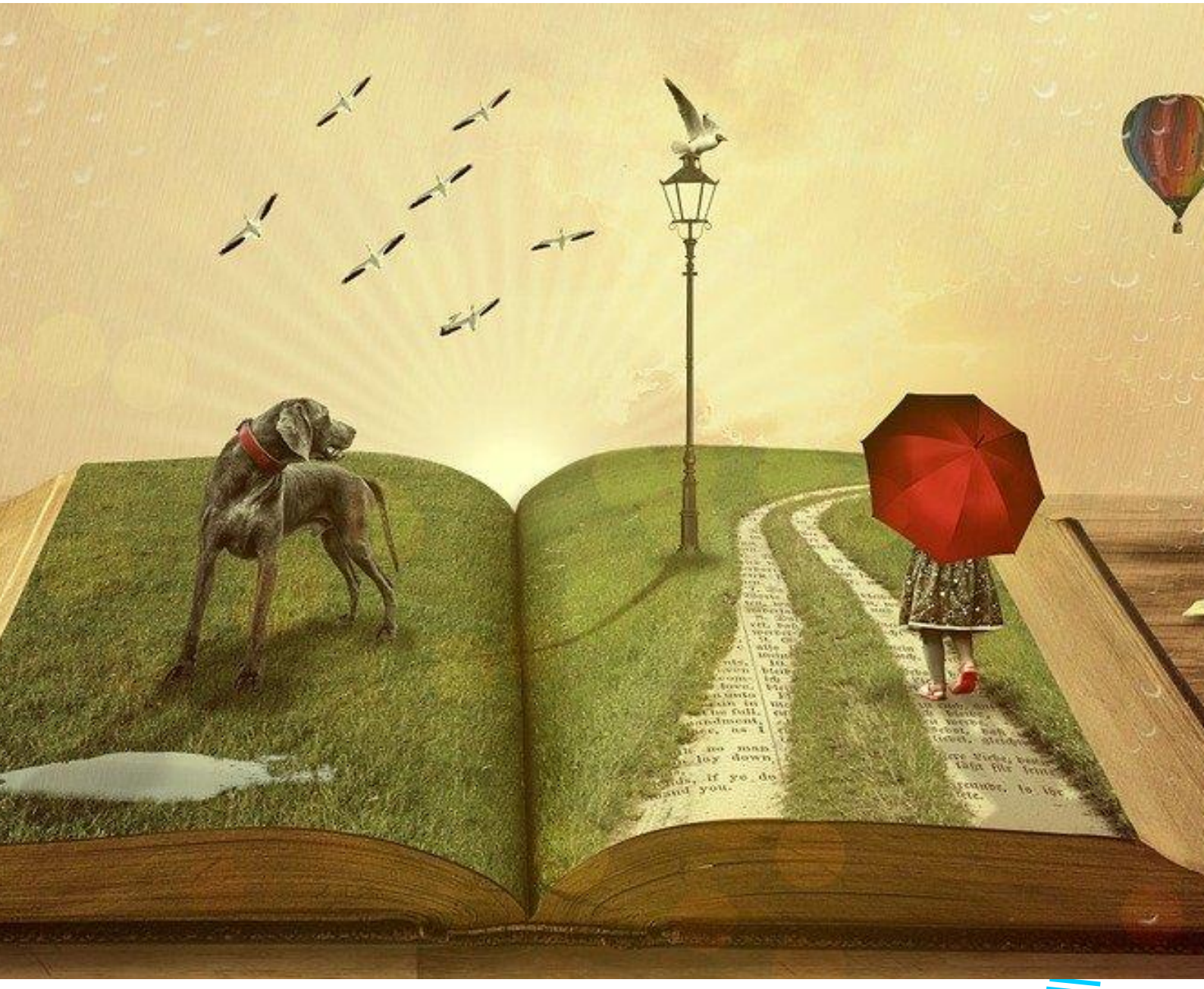
CLIL, then, is a complex methodological approach which, in most contexts, has led to innovative teaching practices. Obviously, there are also challenges involved, particularly when implementing with young children. It seems, however, that when implemented, it leads to several potential educational benefits for learners which include: learning content through more modern and innovative approaches; expanded levels of communicative competence in the L2; high levels of cognitive engagement; and unique opportunities to engage with cultural dimensions of both home and target cultures.



INTEGRATIVE APPROACH

Practically, curriculum integration occurs when learners engage in collaborative experiences to find answers for personally meaningful questions. An integrated curriculum is thus the organization of learning experiences to ensure valid connection between disciplines (Murdoch, 2015, p.43). Although there is no commonly agreed definition, educators agree that an integrated curriculum should include (Lake, 1994, p.2):

- A combination of subjects learnt together;
- An emphasis on projects rather than separate subjects;
- Use of sources that go beyond textbooks;
- Promotion of relationships among concepts;
- Thematic units are used for organizing principles;
- Flexible schedules; and
- Flexible student groupings.

3.3 Value of the Integrative Approach to Learning

The SeLFiE model is based on an integrative approach to learning, linking school subject areas such as natural and social sciences, engineering, technology and arts with second language learning. It is the natural choice to make given that both CLIL and STEAM approaches are used. Nevertheless, it is interesting to review the key aspects of integrated learning experiences.

Integrated curricula are not a new idea. For example, during the 1960s, there was a movement in the US which promoted integrative teaching based on the pedagogical principles of constructivism. The "project method" was one example of this movement. In such approach children completed a project which was experience based as they worked collaboratively, with the group taking full responsibility for its learning. Many supporters of integrative approaches argue that an integrated curriculum can help children develop competences which are required in the twenty first century. Such competences are hardly developed through traditional education which is characterized by departmentalized subject learning.

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As can be noted, project-based and collaborative methodologies — including inquiry, problem-based learning and engineering design methodologies, among others— are needed to ensure that students have the appropriate learning experiences. Also, it needs to be highlighted that integration is principally about conceptual learning. Integration concerns the unifying way in which knowledge is constructed by the learner and so, the importance of incorporating a greater focus on the learning of core concepts in curriculum design.

There are several ways of blurring the traditional boundaries within and across different subject areas. Some educators describe up to ten forms of integration which can be implemented. Although the approach to an integrated curriculum is often a practical decision based on the resources available e.g. time, specific learning goals and the school environment, in the SeLFiE model we consider that three forms are particularly suitable for our CLIL+STEAM approach within our primary school context: the connected, the multidisciplinary and the interdisciplinary approaches, as defined by Gresnigt et al. (2014).

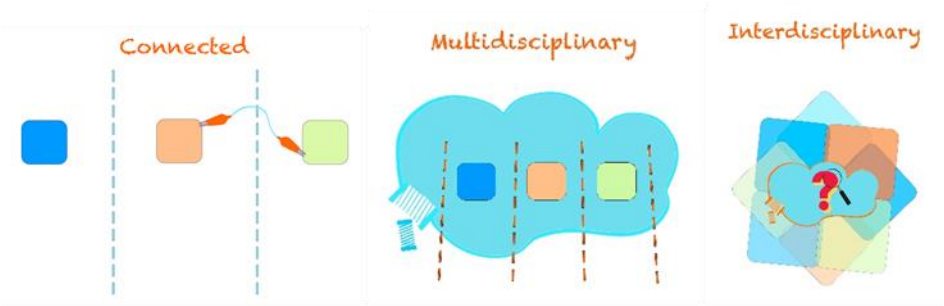

Figure 1. Disciplinary connection forms for CLIL+STEAM approach.

Connected integration: In this type of curricular integration, teachers make explicit connections between the separate school subjects taught. It is the most basic level of integration and does not imply any "joining" of subjects, or resolving any single problem. For example, you can organise an English storytelling lesson which covers content about the Solar System; have a science inquiry activity related to a science topic addressed in the book such as Moon phases; and in Mathematics address scales, using the different sizes of the planets covered in the English lesson. The focus of learning in each case is the subject taught, not the theme (the Solar System), and integration is mainly provided through the context chosen. If you look at figure 1, you can see how the subjects remain

separate in such approach, with links between them. Although such connected integration allows a true CLIL approach as children can be totally immersed in a second language as they learn, it does not really involve integrated STEAM lessons. However, it must be acknowledged that sometimes, the school organization does not allow teachers to implement a more integrative approach to learning, particularly if strict time slots for the different subjects in the school timetable need to be followed. In such circumstances, this connected integration is the best option which teachers can take to help students construct a less fragmented understanding of the subject areas that they are learning.

Multidisciplinary integration: in this case, two or more subjects are organised around the same theme or topic, but the disciplines still preserve their separate identity. That is, concepts and skills are learned separately in each discipline but within a common theme. Sometimes school projects have this structure. Taking the same example of the Solar System, as a teacher you can work on the topic of the Solar system in the English lesson by organising several activities related to stories about the Solar System; in the Maths and Science classes, you can develop project-based activities about the dimensions of the planets, their distance from the Sun and space travel; and in the Humanities, carry out a project about unknown historical figures in Astronomy. As can be noted, this type of integration allows a truer STEAM integration, as the focus of the activities is the topic (Solar System) and not the subject taught, even if each activity is developed in its specific subject time slot. If you look at Figure 1 you can note how the topic engulfs the different subject areas, even if they are separate from each other.

Interdisciplinary integration: in the interdisciplinary integration, learning starts from a group or personally meaningful question/s and there may be no reference to specific disciplines or subjects. Closely linked concepts and skills are learned from two or more disciplines with the aim of deepening knowledge and skills and not subject specific competences. In this case, although the whole project can be divided in various activities including guided inquiries, their organization depends largely on the students' pace and demands. The focus now is learning about the topic/project in an integrated way, without using any subject discipline boundaries. Coming back to the example of the Solar System, you can as a teacher tackle a central problem or question such as 'How can we inhabit Mars?' You can then use this question to include activities aimed at finding answers to this question. So you may get children to read books or news; they will have to understand scales, distances, movements, space crafts, and gravity in order to

understand challenges related to living on Mary. You can also ask the children to look at the economics aspects of spaceflight. They can also design rockets, etc. So, if you look at Figure 1, you find the that the question/problem is central to the learning, and the different subject areas are learnt in an integrated way as children engage in activities directed at finding answers to the question set.

As a final note, it is worth stressing that research shows that curricular integration increases students' motivation, attitudes, and appreciation of more holistic knowledge which is useful and can be applied to real-world situations. In addition, more effective learning takes place when meaningful connections are made across subjects.

It is believed that technological tools and ICT-inspired pedagogical approaches combined with task-based learning (TBL) can transform children's learning experiences as they may increase motivation, as well as promote autonomous learning and language acquisition (Roessingh, 2014). In task-based learning, you can use ICT to design and organise authentic language tasks by providing a platform for innovative and stimulating pedagogy and practice that encourage open-ended inquiry, knowledge construction and collaborative learning, at the same time that integrates listening, speaking, reading and writing. This will allow you to gradually move away from teacher-led to learner-directed teaching and learning.

3.4 The role of digital learning

In a world that is becoming increasingly reliant on digital technology for most aspects of daily life, we cannot ignore its role in teaching and learning. Keeping in mind that children today are born and raised in digitally-rich environments, it is imperative that as educators we explore the multiple ways in which we can use the available technologies in classrooms and schools to engage and motivate learners. From a young age, children are exposed to a multitude of technological and digital devices like tablets, mobile phones, game consoles, laptops and interactive whiteboards. We can use these devices advantageously in educational settings to enrich the quality of their learning. In this way, schools need to provide access to ICT-rich learning environments which may help you as teachers to bridge the gaps that often exist between children's and adults' life-worlds, thus reducing the 'digital disconnect' between the home and the school (Levin & Arafeh,

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2002). ICT (Information Communication Technology) is also regarded as an effective means of fostering intercultural understanding and exchanges, which many of you experience in today's culturally and linguistically diverse classrooms.

Social learning platforms such as Edmodo are practical and effective tools which you can use to share resources with other educators and with your students (Zakirova & Haydarov, 2020). You can also set up easily accessible class libraries through such social learning platforms to promote more reading. Furthermore, you can also use platforms such as Kahoot to engage the whole class in quizzes and surveys, and you can create and use podcasts and vidcasts to provide audio and video resources, thus utilising a wider variety of tools and resources to motivate and engage your students. You can also empower learners by asking them to prepare their own podcasts and vidcasts to share with you, class peers and other audiences. Zakirova and Haydarov (2020) also refer to an online portal called SpeechPeek. This portal allows you to create interactive speaking and listening exercises for your students to complete and submit remotely. This digital tool is extremely effective in improving and assessing students' speaking and pronunciation skills. Similarly, the website Lyrics Training can be used to teach language through music. You can ask students, for instance, to watch and listen to a music video whilst filling in the missing lyrics of the song. The use of digital games also has great potential in the teaching of language. Digital games can serve as texts and can be used in class to engage the disengaged (Byrne, 2012).

Computational thinking may also be worth considering in an integrative educational model where language learning and STEAM subject areas coexist. Computational thinking is defined as the ability to formulate one's thinking in such a way that can be communicated to a computer to achieve specific desired outcomes.

Thus, computational thinking may help primary school-aged learners develop the ability to approach and solve everyday problems. Jacob et al. (2018) put forward the idea that there exists a relationship between children's sense-making and computational thinking as learners use informal language and everyday experiences to question and explain algorithm compositions within inquiry-based approaches. Language-rich environments may thus promote computational thinking, and conversely, children's emerging computational thinking skills can be used to enhance their language and literacy skill development.

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So, when you are planning learning activities for your students always think of ways in which you can use digital skills to both motivate your students as well as to enhance their learning. At the end of the day, children learn more effectively through their preferred modes of learning, and using digital tools is something which all children tend to enjoy.

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4. Interactive methodologies

Now that you have gained some background of what STEAM and CLIL involve, ways in which learning can be integrated, and the way that you can use digital tools, we can move on to consider what pedagogies are best suited to implement an integrated curriculum. We start with the project-based approach, and then move on to inquiry-based learning, technology and engineering methods and storytelling. As these methods are all implemented through group work, we also discuss the social construction of knowledge, and then consider the implications of integrated curricula to learning through mathematics and music. We cannot leave out the importance of methodologies which promote children's creativity. All these different pedagogical aspects are integrated in the SeLFiE model which is then presented in section 6.

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4.1. Project-based Learning (PBL)

Recent years have seen governments, through their political and education plans, emphasise and prioritise the need to build up human capital, mainly with respect to the acquisition of 21st century skills such as communication, thinking, and problem-solving skills. This shift in educational focus towards these transversal skills (which cut across different disciplines) has brought about the rethinking of the traditional pedagogical practices used in schools. This shift is taking place, albeit the reality of school which still experience persistent accountability pressures mainly due to standardised testing of specific content knowledge and skills.

A change in pedagogical practice in response to this new challenge is, none the less, particularly evident, with an increasing number of educators transitioning from the teaching of separate subjects to a project-based approach to teaching and learning.

Katz and Chard (2000) are strong advocates of the project-based approach, and state that the overall aim is to 'cultivate the life of the young child's mind' (p. 6). They use the term 'mind' to refer to 'not only to knowledge and skills, but also [to] social, emotional, moral, aesthetic and spiritual sensibilities' (p. 6). The authors also use the term 'project' which to them involves the in-depth study of a particular topic. This study is usually undertaken by a whole class working on subtopics in small groups, sometimes by a small group of children within a class, and occasionally by an individual child. The key feature of such project work is that it is an investigation, a piece of research that involves children in seeking answers to questions they have formulated themselves or in cooperation with their teacher. (p. 2).

This view of project-based learning provides teachers with the opportunity to implement curricula responsively and openly. There is no one way of how to implement project work. It can be applied at all levels and amalgamated with subject-based teaching and standardised curriculum approaches. Investigations emerge from the learners as sources of knowledge or their interests, and evolve into an in-depth study of environments, people and objects that are meaningful to them and framed by the educator. Projects can take up to weeks or several months to complete, depending on the nature and complexity of the chosen project and the learner's age. Within this teaching and learning process, learners can take initiative as well as responsibility for their own learning as they actively participate in planning and assessing their work.

Several scholars have documented the main benefits and challenges of using the project-based approach, and how this pedagogical tool can shift a more standardised curriculum

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based on content knowledge to one having a greater focus on the children's quality of learning life in schools. The project-based approach was found to provide early childhood teachers with opportunities to be flexible in their teaching and learning process (Beneke and Ostrosky, 2009). It enables them to differentiate classroom activities more, increasing children's participation and learner agency, leading to a feeling of ownership and control over their own learning as they experiment using real objects. Project work was also found to promote collaboration among learners which improves their overall learning outcomes. Educators were also amazed with how much children are able to take on new leadership roles, think critically, pose questions, increase their level of involvement in learning, as well as respond, and communicate in meaningful ways. The project-based approach also served to integrate different areas of subject learning such as science, technology, engineering, arts, mathematics (STEAM) and language acquisition, due to the authentic exploration and representation that it promotes. The role of the educator is also key to model thinking, frame and structure the process, from supporting children in posing questions, to expressing ideas, theories and interests as well as through the feedback that the teacher provides (Marx et al., 1997).

The successful implementation of project-based learning is not without its challenges. It is well documented that time to prepare, and the length of project work are a concern to many teachers. Another challenge is the shift in the teacher's role from that of an instructor to a facilitator of learning. Some teachers tend to resist the shift in the responsibility of learning from them to the students. They also struggle with the management of behaviour during collaborative work. Despite the evidence that learners who experience PBL perform well and even demonstrate higher achievement in high-stakes testing (Parker et al., 2013), some educators still persist with focusing on curriculum content rather than the learning experience.

In light of the above, the struggles of educators must be understood through their experience within project-based contexts (Revelle, 2019). Human and physical resources and professional monitoring and support become essential to overcome such challenges. This toolkit attempts to provide such stepping stone as it documents some teachers' experiences of project work and its 'spirit, material and method of education' (Dewey 1916/1966, p. 81) promoted when combining STEAM and second language learning within different European contexts.

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4.2 Inquiry-based learning

Inquiry-based learning (IBL) became an increasingly popular pedagogical approach to teaching STEM subjects in the U.S. towards the beginning of the 21st century (NRC, 2000) and later on in Europe with the European Commission publishing a policy document in 2007 promoting it (Rocard et al., 2007). This pedagogy was considered appropriate for young children in the early years and primary level as it builds on children's innate tendency to question the world around them, wanting to learn how nature works. Inquiry thus serves to feed children with learning experiences when they are still in their 'curiosity golden age' (Rocard et al., 2007).

Inquiry thus involves teachers and/or students asking questions or identifying a problem which they then proceed to investigate together. They use the data they collect as the evidence on which they can draw conclusions. These conclusions are then communicated and shared with others: students and teachers in the school context. The National Research Council (NRC, 2000) identified the skills that young children achieve when they engage in inquiry-based learning. These include the following:

- **Children are able to ask questions which can be answered through investigations.** These questions can be about objects, organisms, and events in the environment. It is important that questions set can be answered through investigations which enable the children to find answers to their queries through scientific knowledge, combined with their own observations;
- **Children are able to plan and conduct simple investigations to answer the question set:** In the case of young children, investigations consist mainly of systematic observations. As students grow older, in the higher levels of primary education, they may start to design and conduct simple experiments. The teacher can decide how much guidance to provide the students, slowly training children to consider ways in which investigations can be conducted. For example, the idea of a fair test can be introduced informally with young children as they consider whether their method is fair, while older primary students can talk about factors involved;
- **Children are able to use simple equipment and tools to gather data:** In early years, students can start using tools other than their senses to observe measure, cut, connect, switch, turn on and off, pour, hold, tie, and hook when carrying out investigations. Students can also use rulers to measure length, height, and depth of; thermometers for temperature; stop-watches for time; beam balances and scales for weight and force; magnifiers for closer observations; and microscopes

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to observe the finer details of plants, animals, rocks, and other materials. Children can also learn to use data loggers connected to computers to collect data when conducting investigations towards the end of primary education;

- **Children are able to use data as evidence to construct a reasonable explanation:** Children learn to use data they collected to formulate explanations. Even at the youngest levels, children start learning what constitutes evidence. They can judge the merits or strength of the data and information that they are relying on when drawing conclusions. When proposing explanations, they learn how to use the knowledge and evidence they collected to support their assertions. Students should test their explanations against scientific knowledge, their own experiences, and the feedback obtained from others;
- **Children are able to communicate the results of their investigations and explanations to others for feedback:** Students need to share their results and conclusions with others, mainly their classmates and the teacher. This process helps them learn how to communicate their work, analyse their work and the work of other students, as well as receive critique and make critical comments of investigations being reported. This communication can be in the spoken form as well as in other formats such as written and visual presentations (NRC, 2000).

Inquiry-based learning thus cannot be considered as just "hands-on" activities (as evidence may come from secondary sources as well) but more importantly because it involves children to be actively engaged in their investigations physically, mentally and socially to different degrees as they understand not only scientific knowledge, but also what it means to do science (Gatt & Vella, 2003).

Harlen (2013) highlights a number of benefits of IBL on students as they: enjoy and have a a sense of satisfaction in finding out answers for themselves; seeing what works by trying things our rather than just being told; satisfying and at the same time stimulating curiosity about the world around them; developing progressively more powerful ideas about the world around; developing the skills needed in scientific inquiry through participation in it; realizing that learning science involves discussion and working with and learning from others, directly or through written sources; understanding science as the result of human endeavour" (Harlen, 2013, p.12).

The teacher's role in IBL also changes: from that of a transmitter to knowledge to one who takes on the role model of an inquirer. Inquiry relies on the teacher refraining from providing answers, to one who instead invites students to investigate. The teacher's answer to children's questions should then be in the format 'I do not know, but let us find

out together". It is not easy to use IBL. However, as you (as teachers) and the children engage in more inquiries, the better both you and your students become at it. Of course, as teachers you need training as well as sample activities which you can follow as you start trying out IBL. Also, give yourself time and practice, as implementing inquiry requires you to shift the way you view and approach teaching and learning, and this takes time.

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4.3 The Story- Based Approach (SBA)

Children love stories, and they are usually very familiar with them in their first language from a young age. Stories play a central role in children's language acquisition. Very young learners bring this pre-knowledge to foreign language learning at school, and this allows them to enjoy listening to stories repeatedly in a different language. Storytelling creates a natural and meaningful way through which to develop and foster foreign language learning from pre-primary education upwards. Therefore, storytelling increases children's interest and motivation as they learn a foreign language, creating a positive attitude towards foreign language learning.

Figure 2: Benefits of storytelling in a foreign language

Ellis and Brewster (2014) identify the many benefits of using storybooks in the foreign language class. Stories can develop children´s imagination and creativity, helping them match fantasy and imagination with their everyday lives, promote rhythm, intonation and pronunciation awareness, develop communication skills, promote intercultural awareness and develop learning strategies. Moreover, stories tend to be predictable texts, with lots of repetitive structures and words that occur repeatedly in the text and help children to predict what´s coming next, understand and participate and interact in the storytelling process. For example, in the picture book ***Dear Zoo*** (Campbell, 1982), we can find this structure repeated seven times during the story: 'So, they sent me a … He

was too ...! I sent him back.' These cumulative structures make this story very predictable and help very young learners to participate and interact in the first foreign language storytelling. Social and emotional skills are also developed, as storytelling is a shared experience where all the class can understand, enjoy and co-create the story together. And picture books can also teach social and emotional skills and help children develop friendship, empathy and feelings. For example, in the picture book ***Yo voy conmigo*** (Díaz Reguera, 2015) the story helps children build and improve positive self-esteem and confidence.

Using stories also promotes cross-curricular work across subjects in bilingual contexts. For example, if students are studying healthy food, they can also learn these concepts by listening to the picture book ***The Magic Triangle*** (El triángulo mágico) (Escribano Hawken, 2019), where the sequence of the story follows the building of the food pyramid. The narrative helps children learn about the food pyramid and encourages them, in a memorable way, to adopt healthy food habits. In the picture book ***A l'Eau***! (Le cycle de l'eau) (Huet-Gomez & Houssais, 2016) provides an ideal way to learn about the water cycle. Thus stories are a good pedagogical approach to adopt for teaching the 4 Cs framework of CLIL (Coyle, 2007) in pre-primary and primary education, as children can learn not only the foreign language but also content, cognition and culture through the storytelling.

Based on the many benefits of using storytelling in a foreign language class, a Story-Based Approach (SBA), also called Teaching a Foreign Language through Stories, is presented as an alternative and innovative approach for foreign language learning. It consists of the didactic use of a storybook to teach a foreign language and is presented as a powerful alternative to traditional methods such as the overuse of textbooks in the foreign modern day language classroom.

The starting point of this approach is the selection of the right storybook for the pre-primary and primary foreign language classroom. According to criteria for selecting story books, authentic or real storybooks are some of the best ones as they were not written for foreign language learners. The language is thus not selected according to the students` language competence, and is contextualised in a natural and authentic narrative context. Amongst authentic storybooks, for example, one finds fairy tales and fables which can be good resources for teaching a foreign language. Firstly, children tend to be very familiar with them in their first language, allowing children to recognise the plot and characters while they are listening to them in a foreign language. They are also very well-known, with children in upper levels in primary education capable of writing

new versions or fractured fairy-tales in a foreign language and share their new stories with their classmates. Picture books are also a great tool as they provide two different and interdependent ways of understanding the meaning of the story: text and pictures. Pictures have a big role and are essential in helping readers understand the story. So young learners can follow most of the narrative by reading the pictures while they are listening to the story in a foreign language. One example is the well-known story ***The Very Hungry Caterpillar*** (Carle, 1969), about the life of the caterpillar through the use of illustrations and text. Picture books are used as excellent read-aloud resources for young learners, as they can also be read at different levels, and used with students of all ages, including teenagers who value good picture books (Johnson, 2002; Trelease, 2019). Pictures books are designed in different layouts to help children interact and understand the plot, as for example, in the case of the lift-the-flap picture book ***Where´s Spot?*** (Hill, 1980), where children can play hide and seek lifting the flaps to guess where Spot is. Some picture books are also published in large enough format so that all the students can see the pictures and share in the storytelling, for example in the Big–Book format of ***The Gruffalo Big Book*** (Donaldson & Scheffler, 2013).

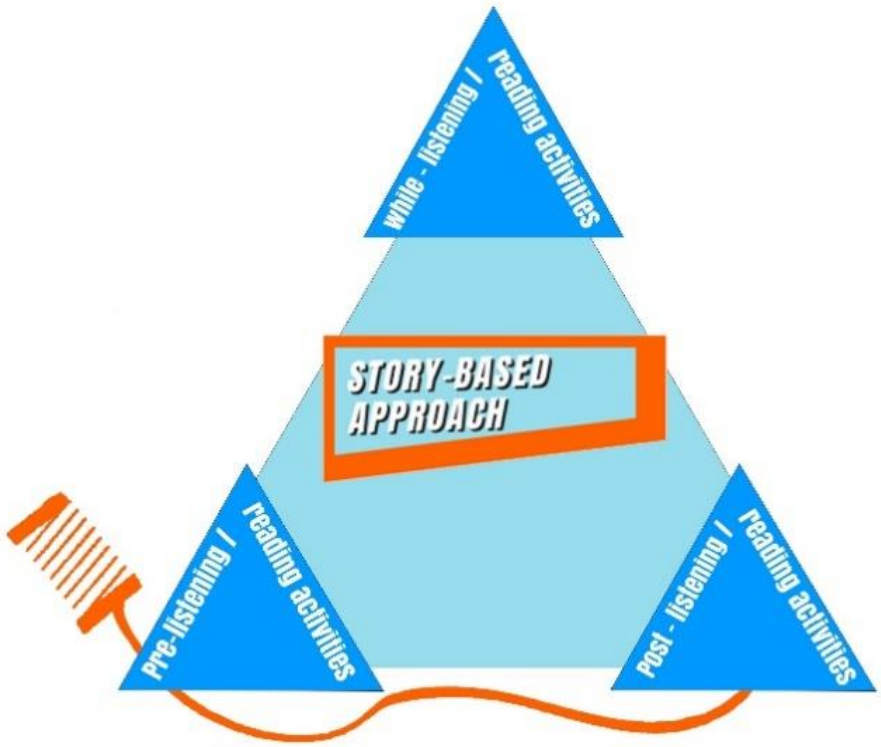

Figure 3: The interrelated and cyclic phases in the story-based approach

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The activities can be adapted to children in pre-primary and primary education according to difficulty and their skills levels. The three phases take place at different phases of the storytelling process as described here below:

After choosing the right storybook to be used in a foreign language class, the story-based lesson needs to be planned with a sequence of three interrelated and cyclic phases: before, while and after listening/reading activities (Ellis & Brewster, 2014; Ruiz Calatrava, 2008; Wright, 1995). The model of this approach is presented in Figure 3:

- **Phase 1: Before listening/reading activities**: These activities are essential as they activate the students' prior knowledge before dealing with the story. They also raise their children's curiosity about the story and motivate them to listen to it by making predictions and anticipating what is going to happen next to the characters, setting, etc. Some activities that can be adapted to different students´ levels include: cover the title and have students guess it and predict the plot of the story; ask questions about the pictures on the cover of the book; select four or five keywords from the text; play Pictionary and have children guess the topic; or play Chinese whisper with keywords, etc.
- **Phase 2: While listening/reading activities.** Teachers act as storytellers to bridge the text and the pictures, promoting the children´s understanding of the story in a foreign language. While teachers are telling the story, they can ask the children's contribution to help them understand, participate and create the story together. These activities help children engage in active listening, which means they participate and are involved in the story, follow the storyline, and ask questions to gain understanding. Some examples of activities teachers can use while listening to the storytelling include: pointing to the main characters; predict what´s coming next; repeat the main structures; read aloud and act altogether; answer questions about the pictures, etc.;
- **Phase 3: After listening/reading activities**: These activities help children review the story that they have just listened to, and to use the story language in a creative way to reinforce concepts, vocabulary, story elements and critical thinking. Storytelling provides an exceptional context for practising communication skills. Some activities that teachers can use include: creating a story map with the story elements; having a short quiz about the story in Plickers or Kahoot; sequencing the events of the story; creating a new version of the story; writing an email to the writer via the publisher; writing an email to a character in the story; turning the

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story into a comic; recreating the story; becoming a storyteller; putting on a play, etc.

As the story is read aloud several times in different ways during the story-based lesson, the activities in the different kinds of storytelling might be different, and they can be equally used in the different phases according to the needs of the students.

4.4 Engineering Design Methodology

The engineering design methodology is an approach to teaching that follows the usual activity that engineers and technical professionals engage in when they design, analyse, and solve problems of complex systems to satisfy the needs of society. Such society needs may involve many aspects, such as the development or improvement of devices (e.g., mobile devices and cars), development of processes (e.g., food processing), and designing and building of infrastructure (e.g., transportation, energy distribution, or waste management). In addition, engineering also addresses difficult and interdisciplinary problems in response to complex situations as they arise, such as: conflicts, crises, and disasters all of which, in searching for solutions, require that engineers consider the complex aspects of human rights, interrelated with clear technological and social dimensions in addition to the engineering design process.

The types of problems engineers face also tend to be poorly structured, with many interrelated factors involved together such as: the problem, the knowledge and resources available; the end users; and the social and political issues involved.. Consequently, engineering problems cannot be solved through a single solution, and their resolution requires the use of several cognitive processes, such as logical reasoning, algorithmic reasoning (as in the case of ICT), the use of rules, decision making, diagnosis, strategic performance, case analysis, and dilemma analysis, all achieved within constraints which may include material, knowledge, time, and budget amongst others.

The use of the engineering design methodology when organising learning for young children facilitates an understanding of scientific ideas from all aspects when applying them to problem solving. It also enhances the understanding of how science affects society through engineering and technology. It enables students to acquire some key concepts, such as the design process, efficiency, sustainability, or limitations (economic, ethical, social, material, and knowledge) inherent to any technological solution. Some

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authors also suggest that the problems posed to students should not only start from their social context, but should also promote participatory practices (e.g., Who is the project for? Whose knowledge is involved in problem definition, data collection, and analysis?), and decision making. An additional benefit, and not one of minor relevance in school contexts, is that engineering design methodology incorporates the notion of error, often absent in traditional learning as students realise that there is no single or perfect solution, and that every solution can be improved.

In the school context, the engineering design methodology tends to be organized around a series of six (6) specific stages (see Figure 4 below).

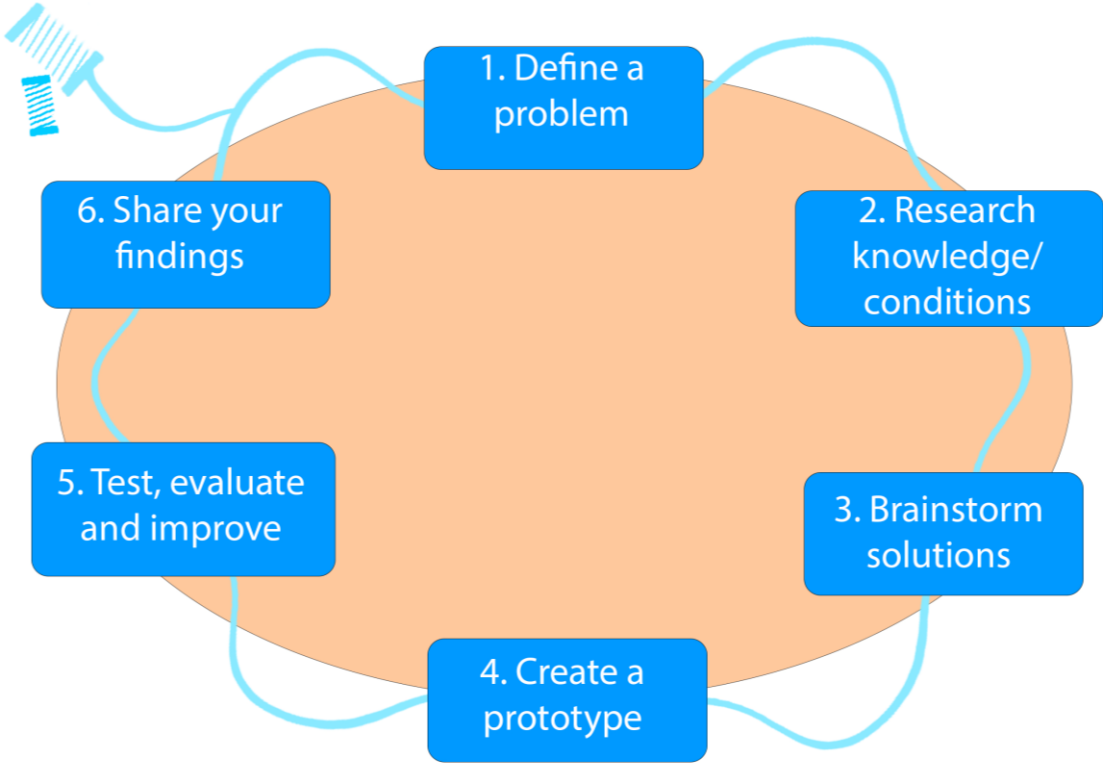
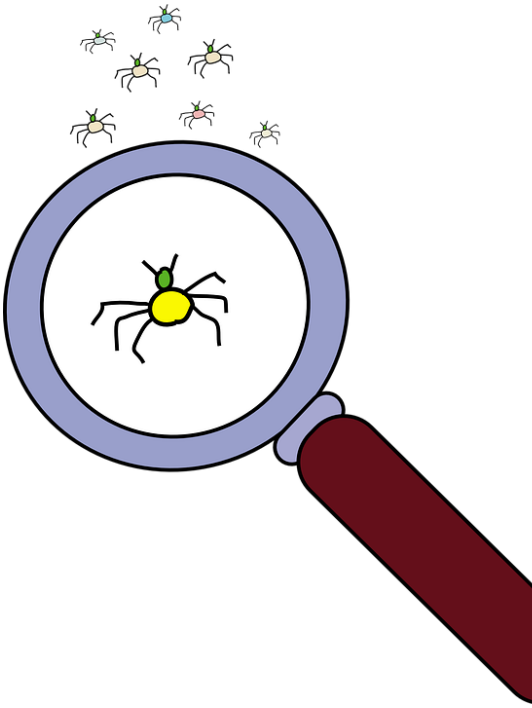


Figure 4. Engineering design methodology stages in the school context.

The process is circular, with interrelations, and can be modified depending on the context. The first stage is **the approach to the problem**, which can be determined by the students' interests or in response to a need or improvement in the school context. Detecting aspects that can be improved is a complex process for students and they need to be trained in how to go through the process. It must also be highlighted that engineering design does not only involve the construction of something, it can also

involve improving existing processes. For example, we may want to improve the current waste separation system in our school. From a curricular point of view, this would involve the application of language, natural and social sciences, art, and mathematics content to start tackling the problem.



The second phase refers to the **investigation of the problem**. It includes the knowledge one has about the problem (in this case, knowledge of different types of waste produced at school, how it should be separated to reduce waste and improve circular economy, the organization of the school, the needs, etc.) and of possible solutions already in existence; the requirements and specifications (e.g., that the containers must include words and images, the containers have to be easy to transport and clean and not very big neither too small, etc.), and the limitations (temporal, material, economic) that must be considered for the solution. In the search for a solution for this "community" type of engineering problem, it is important to identify the community perspectives. In this example, what do the different groups (students of different ages, teachers, cleaning staff) think about the waste separation at the school? What type of container do they prefer? And so forth.

The next phase corresponds to the **development of possible solutions**. It is relevant that students can express their ideas and propose different solutions in an informed way. When several possible solutions are available, we proceed to the selection of the one that is considered the best according to any of the aspects considered or established criteria. It should be noted that no solution is absolutely perfect and that there may be more than one that is acceptable. For example, imagine that the solution selected is the one that involves an improvement in the quantity, distribution, and clear identification of the waste containers at the school.

The fourth phase is **the construction of the prototype**, or in this case, a first version of the containers. Once the prototype is built, it needs to be **rigorously evaluated**, both from a technical and social point of view (i.e., Is it a good container? Is it clear to identify by all what to throw in? Is it easy to clean? Is it easy to transport? Is it easy to be reached by the students of the lower grades?) These results — pros and cons of the prototype and areas for improvement detected — **must be communicated**. Finally, it is ideal that students have the possibility to improve the prototype, either by introducing small modifications or by designing a completely new solution, which better considers the

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technical and social specifications of the problem. Finally, it should be noted that the search, design, selection, construction, and evaluation of solutions to the initial problem must always be based on the evidence and scientific knowledge available for the level of the students.

As students construct and manipulate materials and design solutions, they can show their understanding with concrete models. As some authors suggest, this materiality related in many cases to engineering problems at school invite participation of students with varying degrees of L2 proficiency.

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It is worth stressing that engineering design methodology offers unique opportunities for L2 learning. Most engineering problems for primary school students focus on producing a material product and students have to explore different materials and their properties and evaluate which are relevant for their design. For example, creating the containers introduces students to a variety of descriptive properties that they have to consider and communicate.

As in the case of inquiry-based learning, when students engage in meaningful and relevant activities, they naturally use different registers to show their peers their knowledge and points of view. In this sense, the use of language is closely tied to experiences with concrete materials, models, and designs, so these hands-on methodologies are extremely useful for improving communication in L2 (National Academies of Sciences, Engineering, and Medicine [NASEM], 2018).

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4.5 Social construction of knowledge and group work

The social construction of knowledge considers the way we learn, and refers to how learning takes place through the building of shared understandings and meanings by a group, in our case by students, as they work together and engage in social interaction, dialogue, negotiation of ideas, and other types collaborative activities. In the classroom setting this often takes place during group work activities where students discuss as they work. As students try to make out what a task is about, identify what knowledge and information they have to help them to decide the way forward, and how to use observations to reach results, students make small individual contributions which enable them to gain insights which are beyond their individual capacity. Social interaction, thus, can be considered as a precursor to knowledge construction, where different actors (in our case students) work together to achieve common epistemic goals (understanding): that is, students are engaged in knowledge co-creation and sharing. Social construction thus brings about a transition to learning from individuals' small knowledge parts into holistic knowledge shared by the group (Lenkauskaite et al. 2020).

The theory of social construction of knowledge was developed by social constructivist theorists who believe that meaning is primarily constructed through social interaction, as learning is a social activity. **Vygotsky is considered as the father of the social constructivist approach to learning. He argued that our understanding of the world is constructed through communication, collaborative activity, and interactions with others (Vygotsky, 1978).**

Vygotsky's theory discarded the belief that knowledge is only the prerogative of the individual and one's own property and value, but instead promotes the idea that learning takes place within a social context where members of a group make their individual knowledge contributions to build more complex shared meanings and understandings, leading to effective learning. Vygotsky believed that students

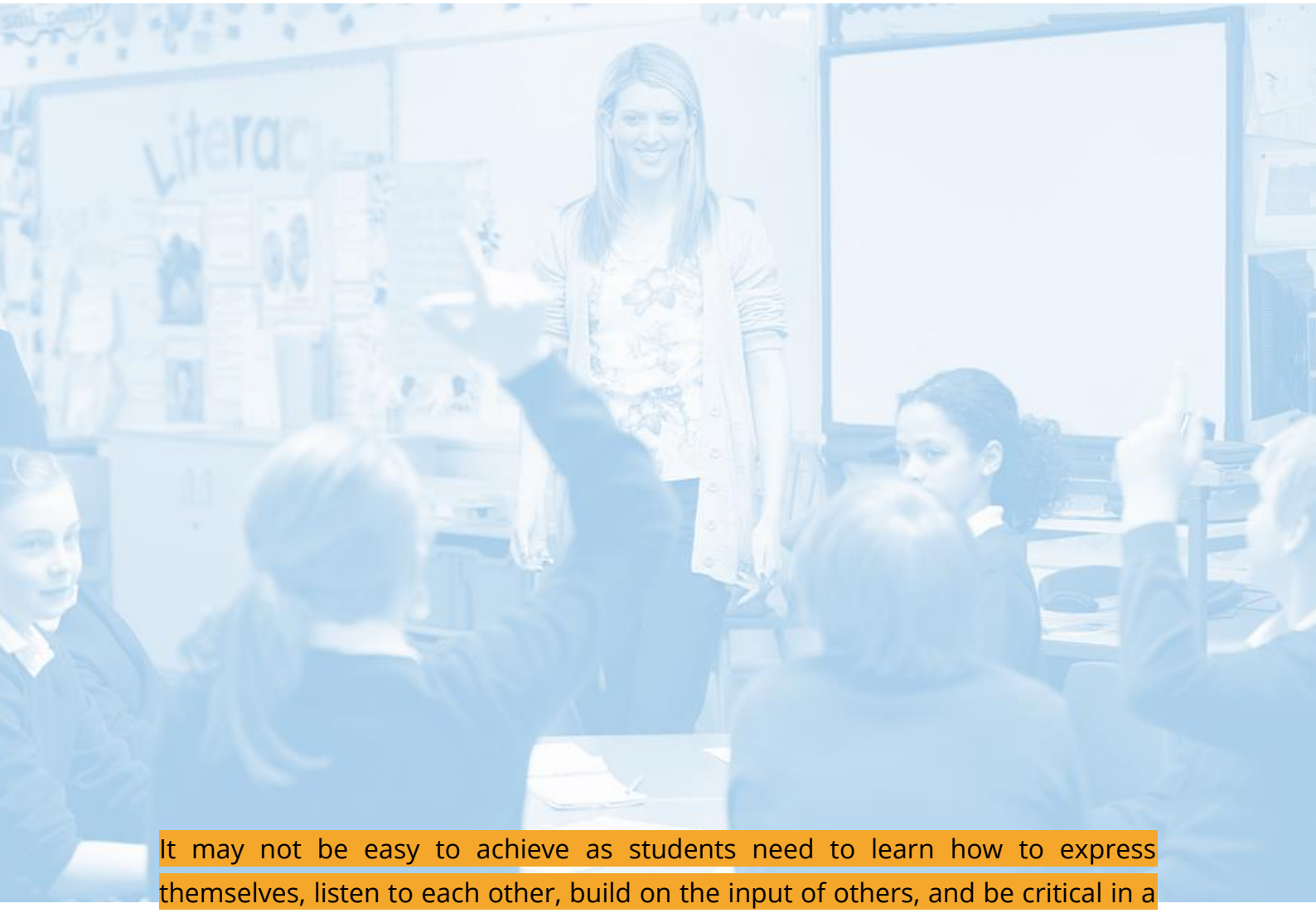
constructed their knowledge through conversation and interactions they have with each other and with their teacher, achieving better understanding of the new material and topics covered as they work together in groups to complete tasks, and particularly as they talk and discuss issues.

Social constructivism (which is used to name the social construction of knowledge) considers learning to involve the building of knowledge as shared understandings of the world. This is why language, artefacts and other typical behaviour which we use as communication channels within a group to reach the shared meanings gain so much importance in learning (Mercer, 2019).

So what are the implications of social constructivism to teaching and learning. Talk takes central stage in the process of learning. Mercer studied different kinds of classroom talk in depth with the aim of identifying good examples of talk which lead to effective learning. Through a number of studies with collaborators (Edwards & Mercer, 1987; Mercer, 1995 ; Mercer & Dawes, 2014) he identified three types of repertoires of practices that lead to maximizing children's learning and development through particular types of dialogue and interactions: disputational, cumulative, and exploratory talk, each of which had different impact on children's learning:

- **Disputational talk** refers to interactions between students where there is disagreement, competitiveness, and individualized decision-making taking place. This was considered to be least effective. Although there are exchanges, there still tends to be too much focus on the individual and less to the content exchange in the interaction;
- **Cumulative talk**, refers to individual as contributors and who build positively but uncritically on what the others say. Construct of 'common knowledge' within this talk is by accumulation, and is characterized by repetitions, confirmations and elaborations. While better than disputational talk, it still lacks the critical evaluation of these ideas;
- **Exploratory talk** is the dialogue which students engage in as they exchange and challenge each other's ideas and critically, and analyse them in a constructive way. It has been shown to be the most productive and effective form of student interaction leading to better achievement in a number of subjects such as mathematics, science, and problem-solving (Vrikki et al., 2019b).

As teachers, it is important to promote student talk in your lessons and activities. However, keep in mind that not all types of talk are of educational value. You need to try and aim as much as possible to provide students with tasks which promotes exploratory talk.



It may not be easy to achieve as students need to learn how to express themselves, listen to each other, build on the input of others, and be critical in a constructive way of own and others' contributions. So stop and listen to students as they talk and steer the conversation to promote reflection among students until they learn how to engage in positive constructive discussions.

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4.6 Creative pedagogies

In a 21st century context, and consequently also in the SeLFiE project, creativity is the focus of many educational policy agendas informed by significant global development in research related to integrating creativity into curricula, creative classroom practice, and its impact on the learners' creativity. Several scholars attempted to define 'creative pedagogies' given that a one-size-fits-all 'creative pedagogy' does not exist. Through a systematic review of literature, Cremin and Chappell (2019) concluded that seven interrelated features characterise creative pedagogies: generating and exploring ideas; encouraging autonomy and agency; playfulness; problem-solving; risk-taking; co-constructing and collaborating; and teacher creativity. Lin (2011) contends that in creative pedagogies, learners experience teaching and learning processes that enhance their creative development through three interconnected elements: creative teaching, teaching for creativity and creative learning. This triad of interwoven elements recognises that creativity can be taught, learned, and developed and highlights the relationship between educators and learners as they experience creative pedagogies. Similarly, Vygotsky's (1978) work highlights that creativity is expressed and developed in relationships within pedagogical spaces that permeate learning to happen through ongoing collaboration and interaction between learners, adults and the environment. Such evidence challenges the long-held belief of creativity being understood as 'creative arts' or the assumption that 'school kills creativity' (Glăveanu, Sierra & Tanggaard, 2015, p. 1). Yet, developing a shared understanding of what constitutes 'creativity', its meaning and value in education remains a challenge for educators and other stakeholders. Educators may be hesitant to explore and sustain creative pedagogies within their practice. Research shows that overloaded and standardised curricula, and formal schooling, may hinder the development of creative pedagogies.

As an educator, you need space to develop creative learning, to be able to take risks, transform your practice, collaborate creatively, and innovate through dialogue and interaction with the children to support them in acquiring new learning outcomes – rather than reproducing traditional methods. To nurture the development of creativity, it is essential that you are cognisant of the three core elements that facilitate creative pedagogy and the relational aspect that underpins its philosophy in practice: (i) stand back; (ii) provide learning experiences that are child-initiated and permeate decision making; and (iii) allocate the time and space required for innovation within enabling environments (Cremin, Burnard, and Craft, 2006). Grounded in the principles of child participation and engendering high levels of involvement in learning, creative pedagogies

are associated with nurturing the learners 'possibility thinking'. Anna Craft coined this term to support the democratic ideology of creativity in education systems (Chappell & Cremin, 2014). Cremin, Burnard and Craft, (2006) point out that possibility thinking, as argued by Craft (2000), is embedded in the 'learners' engagement with problems, suggesting that it is exemplified through the posing, in multiple ways, of the question "what if?'" (p. 109). Such open dialogue and interaction sustain shared and possibility thinking and conceptualises creative pedagogies as a process rather than prescriptive content transmitted to learners.

Several school-based research studies reveal the success in learning when creative pedagogies and language learning are integrated. Effective second language learning requires a learning environment that embraces creativity through collaboration and interaction and nurtures intrinsic motivation - key to learners' knowledge retention. In language learning, when you teach creatively, there is a greater likelihood that youmotivate learners and engage them in the learning process, activating the potential of their creative disposition to promote language performance. Adopting creative pedagogies also means that you view children as competent and able with prior funds of knowledge and identity rather than passive recipients of the information. As an educator, you need concrete guidelines, tools and approaches to expand your pedagogical repertoire in language and literacy learning and beyond. Awareness of creative pedagogy and how it is being understood is key to restore or further promote wonder, curiosity and play in learning and across diverse cultures and educational contexts. Learning is creation, an underlying principle of this toolkit created by and for educators.

4.7 The teaching of Social Knowledge/Studies

Having discussed general pedagogical aspects, we now move to some area specific pedagogies which are useful to keep in mind. In this section we tackle the teaching of Social Knowledge, or Social Studies as is known in some educational systems. We then visit pedagogies in Mathematics and then Music. These are not the only area pedagogies that you can consider in integrated learning and you can consider teaching approaches in other areas when integrated learning.

Teaching methods in Social Knowledge combine teaching of strategies that develop both scientific knowledge as well as a set of methods, techniques, and procedures. To do this, we must first ask ourselves why Social Knowledge is taught, to whom, and what the benefits to students are. The purpose of Social Knowledge is to promote critical and responsible citizenship, able to participate in social change. For example, the learning of

history is oriented towards understanding society and societal issues around us and how to participate actively in decision making.

Inquiry applied to learning Social Knowledge goes beyond the mere memorisation of information which has been shown to be inefficient and obsolete. Information itself does not produce knowledge, but to achieve this transformation, information needs to involve organising, relating, analysing, and synthesising information and making inferences and deductions in order to gain knowledge. The inquiry method can be promoted in class with students through discussions, debates, simulations, project work, simplified investigations, case studies, or problem-solving projects. These approaches enable students to become accustomed to considering different perspectives and interpretations of problems, as well as how to freely and respectfully expressing their own points of view. In these scenarios, cooperative techniques play a fundamental role because interaction with peers facilitates learning and is a motivating element (Gómez Carrasco and Rodríguez Pérez, 2014). To this purpose, we must consider (Figure 5):

1. **Selecting content based on real social problems** (e.g., poverty, victims of wars, walls in the world, refugees, violence against women, inequalities between territories, exploitation of children), considering an interdisciplinary and holistic approach.
2. **Problematizing the content and identifying similarities and differences** in social problems of the past and present, aimed at the education of the future.
3. **Selecting the sources to work with** (primary and secondary sources, media, songs, etc.) and providing the tools for reading, interpretation, and critical analysis (graphs, tables, archaeological material, historical documents, etc.).
4. **Encouraging the development of assumptions or hypotheses** and promoting discussion and debate.
5. **Verifying the diversity of evidence or sources** in order to select them and submit them to critical analysis.
6. **Proposing alternatives or solutions** to the problems presented.
7. **Enabling classroom actions to be reflected in the locality**, which makes it possible to demonstrate the viability and real effectiveness of proposals or social interventions.

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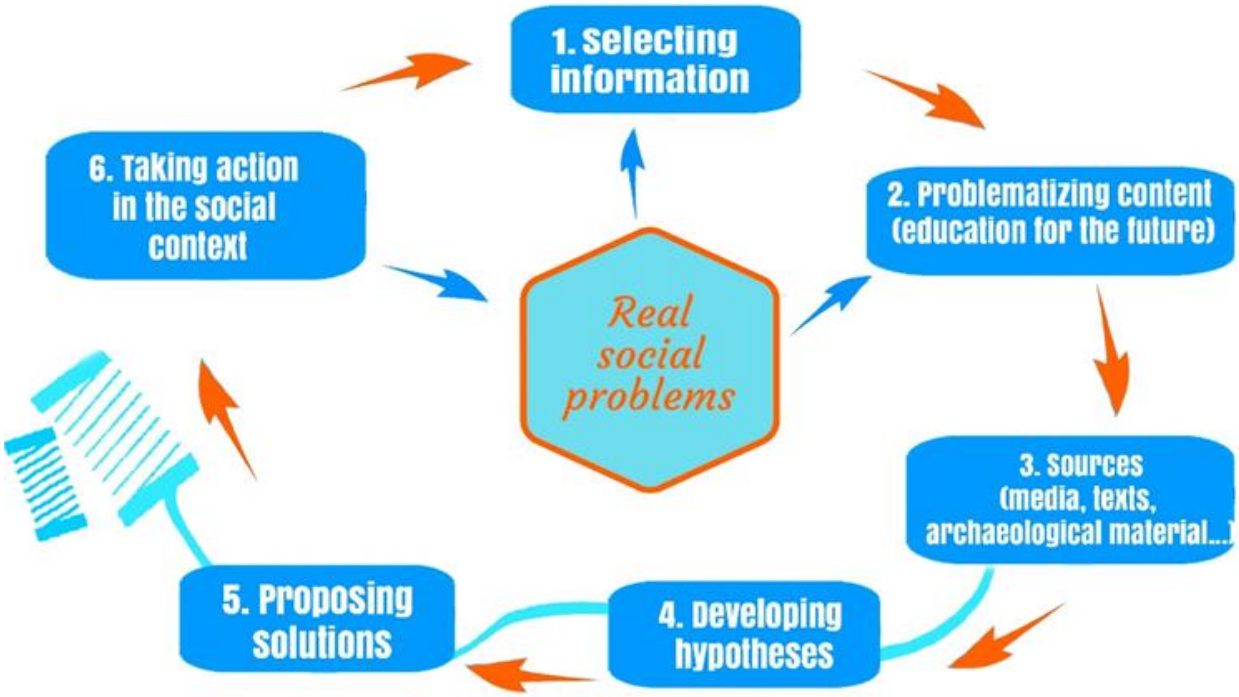

Figure 5. Stages of inquiry methodology in Social Knowledge education

Considering that the purpose of the Social Knoweldge/Studies , and History in particular, is to develop critical, responsible, and active citizens capable of proposing and participating in social change, the teaching of History should make invisible people, groups, or identities visible. Gender in particular should also be included in the process as a category of social analysis. The following are a series of guidelines for introducing concepts and perspectives in the classroom in a simple way:

1. **Reflection and selection of content**: Avoid the uncritical transmission of stereotyped historical discourses. A reductionist (where issues are reduced to a different, usually more simple level) and anachronistic (when something or someone is in the incorrect time period) view of the historical past and present-day society should be avoided. Thus avoid:
    a. Promotion of non-androcentric (masculine) interpretations of the realities studied.
    b. Problematization of social inequalities, deconstructing (breaking down the meaning of) relations of domination in terms of the protagonist profile of the political or military leader.

   c. Identification of stereotypes (a widely held but fixed and oversimplified image or idea) and prejudices.
2. **Avoiding methods that promote memorisation or uncritical recall**, and which are far removed from the historical understanding and the construction of social knowledge.
3. **Analysis of social invisibilities** and absent identities (people in the society who have been separated or systematically ignored by the majority of the public).
4. **Construction of counter-narratives** from the vantage point of those who have been historically marginalized (based on social justice and Human Rights); i.e., as an alternative to hate narratives (often directed against women and the LGTBIQ community) oriented towards social action and the development of critical thinking such as:
   a. Recognising the presence of groups in a contextualised situation of vulnerability in order to avoid hate speech.
   b. Considering emotions and feelings as categories of social analysis.
   c. Reflecting on the limits of the right to expression.

Social Knowledge education, especially in History, should tackle developing historical concepts such as historical empathy from a relevant or historical perspective. In this aspect, it is essential for students to understand how patriarchal and subjective categories have been constructed, as well as to analyse the hierarchical positioning of men over women's actions and narratives. Moving away from the reductionist vision of history based on the public sphere allows us to approach a vision of history based on the understanding of social relations and practices, thus promoting a holistic perspective, which helps develop critical thinking skills that can encourage certain actions such as responsible citizenship.

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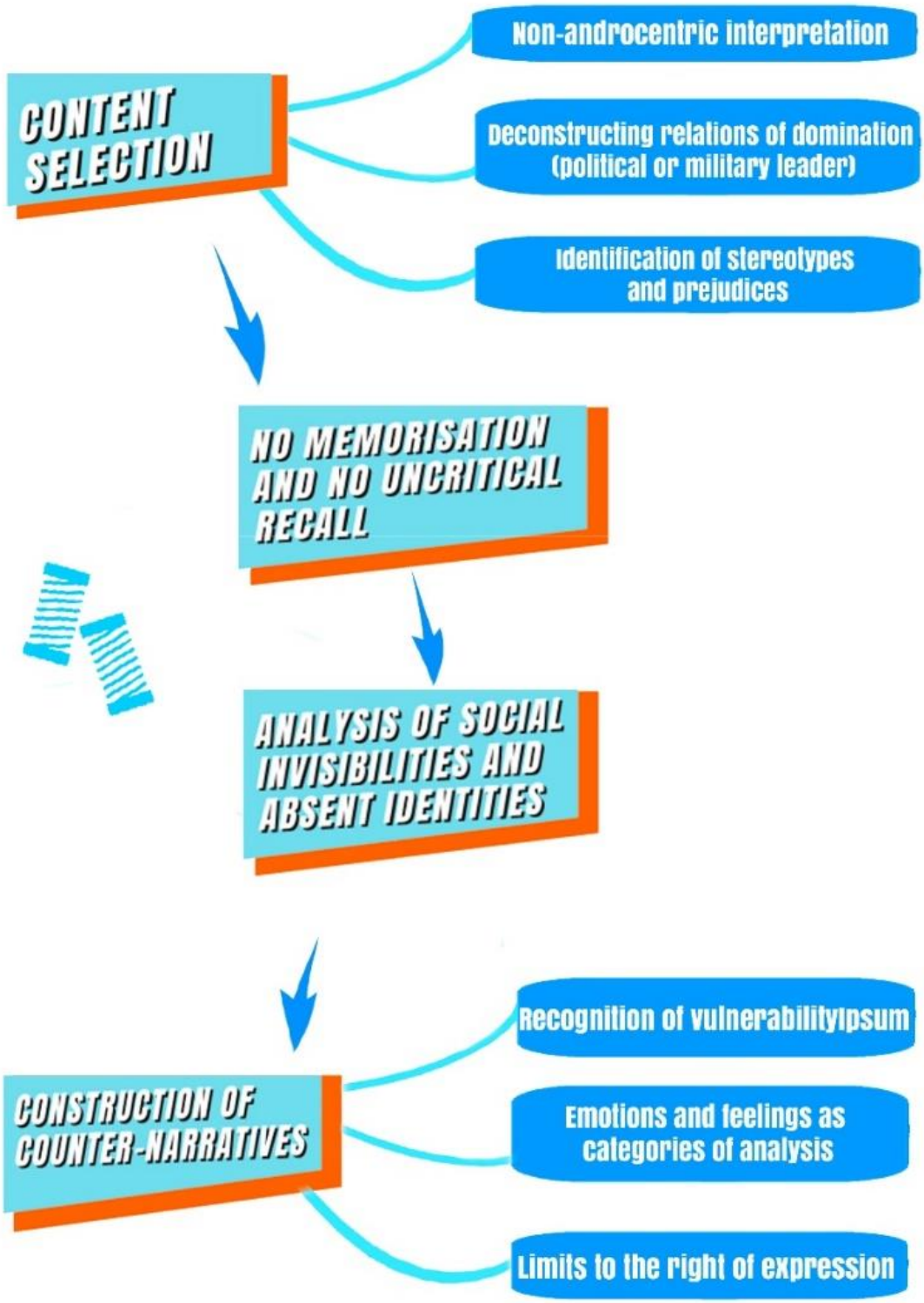


Figure 6. Proposal for training critical citizens through Social Science.

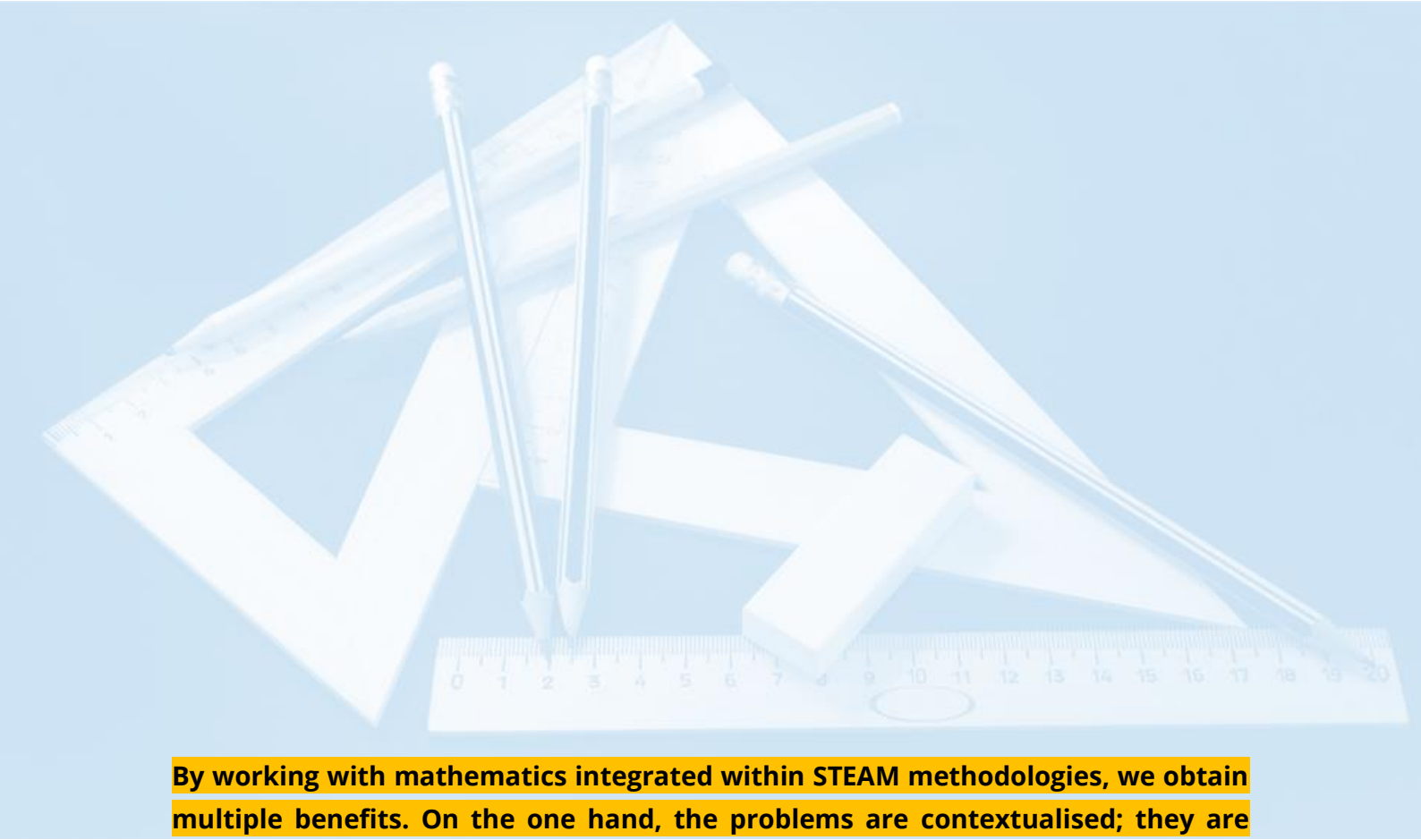
The application of these working methods to the learning of a second language makes it possible to develop skills of comprehension, communication, and application of concepts based on one's own criteria (Bloom et al., 1984).

Social Knowledge/Studies is thus one of the most integrated subjects in the school curriculum; with the terminology itself involving the application of numerous terms of Latin origin, which facilitates the association of concepts, the relationship between them, and their better assimilation.

On the other hand, it enables pupils to read and interpret texts in two different languages. Working with texts in two languages widens the perspective of historical work and contributes to the production of more complex historical concepts, developing cognitive, linguistic, and communication skills. Moreover, in order to achieve a greater impact on the learning process, this must be complemented by the repetition of terms, the use of numerous synonyms, the occasional translation of a term, and the use of visual support material (Del Pozo, 2011).

In conclusion, bilingual practice increases the analytical capacity of students, as their learning is consolidated with the use of innovative methodologies that contribute to increasing their retention and their capacity for understanding in a natural and meaningful way beyond mere memorisation, and therefore contributes to the creation of knowledge.

4.8 Mathematical methodology



By working with mathematics integrated within STEAM methodologies, we obtain multiple benefits. On the one hand, the problems are contextualised; they are motivating and allow a technique to be more easily associated with a problematic situation.

This allows us to have a practical example of how to use this tool so that our brain is able to accumulate more information and access it more easily when needed. On the other hand, when using an INTEGRATED STEAM approach, it is more difficult to fall into the temptation of proposing problems that force the use of mathematical content that is inapplicable. When we use integrated STEAM, everything makes more sense!

Key Ideas for Integrating Mathematics in STEAM+L2

When we integrate STEAM using a second language, we are naturally learning both mathematics and that second language (L2). Both mathematics and L2 enable communication and make sense within a problem context that requires typical problem-solving steps. According to George Polya's method (1965) the main stages are to: (i) understand the problem, (ii) gather information and organise the data, (iii) shape a plan of action, (iv) execute the plan, and (v) check. Language and graphic representation will

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be key in all these phases. In particular, immersion in the knowledge and understanding of specific mathematical content facilitates the understanding of the problem and the proposal of solutions. If this content is gradually assimilated, the development of cognitive skills is improved, allowing the creation of links between knowledge formation and the second language. Finally, the cultural context allows the perspective to be broadened towards knowledge of others and of oneself.

Students' problems or concerns should be the backbone of the process. We should not look for mathematical problems, but for the mathematics of the problem. A typical mistake is to relate mathematics only to numbers and operations, thus relegating most of the mathematical tools. It is important not to forget other blocks of content.

In our daily lives, mathematics is the means, not the end, and this is how we should think of it in an educational environment. **Mathematics can be understood as tools that we use to solve problems and questions, organise data, or make decisions.** Forcing the use of tools whose usefulness is not perceived favours a disconnection with the real world of the technique that is being learned: either a situation arises in which this learning makes sense or perhaps it is not the time for this learning.

1. the acquisition, comparison, and quantification of magnitudes;
2. the recognition of geometric properties or orientation in the plane and in space;
3. the recognition of events with different probabilities, the representation and manipulation of data, or the interpretation of statistical graphs;
4. the planning of the problem-solving process, approaching the method of scientific work, the use of logical thinking, and the integration of information and communication technologies in the learning process.

Mathematics is much more than adding, subtracting, multiplying, or dividing. In fact, solving arithmetic operations quickly does not guarantee developed mathematical thinking. Moreover, we should not forget that learning to think requires the development of language: the development of logic and the development of language are inevitably linked.

All concepts should be worked from different points of view through several activities: kinaesthetic, manipulative, oral, and graphic (on multiple modes of representation in early childhood and/or writing in primary school). At the same time, it is important to make use of Gardner's multiple intelligences, promoting the use of all of them to acquire and consolidate concepts. Design activities are those that travel from concreteness to abstraction; for example, an activity may start with an experiment

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or manipulative problem to allow students to work on the concept in the abstract before moving on to symbolisation, generalisation, and formulation. Figure 7 shows the eight intelligences proposed by Gardner and an example of how different content (also mathematical content such as triangles) can be dealt with using different intelligences. By using multiple intelligences, we ensure kinaesthetic, manipulative, representational, and graphic activities and facilitate language learning in a contextualised way.

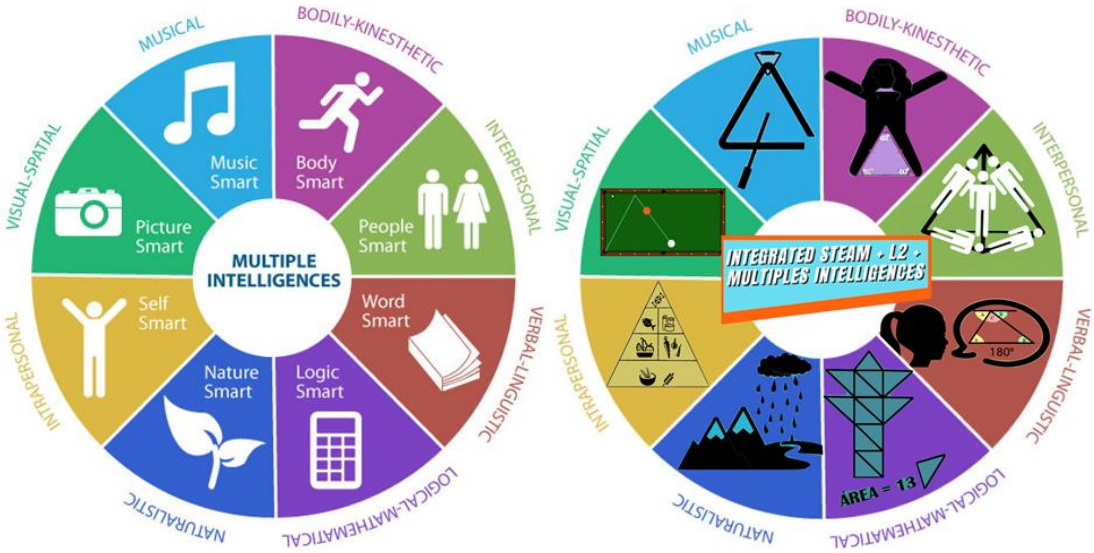

Figure 7: (Left) The main multiple intelligences suggested by Gardner. (Right) Scheme of activities STEAM+L2 applied to Gardner multiple intelligences using the properties and applications of triangles as the common thread

Different methodologies may work in different contexts. Surely there is not one that is better than the others. The right one is the one that works in the group at that moment, so we must be flexible and adapt. Ideally, a certain amount of curiosity should be generated in the classroom and, within a pre-established order and routine, there should be room for uncertainty. You can lose interest in a series if they reveal the ending; a film stops engaging you if you know what will happen**. Therefore, let's avoid spoilers in the classroom and let the students discover the formula, the rule, or the mystery!**

In fact, it is necessary to allow solutions to be reached through trial and error. We learn from expressing and communicating mistakes. The problems posed do not always have a unique solution; sometimes they have no solution at all or many or even infinite solutions. The more restrictions the problem has, the fewer the number of possible solutions; in fact, it may even be necessary to relax some of the characteristics of the problem in order to propose a solution. For example, it may be difficult to find a container format that optimises the volume with respect to the surface area that is cheap, resistant, attractive to the public, ecological, local, recyclable, light, or shock resistant.

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Consider Bloom's taxonomy. A pupil learns a concept at different levels: first he/she recognises, then reproduces, applies, and relates it to other concepts. It is interesting to work with the body (perceiving or feeling the situation to be studied) and then with materials of varying sizes (taking into account the limitations of fine motor skills) until the concept can be drawn or represented before moving on to greater abstraction (e.g., the generalisation of a result). In other words, start with the kinaesthetic, then the manipulative (from large to small as motor skills allow), and finally to more mental activities, which can be oral or written.

Figure 8 shows a pyramid similar to the one proposed by Bloom with an example of application for the magnitude time. It is possible to integrate STEAM through a second language by making use of multiple intelligences and Bloom's taxonomy, taking care of the order of the activities and their variety.

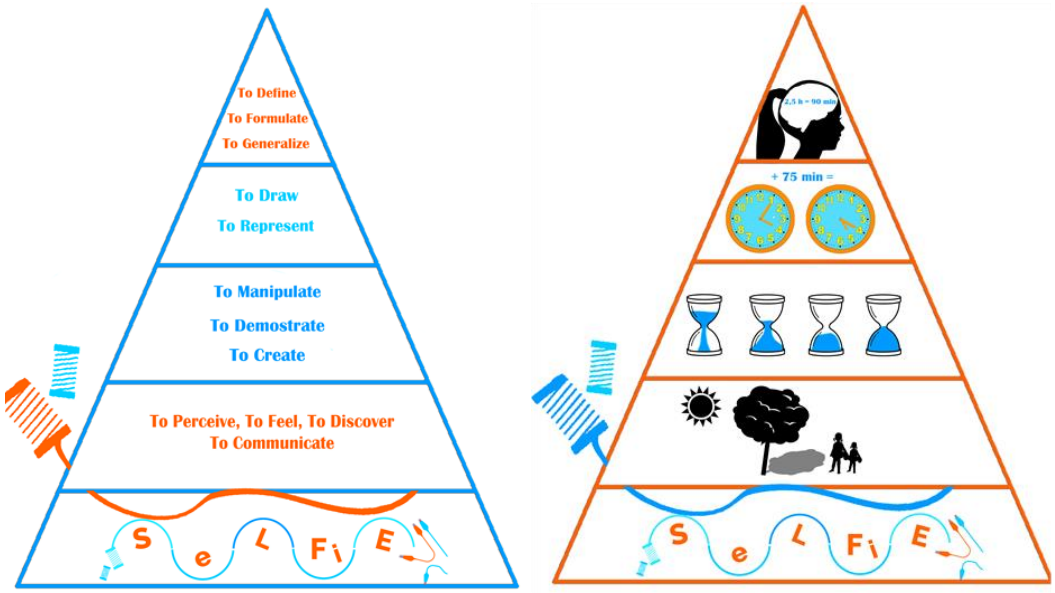

Figure 8: (Left) Activities requiring less abstraction should be performed before abstract ones. Activities with a higher level of concreteness are at the bottom, while more abstract activities are listed at the top. (Right) Example of time-related activities ordered from least to most abstract.

The order matters: more time and weight should be allocated to motor and manipulative activities, as exemplified by the pyramid in Figure 2. However, not necessarily all activities (using all the intelligences) should be contemplated in the same session; they can be planned on different days.

It is important to use attractive materials or those close to the children's lives. They can be recycled materials and retrieved at zero cost. When using unfamiliar materials, it is advisable to include a variable amount of free play time. **In mathematics, play in its**

broad sense (symbolic, creative, sensory, motor, board, digital play) should always be very present and, consequently, in SELFIE , too.

Finally, the use of self-assessment or peer assessment is recommended. It encourages pupils' responsibility and independence and can help to reduce the stress of a grade expected from the teacher.

4.7 Learning through Music

Music, as a vehicle of universal expression, has indisputable strengths in education whether it is considered a value in itself or has a mediating role. Its use in the teaching-learning process develops key skills in students, including collaboration, communication, self-reflection, creativity, and innovation. But how can a primary school teacher working in the mainstream make use of music and to what extent can it be used to teach non-arts disciplines?

The answer to these questions raises two possible itineraries based on the teacher's own musical training: those who have not received specific training and those who have. The focus of this text is on the former; i.e., teachers who have no technical-musical knowledge other than the one received during their bachelor's degree in education.

The subject of music education, which all primary and early childhood education teachers usually take, becomes a basic pillar for teachers to use music in their teaching. This work can be articulated around a main axis whose relevance, pertinence, and advantages have been widely demonstrated in the educational field: the use of song as a didactic tool.

Far from being a closed field of study, however, it is necessary for the teacher to go deeper into the use of this tool since "not everything goes" in the field of songs. A series of basic guidelines can and should be established to optimise its use and transcend the tool itself to become an instrument that mediates holistic competency learning. Some of these guidelines are:

- **Live voice**: a song performed live by the teacher has much more significant consequences on learning. In this sense, it is necessary for teachers to be aware of their vocal identity, of their intrinsic strengths and weaknesses, and how its good use has very positive implications for their students. Teachers should value their own voice and take care of it. There are many prejudices on this subject that lead to a very poor vocal self-concept, which, in turn, has led to an abusive and uncritical use of Internet platforms. In any of the cases and saving the exceptions, it is more convenient for the teacher to sing in class without digital intermediation than to use the latter as a rule.

- **Selection of songs**: when selecting songs to work with students, it is necessary to establish minimum technical criteria that favour and optimise the use of the tool.
    - ✓ **Vocal model**: for songs taken from the Internet, it is important to select songs with the best possible vocal model for the students. This means avoiding interpretations of pathological voices; i.e., with phonation problems, torn voices, etc. These are styles that, although from our point of view as adults may be "beautiful," are very harmful for children since they will try to imitate the model proposed. It is advisable, in this sense, to work with female voices since women's vocal timbre is comparable to that of children.
    - ✓ **Vocal tessitura**: this factor tries to avoid songs that may be excessively high- or low-pitched for children. The larynx (of both boys and girls) does not develop until after puberty, so the songs selected should be in accordance with this fact. As a rule, the less extreme the song is in the range of its notes, the more it will be adapted to the students' abilities and the easier it will be for them to interpret it comfortably. Rap, in this sense, can be a very good tool when working only with a spoken voice.
    - ✓ **Duration**: singing requires an important vocal overexertion for the students, so it is necessary that the musical material used does not exceed three or four minutes in length.
    - ✓ **Rhythm**: songs with a marked rhythm are much more attractive to students, so their motivation to learn and memorise them will be higher and facilitate the learning process. Rap, in this area, is once again a very appropriate and valid resource.
- **Body:** incorporating simple choreographies to the songs (designed by the students themselves if possible) has proven to be very effective in generating deeper learning. It is necessary for the teacher to get out of her/his comfort zone and incorporate the corporal dimension in the teaching methodology. Music is a very appropriate way to introduce it.

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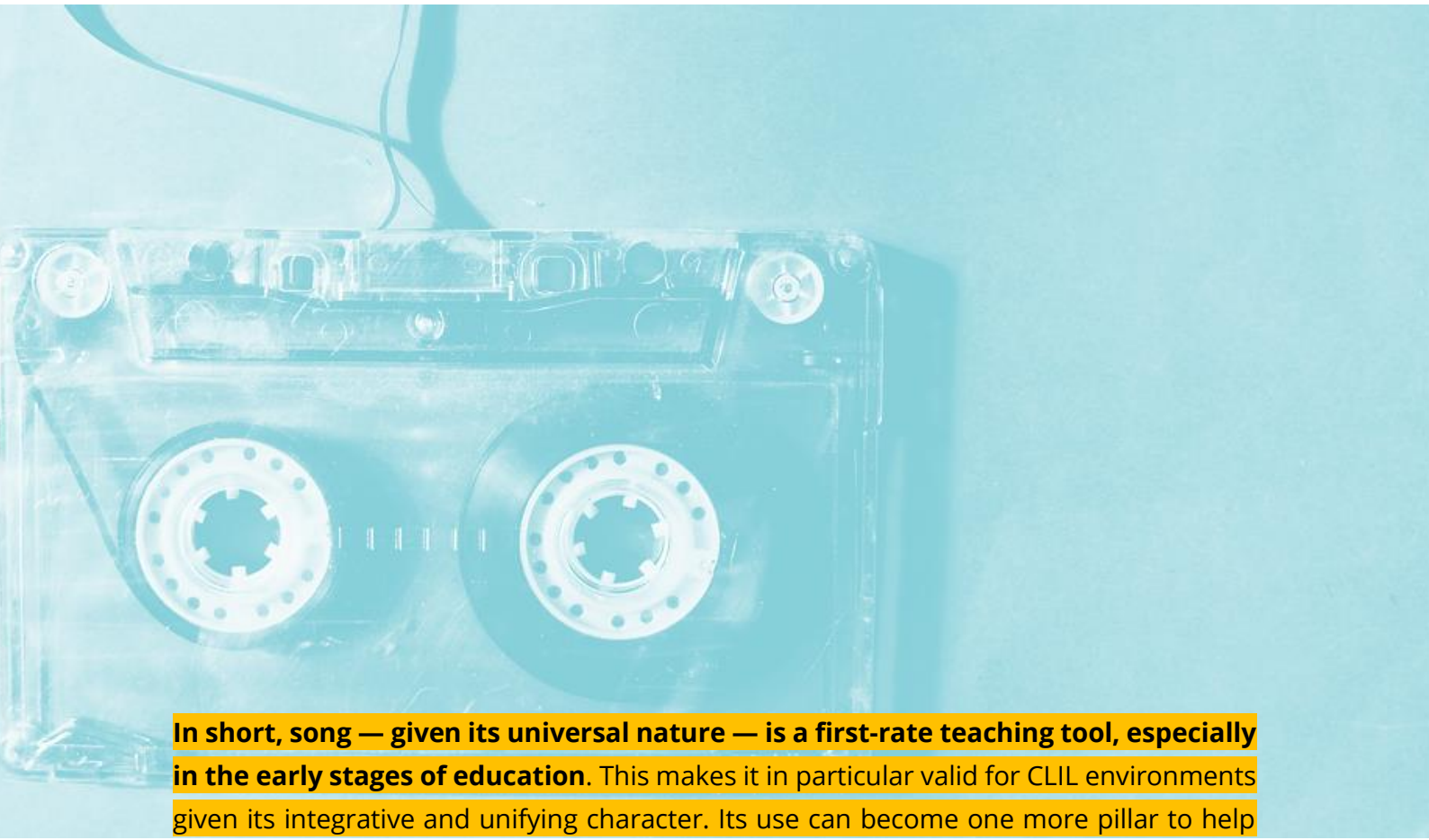

In short, song — given its universal nature — is a first-rate teaching tool, especially in the early stages of education. This makes it in particular valid for CLIL environments given its integrative and unifying character. Its use can become one more pillar to help develop linguistic competence in a non-native language and also facilitate the acquisition and deepening of the content of the curriculum subjects.

We have thus considered a wide range of general and area specific pedagogies. We can now move on to the next section where we present the SeLFiE Pedagogical Model for the integration of STEAM and Second language learning.

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5. The SeLFiE Pedagogical Model for the integration of STEAM and Second language learning

Having read about different aspects of teaching and learning approaches, it is understandable that, as a teacher, you may be asking how it can be possible to combine all these aspects when teaching in an integrated approach. It is not as difficult as you might imagine. The picture is complex if you consider all these aspects as separate and dissociated from each other. Children's learning and development is a holistic process. What you need to do is to be aware of them as you teach through one holistic project. At the end of the day, the learner is one and learners should not compartmentalise their learning. This was, student would not need to learn to apply and integrate separate knowledge parts when making sense of a particular situation. For example, rather than learning specific sentence construction through structured language exercises. Instead they can learn to express themselves as they share their investigation results. Thus, through an integrated project approach, learning is really authentic and reflects better the real world, making it easier, not only for children to learn concepts, but also with respect to how to apply their learning from one context to another.

This section presents the SeLFiE pedagogical model as a theoretical construct. It is then illustrated with practical examples in section 6.

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5.1 Balance between language and subject content taught in the Selflie Pedagogical model

Innovation in pedagogy often involves taking existing approaches, tools and practices, and bringing them together in new ways of teaching and learning. This is what the SeLFiE pedagogical model does as it proposes innovation in how to provide a holistic education where children, through storytelling and other authentic activities, combine STEM (Science, technology, engineering and Mathematics) learning through the arts (thus STEAM) while also engaging in second language learning (STEAM+L2). This approach thus creates an authentic learning environment which is similar to the real world where different knowledge areas are often intertwined.

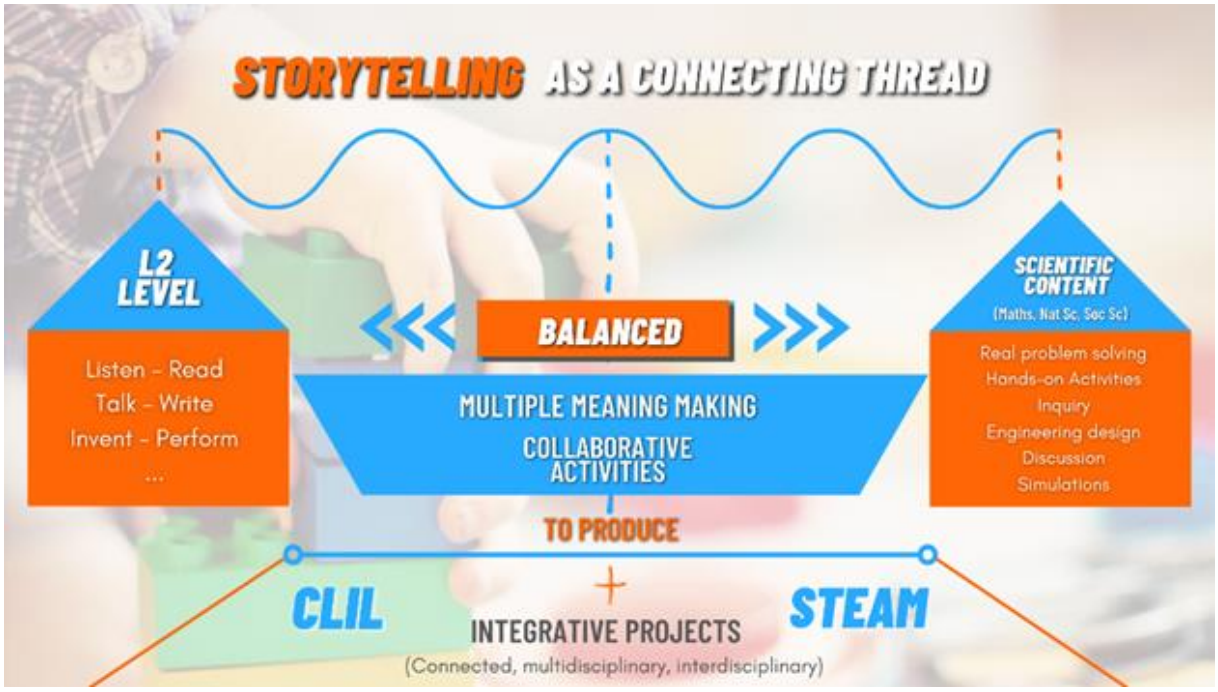

Figure 9: The SeLFiE Model for STEAM+L2 learning at primary level

The SeLFiE Pedagogical Model combines the learning of STEAM subjects with second language learning, through the use of different active, inquiry, student-centered and collaborative methodologies. It reflects reality's complexity by taking an integrated approach to learning which involves connected, multidisciplinary or interdisciplinary STEAM learning with CLIL. Story-telling in its widest possible meaning, is used as the thread which motivates and engages children to tackle an issue, connecting one inquiry to another as children investigate different aspects included in a story or focus on a particular topic. Engaging children in inquiries which may or may not be carried out in their second language, create opportunities where children can communicate and

collaborate as they work, and to share their findings with others in a language other than their native language.

Stories bring meaning to children's lives as they convey values and emotions, and validate learning as children are able to connect with others and society outside their immediate environment through story telling. Stories are often associated with children's books and narratives. However, teachers also often create characters and contexts as bases of stories which they use to motivate students, but also to link different aspects of a topic. Thus, in the SeFLiE pedagogical model we take a wide view of 'stories' which range from narratives to topics and themes.

As shown in the pedagogical approach (SeLFiE Model) above, stories form the interconnecting thread between the different learning activities, as well as link scientific content with second language learning. The model conceptualises children engaging in project work which is based on elements related to a 'story'.

The children pick aspects in the story that they want to learn more about. For example, if the story talks about a group of children who went out in the sea on a boat, they may wish to know why boats, which are large and heavy, can float on water just the same. They may want to know whether boats which float in the sea will also float when placed in other liquids. They may want to learn how weather and wind can affect how fast a sailing boat moves, and which would be the best design for the sails. Also, they may want to learn why people move or have moved in boats around the world. All this highlight how interest elicited through the story can easily develop into inquiries which can lead to tackling STEAM subjects. Of course, students need to discuss as they work in group, share their work and communicate their results with others which makes language key to the learning process. The role of the **A**rt plays an important role, as provides different modes and channels through which they learn express themselves. Children thus, in the SeLFiE pedagogical approach, can work together through collaborative activities involving authentic hands-on (inquiry & engineering design) STEAM activities and practices which lead to multiple meaning making.

Keep also in mind that technology can provide different forms of support to the process as children can use it for engaging in discourse (every day and scientific), in listening & writing by using the computer, slow motion, video storytelling and other programs.

CLIL, like inquiry, promotes active methods, co-operative classroom management, and emphasizes all types of communication (linguistic, visual and kinaesthetic). Authentic

engagement of second language learning can also be promoted through collaborative projects between children in different countries and thus of different languages. The eTwinning programme is one means through which the SeLFiE pedagogical approach can be implemented as children from different countries, and thus different native language and culture, share a story or stories to engage in STEAM learning while also overcoming the linguistic challenge.

As students' second language knowledge varies a lot, it is necessary that as the teacher, you scaffold learning between comprehensible language and accessible content through multiple meaning-making tasks. This way you can balance content knowledge with comprehensible language to make content accessible. The model thus builds on promoting the social construction of knowledge as students work in groups. It also promotes divergent thinking as children need to find innovative ways to investigate aspects of STEM, and use another language to explain and share their work in interesting and artistic ways.

The SeLFiE Pedagogical Model thus represents a holistic approach to learning which reflects both the complexity of life which is both multicultural and multilingual, as well as tackles the understanding of the authentic complexity of the natural world.

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5.2. Co-teaching in the SeLFiE Model

In the same way that different subjects areas in the Selfie Pedagogical Model are presented in a holistic way, teachers must also work together to ensure that the project remains as one. This thus calls for co-teaching both in cases where children in the early years and primary may have more than one regular teacher, or else have a number of specialist teachers working with one general class teacher.

The integration of CLIL and STEAM can be viewed as an integrative approach that attempts to remove barriers between subjects and create clear connections among them (Sengupta et., al. 2020). This also implies a "connection" among teachers, removing barriers due to their subject specialisation. As Wu, Cheng, & Koszalka (2021) state, 'teachers from different disciplines [can] share roles and systematically cross discipline boundaries while planning, teaching, and working together to help their students accomplish common transdisciplinary educational goals' (p.139).

Co-teaching is an innovative approach rooted in the philosophy of inclusive education, where two (or more) teachers collaborate to deliver instruction together to a single group of students. It often occurs between a generalist (class) teacher and a specialist teacher. Both educators share responsibilities and actively participate in the development of the learning process. Both teachers contribute in the same way as they together create learning situations that cannot be achieved by a single teacher (Friend, 2008).

Co-teaching can be an effective educational strategy and very suitable approach in SeLFiE Pedagogical Model (CLIL+STEAM approach) within the early years and primary context due to its numerous benefits (Gillespie & Israetel, 2008). Through co-teaching, you can as teachers:

- cater more effectively for students with diverse needs;
- work cooperatively and learn from other teachers;
- create a positive environment where the positive reinforcement of students' learning is possible; and
- organise students flexibly around the classroom.

Moreover, this approach has several other educational benefits (Beninghof, 2015), which among others allows you: to make your teaching more personalised; improves the academic performance of those students who present more difficulties, as well as those who manifest high abilities.

Due to the diversity of professionals involved in co-teaching between teachers of different specialisations and skills, it is essential to identify those factors that determine the effectiveness of co-teaching (Table 1), as well as the relationship among them (Figure 8).

Table 1. Factors involved in co-teaching

Factor	Definition
Cooperation	Teacher and co-teacher (teacher, special teacher, support teacher, language teacher or pre-service teacher) should collaborate and help each other
Co-experience	Teachers should share their knowledge to enrich instruction with different teaching styles
Co-generative dialogue	Teachers should talk before and during the class. These talks should be aimed at solving problems related to the instructional process
Co-respect	Teachers should accept the presence, opinions and help of the peer
Co-responsibility	Teachers should feel involved in teaching planning, a fact that implies agreeing on content, strategies and procedures (co-planning)
Co-leadership	No one should hold the role of main teacher or, in the opposite case, subordinate

Even though this is a growing practice in education, the research is rather vague in specifying how this approach can be implemented on a daily basis. Cook & Friend (2013) proposes six models on how you can achieve this in class:

1. **One teach, one observe:** one teacher delivers the instruction and the other is the one who gathers information about the progress of the students
2. **One teach, one assist:** one teacher has the main responsibilities in the teaching process and the other is the one who helps the students in the different tasks.
3. **Station teaching:** The whole group is split into two groups. Each group spends a designated amount of time in each of the stations with one of the teachers and then, they change the station, and thus, the teacher.
4. **Parallel teaching:** The whole group is split into two groups and contrary to the station teaching they spend the whole time with one of the teachers.

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5. **Alternating teaching:** The students are provided with two different perspectives of the same information.
6. **Team teaching:** both teachers are actively involved in the lesson. They share every aspect of the teaching process.

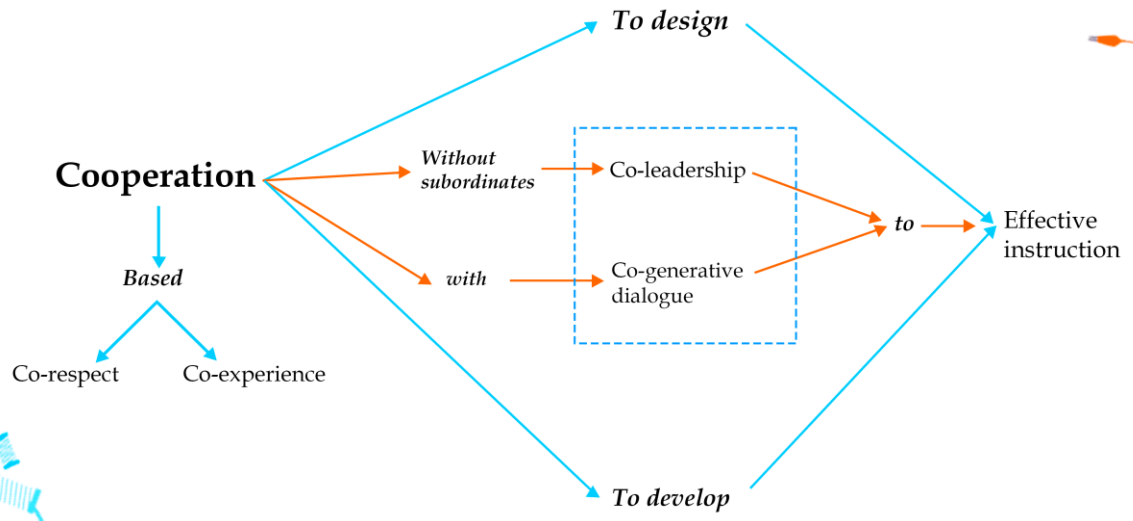

Figure 10. Relationship between the different factors that determine the effectiveness of co-teaching

Co-teaching is thus an integral aspect of the SeLFiE Pedagogical Model as, in order to achieve real integration in teaching, it is also necessary to collaborate with other educators. This collaboration can be with other professionals such as subject specialist teachers, but also possibly with teachers in the same year, teacher assistants as well as school management. In order to make learning a holistic experience, it also needs to be holistic in the way that it is implemented. Do not expect to be able to implement the SeLFiE Pedagogical Model on your own, but talk and share the possibility of collaboration with colleagues. What is important is that you work together as colleagues in a democratic and respectful way, using each one's pedagogical strengths to make learning effective, creative and fun for the children.

5.3. Provision of Challenge for Highly Able and Gifted Learners

As teachers, we often find ourselves concerned about the weakest of our students and how they are coping with the new learning. We are much less concerned, even if we should, with whether we are also providing engaging and challenging enough learning experiences to the high achievers, those who we call 'gifted'.

If you are working with early years and primary school-aged children, you often find yourself looking for effective ways to support and address the diverse strengths and needs of all learners in their classrooms, not only those who are weak, but also those who can reach higher levels of performance or attainment. Differentiation is one of the ways through which educators adapt their teaching and learning process. Through inclusive practices, you can try to provide learning opportunities for the different potential and abilities of different learners as you cater for their multiple intelligences.

In many educational settings, there are usually more support systems in place for scaffolding and adapting the curriculum to students with learning difficulties or disabilities. Unfortunately, there tends to be much less attention given to those students with higher potential, ability or giftedness. Highly able or gifted learners are defined as those students who have the capacity for learning at a rate and depth that is beyond what is usually expected from peers of their age. These students also require adequate provision for their affective and academic needs to be met. They tend to possess a heightened imagination, experience 'over-excitabilities' or magnified sensations, asynchronous development and are also able to think in novel and inquisitive ways. As exemplified by Gardner's theory of multiple intelligences, highly able and gifted learners do not constitute a homogeneous (same type) group but are multidimensional, where giftedness can be manifested through high aptitude or achievement in one or more domains of intelligence, such as intellectual, language, mathematical, artistic, creative or leadership capabilities. Catering for their needs is thus a challenge.

As teachers we need to keep in mind that every child has the right to an educational programme that enables them to reach their full potential and to have positive and fruitful schooling experiences.

The SeLFiE project in promoting the integration of content and language learning through STEAM projects, presents an invaluable opportunity for creating stimulating learning environments where differentiation happens at the level of the curriculum, the pedagogy adopted, as well as in the design of the environment. Creative pedagogies are built on the premise that children are active participants in the social construction of knowledge and that the educators' role is to facilitate the teaching and learning process through the provision of enabling environments. Research in the field of gifted education highlights the need to implement flexible pedagogical frameworks, 'smart contexts for smart learners' (Barab & Plucker, 2002) that permeate the development of higher order and creative-thinking skills.

Pedagogical approaches such as project and inquiry-based learning that promote independent and discovery learning, and opportunities for real-life experiences and integrated approaches enable teachers to support gifted children in their learning (Freeman, Raffan & Warwick, 2010).

In the same way, in gifted education, stories are seen as a 'vehicle for creative thinking' in that stories 'can evolve in cross-curricular ways, across cognitive, social/affective domains, as well as, across subject areas … Stories facilitate the multiple, richer and deeper development of creative-thinking skills such as: summary and synthesis, questioning, modeling, evaluation, interpretation, and criticism' (Said & Farrugia, 2021).

Do not forget that your students may share interests but come with different abilities. In using project work, you can allow them to engage in inquiries according to their capabilities, ensuring that you challenge all your students, who can achieve different depth in their understanding and meaning making about how the world works.

In conclusion, the creative pedagogies and integrative approaches in the SeLFiE Pedagogical Model connect second language learning with science, engineering, technology, and the arts, in a novel way where challenge becomes embedded in the STEAM projects. If implemented intentionally and purposefully, we may succeed to, not only provide an enriching and meaningful learning experience for all learners, both those who need additional support, as well as those who are, or have the potential to be, at the higher end of the ability spectrum to feel recognised, respected and adequately provided for. The students' active participation, engagement and motivation are likely to be manifested in rich 'smart' classroom environments that promote a combination of subject areas, inquiry and innovation, the use of tools and artefacts that enhance the social

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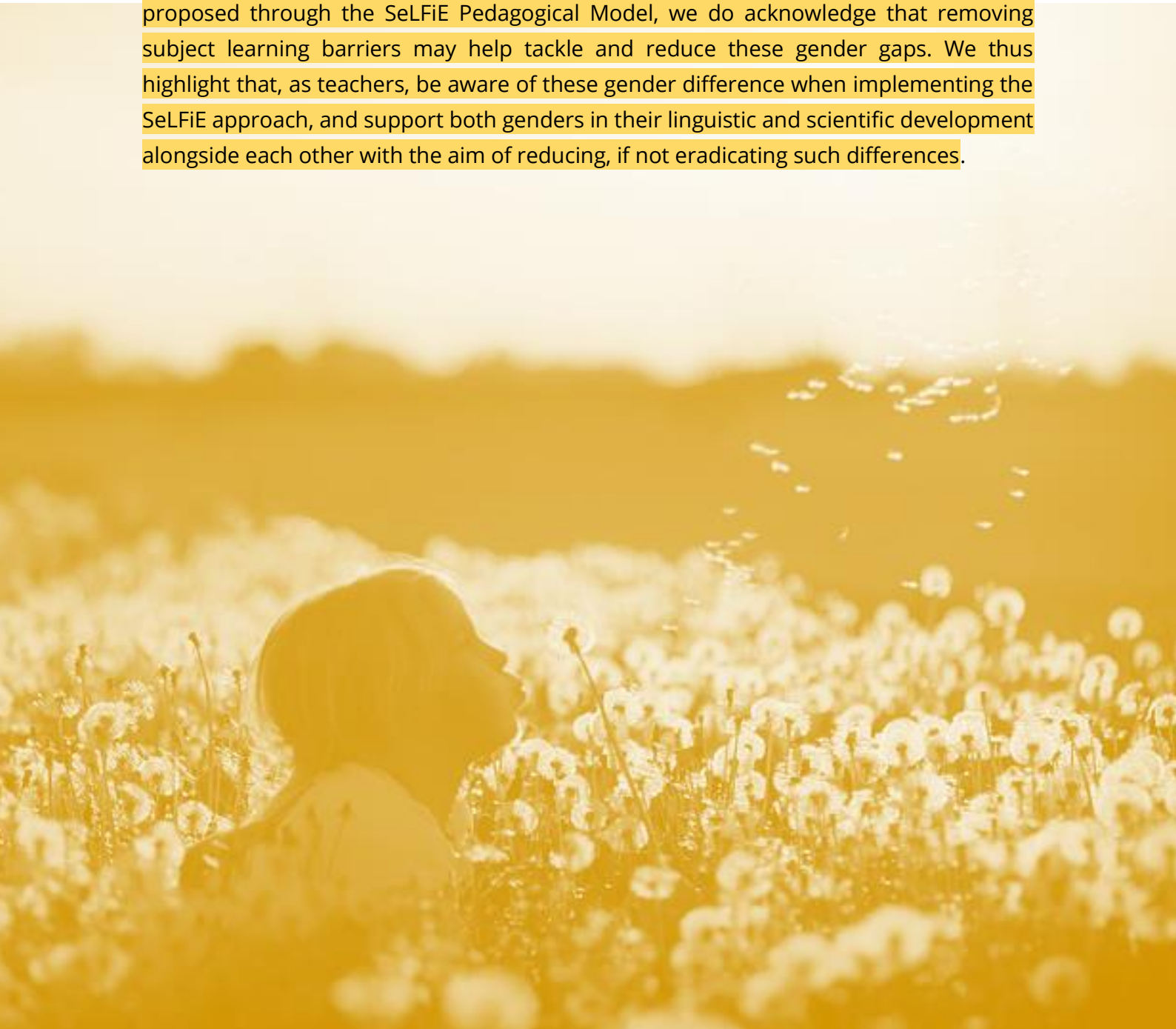
construction of knowledge, flexible groupings with learners working collaboratively on specific projects, and real-life experiences.

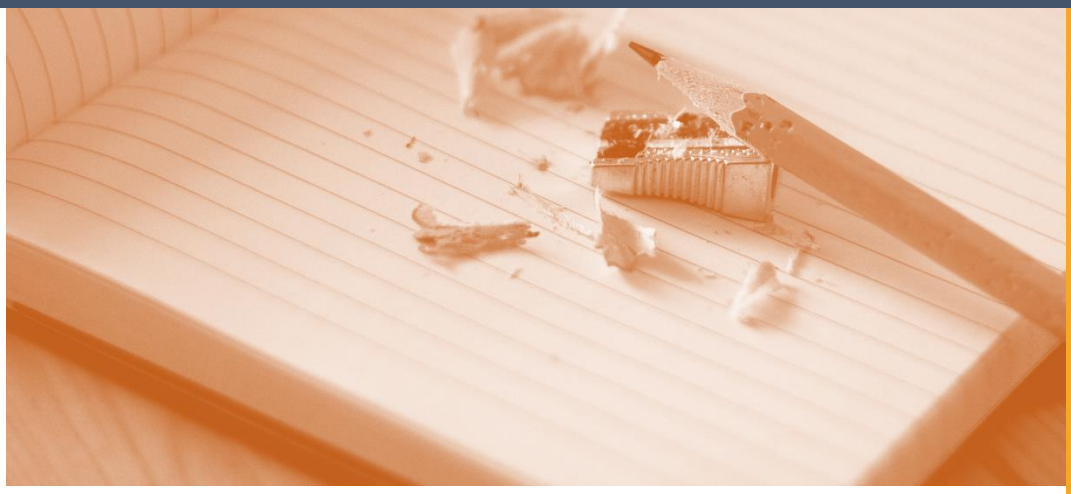
Before moving to the practical application of the SeFLiE Pedagogical Model, a short note about gender differences. Girls' and boys' performance in the PISA assessment has consistently found that girls outperform boys in reading and that, to a lesser extent, boys outperform girls in mathematics in many of the participating countries. These gender disparities raise concern due to long-term consequences with respect to personal and professional future.

Boys may fall behind due to their limited linguistic skills, while the under-representation of girls amongst top performers in science and mathematics can possibly explain the persistent gender gap in careers in science, technology, engineering and mathematics (STEM) fields. While we do not have any evidence on whether the integrated approach proposed through the SeLFiE Pedagogical Model, we do acknowledge that removing subject learning barriers may help tackle and reduce these gender gaps. We thus highlight that, as teachers, be aware of these gender difference when implementing the SeLFiE approach, and support both genders in their linguistic and scientific development alongside each other with the aim of reducing, if not eradicating such differences.



6. Identification and selection of the examples of good practices

Having presented the SeLFiE pedagogical Model, it is obvious for you to question how all these aspects can be implemented in practice. This section serves to present one example of good practice which have been identified in schools in the project partner countries; others equally useful, can be found at the project website (https://project-selfie.eu/). They serve to illustrate how teachers in the early years and primary years have managed to teach in an integrated project approach, tackling subject content learning and skills development with second language learning and competence development.



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6.1. Methodology and Criteria used for the selection of examples of good practices

Before presenting the examples of good practice, we would like to share with you the process that we followed and the criteria which we used to identify these examples of good practice. We firstly felt that as a group of educators from different countries, and thus from different cultures and education systems, that we needed to develop a common understanding of the key characteristics which the examples of good practice should possess. This ensured consistency between our pedagogical framework and the examples which we provide here. We decided that in selecting the examples of good practice it is most important to ensure that the cases included as many aspects possible of the three key elements of the SeLFiE Model (STEAM, IBL and CLIL).

In order to facilitate the process for the partners, a grid with the criteria which the examples chosen needed to fulfil was drawn up following discussions within the partnership.

Table 2: Checklist of key elements for examples of good practice

STEAM	Partial	Full
It Is project-based		
Learning of meaningful maths, science, and technology content		
Solve real-world problems through hands-on learning activities		
Involves creative design		
Inquiry-based learning		
Starts with a problem or a question		
Involves investigations to test ideas or find answers to question		
Children are involved in group-work		
Evidence (observation) are used to draw conclusions		
CLIL		
Learning related to curricular areas other than foreign language		

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The first set of criteria consider the subject areas as well as the integrated approach. Thus, examples of good practice are to include as much as possible projects which target subject areas such as Mathematics, Science, Technology, and Engineering, as well as Social Sciences or Arts. The activities must be mainly inquiry-based in terms of starting with a problem and/or question, involves investigations to test ideas or find answers, as well as use observations as evidence to draw conclusions. With respect to language learning and the use of CLIL, learning is to involve other languages than the use of second language, as well as exposing students to new foreign language(s). It was not expected that the cases tick all the elements of the three aspects, but the more aspects ticked, the better fit was the case under consideration, a potential example for inclusion in the toolkit. We are aware that the SeLFiE pedagogical approach is innovative and thus there are limited current examples of good practice. It is for this reason that some of the cases only have elements of it. However, they can still be an inspiration alongside the project's other outputs.

6.2. Examples of Integrated Models in practice

This section takes one of the examples of good practice were identified by the partners and uses it to describe how integrated approaches can be implemented in early and primary schools. In the toolkit only one example is presented. However, a number of other examples can be found on the project website. Although they are not based in Selfie model, they show how integrated approaches have been implemented in bilingual provisions in Europe.

The example considered here is called '**Space mission: Help Big Eye!'**. This example comes from a La Merced y San Francisco Javier School in Burgos (Spain). The teachers at the school were unsatisfied with teaching of science at their school as it mainly involved learning from a book unit by unit, covering content in separate topics. They noted that students could not associate or combine different ideas encountered during lessons to new contexts. This was due to learning being very systematic and presented as separate compartments of knowledge.

The project

In response to the learning challenge in their school, the teachers embarked on a project. This project combined the three main curricular areas of learning at the school: Social Science/Studies, Natural Science, and Arts and Crafts. The project was called **SAP - Scientific Artistic Project**. The project was implemented in a bilingual context where children's native language was Spanish and the project was mainly carried out in English. SAP forms part of the school's formal curriculum of and is implemented over the scholastic year. At the time of reporting there were 6 teachers from different specialisations involved. The project aimed to make learning more meaningful for students, enabling them to apply content in context, as they enjoyed themselves and lived a story where they have a "mission" that they have to achieve. SAP starts in the first grade of primary when children are 5-6 years old and finishes when they are 9-10 years old. Nowadays it is been considering carrying on this methodology to the oldest students who are 10-12 years old. There are 6 missions per year, with different missions for each grade.

The project worked this way. The students were assigned two missions each term term (three months each term). The missions were not static but could be adapted or modified depending on the social context, the students' curiosity or special world events. Each mission lasted approximately 6 weeks. They included 5-6 hours (depending on the course) per week dedicated to the mission (3 hours for the Sciences and 2 for the Arts). There was also one moment reserved in a specific session each week where students could bring or show different materials or investigations carried out in the mission that week. The project content was selected from the Spanish curriculum framework. During these missions, students developed a portfolio and at the end, had a final product.

This mission was implemented with students in the first grade (5 and 6 years old). Most of these students can read and write properly in their native language (Spanish). However, they have started learning English this year. So their level of English proficiency is just enough to understand the concepts but they cannot express "free written or spoken ideas" because they would need complex grammar structures which have not yet developed. A mission took 7 weeks with 5 sessions (hours) per week.

The number of students working on the project at the same time varies. In the school, there are three sections per grade. So in some sessions the classes meet up in a specific class at the same time in order to do some special activities or present some content (approximately 75 children all-together).The students can also divide in three smaller groups of around 25 students. When working on specific objectives or content, students

can work in even smaller groups of 4-5. When assessing content, children work individually. (Note that this applies to prior the Pandemic).

Students could work in different spaces: in a special SAP classroom where teachers and students could carry out the sessions together, in this case up to 75 students at one go; in their normal classroom; outdoors; or in the computer room. At the end of each mission, there was a presentation. Some missions were also carried out with parents or older students from the high school.

The Story

It was very important to motivate the students to take on the mission. The story provided this strong motivation as well as the links between the different activities in which the students were engaged. Here we present one single mission and the activities that it involved. The **SPACE MISSION: HELP BIG EYE!** is a story about the school Mascot Raccoony. In a previous mission, Raccoony got lost in the city and students had to find it. In this mission, Raccoony had another adventure when he met Big Eye, an alien from Mars who wanted to visit his friend on Earth. The teachers told the students a story about the adventures of Big Eye on Earth and how impressed he was with the sea, clouds and living things...Since he was an alien, he did not understand how the world works. At the end of the story, Big Eye wants to go back to his planet with his rocket but he bumps into a tree and his rocket crashes. And here the mission starts. The children have to help Big Eye to go back to his planet. To do that, they have to learn everything about space (where his planet is, what is a planet...) and also to learn the differences between Earth and Big Eye's planet. They need to investigate all the questions about the Earth that Big Eye poses (What are living things? Are all living things similar? Why are there clouds in the sky? Are a few examples. At the end of the mission, the students had to design and make their own rocket in groups in order to help Big Eye.

The Activities

The missions involved a group of activities divided into five sections and one final product for the final assessment. The activities were the following:

- **Living things:** The students were motivated to carry out this activities through the story. Big Eye did not know what a living thing is, he tried to speak with a table, a plant and a child... The children were asked if they could explain what a living thing is? The teachers used songs and Power Points and videos to introduce all the content. The children selected the three big groups of living things. They engaged in craft to produce a life cycle wheel choosing a living thing. They looked at how

animals and plants were different, and the different characteristics of living things were different between them;

- **Solar system:** Celestial bodies, Sun, Earth, Moon and their movements. The children were invited to guess where Big Eye´s planet is, and what other celestial bodies they can find the in universe. The students investigated celestial bodies (sun, planets, satellites), they studied shadows and how the sun moves during the day. They looked at the sunset and its colours. They also investigated the Earth and how it rotates round the sun, and how the moon moves round Earth.
- **Time: seasons, calendar, clock:** The children spoke about the Perseverance Rover sent to Mars and how it took more than 8 months to travel from the Earth to Mars. They were asked whether this was more or less than a year? How can they count or measure the time? The children investigated how Earth was born, how long it takes to go round the sun, how many days and months;
- **Water and Air: properties and characteristics:** After reading the news about the landing of the Perseverance in Mars, the children noticed the importance of Water for life (one of the mission of the Perseverance was to find if there was water in Mars and analyse what it could happen). Big Eye supported the idea as he had never seen so much water before on any other planet. The children brainstormed about what they use water for? They asked about not wasting water if there is so much water in the Earth? The students coloured in a world map with two different colours where they could find salt water or fresh water. They tested whether there is more salt water than fresh. They explained the properties and characteristics of water and did some experiments where they had to hypothesise and write down the results. Finally, they shared their results and elaborate the conclusion. They also investigated air and its properties;
- **Inventions and discoveries:** To promote creative thinking, the children were invited to make a rocket to help Big Eye go back home. The children investigated inventions and designs to travel to outer space and how later those inventions were adapted to use in the daily life. They discussed the difference between invention and discovery. They then designed their invention in groups of four in response to this need. They filled in a worksheet explaining the process, materials, used... and finally they created a prototype (STEAM: Engineering design);
- **Final product: Making a rocket:** This activity involved STEAM based on engineering Design. The children, in groups of four, made a drawing about what they wanted to make. They then presented the idea to the teacher who helped them make their ideas concrete by giving them some clues to improve their

design. The teachers then gave them a list of materials and asked them to build the rocket.

It can be noted how the activities engaged the children in learning different aspects of STEAM: characteristics of living things and Space in science; distances and time in mathematics, engineering and technology when designing and building the rocket. There were also many aspects of Art as the children drew and make models. Learning social knowledge was tackled as the children discussed space research and its uses. The presence of inquiry-based learning was also strong as the children carried out investigations to find answers to questions posed. In addition, as the children worked in groups, social construction of knowledge took place as the children discussed their work and the teachers scaffolded the learning process.

And how was Second Language Acquisition integrated with STEAM Education?

This project promoted English as Second Language which students have to learn. The missions provided a context, thus implementing a CLIL methodology (Content and Language Integrated Learning). The teachers planned the sessions aware of what vocabulary and grammar structures needed to be taught. This content should take some

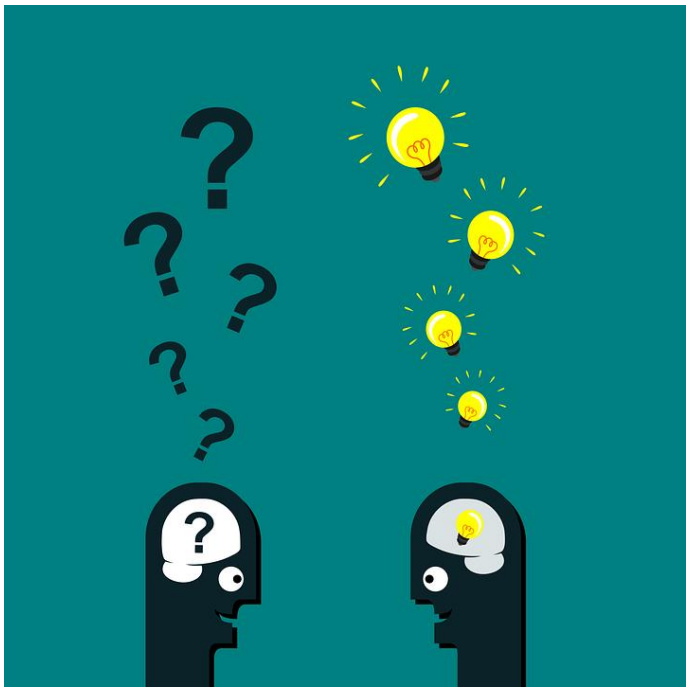
time to teach at the beginning of each mission. English structures needed to be easy and simple to explain and the teachers used many gestures to help the students to understand. The children were encouraged to reproduce or use this new vocabulary or structures as they worked.

The children were involved in second language through games and activities, kahoots, quiztlet or genially. All the PPTs were also in English as well as most of the worksheets in the portfolio. The children also had short weekly assessments in order to check their level of English and their learning over the week. Based on their performance, the teachers adapted or reinforced the English structures or vocabulary. Most of videos were also in English and obviously, communication with the teacher was also in English. Students also presented their work in English in a very simple way with the support of the teachers.

Reflection and assessment

At the end of the mission, students assessed themselves and their classmates in their group. Moreover, the students fill a sheet called "My learning diary" where they expressed two new things that they learnt, one thing that they wanted to improve, one thing they were proud of, three words they learnt in English (in a sentence) and a draw of one activity that they enjoyed. The final assessment was in the native language because they needed to assess what the children really learnt. This exercise also assessed key competences such as problem-solving, using different skills; or integrating knowledge learnt.

As can be noted, it is possible to integrate learning in a meaningful holistic authentic way.



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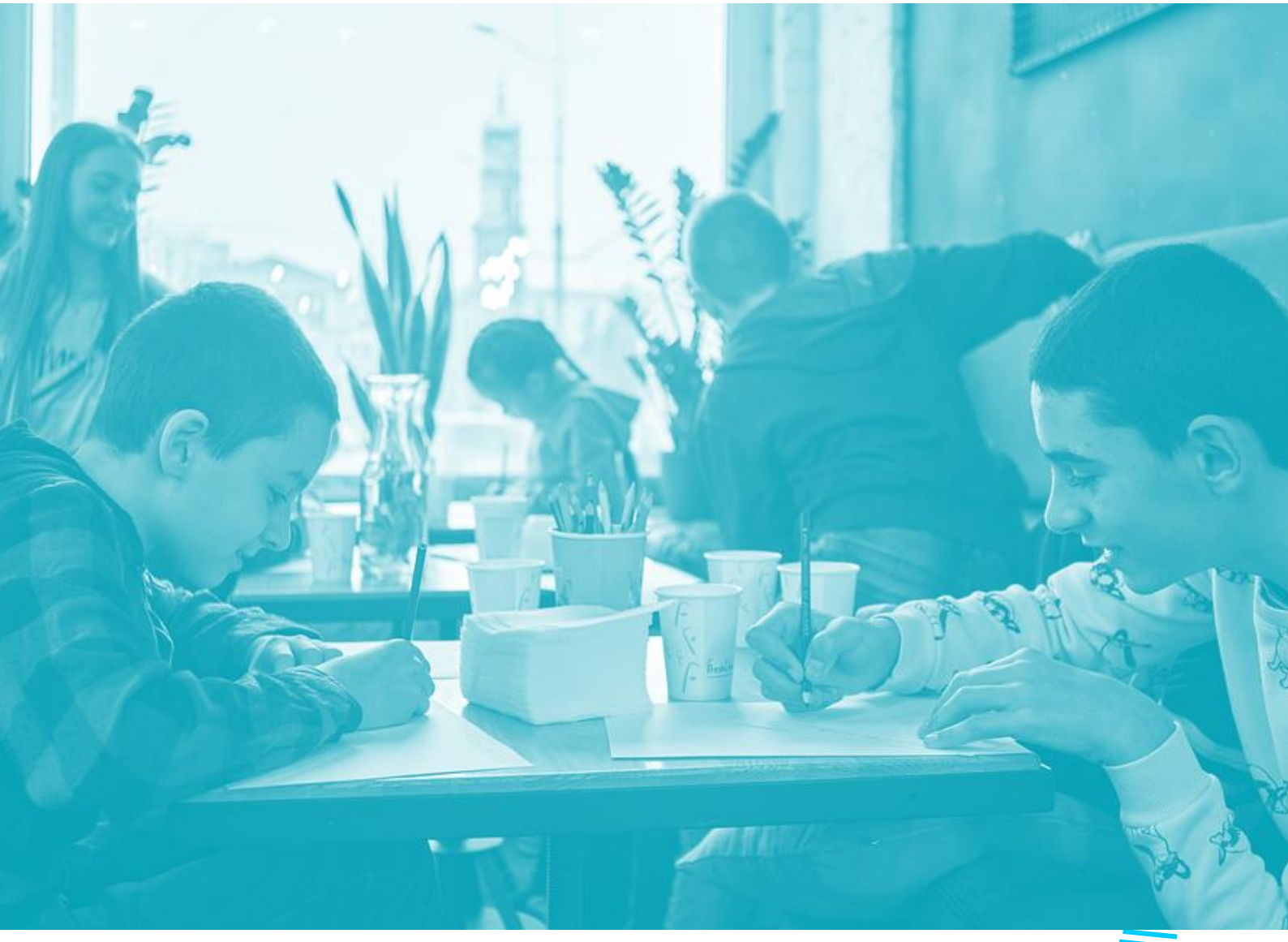
7. Conclusion

This brings us to the end of the Toolkit. We hope that this reading journey can now also take you on a new teaching adventure where learning is authentic as well as promotes effective learning as children have fund. Do not forget that you can learn more about the project and access our additional educational materials (several examples of good practices, open educational resources, a MOOC course about Selfie model as well as new didactical units based on our model) on the project website https://project-selfie.eu/ and on open access.

Thank you and Happy teaching!



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STEAM educational approach and foreign language learning in Europe

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