SPEM – Schools Plastic FreE Movement

D6.1 Training Modules

Partners:

Schools Plastic freE Movement
Erasmus+ KA3 [621506-EPP-1-2020-1-IT-EPPKA3-IPI-SOC-IN]

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DOCUMENT CONTROL PAGE

Document name and Deliverable:	Training Modules (D6.1)
Document responsible Organization:	P03 – Panevezys Provincial Educational Centre – PRSC (Lithuania)
Document collaborating Organizations:	P01 – Istituto Comprensivo di Bosco Chiesanuova – Europole (Italy) P02 - Regional Directorate of Education Castilla y Leon – JCYL (Spain) P03 - Panevezys Provincial Educational Centre – PRSC (Lithuania) P04 - Make it Better – MiB (Portugal) P05 - Turkish Ministry of National Education (Turkey) P06 - Friends of Education – FoE (N. Macedonia) P07 - University of Burgos – UBU (Spain)

DOCUMENT HISTORY

Version	Date	Change editors	Changes
0.1	10/05/2021	Reda Makneviciene, Jurgita Vaitiekuniene (PRSC)	First draft of the Document
0.2	14/05/2021	Elena Milli, Roberta Busato (Europole)	Comments and feedback
0.3	15/09/2021	Bojan Vasilev, Marina Tanaskoska (FoE)	Draft of Module 1
0.4	04/10/2021	Gloria PérezdeAlbeniz (UBU)	Draft of Module 2 and 3
0.5	11/10/2021	Elena Milli, Roberta Busato (Europole) Renata Jankevicenie, Reda Makneviciene (PRSC)	Draft of Module 1
0.6	15/10/2021	All partners	Contributions to the Modules
0.7	05/11/2021	Reda Makneviciene, Renata Jankevicenie, Jurgita Vaitiekuniene (PRSC)	Revised Version for the partners reivew
0.8	15/11/2021	Stefano Cobello (Europole)	Feedback and editing
Final version	19/11/2021	Jurgita Vaitiekuniene (PRSC)	

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1 Introduction

Schools Plastic freE Movement – SPEM is a co-financed project within the Erasmus + program (KA3 - Social inclusion and common values) with the grant agreement number 621506-EPP-1-2020-1-IT-EPPKA3-IPI-SOC-IN. SPEM project aims at answer to the priorities of the European Commission to develop and implementing innovative methods and practices to foster inclusive education and promote common values, in particular enhancing the acquisition of social and civic competences, fostering knowledge, understanding and ownership of values and fundamental rights.

To address these priorities the project will develop and implement, through the creation of a movement of educational organizations, a new inclusive pedagogical model addressed to children aged 5 to 13 in particular to those at risk of marginalization and underachievement (migrant, disable, high potential and gifted pupils). In this way the project will develop an educational strategy to prevent early school leaving and to improve the motivation to approach the studies of STEM subjects and the scientific careers as a paradigm and tool for a social change to a sustainable future.

The challenge of this project is to instill motivation in the pupils so that they follow the idea of a possible scientific career from an early age to give their contribution to the protection of planet earth. SPEM, starting from the ecological consciousness that young people have shown in these years, wants to create a pedagogical approach that gives them the awareness that by studying they can change the world. The project will create a Schools Plastic Free Movement gathering all the involved institutions at European level to boost concrete actions to reduce the plastic pollution and to promote scientific careers as an important contribution to protect the earth.

By applying the SPEM pedagogical model, the whole teaching approach will be modified toward a participative learning process, teachers will be trained in the use of inquiry based science approach and in the development of educational activities that can encourage the construction of relational and learning networks within the classroom, to educate to self and group responsibility and to environmental and social awareness. Teachers will facilitate the creation of a proximal development environment in which pupils will increase their competence to learn to learn and metacognitive skills, thanks to the support of the peer group.

This deliverable collects the training modules that will be used during the training courses to the teachers interested in implementing SPEM model and to innovate their teaching methodology.

The content presented in this course will improve teachers' skills and knowledge on new teaching strategies. This training course is designed to inspire teachers and help them generate ideas to boost students' ecological awareness, interest in science and engage their participation during classes. Spreading pro-social values among children and young people will pave the way for a future society that is respectful towards the environment.

2 Main reference pedagogical framework

2.1 Inclusion at school

For over 30 years, the philosophy and practice of inclusive schools has grown from minimal awareness to a recognized bedrock component of schools around the globe that demands high standards of excellence and equity for all students. Yet there is still confusion and widely varying

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definitions of the "inclusion." The lack of a common understanding of this important practice actually impedes further progress for students, their families, and the educators who teach them[1]. The 4th Sustainable Development Goal (UN 2030 Agenda for Sustainable Development) aims at guaranteeing equal and accessible education by building inclusive learning environments and providing the needed assistance for persons with disabilities[2].

Simply stated, inclusive education means that all students are full and accepted members of their school community, in which their educational setting is the same as their non-disabled peers, whenever appropriate[3].

Inclusive education means all children in the same classrooms, in the same schools. It means real learning opportunities for groups who have traditionally been excluded – not only children with disabilities, but speakers of minority languages, children with educational-psychological-social difficulties, too. Inclusive systems value the unique contributions students of all backgrounds bring to the classroom and allow diverse groups to grow side by side, to the benefit of all[4].

Picture 1. Why is inclusive education important?

Why is inclusive education important?

◆ It improves learning for all children – both those with and without disabilities.
◆ It promotes understanding, reduces prejudice and strengthens social integration.
◆ It ensures that children with disabilities are equipped to work and contribute economically and socially to their communities.

Inclusive education involves transforming the whole education system - legislation and policy, systems for financing, administration, design, delivery and monitoring of education, and the way schools are organized.

STEAM integration in the classroom should not be dependent on student ability levels; an inclusive classroom promotes STEAM access for all learners. Because projects are simply facilitated by teachers, there are very few boundaries for what students of all abilities can do and create[5].

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1 https://inclusiveschools.org/category/resources/inclusion-basics

2 https://sdgs.un.org/goals/goal4

3 https://inclusiveschools.org/category/resources/inclusion-basics/

4 https://www.unicef.org/education/inclusive-education

5 https://resilienteducator.com/classroom-resources/steam-projects-inclusive-teaching/

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2.2 Change of environmental behaviours

The rise of climate change is a global challenge. The individuals have a responsibility to change how they live on a day to day basis to reduce the further onset of dangerous climate change. If all play their part together, then many small changes will multiply into a large contribution[6].

How can increasing the understanding and using what is known about humans and human societies to make sustainability initiatives more effective? No one has all the answers, but the pool of knowledge is deepening[7].

There has been a significant increase in performance of pro-environmental behavior during past years. Waste sorting and purchase of environmentally friendly goods increased the most, meanwhile water and energy saving behavior increased the least[8].

Plastic pollution has become one of the most pressing environmental issues. Once at sea, sunlight, wind, and wave action break down plastic waste into small particles, often less than one-fifth of an inch across. These so-called microplastics are spread throughout the water column and have been found in every corner of the globe, from Mount Everest, the highest peak, to the Mariana Trench, the deepest trough.

Microplastics are breaking down further into smaller and smaller pieces. Plastic microfibers, meanwhile, have been found in municipal drinking water systems and drifting through the air. Once plastics break down into microplastics they are virtually impossible to recover. The solution is to prevent plastic waste from entering rivers and seas in the first place. This could be accomplished with improved waste management systems and recycling, better product design that takes into account the short life of disposable packaging, and reduction in manufacturing of unnecessary single-use plastics.

SPEM project aims to raise awareness about the impacts of plastics on nature and to teach children about alternatives to single-use plastics.

2.3 Inclusive STEAM model for changing environmental behaviours

Teachers have a critical role in shaping the lives of their students. The SPEM pedagogical model describes what effective teachers do in their classrooms to engage students in intellectually challenging work. It provides an overview of the learning cycle and breaks it down into three domains or phases of instruction: **Problematization, Understanding, and Action.**

Students face complex real-world problems, attempt to solve them with information they already possess, allowing them to appreciate what they already know. They also identify what they need to learn to better understand the problem and how to resolve it. The learners engage in self-directed study to research the information needed, then they return to the problem and apply what they learned.

Cooperative Learning involves structuring classes around small groups that work together in such a way that each group member's success is dependent on the group's success. Cooperation is not having students sit side-by-side at the same table to talk with each other as they do their individual assignments. Cooperation is not assigning a report to a group of students where one student does all

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6 *https://www.local.gov.uk/our-support/financial-resilience-and-economic-recovery/behavioural-insights/environment*

7 *https://rethink.earth/changing-behaviour-to-improve-sustainability/*

8 *https://link.springer.com/article/10.1007/s10668-021-01329-9*

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the work and the others put their names on the product as well. Cooperation involves much more than being physically near other students, discussing material, helping, or sharing material with other students. There is a crucial difference between simply putting students into groups to learn and in structuring cooperative interdependence among students. The main methodologies proposed in this framework - inquiry based learning, engineering design and design thinking - are all methodologies that use and promote cooperative learning.

Extensive research has compared cooperative learning with traditional classroom instruction using the same teachers, curriculum, and assessments. On the average:

◆ Students who engage in cooperative learning learn significantly more, remember it longer, and develop better critical-thinking skills than their counterparts in traditional lecture classes.

◆ Students enjoy cooperative learning more than traditional lecture classes, so they are more likely to attend classes and finish the course.

◆ Students are going to go on to jobs that require teamwork. Cooperative learning helps students develop the skills necessary to work on projects too difficult and complex for any one person to do in a reasonable amount of time.

◆ Cooperative learning processes prepare students to assess outcomes linked to accreditation[9].

Finally, the SPEM model, provided in the theoretical framework for integrated STEAM education is a modern methodology that perfectly matches the principles that underpin inclusive education, presenting itself as a suitable alternative for a large variety of social groups at risk of exclusion.

3 Training modules structure

The work of this deliverable reflects one of the main objectives of this project: to improve teachers' professionalization. The scope of this deliverable is to develop the training modules for the teachers in order to improve their knowledge, skills, and attitude in the use of innovative inclusive teaching approach and become facilitator of the small scale university-like researches.

The training modules promote 3 main areas of the training-learning process:

a) Inclusion and attention to the specific target group of the project (gifted, disable and immigrant students)

b) Scientific research towards plastic free environment

c) Promotion of team work in small scale research center simulation

The material develop will be used also during the cascading seminars that will be organized to further disseminate the impact of the project and its pedagogical model at the local/national level.

The training course is divided in 3 modules, each composed by units.

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9 https://serc.carleton.edu/sp/library/cooperative/index.html

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4 Module 1. Inclusion at school

The slides of this module are available at this link: https://schoolplasticfreemovement.org/spem-training-module-1-inclusion-at-school/

4.1 Introduction and general overview of the module

The module is composed by 3 main units:

1) Diverse school and characteristic of inclusive school

This units helps the teachers to reflect on how the commitment to inclusive schools requires interpreting individual differences as opportunities to improve learning rather than as problems to be solved. Thus, inclusive policies and schools should value the achievements and contributions of all students, regardless of their personal or contextual characteristics, tending to reduce inequalities.

2) STEAM for inclusion. Processes that inhibit learning and innovative strategies for the inclusion and harmonious growth of children

This unit explores issues related to inclusion through the use of integrated STEAM and how they can be a powerful mean for inclusion. The focus will be on the types of children at high risk of exclusion (gender, disabled, immigrant, and gifted) and then provide the main theoretical background to promote inclusion through STEAM teaching. The unit goes beyond the school implementation suggesting how this approach can have an impact on the community of reference (e.g., families).

3) Inclusive methodologies: inquiry learning at Natural and Social sciences, engineering design, etc.

The purpose of this unit is to present useful and engaging methods to study STEAM subjects: problem-based learning (PBL), inquiry based learning (IBL), design thinking and SCAMPER. This Unit introduces the definitions of methods and their main implementation steps in the classroom, the role of teachers and students, the potential inclusion of disadvantaged students, as well as strengths and weaknesses of the methods.

4.2 Learning Outcomes

The goals of this training module are to:
- raise awareness of diversity among teachers.
- present particular examples for inclusion in classrooms.
- provide teachers with example of activities to develop tolerance and respectful attitudes in class.
- introduce useful strategies and tools to build a highly inclusive school through integrated STEAM-based teaching organization.
- stimulate teachers with an overview that goes beyond the school to make inclusive action even more extended toward the target community.
- encourage a reflection on the elements that change the lesson planning.
- Identify the roles of teachers and students in the implementation of engaging and inclusive integrated-STEAM-based teaching approach.

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◆   Identify the benefits that the inclusive STEAM teaching offers to students and teachers.

4.3   Outline

This module lasts about five hours and is organized in three different units, which meet the objectives defined above:

1) Diverse school and characteristic of inclusive school

This introductory unit lasts about one hour and 30 minutes

◆   General introduction (45 minutes)

◆   Introductory activities (10 minutes)

◆   Main Part (25 minutes)

2) STEAM for inclusion. Processes that inhibit learning and innovative strategies for the inclusion and harmonious growth of children

This unit lasts about one hour and is organized in 2 different moments:

◆   Theoretical framework of the methodological approach through STEAM (45 minutes)

◆   Reflection on the elements that change lesson planning. (15 minutes)

3) Inclusive methodologies: inquiry learning at Natural and Social sciences, engineering design, etc.

This module will require approximately 1hour 30 minutes to review and to acquire the necessary knowledge, plus the time required for the evaluation.

4.4   Unit1. Diverse school and characteristic of inclusive school

◆   General introduction

"The fundamental principle of the inclusive school is that all children should learn together, wherever possible, regardless of any difficulties or differences they may have. Inclusive schools must recognize and respond to the diverse needs of their students, accommodating both different styles and rates of learning and ensuring quality education to all through appropriate curricula, organizational arrangements, teaching strategies, resource use and partnerships with their communities." (UNESCO, 1994)[10]

At a time when the educational landscape is rapidly changing and diversity is more and more present in today's classrooms and in the immediate environment, schools need to sustain fully the learners despite their diversity. They are called upon to cater for learners of increasingly diverse abilities and of a broad range of family, ethnic and cultural backgrounds. Respect and equal commitment to all learners is more important than ever and inclusive school cultures and education are becoming more widespread.

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10 https://www.european-agency.org/sites/default/files/salamanca-statement-and-framework.pdf

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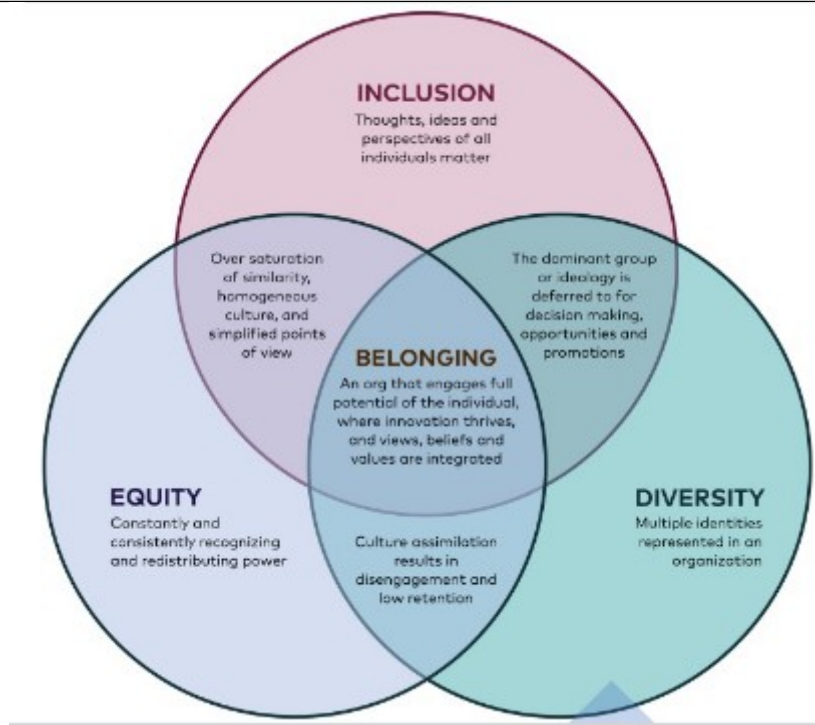
When schools are becoming more inclusive, one of the first matters to be tackled is teachers' training.

Inclusive schools should aim for students to learn to be, live, and participate in society, working with the community and taking on a social projection that goes beyond the strictly educational context.
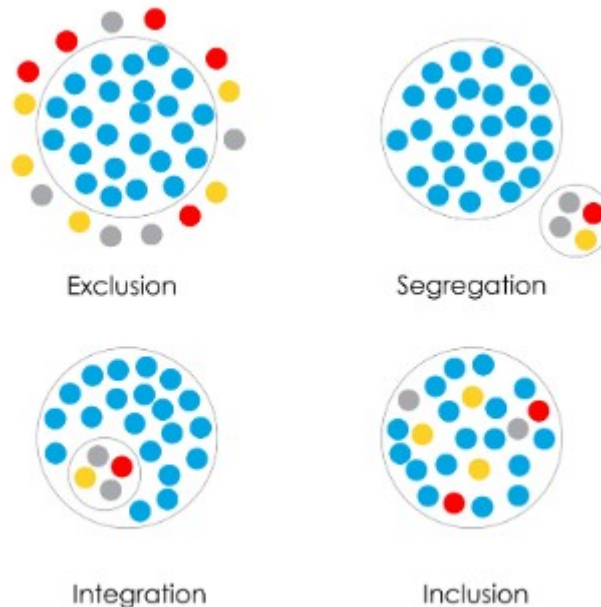
◆ **Inclusion Values**
- respect for diversity (differences are the source and means of education)

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- supporting learning and development (belief in the possibility of progress and education of all children)
- teaching flexibility (diverse teaching strategies and methods and assessments that are aligned with different learning styles and experiences)
- cooperation (team work)
- continuous personal and professional development (lifelong learning).

◆ Introductory activities (10 minutes)

Teachers are given the following activities:

Icebreaker: list three things that make you special and unique among us.

Team work: List all the characteristics that make you different in your workplace.

Group work:

> What minorities do you have in your classroom among your students?
>
> How do you respect diversity?
>
> How do you use differences as the source and means of education?

◆ Main part (25 min.)

Facilitator reads the introduction for the main activity: Educators need to ensure teaching materials and resources avoid unconscious biases through stereotyping, are appropriate and sensitive to context, and are representative of the learners in their classrooms.

They can mirror children's reality where they see themselves represented; they can provide windows through which children can see other people's lives in different places with different experiences; and doors which can take them into and out of different situations. They enable children to recognize who they are and play an important part in developing children's identities by enhancing their sense of self. All children have the right to see themselves in books and have the 'right to occupy this literary space'

All the children have the right to see themselves reflected in the stories available to them. Diversity is more than just seeing yourself reflected in the world of literature, it's about others being able to see you too. Every child should have a voice. No child should be invisible.

The teachers are divided in two groups and are given two stories. They should discuss the content of the story inside their group (10 minutes) and after that to present their impressions and conclusions with the participants of the other group (10 minutes).

They should discuss among the members of their groups about:

- What type of diversity is presented in the story?
- Find the message of the story, and how can we use it to raise the awareness in our schools?
- What can teachers do to overcome the stereotypes connected to diversity?
- Can you reshape the disability of the characters in the story into something unique and amazing?

Story No. 1 – "Perfectly Norman" (https://www.youtube.com/watch?v=PuquD9-2l-w)

Perfectly Norman, which can also be used to encourage social model thinking, is the story about a boy, Norman, who had always been perfectly 'normal' until the day he grew a pair of wings. At first, although surprised, Norman is happy and tries out his wings and experiences immense joy.

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But he then begins to worry about what other people will think of this visual marker of difference and decides to cover up his wings with a big coat. This makes every-day routines difficult and uncomfortable and prevents him from taking part in activities with his friends. As the story unfolds, we follow Norman through a cycle of emotions until he comes to a moment of understanding and self-realization, 'It occurred to Norman that it was the coat that was making him miserable, not the wings'. It was Norman's own attitudes towards his difference, his fear of other people's attitudes towards his difference and the big coat which had become barriers preventing him from full and equal participation. Norman finally accepts his difference and takes off his coat, revealing his wings and flies into the air, where he is joined by other children who have wings. He is happy again!

So Norman's story is not just about accepting our differences; it's about celebrating and enjoying them too! Using the magical wings as a metaphor for Norman's difference seemed perfect because they could represent anything – and I wanted the book to be as relatable as possible to all children. Perfectly Norman is a celebration of difference, inclusivity and individuality. It can be used as a springboard for discussion about differences and similarities and about the barriers in society that people with differences face. Children can be asked what the wings may represent for each child and whether they identify with any of these children.

Story No. 2 – "Amazing" (https://www.youtube.com/watch?v=ueAoTqkuIMQ)

Amazing is an example of a story about the friendship between a boy and his pet dragon Zibbo. The front cover shows a diverse group of friends all on wheels – a scooter, a bicycle and a wheelchair. The boy using the wheelchair, the main character, is at the front leading the group of friends. The girls are wearing camouflage designs, or violet and yellow flowers and the boys have donned pink or Viking helmets. Another child is wearing a hearing aid. The boy's wheelchair has stylish wheel covers to celebrate his individuality and to personalize his source of independence. This transforms a functional, medical device into an object of self-expression and challenges negative associations with wheelchairs. Amazing is narrated by the main character in the first person, who tells the story about all the things he and Zibbo do together and how Zibbo is a little different.

The author of the book did not want the child's disability to define his "Amazing" story in the same way that his students did not want to be defined by their disability. In his mind his students are defined by their hobbies, interests and aspirations. Yes, they required different levels of assistance, but they really didn't want to be treated any differently to anyone else. He wanted to present the inclusion of his main character's wheelchair to be entirely incidental. This is very important.

◆ Conclusion

A powerful speech by Stella Young - https://www.youtube.com/watch?v=SxrS7-I_sMQ

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4.5 Unit 2. STEAM for inclusion. Processes that inhibit learning and innovative strategies for the inclusion and harmonious growth of children

◆ **Plenary presentation** of information slides in which teachers can learn:

- the main conditions of social exclusion, with particular reference to the school context;
- Characteristic of inclusive schools: setting guidelines for action
- the theoretical basis and references on using STEAM in the classroom.

They can also learn the advantages that the approach offers from a perspective of student activation and cooperation.

◆ **Social Exclusion**

What is it?

Coexistence has been somewhat ingrained in human nature. There have always been some people with better adaptability skills. Society has simultaneously advocated actions that have some people finding it difficult to identify where they have the right to count, in some way making them the mainstream's victims. Vulnerable educational groups receive special attention in European Union and are committed to addressing issues like discrimination, and inequality, enabling the development of active citizenship for all.

Immigrants

Due to the effects of climate change, wars and conditions in which basic human rights are not guaranteed we may assume that a new era of mass migration is already active, which will further increase the variety already present in European nations. To foster strong interethnic interactions and long-term social peace among its residents, today's societies must undergo acculturative processes for both immigrants and non-immigrants from the host society. As the report on Gender Equality and Women's Empowerment in the Digital Age (A8-0048/2016) points out, stereotypes that start as early as the school years (and also include hobbies and toys) limit girls' participation in studying and pursuing professions in the sciences.

Social excluded Children

The risk of social exclusion in childhood is present in several countries of the European Union. Social exclusion may be caused by a variety of socio-cultural circumstances. These kids begin their lives at disadvantage because of the danger of exclusion. They have less access to fundamental services like health and education than their peers, and other barriers, such as language barriers for immigrants, may be introduced.The reasons why a child is a victim of social exclusion can be:

- to be born or grew up in families with low levels of both education and economic support.

- to have few social support networks

- to be part of a culture that is either in a minority or socially excluded from itself

- Have had family or personal breakdown, or both.

Children with high potential

The gifted, or Children with High Potential, are one of the groups that are rarely taken into account when discussing school dropout rates. The substantial learning level gap between them and the group, and the unprepared didactics to acknowledge this diversity as an enrichment, causes exclusion and increasing demotivation in school attendance. The gifted child, compared to peers, shows, or has the resources to show, amazing ability at a given time and in specific areas, considered to be prominent in his or her home culture. These children score very high on IQ tests. The higher the score, the greater the discrepancy between the subject's chronological age and

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mental   age.

This aspect has repercussions on both the emotional-relational and educational levels. The paradoxical aspect is that these students often do not perform well in school.

Children with disabilities

Children with disabilities have very high needs from the point of view of structuring inclusive teaching. It is most important that they be included within the class group without taking advantage of spaces dedicated to them. Social interaction greatly aids in a child's development and facilitates his or her learning process, both in the social-emotional-relational and cognitive spheres.

◆ Inclusive schools

Inclusion means welcoming without judgment the characteristics of people who are part of a community. In an inclusive context, diversity is seen as an asset, an added value. Each member of the community, thanks to his or her characteristics can initiate processes that enhance the sensitivity and empathy of others. The context must, therefore, have elements that point in this direction. Teachers, for example, must be followed and supported by constant training that ensures this kind of vision and attitude.

A new perspective

It is very important for educational institutions to develop a system for monitoring the well-being of each individual pupil in school. This step is worth much more than any formal document drawn up for children with special educational needs. All children are special, and an evaluation system that takes into account how they feel at school, how accompanied and supported families feel, and how effective certain teaching strategies have been proved to be encourages the implementation of the inclusive aspect. Every child manifests needs or demands for attention that may be related to the behavioral or cognitive sphere. Each also holds the potential to be developed. The educational setting must keep both aspects in mind in order to include each child and ensure the most nurturing and positive learning process possible.

Tools, policies and strategies

Teacher training is important because through it they can learn about the mental processes, strongly linked to emotions, that regulate learning; they can inform themselves about the new frontiers of pedagogy and gain knowledge about the organization of the learning space, including a whole range of tools that activate cooperative learning.

Tools for teaching include educational robotics. In recent years, children have been able to benefit from this new element that stimulates computational thinking, creativity, cooperation, and inclusion. Robotics fosters autonomy and puts the teacher in a position of an observer, not directly responsible for the process of growth and learning. Let's say, robotics is a Montessorian tool of the new millennium, helping the child to do it on his own without the fear of being judged.

There are challenges in the school system such as absenteeism and early school dropout, which occur more frequently among children at risk of exclusion. STEAM can be an excellent way to involve children and stimulate them in a new way. Math, art, robotics and technology have a universal language that can include everyone. This methodology combine these disciplines as opportunities to participate through free expression, shared planning and experimentation. Using math, science, and technology through cooperation and game play helps all children experiment, find solutions, and express themselves to arrive at a shared end product in which stereotypes related to the male/female distinction disappear.

Developing leadership for inclusion and diversity

The reality of education is not always well suited to an inclusive focus due to the numerous factors,

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dependent on very many variables, that can be summarized by the importance of two pillars of inclusion: knowledge and experience. The leadership team must be able to develop a shared vision for a school that is inclusive of all cultures if the inclusion proposal is to succeed. This group must actively participate in identifying the problem and the goals to work toward. Policies and strategies will guide this group's actions. The leadership team must include teachers, students, governors, and parents.

High expectation and achievement for all

It is necessary to develop and maintain a clear plan for inclusion over the course of the project. Data are applied to produce goals for schools, departments, and specific students. This will help to discover areas for interventions by creating a realistic picture of student progress despite various realities.

Respond positively to diversity

The role of the school is to plant the seeds for a brighter future. While diversity enhances the learning environment for all students, school is a welcome place for students and families from many backgrounds and is sensitive to the needs of recently arrived pupils.

◆ Encouraging innovation and change

The school will almost always introduce innovative change. All essential resources must be made accessible, and those adjustments must be thoroughly studied. Change must be viewed as a tool to test new laws, which may be changed once more if outcomes are unfavorable.

Learners' voice

The ideas and ambitions of students at school must be known, understood, and taken seriously by schools that have made the decision to follow the path of inclusion. Since students positively influence the school's culture, decision-making at the school benefits from their input.

Ethos of respect

Bullying-free, safe learning environments are essential in inclusive schools. According to national policies, bullying incidences must be monitored and dealt with quickly and effectively. Understanding other people's cultural realities must be the primary means of fostering respect for diversity. This knowledge is gained throughout the entire educational setting, not only in class instruction.

Culturally inclusive curriculum

Schools must encourage students to acquire knowledge by providing appropriate curriculum, but much more crucially, by experiencing the benefits of this understanding. For students to grasp the modern world, the curriculum must reflect the contributions made by various cultures and realities over the course of history.

Engaging parents, carers, and families

Parents and caregivers must be included in the educational process so that the schools may offer them support for encouraging their children's learning as well as ongoing communication. It could be accomplished by providing parents with educational opportunities, such as diversity and inclusion training. It is critically important to create a sense of community through formal and nonformal moments. The latter help people to act more spontaneously and relaxed.

Staff learning for inclusion and diversity

Headteacher leadership programs have to address issues of diversity and inclusiveness. This training must be ongoing and offer educators a variety of learning opportunities, including participation in complicated processes to enhance professional practice, as we live in a changing environment.

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◆ The STEAM approach for inclusive schools

In recent decades, many researchers have affirmed that a solid scientific culture is essential for life in modern society. Moreover, the Western world is witnessing a worrying decrease in the number of young people, especially girls, choosing studies in the scientific and technological fields.

Therefore, a new approach, known as STEM (Science, Technology, Engineering and Mathematics), is considered, which supports the introduction of these disciplines in an integrated way from an early age

In recent years the traditional acronym STEM has been joined by the A for Arts, moving from STEM to STEAM. Above all, adding arts to the disciplines of the science core means taking an interdisciplinary approach. In the STEAM approach, students are encouraged to take an experimental attitude, resorting to imagination and creativity to make new connections between ideas.

The theoretical approach

The theoretical framework for STEAM education is based on the epistemological position of the American philosopher of science Larry Laudan.

Integrated STEAM is a model that suggests an epistemological study of scientific evolution and is made up of three degrees of commitment to the same standing in science, each of which interacts complexly and is not necessarily modified simultaneously: dedication to theories, methodologies, and goals.
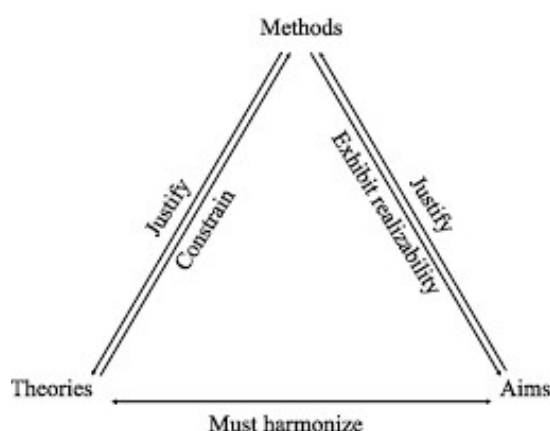
The goals of integrated STEAM education according to the framework we follow are the integral competency development of all students assuming a much wider perspective in which various dimensions converge. These goals can be achieved by using a proper methodology. The use of active approaches is suggested in keeping with the idea that science is a constant problem-solving activity

Wide scope of action for inclusion (students, teachers, and families)

Schools need to be supported by a favorable legal, policy, and financial environment; they also will be impacted by how the various actors interact. The majority of the characteristics for a better society are disseminated through educational institutions. For such a source to exist, a number of requirements must be fulfilled by the educational system, educators, and families.

Legal framework and policy

A sufficient legal framework must be instituted through national policy, but targeted funding will

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show that inclusion is a clear priority. A long-term plan with intermediate goals is also necessary in addition to this first phase.

Teacher training

One of the first issues to be addressed when schools are made more inclusive is teacher preparation. It is extremely challenging to provide specialized instruction for every kid at risk of exclusion due to the wide variety of circumstances they face. Staff must learn and internalize general principles that apply to all exclusionary circumstances. People from comparable cultural backgrounds are still frequently found in academic teams today, therefore schools must give their teachers the required cultural training.

Regional support

The regional level can help schools with monitoring, advising, and assessment tasks like those that make it easier to identify students who are at danger of being excluded, encourage innovation and the spread of best practices, and build strong ties between schools and the community.

Parental engagement

Parent involvement is essential. The inclusive school must give parents chances to help their children's learning about inclusion. This tool tries to give parents the resources they need to care for their kids, but it also aims to change the dynamics of the family. Some parents need to be guided by the school's professional figures to become active participants in the inclusive learning process

4.6 Unite3. Inclusive methodologies: inquiry learning at Natural and Social sciences, engineering design, etc.

◆ Problem Based Learning

Definition of the method

Problem-Based Learning (PBL) is a student-centered approach to learning, in which complicated real-world problems are used to challenge students. The problems are used as a tool to achieve both the required knowledge base and the skills to 'solve' them (Barrows, 1986). The basis of PBL is that students learn by *doing* (Duch et al, 2001).

[11]

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11 https://educationaltechnology.net/wp-content/uploads/2020/01/Problem-Based-Learning-1.png

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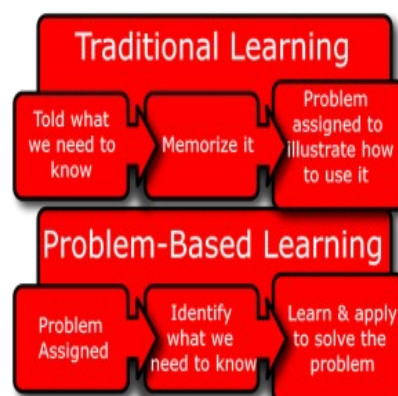
PBL is based on the messy, complex problems encountered in the real world which encourage to learn, integrate, and organize the information obtained so that it could be used to solve future problems. PBL encourages students to solve problems effectively and think critically. It can also provide opportunities for working in groups, finding and evaluating research materials, and life-long learning (Duch, Groh and Allen, 2001).

Implementation in the classroom (steps of the method)[12]

What are the steps in problem-based learning?

Step 1: Explore the issue. Gather necessary information; learn new concepts, principles and skills about the proposed topic.

Step 2: State what is known. Working individually and in groups, students list what they already know about the scenario as well as the areas in which they are lacking information.

Step 3: Define the issues. Frame the problem in a context of what is already known and information the students expect to learn.

Step 4: Research the knowledge. Find resources and information that will help create a compelling argument.

Step 5: Investigate solutions. List possible actions and solutions to the problem, formulate and test potential hypotheses

Step 6: Present and support the chosen solution. Clearly state and support your conclusion with relevant information and evidence.

Step 7: Review your performance. Often forgotten, this is a crucial step in improving your problem-solving skills. Students must evaluate their performance and plan improvements for the next problem.

Main Components of the method - The PBL learning process

In the PBL learning process, students face a problem and use their previous knowledge try to solve it. In the process they find out what they do not know and what they need to learn to do their best.

Once they have found out what they need to learn, students search for information necessary to solve the problem in different sources (internet, books, magazines or people's experience). Be doing so, they personalize their learning.

The students then get back to the problem and apply their knowledge to work with their problem further on and solve it.

Once the problem has been solved, the students assess themselves and their peers. In this way, they learn to evaluate each other constructively. This assessment skill will be very valuable for their future learning experiences.

Suitability for STEAM

PBL can be used to study all subjects, just a little bit of creativity is necessary. While the main problems can differ for various subjects, there are some features of good PBL problems that are useful.

- The problem must be motivating. Students must be motivated to do deep research into the problem.

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12 https://teach.its.uiowa.edu/sites/teach.its.uiowa.edu/files/docs/docs/Steps_of_PBL_ed.pdf

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- The problem should ask students to justify their decision and be ready to prove it.
- The problem should be connected to the students' previous knowledge.

One of the most attractive features of PBL is that it helps develop in students both, subject-specific skills (using diagrams and abstract models, acquiring and using relevant data, analysis of real-world issues, etc.) and transferable skills (time management, teamwork, independent learning, decision making, problem solving, communicating ideas and results, etc.). (https://www.economicsnetwork.ac.uk/handbook/pbl/21).

Strategies to include disadvantaged students

- Take time to explain instructional processes, answer the questions, consider their suggestions, and probe their hypotheses.
- Embed lessons with connections to the real world, and show relationships between the content/skills and the lives of real people.
- Monitor the disadvantaged students as they work, prod their learning, and support their hesitation[13].

Teacher's role

The main role of the teacher in PBL is that of an assistant or educational coach leading the students in the PBL process. As learners become more proficient in the PBL learning process, the teacher becomes less active[14]

Students' role

In PBL, learners are progressively given more and more responsibility and become increasingly independent of the teacher for their education. PBL produces independent learners who can continue to learn on their own in life and in their chosen careers[15].

Advantages of Problem-Based Learning

For students

- it is a student-oriented approach;
- students find it more engaging and rewarding;
- it facilitates comprehension;
- students who have PBL experience evaluate themselves higher;
- PBL prepares for lifelong education.

For teachers

- students are more engaged during lessons;
- it increases the time students spend studying;
- it fosters crossdisciplinarity.

◆ **Inquiry Based Learning**

Definition

Inquiry-based learning is a learner-centered approach that channels learning through questioning and discovery. Students pursue their interests in search for answers to their own questions. They can collaborate to formulate their examination and then organize their quest for relevant

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13 https://www.naesp.org/sites/default/files/resources/2/Middle_Matters/2007/MM2007v15n4a2.pdf

14 https://www.siumed.edu/academy/what-problem-based-learning-pbl.html

15 https://web.cortland.edu/frieda/id/IDtheories/46.html

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information.

The basic components of an inquiry are:

1. Making observations;

2. Posing questions;

3. Examining books and other sources of information to see what is already known;

4. Planning investigations;

5. Reviewing what is already known in light of experimental evidence;

6. Using tools to gather, analyze and interpret data;

7. Proposing answers, explanations, and predictions;

8. Communicating the results and

9. Personal evaluation and response" (Kidman & Casinader, 2017, p. 6)

Inquiry-based learning and the teacher

Teachers' inquiry about the topic of interest is of paramount importance for the success of children's inquiry.

- First teachers need to become "inquiry literate" and then, encourage students to "engage" in inquiry at a deep, personal level (Kidman & Casinader, 2017, p. 32). A teacher must know and must understand what the inquiry process is like.

- Teachers will have to teach students skills and gradually move them through stages that eventually increase students' independence and intellectual capacity.

- Teachers can take up "six key behaviors" or roles with the process of transition: that of "direct instruction provider", "organizer", "questioner", "discussion facilitator", "mentor" and "facilitator of interpretation" (Kidman & Casinader, 2017, p. 36).

- Teachers' role is also to support students,

- Care for the development of the whole student and

- Lead towards situated and authentic learning

The benefits of inquiry-based learning for social and emotional development

The inquiry-based learning approach promotes and strengthens children's social and emotional development in several ways:

- It promotes students' self-esteem, self-regulation, and self-efficacy.

- It promotes meaningful engagement to learning, which means that children are emotionally involved in the learning activities.

- It enables children to develop a healthy reliance on each other, to experience vivid social interactions, good relationships and positive feelings towards peer.

- It fosters and develops communication skills.

◆ Design Thinking

Definition of the Method

Design thinking is an approach to problem solving that uses tools, methods, and processes of professional designers (Elsbach & Stigliani, 2018). Originated in the 1960s, design thinking refers to both what designers are thinking and doing while they work. From this perspective design thinking is about two different but related processes and concepts, a unique way of looking at the world and specific activities and methods that designers engage while they work (Clarke, 2020).

Main Components of the Method

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The major focus of design thinking is problem solving. All problems that need creative solutions can be addressed by design thinking. Design thinking methods are organized into three broad categories of need finding, idea generation and idea testing (Elsbach & Stigliani, 2018). More specifically the phases are to empathize, define, ideate, prototype and test (Stanford d. school). To describe the problem context from different stakeholders' perspective, designers use human-centered and empathetic methods. With their empathetic understanding, they reframe the problem and start to generate solutions. With prototypes designers find opportunities to take stakeholders' opinions on the solutions and test the effectiveness. After the test phase, the cycle may end, or relevant revisions can be made to improve the product.

Implementation in the classroom

To implement design thinking in the classroom, teachers provide guidance in each of the design phases. First, in the empathy phase students will engage in "try, observe, and ask" activities to understand the problem thoroughly from different perspectives. For "define and ideate" phases, open-ended questions and brainstorming techniques will encourage students to reflect their empathetic understanding into their solution strategies by further research. Within the "prototype" phase students are allowed to develop many rapid prototypes to take opinions from different audiences, so that they can improve their product and solutions according to their needs. For the "test" phase students both test their design products with respect to the problem and reflect on the overall design cycle. Students also prepare presentations to share their process and products.

Students' Role

Students' role in design thinking is to participate in design thinking activities to create innovative solutions for complex problems. Students have individual accountability in all group activities. Developing a participatory approach to find and understand the complex problems of the 21st century, developing an open, explorative attitude, willingness to take part in the solution process and developing an ethical mindset are also among the roles of students within design thinking practices (Beligatamulla et al., 2019).

Teacher's role

The roles of the teachers in design thinking are to plan the process carefully to encourage all students' participation in the activities. By asking questions, providing resources and materials, and creating opportunities for students to experience design thinking skills teachers create an effective learning environment. Teachers' monitoring and facilitator roles are prominent.

Strategies for inclusion of disadvantaged students

Following the equity principle of design thinking education, all students must be given opportunities to participate in activities regardless of their gender, academic achievement, socio-economic status, etc. Having high expectations from all students, teachers can use differentiated learning strategies to encourage participation of all students in the learning process. Research shows that design thinking helps students reduce cognitive bias in different categories such as projection bias, which is very valuable in terms of inclusion (Liedtka, 2015).

Advantages and disadvantages of the method

Having strong goals and outcomes, design thinking practices also have some limitations. Lack of creative confidence or mastery, wrong priorities, shallow ideas, anxiety and frustration, creative overconfidence, and teamwork conflicts are among the major limitations that students and teachers can face during the implementation (Panke,2019).

◆ **SCAMPER**

Definition of the method

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The Philosophy of SCAMPER is based on the concept that ''Any idea has emerged from another idea'' (Michalko, 1998). SCAMPER is a practical and joyful brainstorming technique in the discussion method, leading to an actual implementation in real life and supporting creative thinking (Glenn, 1997). The SCAMPER brainstorming technique uses steps to review an object.

Main components of the SCAMPER Method

SCAMPER is the most convenient technique to use when students reach a dead end, or when they are about to steer away from the core of the subject (Swain,2001). The questions used help to think fluently and flexibly, so as to lead to a creative thinking system (Özyaprak, 2016).

While implementing SCAMPER, a unique object is chosen and transformed, improved, disintegrated or compounded with other objects through a brainstorming process. Questions asked allow a variety of opinions to emerge, enabling learners to develop their creativity as they start thinking in new ways about an object.

Implementation in the Classroom

According to the English dictionary, 'to scamper' means ''to run with quick light steps, especially through fear or excitement'' (Oxford, 2011, as cited in İslim, 2011). The acronym stands for an educational technique covering seven steps, as developed by Eberle in 1977. Lets' look at the letters which make up the acronym:

S: Substituting parts of the product or process for something else.

Sample questions: What/Who else instead? What other materials, strategies, should I substitute?

C: Combining two or more parts of the product or process to create something new or to leverage synergies.

Sample questions: What elements could I mix together? What parts may I join together? Which processes could I combine?

A: Adapt - Think about which parts of the product or process could be adapted or how you might change the nature of the product or process.

Sample questions: Is there something similar? Which part could be changed to obtain a different result? What can be added or removed to optimize the solution for the given context?

M: Modify, Minify, Magnify - Think about changing parts or all of the product or process, or distorting it in an unusual way.

Sample questions: Which parts could I make bigger? Which parts could I make smaller? Which elements could I add or remove to modify the end product?

P: Put to another use - How would you put this object to another use, how could you reuse something from somewhere else?

Sample questions: What other ways are there to use this? Can the same solution be used in another place? Who else could benefit from this?

E: Eliminate - Think of what might happen if you eliminated parts of the product or process and consider what you might do in that situation.

Sample questions: What could I remove? If I do remove it, what could I miss, what could go faster, or slower? How can I reduce the amount of material used, or the amount of time dedicated?

How can I make it lighter, or smaller?

R: Reverse - Think of what you might do if parts of the product or process worked in reverse or were sequenced differently (Serrat, 2017).

Sample questions: Which parts can I rearrange? Which layout fits best? Which functions can be swapped?

Teacher's Role in SCAMPER

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The teacher determines the specific problem students need to solve. The students then brainstorm a wide range of solutions using the different techniques defined by the acronym. Recording every idea expressed during the brainstorming without judging it increases the production of creative ideas. The students apply the technique, following each step indicated by the letters of the acronym. The teacher acts as an assistant by addressing any question, contradiction or conflict that may arise.

Strategies to include disadvantaged students

Ensure that everyone receives a similar share of air-time, and everyone is actively engaged; ask probing questions if needed. Criticise no idea, as wild as it might appear to be; in fact, try to encourage outlandish ideas, as they are very useful to open up the conversation. Encourage students to build upon each other's idea. Provide specific, repeated, evidence-based, personal and collective encouragement. Be flexible in giving students opportunities to build and check understanding.

Strengths and weaknesses of the SCAMPER method

Whereas the SCAMPER technique has been used for visual design to compose creative, productive ideas, some shortcomings can be observed like the lack of inclusion of the educational context. (Ang, Long, Yuen and Wong, 2018).

Although the new technique is challenging, lessons promote student engagement, creative thinking and the ability to recall content knowledge. SCAMPER can be utilized for learners who lack motivation or who have learning difficulties. SCAMPER is used as a learning tool that fosters awareness, drive, fluency, flexibility, and originality

4.7   References

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SPEM Deliverable 5.1 (2022) Inclusive pedagogical model for gifted, migrant and disable students

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5 Module 2. Change of mindset about environmental problems

The slides of this module are available at this link: https://schoolplasticfreemovement.org/spem-training-module-2-change-of-mindset-about-environmental-problems/

5.1 Introduction and general overview of the module

As many philosophers and scientists have noted, we are living a new era in which the human being has become a transformative force with a global and geological scope. This new era is called the Anthropocene, a term coined in 2000 by the Dutch chemist Paul J. Crutzen (1933), winner of the 1995 Nobel Prize in his field for his contributions to the chemistry of ozone in the Earth's atmosphere. In the Anthropocene, humanity's combined impact on the Earth equals or exceeds the power of natural forces (geological and biological). An impact that is accelerating global warming and biodiversity loss, both central global issues. One important element in this complex panorama is our misuse of diverse materials, as plastics, which surrounds almost any aspect of our daily life. Although there is no single solution, nor any common consensus for solving these incredibly complex problems, it might appear relevant to rethink the society/nature nexus from a relational perspective. As well as to better understand the problematics associated to plastics. So, in this module, teachers are going to discuss some new venues for understanding the relation nature-society, as the ethics of care and ecofeminism. After we are going to introduce scientific notions about the environmental problem of plastics and some targeted solutions for plastic pollution. Finally, we are going to discuss how these new ways of thinking could be introduced in inclusive school settings.

5.2 Learning Outcomes

The objectives of the module include:
◆ Understand some new ways for rethinking the nexus nature/society
◆ Develop some scientific knowledge about plastics and plastics pollution
◆ Be able to produce useful activities for promoting an ethical environmental behaviour within inclusive school settings.

5.3 Outline

This module is composed of 4 units, taking approximately 2-3 hours to complete each one and three hours to develop the final activity of Unit 4.

5.4 Unit 1: Rethinking the relation nature/ society. Ethics of care and Ecofeminism

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This unit support the introduction of the discussion for understanding the relation nature-society

◆ **Ethics of care:**

Teachers will read the document:
Ethics of Care ethics, from Encyclopedia.com https://www.encyclopedia.com/science/encyclope-dias-almanacs-transcripts-and-maps/ethics-care
Alternative Paradigms: Care Ethics and Feminine Ethics
https://www.youtube.com/watch?v=4iaCpAFypq8

Assignment

In groups, teachers will choose an environmental problem and discuss how this theory would apply, particularly trying to think how this form of thinking is different from the usual one.

◆ **Ecofeminism**:

Teachers will read the document:
-    What is Ecofeminism?, from the European Institute of the Mediterranean.
https://www.iemed.org/publication/what-is-ecofeminism/

And see the video:
-    Ecofeminism: A Global Crisis
https://impakter.com/what-is-ecofeminism-3-key-takeaways-from-vandana-shivas-activism/

Assignment

In groups, teachers will choose an environmental problem and discuss how this theory would apply, particularly trying to think how this form of thinking is different from the usual one.

5.5   Unit 2: The environmental problem of plastics

◆ **Introduction to the discussion:**
From the many global issues that human beings have caused during the Anthropocene era, plastic pollution has become one of the most pressing environmental issues, as rapidly increasing production of disposable plastic products overwhelms the world's ability to process them as waste.

◆ **Group activity:**
Teachers will develop in groups a search in Internet and produce a presentation about plastics. Each group will address one of the following topics.
• History of plastics
• Diverse types of plastics and their use
• Facts about plastic pollution
• Targeted solutions for plastic pollution

◆ **Assignment**:
After sharing the presentations, the whole group will discuss, using the theories addressed in the previous units, some "tentative" ways to address the environmental problem of plastics.

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5.6   Unit 3: The Social Practice Model

◆   **Introduction**

In this unit we are going present the social practice model. From the several theories and models of behavior and behavioral change, we adopted Social Practice Theory (SPT).
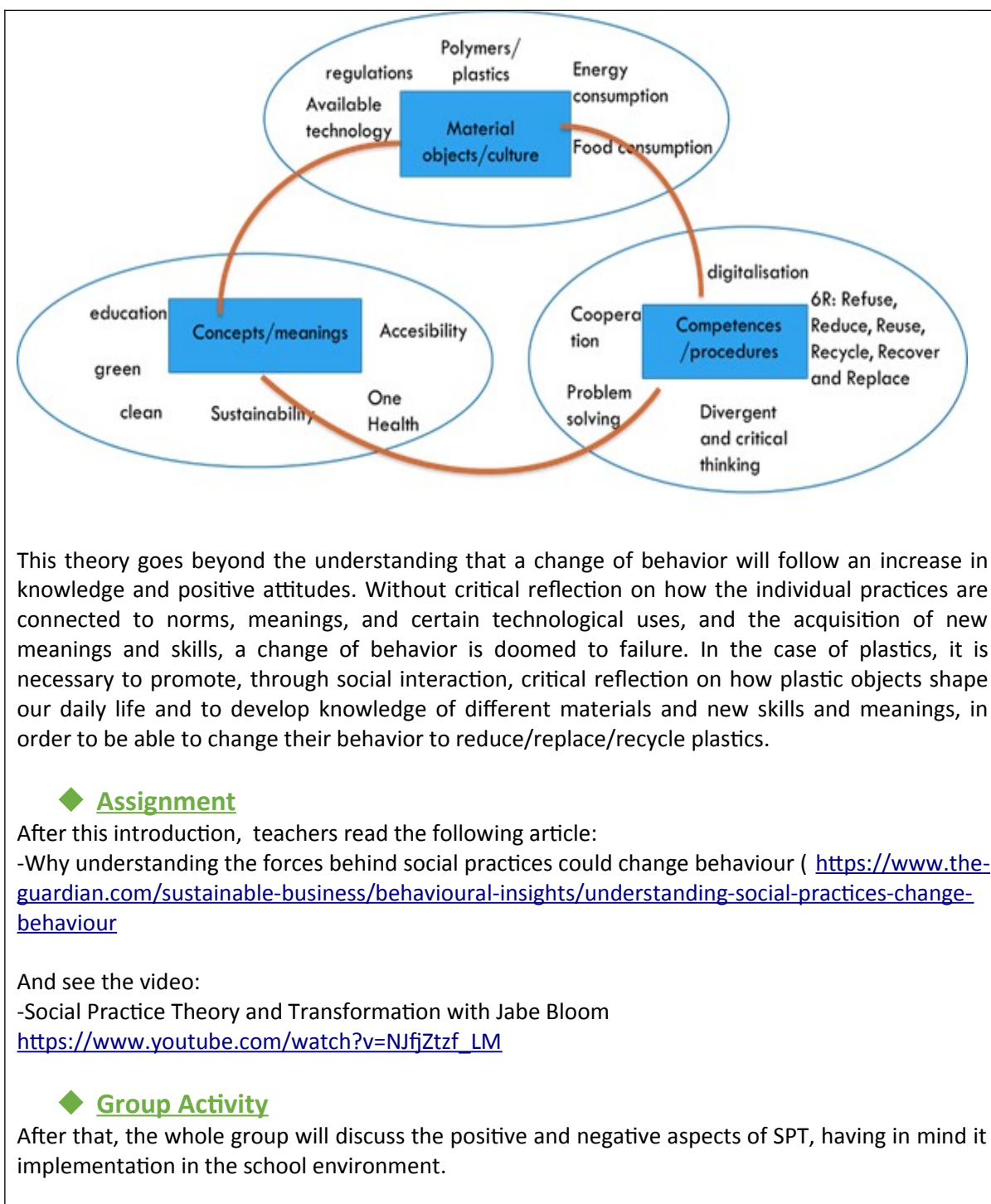
SPT uses elements from science, technology, and society studies (STS studies); in particular that non-human 'actors' have a role in causing certain behaviors. The central insight of SPT is the recognition that human 'practices' (ways of doing, 'routinized behavior', habits) are themselves arrangements of various inter-connected 'elements', such as physical and mental activities, norms, meanings, technology use, and knowledge, which shape people's actions or 'behavior' as part of their everyday lives (Reckwitz, 2002). So, from the perspective of SPT, we need to focus not on individual behavior for understanding and changing environmental conduct, but also on social practice - and on the interaction of people's practices and their material contexts (Morris et al., 2012).

This situation leads to our reflecting upon why certain practices are done ('produced' and 're-produced'), how and why others are prevented, and considering the role of technology in how they are done and how they evolve. So, if we are to understand behavior, we must consider the relations between (Morris et al., 2012):

- **material objects** (that make it easier to perform certain activities in specific ways);
- **meanings** (concepts associated with activities that determine how and when they might be performed); and
- **procedures** (competencies that lead to activities that are performed in certain ways).

The figure shows some of the possible objects, concepts, and competences that should be considered, in order to change our behavior related to plastic use and abuse, from the perspective of SPT. For example, we need to understand how plastics and polymers in general shape our life, particularly as regards food and energy consumption; which are the drawbacks to their mass use; the existing regulations on their usage as well the available technology to reduce their use and replace them for a healthier life and a sustainable planet for all.

We also need to understand – or to understand anew – such concepts as accessibility, sustainability, one health, etc. Finally, interrelated with objects and concepts, is our need to develop new skills and procedures to reshape our lives with fewer plastics: cooperation, problem solving, and digitalization are some of these new competences we have to develop, in order to succeed in our efforts to reduce the use of plastic.

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This theory goes beyond the understanding that a change of behavior will follow an increase in knowledge and positive attitudes. Without critical reflection on how the individual practices are connected to norms, meanings, and certain technological uses, and the acquisition of new meanings and skills, a change of behavior is doomed to failure. In the case of plastics, it is necessary to promote, through social interaction, critical reflection on how plastic objects shape our daily life and to develop knowledge of different materials and new skills and meanings, in order to be able to change their behavior to reduce/replace/recycle plastics.

◆ **Assignment**

After this introduction, teachers read the following article:
-Why understanding the forces behind social practices could change behaviour (https://www.the-guardian.com/sustainable-business/behavioural-insights/understanding-social-practices-change-behaviour

And see the video:
-Social Practice Theory and Transformation with Jabe Bloom
https://www.youtube.com/watch?v=NJfjZtzf_LM

◆ **Group Activity**

After that, the whole group will discuss the positive and negative aspects of SPT, having in mind it implementation in the school environment.

5.7 Unit 4: Introducing an ethical environmental behaviour in inclusive school settings

The recent past has been marked by increasing effort to foster sustained ecologically responsible

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behaviours, although the programmes that were developed hardly appear very effective (McGuire, 2015). McGuire argued that what is wrong is to base all the programmes on transmitting the notions of knowledge and attitudes as the main targets of environmental education. From his point of view, the environmental education programmes should address two facets of human decision-making: conscious awareness and the automatic processes which provide an immediate reaction (positive, negative, bias) when confronted with a situation or a stimulus. So, environmental education should target not only our knowledge and attitudes, but also our overall identity and subconscious, to convince human beings that sustainability is a part of their identity.

From this point of view, it is relevant that children acquire new ways to think about environmental problems; it is not just that they receive information about, for example, the sea of plastics, but that they are able to position themselves and see the problems from other perspective/logic that logic of the consumer society that surrounds them.

◆ **Assignment**:

In this unit, teachers will read McGuire's article (https://files.eric.ed.gov/fulltext/EJ1081842.pdf) and following his ideas, in small groups will develop a set of short activities (3-4) for introducing the points of view of the ethics of care for very close behaviours related with children's plastic consumption (for example, toys, clothes, games, cell phones, etc).

1- Revise the principles of the ethics of care
2- Select a children's plastic consumption
3- Rethink the selected consumption from the ethics of care. For example, think how a specific living being (plants, animals, humans) is hurt with the microplastics produced by the disintegration of plastics toys
4- Develop 3-4 activities that could help children understand the principle that no one should be hurt in the specific case selected.
5- Use at least one the methodologies introduced in the previous module.

5.8 References

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6 Module 3. Inclusive STEAM model for change of environmental behaviour

The slides of this module are available at this link: https://schoolplasticfreemovement.org/spem-training-module-3-inclusive-steam-model-for-change-of-environmental-behaviour/

6.1 Introduction and general overview of the module

The pedagogical and transformative nature of education cannot go unnoticed when seeking to solve problems that afflict the global population. For this reason, it is not surprising that, for decades, education has been considered an essential means to solve environmental problems.

To this end, the need for sustainable development has to be understood as the greatest educational challenge, and it cannot be understood that environmental education continues to be understood as something complementary and, moreover, not understood as a critical approach for the development of a more sustainable society.

One of the problems is that the vision of sustainable development in most educational proposals is described as a process driven by expert knowledge, where the role of students is passive; generally developing proposals to modify actions that only have short-term results. However, Environmental Education should focus on preparing students to take responsibility by fostering their ability to analyze, question alternatives, and negotiate decisions (Vare & Scott, 2007), within a protagonist. Therefore, Environmental Education must transcend small daily actions and empower people with critical attitudes wishing to reach solutions that advance the goal of sustainability; an education that promotes the integration of the best traits of individuals and that, as an instrument of socialization and critical attitude, adopts valid responses to the challenge of global change that humanity is facing (Novo, 2009). For reaching these objectives, models based on STEAM strategies and methodologies seem appropriate.

In this module, teachers will discuss the social practice theory and will be presented with SPEM pedagogical model (based on social practice theory and STEAM model and strategies), as well as practice several activities that SPEM partners developed using the model. Based on these as well as in the ideas developed in Module 1 and Module 2, teachers will develop an innovative a pedagogical action that could be put in practice in their contexts.

6.2 Learning Outcomes

The objectives of the module include:
◆ Understand the principle of the social action theory
◆ Understand the SPEM pedagogical model
◆ Develop innovative activities , using SPEM model, for changing students' environmental behavior.

6.3 Outline

This module is composed of 3 units, taking approximately 1-2 hours to complete each one and

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three hours to develop the final activity

6.4   Unit 1: A three-step pedagogical model: Problematization, Understanding, and Action

For defining the pedagogical classroom model for changing environmental behaviour within inclusive school settings, we are going to apply the SPT and McGuire's proposal, discussed previously. Following these ideas, we must pursue awareness raising among children and young people of environmental problems related to plastics, leading to a transformation in the consumption and choices we make, both for them and for the adults around them.
This theoretical framework defines a coherent pedagogical model, characterized by three steps:
- **Problematization,**
- **Understanding,**
- **Action**.

In other words, we need to start from problems that have the characteristics described by Marshall (2015) as well as McGuire's criteria:
- Initial problems should be as authentic as possible to each student;
- have different possible solutions,
- involve different "points of view" for the search of solutions,
- be at once recognizable to children,
- children's contribution to the problem should also be recognizable,
- cooperative action should be mobilized.

We need to propose several problematic situations, not only relating to "obvious" aspects of plastics, such as recycling, in order to engage students' social and personal identities in as many behavioural domains as possible, to increase the influence exerted on global self-identity. This allows us to problematize our environment and the customs, habits, etc. that we have.

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The SPEM complete model will be presented, and it will be exemplified with different activities that have been developed by SPEM partners so far. In small groups, teachers will discuss the possibilities and difficulties they would find for applying the model in their classrooms.

6.5   Unit 2: Adaptations for inclusive school environments

◆ Introduction

The recent history of education shows how much effort has been invested in inclusive work for different groups at risk of exclusion. Most of the initiatives have been described with a view to adapting the standards imposed by the curriculum to the different realities with which the students were concerned. However, in line with other trends aimed at greater educational efficiency, the new currents are moving away from adaptations that lead to integration, to focus on enrichment of activities that lead to inclusion. The kernel of this enrichment is in the response to the special needs and the realities that the different groups at risk of exclusion present, but it is finally developed, in order to add value to the usual activities in favor of an undistinguished group.

STEAM strategies and the methodologies explained in Module 1 offer this enrichment in a natural way. The incorporation of illustrative content, and the fact that it is based on experimentation, provide the necessary motivation for the student to assimilate the concepts from a friendly and practical point of view. These characteristics are especially interesting for students at risk of socio-cultural exclusion (gender, racism, xenophobia, etc.), as they leave room for personal development to such a degree that cooperation with their peers favors their interpersonal relationships. On the other hand, the great variety of degrees of complexity means that work is at several levels, giving space to students with very different characteristics within the same objective, so it is also suitable in an environment with people at risk of exclusion due to functional diversity. In this sense, it is especially interesting for groups in which there is the presence of gifted students, who tend to find the activities very motivating, as they can test their capacity for reasoning and logic without overlooking social skills and cooperation with peers.

◆ Assignment

After the introduction and revision of the topics about inclusion discussed in previous modules, teachers are going to see and discuss the following videos,

-Equity, Diversity and Inclusion in STEM Education: https://www.ontariosciencecentre.ca/teachers-plus-students/teacher-resources/professional-learning-resources/equity-diversity-and-inclusion-in-stem-education
-How active learning can improve inequities in STEM: https://www.youtube.com/watch?v=8GtluzBpVi8&t=29s
-Inclusion in STEM : https://www.youtube.com/watch?v=PWsor3Kg-vU

◆ Assessment:

Innovative activity using inclusive STEAM model for change of environmental behaviours
This module has only one global assessment. In small groups, teachers are going to develop an inclusive activity using SPEM model for change of environmental behaviors, in particular related with the misuse of plastics. When designing the activity, teachers have to make explicit its

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inclusive characteristics. The activities developed are going to be discussed in the whole group and considered for being shared in the Nobody Less Community Network

6.6 References

Morris, J., Marzano, M., Dandy, N., & O'Brien, L. (2012). Theories and models of behavior and behavior change. Forestry Research.

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