Revista Românească pentru Educație Multidimensională
ISSN: 2066-7329 | e-ISSN: 2067-9270
Covered in: Web of Science (WOS); EBSCO; ERIH+; Google Scholar; Index Copernicus; Ideas RePeC; Econpapers; Socionet; CEEOL; Ulrich ProQuest; Cabell, Journalseek; Scipio; Philpapers; SHERPA/RoMEO repositories; KVK; WorldCat; CrossRef; CrossCheck

2023, Volume 15, Issue 2, pages: 503-517 | https://doi.org/10.18662/rrem/15.2/746
Submitted: December 7th, 2022 | *Accepted for publication:* January 19th, 2023

EduCardia: an ICT-Enabled Methodology for Assessment and Improvement of Socioemotional Competencies of Students Based on In-Person and Online Activities

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Abstract: Creating a positive school environment in classrooms can enhance the academic and social outcomes of students. In order to promote inclusive education, it is crucial that all students develop the skills to communicate, understand each other, and work together effectively. Although there are numerous research findings and guidelines available for developing social and emotional learning (SEL) materials and implementing SEL training in classrooms, there are limited methodologies and tools openly accessible for assessing SEL competencies. In the current work, we present EduCardia as a methodology to evaluate and enhance the socio-emotional competencies of primary and secondary level students. EduCardia provides both SEL material development and digital tools for teachers to efficiently perform assessment processes in their classrooms and monitor the progress of students' socio-emotional competencies. With access to assessment results, group-based educational activities can be organized to improve inclusion, social cohesion, and promote educational equality. The EduCardia methodology aims to create a supportive school environment that can prevent all forms of discrimination and foster socio-emotional development of students.

Keywords: *emotional intelligence; sociometry; emotional training; social cohesion; inclusion; psychometric tool.*

How to cite: Fotopoulou, E., Zafeiropoulos, A., Cassà, E.L., Colomeischi, A, Papasolomontos, C., Bisquerra, R., Papamichael, M., Thanou, A., Papavassiliou, S. (2023). EduCardia: an ICT-enabled methodology for assessment and improvement of socioemotional competencies of students based on in-person and online activities. *Revista Românească pentru Educaţie Multidimensională, 15*(2), 503-517. https://doi.org/10.18662/rrem/15.2/746

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1. Introduction

Existing research outcomes have come up with evidence that high quality Social and Emotional Learning (SEL) programs help children and adults to grow and practice their emotional intelligence (Durlak et al., 2011). The strengthening of emotional intelligence characteristics has further positive impact on improving students' academic performance (Parker et al., 2004), development of social competencies (Márquez et al., 2006) and elimination of deviant behavior at school (Petrides et al., 2004). In addition to improvements on individual characteristics per student, strengthening of emotional intelligence also contributes towards the development of a collaborative and inclusive school climate (Brown et al., 2019) and the building of collective emotional intelligence (Fotopoulou et al., 2022).

Despite the existence of numerous research findings and guidelines for creating social and emotional learning (SEL) materials and implementing SEL training in classrooms, there are only limited openly available methodologies and tools for assessment purposes. Practitioners use SEL because they trust research outcomes and feel that this helps children to better handle stress, have better classroom behavior, and improve their academic performance. But they have limited access to assessment tools that can help them achieve a close follow up between the emotional training sessions they implement and the impact they have on their groups both at emotional and social level.

For instance, according to the report of the World Economic Forum entitled "New Vision for Education: Fostering Social and Emotional Learning Through Technology" (World Economic Forum, 2016), application of SEL activities is held back -among other reasons- by the lack of valid and reliable SEL measurements. The report highlights particular product attributes that strongly relate to ten competencies and character traits, such as adaptability, leadership, and collaboration. It also identifies technological developments such as advanced analytics, machine learning, and affective computing that can enhance social and emotional learning (SEL) and potentially lead to innovative learning approaches.

From this viewpoint, we introduce the EduCardia methodology in this study. It addresses both the creation of SEL material and a range of digital tools that empower teachers to effectively implement assessment processes in their classrooms and monitor the progress of students' socio-emotional competencies. Access to assessment outcomes enables educators to organize targeted group-based educational activities that enhance

students' inclusion and social cohesion within the group. We claim that the Educardia methodology provides an end-to-end process to empower the socio-emotional competences of the students in a measurable way. Following, we present in detail the steps of the EduCardia methodology and the supported material and tools that can be used to facilitate its ease adoption.

2. Background and Motivation

In the past three decades, considerable efforts have been devoted to defining and measuring Emotional Intelligence (EI) and developing strategies to enhance it. Top-down approaches have aimed to establish EI theories and models that can support psychological assessments, while bottom-up approaches have produced various emotional training activities that may lack a strong theoretical basis but can be easily integrated into school curriculums. However, both approaches face obstacles that impede their widespread adoption, while the connection between theoretical findings and the application of specific emotional training interventions at individual and group levels is often unclear (Cherniss et al., 2006).

So far, there hasn't been a standard format for representing concepts in Emotional Intelligence (EI) models, leading to inconsistencies and lack of clarity. Additionally, there hasn't been much effort made to provide open access to such models and measurement instruments (Fotopoulou et al., 2021; Fotopoulou et al., 2022). The available instruments ignore the examination of social dynamics of a team, missing the complementarity they could gain by adopting sociometric and Social Network Analysis (SNA) indexes. Regarding the interlinking between the theory and the activities coming from the literature, there is a lack of available tools that offer both assessment functionalities and at the same time support teachers to better decide what kind of emotional training interventions better fit to their group at a specific period of time.

The main motivation for the development of the EduCardia ICT-enabled methodology for assessment and improvement of socio-emotional competencies of students stems from the need to address these challenges. A continuous and periodic assessment and intervention process is considered. Based on the assessment results, interventions are planned to improve the students' capabilities at individual and classroom level, while valuable information is made available to the teacher at each step to guide him/her towards the application of targeted activities. The overall methodology and the delivered training material and tools are going to be

made openly available, overcoming existing barriers related to openness and interoperability of relevant solutions.

3. Methodology

The EduCardia assessment methodology consists of a set of procedures that should be followed by teachers to assess and improve the socio-emotional skills of the students. Based on the methodology, the necessary theoretical background is provided to teachers to get accustomed with the aspects of emotional intelligence and its positive effects. The Educardia assessment methodology is composed of seven steps, part of which can be applied in a periodical way. It is targeted to students in primary and secondary schools, while it can be applied within the classroom or in an online mode.

The first step regards the familiarization of the teachers with the EduCardia pedagogical material and tools. In this phase, the teachers are trained based on the developed SEL material and enrich their knowledge on aspects related to emotional intelligence, emotional education and assessment techniques. The teachers are also trained on the usage and configuration of the developed ICT tools.

Following, in the second step, the assessment process takes place. To achieve so, the developed EmoSocio Inventory and the EmoSociograms psychometric tool are used. The EmoSocio Inventory includes a set of items that are used for assessing social and emotional competencies of the students, while EmoSociograms regards a software tool used for collecting the students' preferences in a straightforward and online way.

In the third step, the assessment results are produced and made available to the teacher of the classroom. Through a set of analysis results and intuitive visualizations, the teacher may observe better the social dynamics of the classroom as well as the social and emotional competences of the students. In this way, identification of persons in need may take place, while assessment of group-based indexes is also provided (e.g., status of the classroom climate).

Based on the assessment results and their interpretation, in the fourth step, interventions can be selected to improve specific competencies at individual and group level. A SEL Activities Repository is going to be made available, where searching of targeted activities may take place, while intelligent recommendations are also going to be provided in an automated way to teachers by considering the socioemotional profile of the classroom students.

Given that many of the activities demand the splitting of the classroom in working subgroups, at the fifth step, an automatic splitting (sub-grouping) of the classroom is proposed based on the sociometric characteristics of the group. To achieve so, graph analysis algorithms are applied, aiming to provide optimal solutions in terms of partitioning of the overall classroom to smaller groups to achieve specific objectives (e.g., improvement in the average empathy index).

At the sixth step, the selected SEL activities are applied in the in-person or online groups of students. Supervision of the students during such activities is important to guarantee the proper application of the socio-emotional interventions. Upon each activity completion, in the seventh step, both teachers and optionally the students can evaluate the applied activity. Based on the collected feedback, rating of the provided SEL activities in the Activities Repository is going to be provided, facilitating teachers to select the more effective and qualitative activities to be applied in their classrooms.

The application of activities can be repeated many times. The assessment process can be realized periodically so as to track the evolution of the social and emotional competencies of students. The frequency of the assessment depends on the type and the needs of each classroom. The objective is to be able to identify changes in the assessed competencies, to proceed to corrective actions (e.g., application of further activities) and to support the development of a supportive school climate. In addition, teachers may contribute to the enrichment of the SEL activities repository by adding new activities and/or modifying the existing ones. Possible modifications could include the differentiation of specific activities depending on the unique characteristics of the groups (e.g., special needs or multicultural diversity).

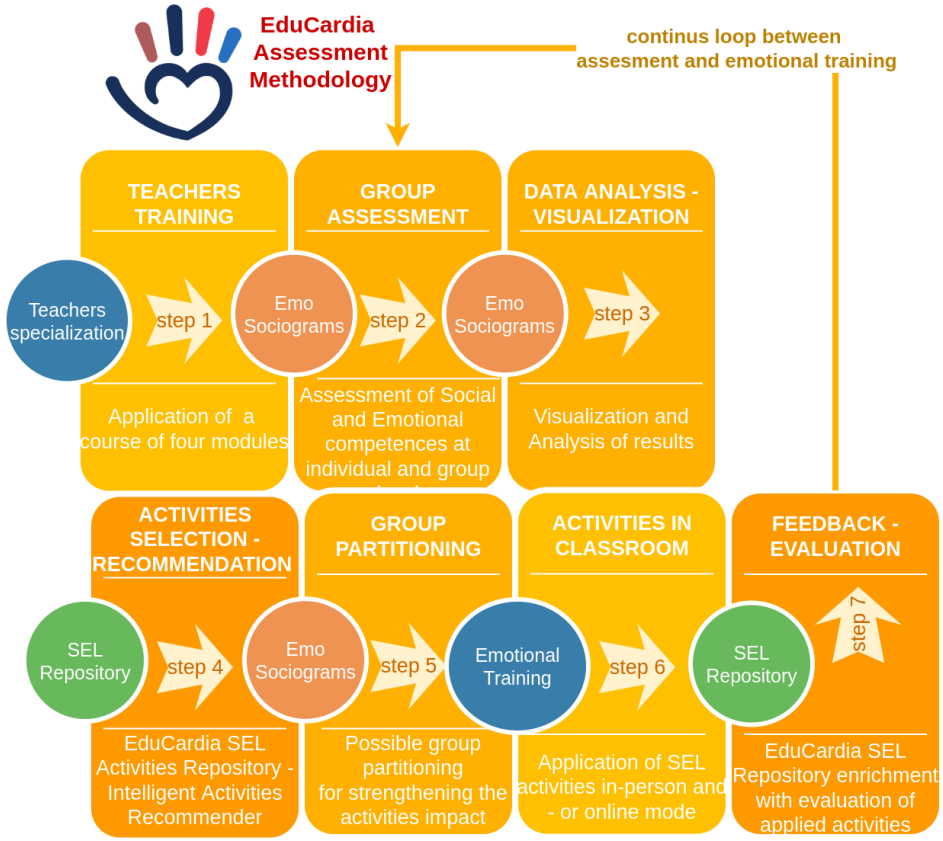


Figure 1. EduCardia Assessment Methodology.

3.1 EmoSocio Emotional Intelligence Model

The EmoSocio Emotional Intelligence (EI) model (Fotopoulou et al., 2021; Fotopoulou et al., 2022) is an open access EI model that represents emotional and social traits. It is based on a comprehensive analysis and combination of the primary constructs presented in recognized Emotional Intelligence (EI) models. It has been further enhanced with sociometric indices at both individual and group levels. Such an enrichment facilitates a better implementation of emotional training activities in a context of classroom's social groups where the proper combination of school mates may be a catalyst to the impact of an emotional intervention activity. EmoSocio can capture both the emotional profiles of students as well as the group dynamics within the classroom (Fotopoulou et al., 2021; Fotopoulou et al., 2022).

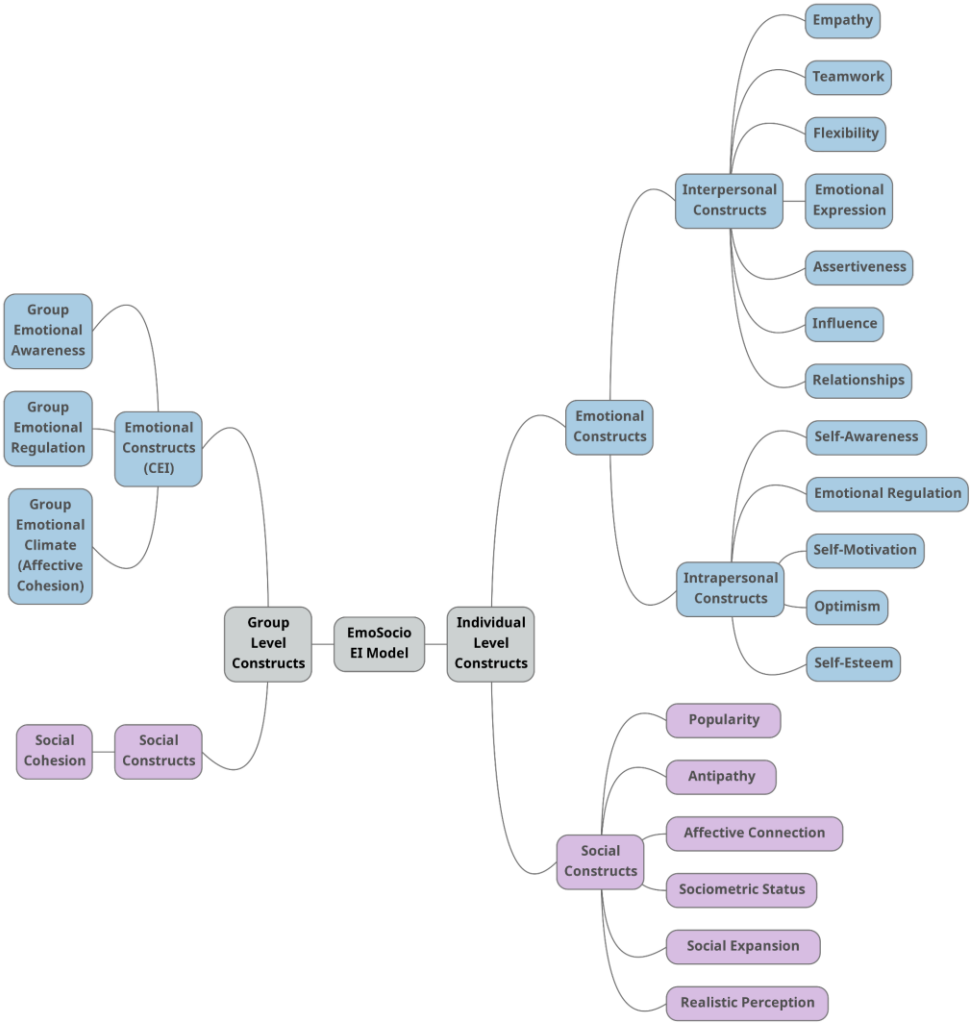


Figure 2. The EmoSocio Model (Fotopoulou et al., 2022).

Currently the EmoSocio model contains scales (definition of constructs and their way of measurement, e.g., self-awareness, empathy, optimism, teamwork) adapted only to adults. A revised version of the EmoSocio model is going to be released that will include the population of a set of valid and reliable inventories (set of items/questions) adapted to school ages from 6 to 18 years old.

Figure 2 depicts the main constructs that exist in the current EmoSocio version for adults. As depicted, Emosocio is composed of both individual and group level constructs. EmoSocio categorizes individual

emotional intelligence (EI) constructs into two groups: intrapersonal and interpersonal. Intrapersonal skills are related to self-awareness, recognizing one's strengths and weaknesses, understanding personal feelings, fears, and motivations. Interpersonal skills involve understanding, collaborating, and working with others, including grasping other people's intentions, motivations, and desires. The intrapersonal EI constructs consist of self-awareness, emotional regulation, self-motivation, optimism, and self-esteem (Fotopoulou et al., 2021; Fotopoulou et al., 2022; Gil-Olarte Márquez et al., 2006). The interpersonal EI constructs are empathy, teamwork, flexibility, emotional expression, assertiveness, influence, and relationships (Fotopoulou et al., 2021; Fotopoulou et al., 2022). On the other hand, individual level social constructs have a significant meaning in a specific group context. For instance, an individual may be popular in one group but not in another. They focus on a member's position within a group and their relationship with other members. The constructs included are popularity, antipathy, affective connection, sociometric status, social expansion, and realistic perception (Fotopoulou et al., 2021; Fotopoulou et al., 2022).

The group-level Emosocio constructs are also divided into two categories. The Collective Emotional Intelligence (CEI) constructs concentrate on group emotional awareness, group emotional regulation, and group emotional climate (Fotopoulou et al., 2022). In the social category, social cohesion is the primary construct at the group level, consisting of a group of sociometric scales that indicate the tendency of group members to remain united and connected.

EmoSocio serves as the foundation for the EmoSociograms psychometric tool, which aims to advance emotional training in the school curriculum and interdisciplinary research in the areas of psychology, sociology, and social network analysis.

3.2 EmoSociograms Psychometric Tool

The EmoSociograms psychometric tool can be applied within a classroom to assess social and emotional competencies of the students. EmoSociograms offers various essential features such as group management, which includes creating and managing groups of individuals within a classroom, assessing social and emotional competencies at both individual and group levels, and managing the resultant assessment outcomes in the form of sociograms that contain emotional enrichment (called as emosociograms). Actually, the term emosociogram is introduced, as an extension of the well-known sociogram from the sociometry theory, where in addition to social characteristics, each node of the sociogram has also a set

of emotional competencies. Furthermore, group-level characteristics are also represented as properties of the overall graph in an emosociogram. Based on the produced emosociograms, the partitioning of a classroom in working subgroups is supported in the software tool. Partitioning takes place considering the current status of the social dynamics and the emotional profiles of the group, as well as the availability of recommended activities that can be applied in sub-groups. The latter are provided through a SEL activities recommender.

EmoSociograms regards a web-based software that can be easily accessed by end users through a web browser. Parallel access to many users and filling in of questionnaires to collect the required information is supported. The EmoSociograms design and implementation is modular, meaning that extra features can be integrated to better support the decision making of the teachers at the moment of creating the personalized emotional education plan of their classroom. Figure 3 depicts a snapshot of the EmoSociograms psychometric tool, where a sociogram of a classroom along with some group sociometric indexes are presented.

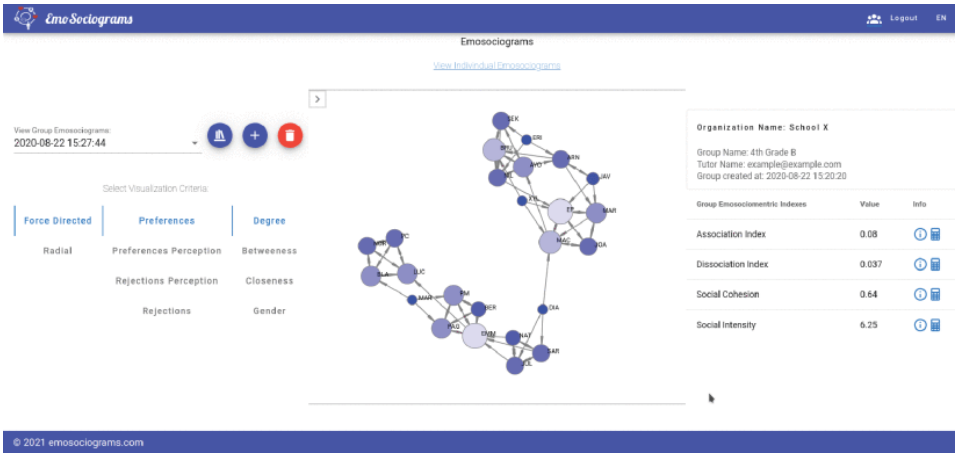


Figure 3. EmoSociograms psychometric tool

3.3 Social and Emotional Learning Activities Repository and Recommender

The SEL activities repository is an open-access repository where a plethora of SEL activities is searchable based on various criteria such as language, age, competences that tackle etc. The objective is to provide to the educational community a centralized place with easy to use scientifically-valid SEL activities that can be adopted by any interested party within

schools and educational communities. The SEL activities are designed and documented from scratch but they are also adapted from existing emotional educational programs or from the literature.

Regardless of the origin of the activities, they are implemented using the experiential learning approach, whereby educators deliberately involve students in hands-on experiences and structured reflection to enhance their understanding and skills. In accordance with Kolb's learning theory (Kolb, 2015), during the execution of an activity, students should progress through a cycle of four stages, as follows (depicted also in Figure 4). Students are having a concrete experience (stage 1), followed by observation of and reflection on that experience (stage 2). This leads to the formation of abstract concepts (analysis) and generalizations (conclusions) (stage 3). These concepts and generalizations are then used to test a hypothesis in future situations, resulting in new experiences (stage 4).

To support effective instructions for the application of SEL activities within classrooms, the EduCardia methodology follows the CASEL (Collaborative for Academic, Social, and Emotional Learning) suggestion. Based on this suggestion, an effective SEL instruction is based on four elements represented by the acronym SAFE. Activities should be instructed in a **S**equenced, **A**ctive, **F**ocused and **E**xplicit manner. **S**equenced stands for implementing activities connected between them to foster skills development; using **A**ctive forms of learning to help students master new skills; **F**ocusing clearly on developing personal and social skills; and targeting **E**xplicit social and emotional skills (Durlak et al., 2010). To facilitate the application of both the experiential learning and S.A.F.E approach, activities are enriched with a set of metadata that facilitate the proper instruction of the activity and at the same time make it searchable based on multiple criteria. Table 1 summarizes the main metadata that are collected per activity.

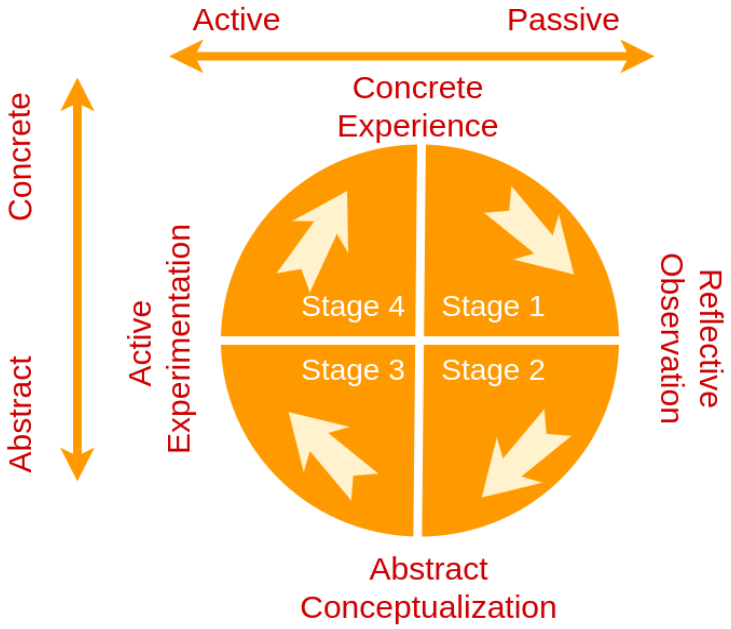


Figure 4: Experiential learning methodology stages

Table 1: Metadata for description of Educardia activities

Title	The title of the activity.
Description	The description of the activity.
Target age group	The target age group where the activity can be applied. (e.g., 6-8 years old, 13-14 years old).
Periodicity	How often the action should be implemented in case it is not a onetime activity.
Duration	How many minutes or teaching hours the activity needs to take place.
Presence	The type of the activity in terms of presence of students (in-person, online, both).
EmoSocio Competencies	The set of EmoSocio competencies that the activity tackles (e.g., empathy and emotional awareness).

Sub-grouping	The types of subgroupings that best fit the activity. For example, the whole class can participate at the same time, or the students can be separated in groups of five persons or the activity can be accomplished per individual.
Teacher role	The teacher may participate, lead the activity without being part of the group or just observe without any intervention to the process.
Adapted to special needs	An activity can be designed specifically for a group of students with special educational needs, or it can be adapted to support such a group.
Source of activity	The source of the activity (e.g., book, publication, project, website).
Material	Description of any material that is necessary to accomplish the activity.
Languages	The supported languages where the description of the activity and the available material are provided.
Dependency to other activities	Any dependency with another activity or set of activities that should be applied a priori or a posteriori of this activity.

Furthermore, the Educardia SEL activities repository can be used as input to a recommendation engine that takes under consideration the socio-emotional profile of a specific classroom and proposes the activities that mostly match the specific profile of an educational group. This may be easy to do manually in case that the repository hosts a few activities, however as the number of activities grows, such a functionality may help teachers to better select and adjust SEL activities to their classroom's needs. In our previous work, we have worked on the development of a recommendation engine that utilized Reinforcement Learning techniques to suggest educational activities to tutors for enhancing the social and emotional competencies of students (Fotopoulou et al., 2020). Such a prototype can be used and integrated in the proposed SEL recommender in Educardia.

3.4 Teachers Training Material

To properly apply the EduCardia methodology, it is important to apply a set of SEL-oriented training activities towards the teachers. Teachers

who possess high emotional intelligence are capable of better motivating their students and comprehending their students' emotional and psychological well-being (Valente et al., 2022). Therefore, the cornerstone of the EduCardia methodology is the training of the involved teachers. The developed teachers' training material is going to be modular and cover four main topics (Figure 5).

Firstly, teachers are familiarized with the concept of Emotional intelligence and the EmoSocio EI model. As part of this experience, they are animated to apply the EmoSocio to assess their individual competencies and reflect on their own strengths and weaknesses regarding their emotional profile. Additionally, at the second module, teachers are trained on how to use the EmoSociograms psychometric tool as well as the EduCardia SEL activities repository. At the third module, teachers get familiarized with the social and emotional learning along with the pedagogical approaches of experiential learning and S.A.F.E. At the fourth module, teachers work on their own skills and attitudes as tutors. Teachers are guided to explore their positioning regarding their level of acceptance, empathy, authenticity and collaboration. Furthermore, they reflect on their communication skills such as their capacity for active listening, assertive communication, observation, feedback and reflection.

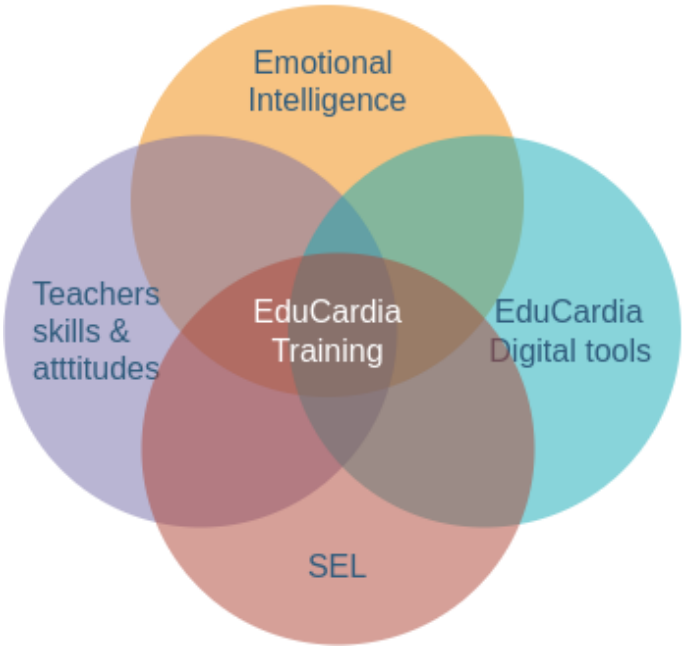


Figure 5. EduCardia Teachers Training

4. Conclusions

The detailed EduCardia methodology regards a novel approach for tackling both the development and assessment of social and emotional competencies of students, taking advantage of a set of digital tools. The overall approach is presented, including its breakdown into a set of steps. In all steps, the need for convergence of information and communication technologies (ICT) with emerging approaches in the areas of emotional intelligence development and SEL training in schools is highlighted.

Based on the specification of the EduCardia methodology, it is in our future plans to develop the tools and the material that is envisaged per step and make it openly available to the educational community. Useful results related to the applicability of the proposed approach in diverse educational settings -focusing on primary and secondary education schools- are envisaged to be produced, leading to fine-tuning actions. Where applicable, the exploitation of Machine Learning (ML) techniques for information management and analysis is going to be considered.

Acknowledgement

The work presented in this manuscript is supported by the Erasmus+ programme of the European Union EduCardia (Project No: 2021-1-EL01-KA220-SCH-000032806).

This paper was presented at the 8th edition of the ENSEC Conference on the topic Social Emotional Learning and Positive Development held at Suceava, Romania, between 30th of June to 3rd of July 2022.

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