Release of the open-source psychometric toolkit (EmoSociograms) and the relevant documentation

Release R5.d

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Contents

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1. Introduction

This document describes in detail the EmoSociograms Psychometric tool developed by the EduCardia team. It regards the final version of the document, following the release of the third version in M30 of the project (R5.c).

EmoSociograms is an open-source tool that supports sociometric and emotional intelligence assessment processes. The EmoSociograms software can be applied to classrooms ranging from 6 to 18 years of age. Teachers can create their own classroom, select and activate questionnaires from a list of emotional intelligence and social interaction assessment measures, run evaluation campaigns and continuously track the evolution of social and emotional competencies of their classroom through interactive visualisations.

The remainder of this document is structured as follows. Section 2 presents a detailed description of what EmoSociograms psychometric tool offers to the teachers. Section 3 provides the architectural approach of the software, while section 4 displays all the technical characteristics and development status of the tool. Section 5 presents how all data collected within the EmoSociograms tool are fully anonymized and offered back to the educational and research community in the form of a knowledge graph while section 6 summarises the main points of the document. Annex I includes an updated tutorial for teachers on how to use the provided software.

This deliverable follows an incremental approach. This means that new content is added upon the previous version of the deliverable R5.c, where Section 5 regards a new section.

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2. EmoSociograms Psychometric Tool

EduCardia has developed an open-source psychometric tool to assess the emotional and social competencies of individuals and groups based on the theoretical foundation of the EmoSocio model (described in detail in deliverable R2.a: Release of the EmoSocio EI Model, Ontology, and Inventory). This tool, called EmoSociograms [1], is targeted to organisations that want to improve the performance of their groups. Among others, it can be applied in working environments for the improvement of the emotional climate of groups and their overall productivity, in educational groups for the improvement of the collaboration among students, the reduction of social exclusion phenomena and the improvement in the achieved learning outcomes, in sport teams for the improvement of the collaboration and the bonding among athletes in the same team, and in clinical teams for the physical and mental health improvement of the patients. The groups may interact in an in-person, digital or hybrid way [2].

EmoSociograms regards a modular open-source software under GNU General Public License v3.0. The core functionalities include the management of the groups (creation of groups, management of group members) and the assessment of social and emotional competencies at individual and group level. Different views (user interfaces) are made available for the people that manage the assessment process and are responsible for the interpretation of the provided results and the participants in each assessment process. The latter have access to a set of questions and their individual results, while the former have full access to all the reports produced at group and individual level. The group-level reports (see Annex I) include the visualisation of emosociograms, the calculation of the values for the social constructs of EmoSocio and the calculation of the values of the CEI constructs. The individual-level reports (see Annex I) include the production of egocentric sociograms, as well as the emotional and sociometric values per group member. The produced sociograms concern the preferences among the group members, the perception of preferences, the rejections and the perception of rejections. The considered criteria regard work preferences and social interaction preferences. Different graphs are produced based on the application of different centrality measures (e.g., degree, betweenness, closeness centrality) [2].

EmoSociograms offer access to three types of psychometric inventories depending on the target age group of the classroom. These inventories are the Emo; Socio; and CEI.

The Emo [3] is built upon a detailed comparison and synthesis of the main constructs represented in widely-accepted EI models. The individual Emo constructs are classified in two categories as intrapersonal or interpersonal. The intrapersonal EI constructs are self-awareness, emotional regulation, self-motivation, optimism and self-esteem. The interpersonal EI constructs are empathy, teamwork, flexibility, emotional expression, assertiveness, influence and relationships.

Socio constructs are meaningful within a specific group context (e.g., an individual may be popular in one group and unpopular in another group). It focuses on the positioning of a member within a group, considering its relationship with the group members. The defined constructs are popularity, antipathy, affective connection, sociometric status, social expansion and realistic perception. At group level, social cohesion is observed as a multi-dimensional construct that reflects the tendency of the group members to stick together and remain united. Concepts specified in the sociometry and social network analysis theory are applied for the measurement of different dimensions of social cohesion.

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CEI focuses on the collective emotional competencies of the group as a whole. Three main constructs are considered, namely group emotional awareness, group emotional regulation and group emotional climate. The specification of each derived construct is based on the synthesis of the associated definitions of the relevant constructs in a set of examined models offered by the literature review.

At present, EmoSociograms target four different age groups between 6 and 18 years of age. EmoSocio 18+ is a tool aimed at evaluating adults' socioemotional competences, both individual and collective. EmoSocio 18+ consists of a set of items or questions divided into 16 dimensions, which correspond to the constructs of the EmoSocio Emotional Intelligence model [2].

EmoSocio 13-18 is a tool aimed at evaluating 13-to-18-year-old children's socioemotional competences, both individual and collective. EmoSocio 13-18 consists of a set of items or questions divided into 16 dimensions, which correspond to the constructs of the EmoSocio Emotional Intelligence model. This model is based on the basis of the individual and collective emotional intelligence [2].

EmoSocio 9-12 is a tool aimed at evaluating 9-to-12-year-old children's socioemotional competences, both individual and collective. EmoSocio 9-12 consists of a set of items or questions divided into 16 dimensions, which correspond to the constructs of the EmoSocio Emotional Intelligence model. This model is based on the basis of the individual and collective emotional intelligence [2].

Emosocio 6-8 is a tool aimed at evaluating the socioemotional competences, both individual and collective, of first years of primary school kids (from 6 to 8 years old). Emosocio 6-8 consists of a set of items or questions divided into 16 dimensions, which correspond to the constructs of the EmoSocio Emotional Intelligence model. This model is based on the basis of the individual and collective emotional intelligence [2].

The aforementioned instruments (Emosocio 6-8, EmoSocio 9-12, EmoSocio 13-18) have been developed by Èlia López-Cassà, Jordi Méndez Ulrich, Salvador Oriola, Núria Pérez-Escoda, Mercedes Reguant and Dorys Sabando, members of the Educardia project.

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3. Architectural Approach

The EmoSociograms architectural approach is depicted in Figure 1. EmoSociograms consists of a backend and a front-end part.

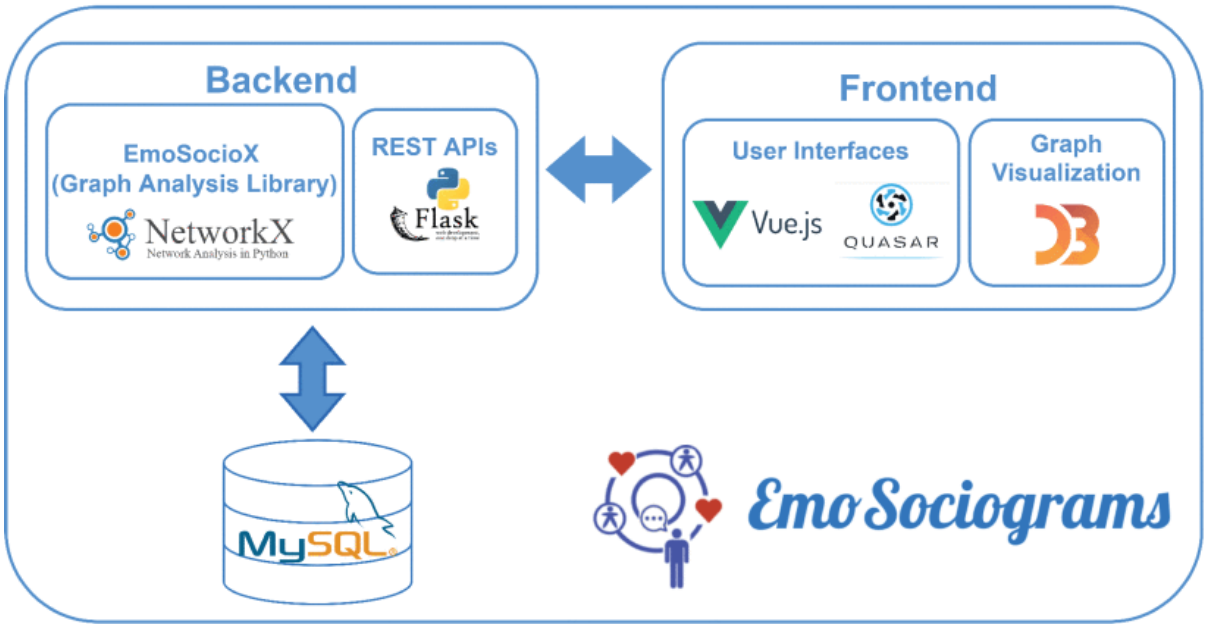

Figure 1 - EmoSociograms architectural view.

The backend part includes the EmoSocioX library and a set of Representational State Transfer (REST) Application Programming Interfaces (APIs). The EmoSocioX library supports various graph analysis functions (e.g., calculation of graph density, diameter, global clustering coefficient, identification of isolated members or cliques, comparison among graphs) and is based on the NetworkX Python library. The REST APIs are written in Python and provided through a Flask web server. The REST APIs support a wide set of functionalities, including the registration of end users, the creation and management of groups and group members, the creation and management of surveys and the provision of the produced results per group. Information storage and retrieval is supported by a MySQL database.

The frontend part is implemented based on Vue.js and the D3.js JavaScript library. The user interfaces are implemented on Vue.js 3 by taking advantage of the Quasar user interfaces development framework. A responsive design approach has been followed, making available views for different types of devices. The visualisation of emosociograms (graphs visualization) is implemented with the D3.js library and integrated in the provided user interfaces.

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4. Technical Characteristics and Development Status

As stated before, EmoSociograms contributes to the management of socio-emotional profiles of social groups. Through the software, a user has the ability to create groups and assign either sociometric or psychometric questionnaires to them. Team members can then participate and answer the questionnaires assigned to them. The answers to the questionnaires are used by the software in order to derive various sociometric and psychometric indicators concerning either the group as a whole or the individuals of the group individually. These indicators are represented in the form of graphs (nodes and edges), bar graphs and tables. The purpose of Emosociograms is, through the supervision of the aforementioned graphs, to help the teacher to extract useful information that will help him/her to apply specific SEL activities to the classroom. Furthermore, the software allows anonymous participation, which means each participant can answer the psychometric questionnaires without belonging to a group and see their results after answering them.

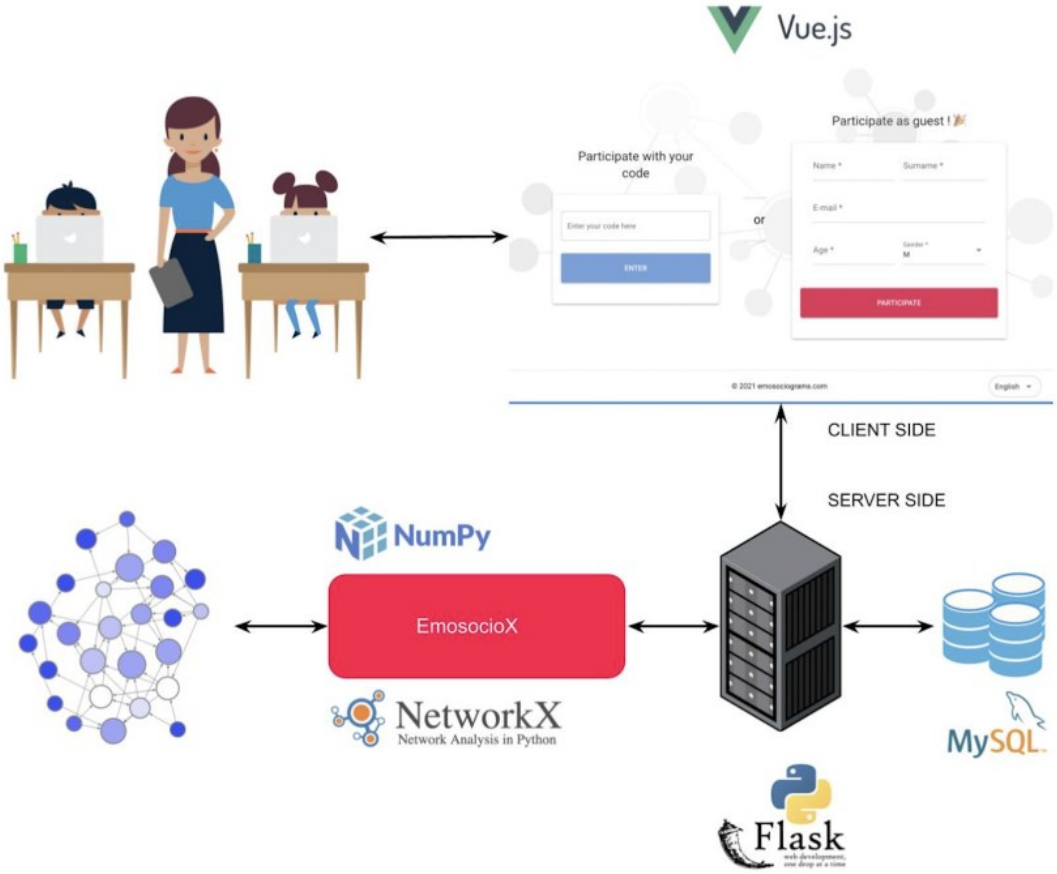

Figure 2 - Representation of the interconnection of the various components of the software

The software consists of four main components.

1. Web Application (Client-side, Front-end)

2. Server (Server-side, Back-end)

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3. Database (persistent storage)

4. Emosociox Library (integrated on the server-side)

The web application provides the basic interface between the user and the application. The server is the main entry point for all the functions of the application. This component is mainly responsible for controlling and interconnecting all the application components. The database takes care of the safe and secure storage of the application data. Finally, the emosocioX library is integrated into the server and contributes to the calculation of all the indicators related to the sociometric and psychometric models.

4.1. Web Application

A web application must be able to manage a user's intentions. Due to the unpredictable nature of user intentions and the fact that actions may not necessarily be performed sequentially, special tools are needed to manage such behaviour. To address this problem the community has created open source libraries / frameworks, which suggest specific methodologies and standards for the convenience of the developer. Some of these patterns are MVC (model-view-controller), FLUX (redux, mobx, vuex) which is based on one-way data movement, and the MVVM (model-view-viewmodel) which is usually based on two-way movement of data and events between the model and the view. These patterns are not mutually exclusive but instead can be used together in an application, each solving specific dependency problems that arise between the application's data, its mutation and the data representation. The basic framework on which the web application is based is Vue.js 3. Vue is the VM part of the MVVM pattern. (see Figure 3)

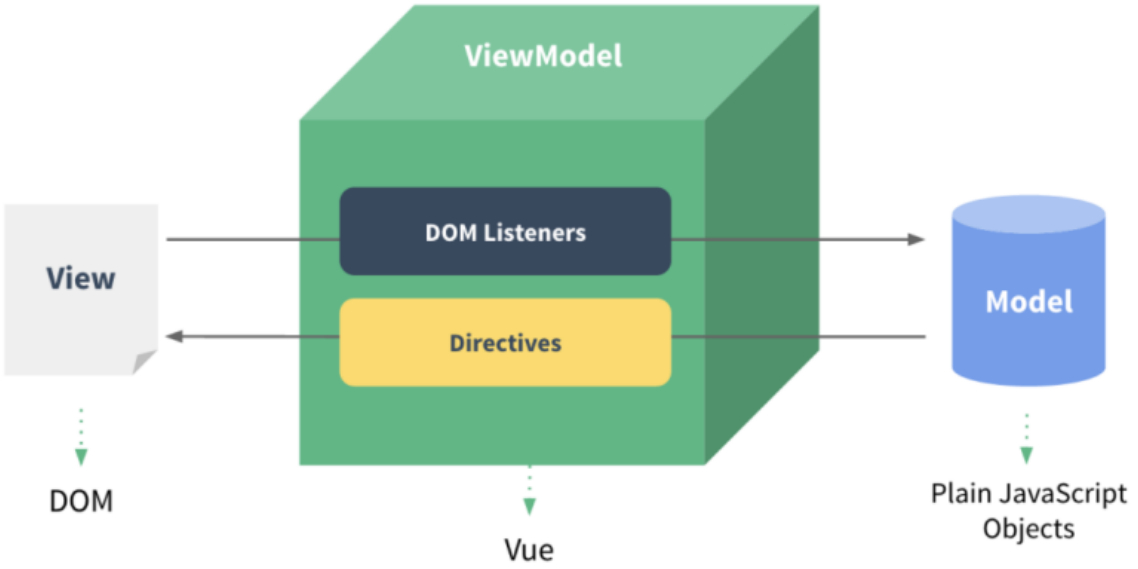

Figure 3. Abstract representation of the Vue library in terms of the MVVM design pattern.

Every change that happens in the model is represented in the view, and every event that happens in the view (i.e., user clicks, user inputs) changes the model. Vue closes this loop between the model and

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the view so that the two are always in sync with each other. Vue also divides a component into three main sections, the template, where it is used for html, the script which is about JavaScript and the style which has to do with CSS. In version 3 which is also the most recent, there is the reactivity system and the Composition API. With these additions it achieves easier modularity between the components and more reusability. Usually, web frameworks create a Virtual DOM between the application and the real DOM of the browser. The reason this is done is because directly using the DOM API by the developer is a painstaking process which can even result in poor performance and poor scalability of the application. Vue, with its reactivity system, enables the developer to change the state of the application and declare the dependencies between the models as he wishes and takes over behind the scenes to change the browser's DOM in order to represent these changes in a fast and efficient way. Also, with the Composition API, common logic used in different parts of the reactivity system can be rendered once and then used in any component that needs to render it. This effectively separates the definition of the model and how it changes from how it is represented. For example, we can create a Counter API as shown below:

```
// Composition API (used with reactivity system)
export const useCounter = (initialValue = 0) => {
 const counter = ref(initialValue);
 const increment = () => counter.value += 1;
 const decrement = () => counter.value -= 1;

 return {
   counter,
   increment,
   decrement,
 }
}
```

Figure 4. Code snippet 1

And then use it in a View component.

```
const { counter, increment } = useCounter();
/* ... */

/* pass counter and increment to a view component as props */
/* <ViewComponent label="counter" @click="increment" /> */
```

Figure 5. Code snippet 2

Essentially, the ViewComponent does not need to know what counter means and how the increment function is implemented, only how to display the prop label referred to in the specific example in the counter and how to display the button which when pressed will call onClick which in a specific example is the increment function. It appears this way that if the increment implementation needs to change, we don't need to change anything in the ViewComponent, just like if the prop label display needs to

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change, we don't need to change anything in the counter model. There is a clear separation of business logic and view logic.

Also, in addition to Vue which is the basis of the web application technology, five additional important libraries were used, vue-router [4], Quasar [5], vue-query [6], d3 [7] and i18n [8]. The vue-router takes over the synchronisation between the browser's url and the display of the components. Because the web application belongs to the category of SPAs (single page applications) the concept of URLs/URIs does not exist in the classic sense of the internal file directory of a server, (i.e /products/t-shirt.html), as there are no different resources that are retrieved by the user, but only one (the index.html), so using vue-router is unnecessary if we oversimplify what we define as an application's functionality. However, because a user's experience is smoother when there is a clear and intuitive connection between the URL and the user's navigation within the application, such a library only redundant cannot be characterised. The second library, Quasar, is a UI framework for Vue.js, which offers a very wide variety of stylistic ready-made components, so an application can instantly acquire a look and feel, without the need to create CSS styles from scratch. Continuing, web applications, especially as they begin to grow, need tools that manage the internal state of the application's data. There are two main categories of states, UI states and states that control the business data. UI-related states are states that reflect the appearance of the application, for example whether or not a loading icon or when an update message should be displayed to the user. The states that control the business data are related to the communication between the web application and the server and are retrieved through the server API (and then from the database) and refreshed continuously, without creating a problem in the user's experience. The vue-query library was used to manage the second type of data. This library aims to continuously synchronise the data of the web application with the data of the database through communication with the server. It provides many features such as data caching, stale while revalidate, cache invalidation, dependent queries and optimistic updates (optimistic updates). Moving on, the d3 library offers the necessary tools to visualise data in the form of graphs or bar graphs. Finally, the last library to highlight is the i18n library. This library helps in the localization of the application, for example in the use of translation of the content in different languages. Currently. English, Spanish, Greek, Catalan and Romanian are the five languages which are supported by the software.

4.2. Server

The server is one of the most basic components of a web application. Its purpose is to orchestrate all the functionality of the application and to manage the communication between the other components. It must primarily offer security, speed and stability. The Emosociograms software server uses the Python programming language. The main libraries used are Flask, uWSGI and SQLAlchemy. The Flask library is used to easily handle HTTP requests. Flask internally uses the interface defined by WSGI (web server gateway interface), which is a gateway interface for forwarding requests to web applications written in the Python programming language. The Flask library is mainly used for the development phase and is not designed to be particularly efficient, stable or secure, nor does it support all possible features of an HTTP server. Instead, it provides tools to help with rapid code development and debugging. Because this library is not sufficient during the transition of the application to production, the uWSGI library is therefore used, which also uses WSGI internally but with the aim of making the application ready for production. In addition, the SQLAlchemy library is

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used, which offers a model-based API (ORM, Object Relational Mapper) for the communication of the server with the database. An ORM library allows the definition and use of models that are mapped to relational tables in the database, without this process being affected by how that database is structured internally. This way there is a clear separation between the application data interface and how that interface and data is stored or retrieved.

4.3. Database Schema (persistence storage)

In the Emosociograms software, two kinds of databases are used depending on the environment in which the application is located. SQLite database is used in the development environment. The main advantage of SQLite is that it does not need the existence of a server in order to establish communication over the network. Because an SQLite database is essentially a single compact file in a well-defined format, it can be easily and instantly transferred from one system to another, thus making it an ideal base choice during application development. In the production environment, the use of an SQLite database is not prohibited, as long as certain thresholds are not exceeded in the number of "queries" that take place at intervals. In Emosociograms software, the database used in the production environment is MySQL. At this point it is also worth noting the value of an ORM library, such as the already mentioned SQLAlchemy, as it does not need any change beyond a simple configuration of environment variables during the transition of the application from the development environment to the production environment.

MySQL which is an open-source relational database management system (RDBMS) for data storage and management. It provides a wide range of features for creating and managing databases, including support for multiple users and concurrent connections, transactional processing, and ACID compliance. One of the key benefits of MySQL is its scalability and flexibility. It can be used to handle small and simple databases, as well as large and complex ones with millions of records. MySQL can also be easily integrated with other tools and technologies.

Figure 6 illustrates the database schema of the EmoSociograms software. Users table stores all users registered in the EmoSociograms platform. They can be teachers or administrators. Each teacher can see only the groups he/she creates while the administrator can see all the created groups of all the teachers. The groups table is used to represent the classrooms. A user (teacher or administrator) can create one or more groups and then add one or more members to this group (see members table with a foreign key to the groups table.) EmoSociograms tool has a set of predefined surveys (surveys table). These surveys host all available questionnaires that are created per target age group. Each survey is composed of one or more questions (see questions table). Tests (see tests table) are created based on a survey (foreign key to survey_id) and a group (foreign key group_id). For each test is created one response code (see responsecode table) per member of the group. After that the member can respond to the test (see responses table). Each response refers to a specific question (foreign key question_id) of a specific test (foreign key test_id) given by a member (foreign key member_id) that selects a choice. The choice is an integer number that ranges from 0 to 10 for the emo and cei surveys while for the socio surveys refers to the ids of the members of the same classroom.

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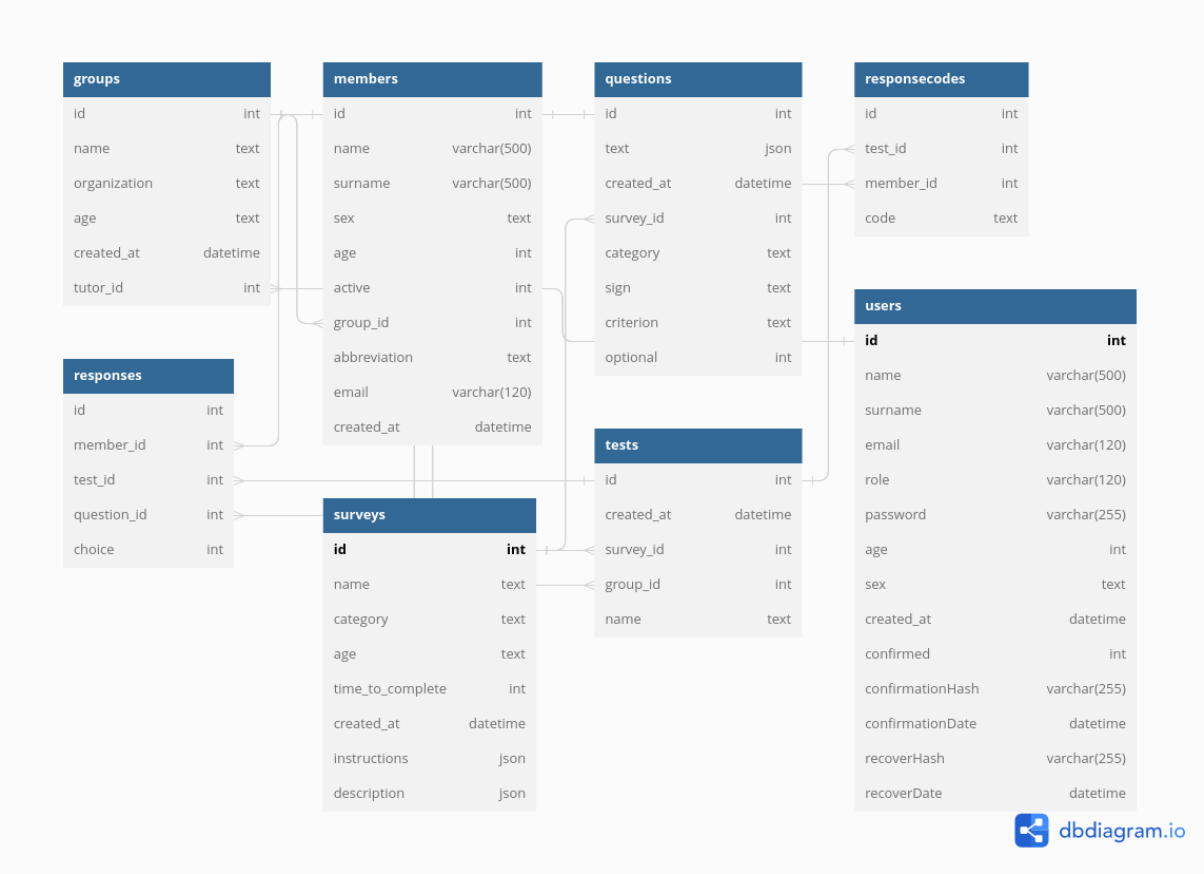

Figure 6 - EmoSociograms Relational Database Schema

4.4. EmoSocioX

The EmosocioX library is used by the EmoSociograms software to calculate the indices of the psychometric and sociometric models. Internally, it uses the NumPy and Pandas libraries for easy data management, as well as the NetworkX library, which provides tools related to graph and network data. This library is integrated in the server and contributes to the transformation of the raw data collected from the questionnaires, into information that reflects the corresponding psychometric models on which the Emosociorams software is based.

4.5. Application Programming Interfaces (APIs)

In computer science, separation of concerns is an implementation design pattern aimed at separating a computer program into distinct units. Each section addresses a separate concern, which is a set of information that affects the code of a computer program. The API (Application Programming Interface) also follows this axis. Various APIs are used in the application, for example the API provided by the d3 library for creating graphs, the API provided by the SQLAlchemy library for server to database communication. In this sub-chapter we will develop the API that is used between the client and the server and belongs to the REST (Representational State Transfer) API category. The key principles of this class of APIs are the use of client-server architecture, absence of memory and internal state,

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caching, homogeneity, separation of systems into multiple layers, and code-on-demand. The principle behind client-server architecture is separation of problems. Separating the user interface from data storage improves the portability of this interface across multiple platforms. It also has the advantage that different components can be developed independently of each other. The absence of internal state means that the communication between client and server always contains all the information needed to execute each request. That is, there is no session state on the server, it is kept entirely on the client. If for example access to a resource requires authentication, the client must authenticate itself on each request. The client, server, and any intermediate modules can cache all resources to improve performance. Information can be classified as cached or uncached. All modules must maintain homogeneity in their communication context, i.e., follow the same rules to communicate with each other. This also makes it easier to understand the interactions between the various modules of a system. Individual modules cannot see beyond the immediate layer they interact with. This means that a client connecting to an intermediary module, such as a proxy server, does not know what is behind it. Components can therefore be easily exchanged or extended independently of each other. Finally, code can be obtained on demand from the client side in order to extend the functionality of the program. However, this is optional because the client may not be able to download or execute this code.

Following, we describe the collection of requests executed by the client-side part of the application (frontend) and served by the server-side (backend) part of the application.

Authentication related APIs

The following APIs are public, i.e., no identification is required on the part of the user. It is a set of APIs that enable a new user to register on the platform and then log in to use the rest of the APIs that require authentication to access specific resources.

/api/register

The user registers for the service by providing some personal information.

/api/confirm/

The user confirms his/her e-mail to be accepted during login.

/api/recover/

The user requests the recovery of his/her account through his email.

/api/changePassword

The user changes his/her password following a request to reset his/her account via his email.

/api/login

The user logs into the application with his/her email and password and gets as a response, a token that represents him/her. Through this token, he/she can access all the APIs that require user authentication. After that, the user can login and is able to create new groups, introduce members to them, choose from a set of questionnaires and assign them to groups.

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/api/groups

The user retrieves all their groups or creates a new group.

/api/groups/:groupId

The user retrieves, changes or completely deletes a group. When retrieving the group, it also receives its members.

/api/members

The user creates a new member in a group.

/api/members/load

The user imports multiple members to a group.

/api/members/:memberId

The user changes or deletes a member. When changing a member, the user can decide whether to enable or disable it. This decision is directly related to the participation of this member in a questionnaire.

/api/surveys

The user retrieves all the questionnaires from which they can then choose in order to create a test. These questionnaires are either psychometric or sociometric.

/api/groups/:groupId/tests

The user retrieves all tests assigned to a group or creates a new test by selecting a specific questionnaire and assigns it to the group. In the case of creation, the members who are deactivated at that moment, will not participate in this new test.

/api/tests/:testId

The user retrieves, changes or deletes a test.

/api/test/:testId/sendmail

The user has the option to send an invitation email to all test participants who have an email and have not yet answered the test.

/api/test/:testId/participant/:participantId/sendmail

The user has the option to send an invitation email to a specific test participant who has an email and has not yet answered the test.

Then the participants of the tests can answer them. Each participant has a personal code and can use it in order to receive information in relation to the test assigned to him, the questions in the test and the possible options to answer. This personal code acts as an identification of each participant allowing controlled access to the information required to be completed.

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/api/participate/:participationCode

The user retrieves information about himself (provided by the teacher when creating the group), as well as the test in which he participates.

/api/surveys/:surveyId/questions

The user retrieves the questions of a specific questionnaire in order to be able to answer the test belonging to the corresponding questionnaire.

/api/test/:testId/participants

The user retrieves the participants of a test. From a participant's point of view, this retrieval only makes sense for sociometric questionnaires as only in these the user answers by choosing among the rest of his group. In psychometric questionnaires, the user answers within a predefined set of options (Likert scale).

/api/answer/:participationCode

The user completes the test and submits his/her answers. When the members of a group have answered a test, then the teacher has access to the results of that test. These results depend on the questionnaire in which the test belongs and can have either a graph structure (graph data) or a table structure (tabular data).

/api/test/:testId/results

The user retrieves the results of a questionnaire.

/api/anonymous/members

Finally, the Emosociograms software allows a visitor to participate in psychometric questionnaires without necessarily belonging to any group. The visitor "registers" using some personal information in order to receive a personal code, which he can then use as already described above in order to participate in the corresponding questionnaire.

4.6. Data Security

EmoSociograms hosts sensitive data regarding the student's name, age , gender along with their social interactions and emotional profile. To ensure the protection of sensitive data hosted on the application, a series of technical and administrative measures have been implemented.

Firstly, all representations of students' social interactions within the system are partially anonymized through the use of abbreviations, preventing the direct identification of individuals. Furthermore, the teachers are encouraged to avoid the use of students' surnames when registering their classroom information into the application. To limit data exposure over time, the EmoSociograms database is also emptied annually at the end of each school year, ensuring that no outdated or unnecessary data is stored longer than needed.

Data transmission security is another critical area of focus. All exchanges of data through the EmoSociograms platform are conducted over a secure HTTPS channel, which safeguards information

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from unauthorized interception during transfer. Additionally, the application is deployed on virtualized environments in the servers of the National Technical University of Athens (NTUA) with heightened security measures to protect its infrastructure from potential breaches. At the database level, all sensitive information is encrypted and fragmented across multiple databases, creating an added layer of complexity that enhances protection against unauthorized access.

Within the framework of the EduCardia project, further safeguards have been established to guarantee ethical compliance and respect for privacy. Contracts are signed between participating schools and the research team to formalize mutual responsibilities and ensure clear data governance. In addition, parental consent is obtained through signed authorizations, allowing the inclusion of students' anonymized data in the research process. This formal agreement structure supports transparency and accountability among all stakeholders.

Finally, all dissemination of project results—whether through academic publications, conferences, or public presentations—is strictly based on fully anonymized data. This practice ensures that it is impossible to identify individual students, their teachers, or the schools involved. Such a comprehensive approach underscores the project's commitment to data privacy, ethical research, and the responsible use of educational technologies.

4.7. Code Availability

The Emosociograms software is an open-source software. EmoSociograms is licensed under the GNU General Public License v3.0. An online instance of EmoSociograms can be found at https://emosociograms.com. The code is available through the Gitlab platform at https://gitlab.com/netmode/emosociograms (see Figure 7). GitLab is an online tool developed by GitLab Inc. for software lifecycle management and provides a git-based space along with wiki, issue tracking, and continuous integration and software development features, using an open-source licence. In this way, collaboration between developers and those who contribute to the development of the software in general is facilitated as they have the ability to share their work and consolidate it in a single space.

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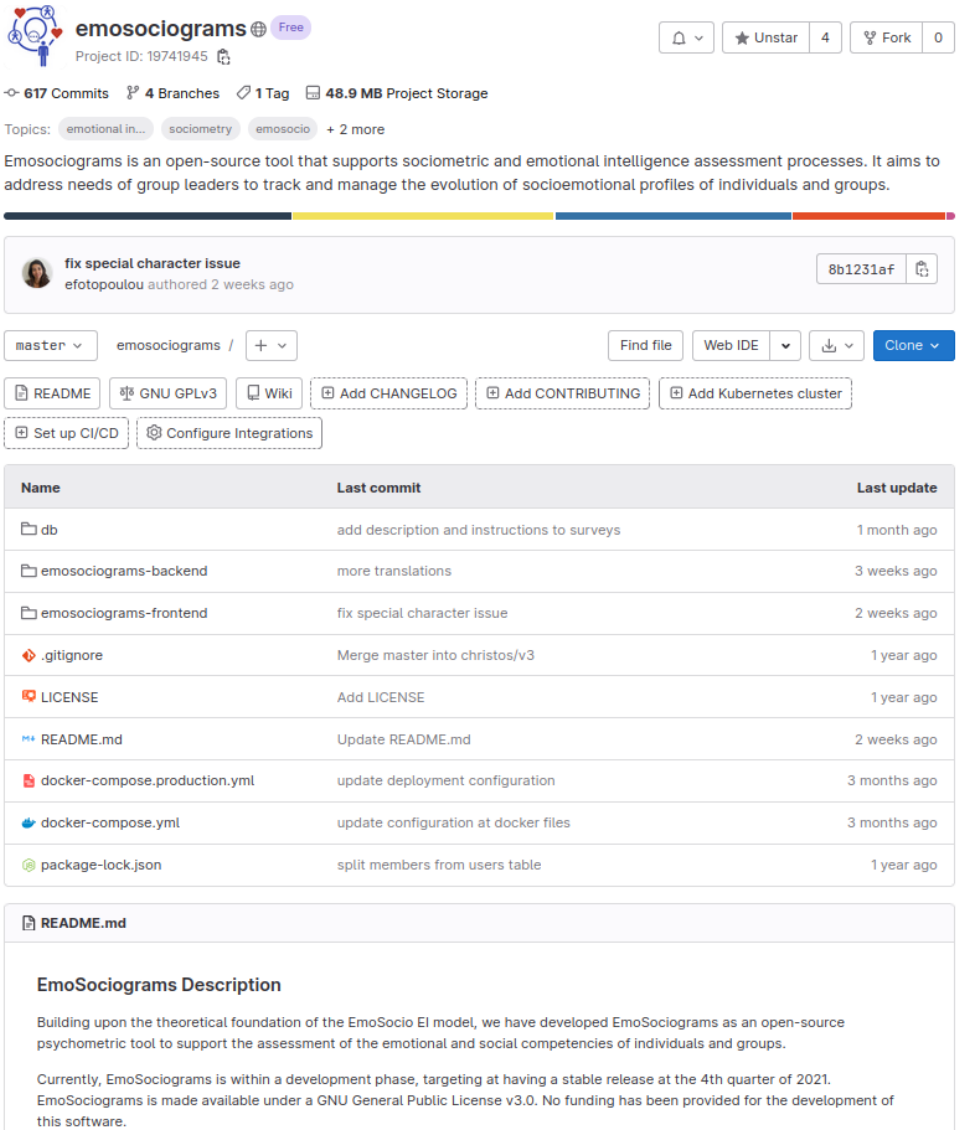

Figure 7 - EmoSociograms GitLab repository

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5. The EmoSocioGraph initiative

During the implementation of the EduCardia project, a data corpus -that tracks the development of social and emotional competencies of K12 students- has been collected via the digital tools of EmoSociograms and the EduCardia SEL activities repository. Our research team decided to offer such data to the research and educational community upon the proper anonymization and cleaning of the data. Towards this direction, we developed a Knowledge Graph (KG), called EmoSocioGraph [11] with the objective to align and interlink the data collected through the EduCardia methodology. EmoSocioGraph aims to be used as an open pool of semantically-aligned SEL related data from multidisciplinary researchers that wish to better support the implementation of SEL programs.

The EmoSocio Knowledge Graph is specified and developed in the form of a labeled property graph (LPG) model. In this model, a graph consists of a set of nodes (discrete objects) and relationships. The main advantage of such a representation is that it can achieve high performance in data management functionalities (storage, fast graph traversal, fast querying). Since the LPG model itself does not support a formal language representation that can be used for automated knowledge reasoning, EmoSocioGraph makes use of different approaches to properly detail the semantic information associated with each node and relationship. First, an EmoSocio ontology has been made available [3], where the ontological description of the main concepts introduced in the EmoSocio is provided. This description is considered as supporting information of the structure introduced in the LPG model. Furthermore, EmoSocioGraph makes use of vectors that enable semantic search. Vectors allow for the accurate querying of nodes that contain properties with large text descriptions. Finally, EmoSocioGraph is thought to provide a rich context to Large Language Models (LLMs) to support a plethora of questions from teachers, developers, and data scientists whose response requires the combination of information hosted within the KG as well as external sources.

The EmoSocioGraph Schema Overview

A high-level view of the structure of EmoSocioGraph is provided in Figure 8.

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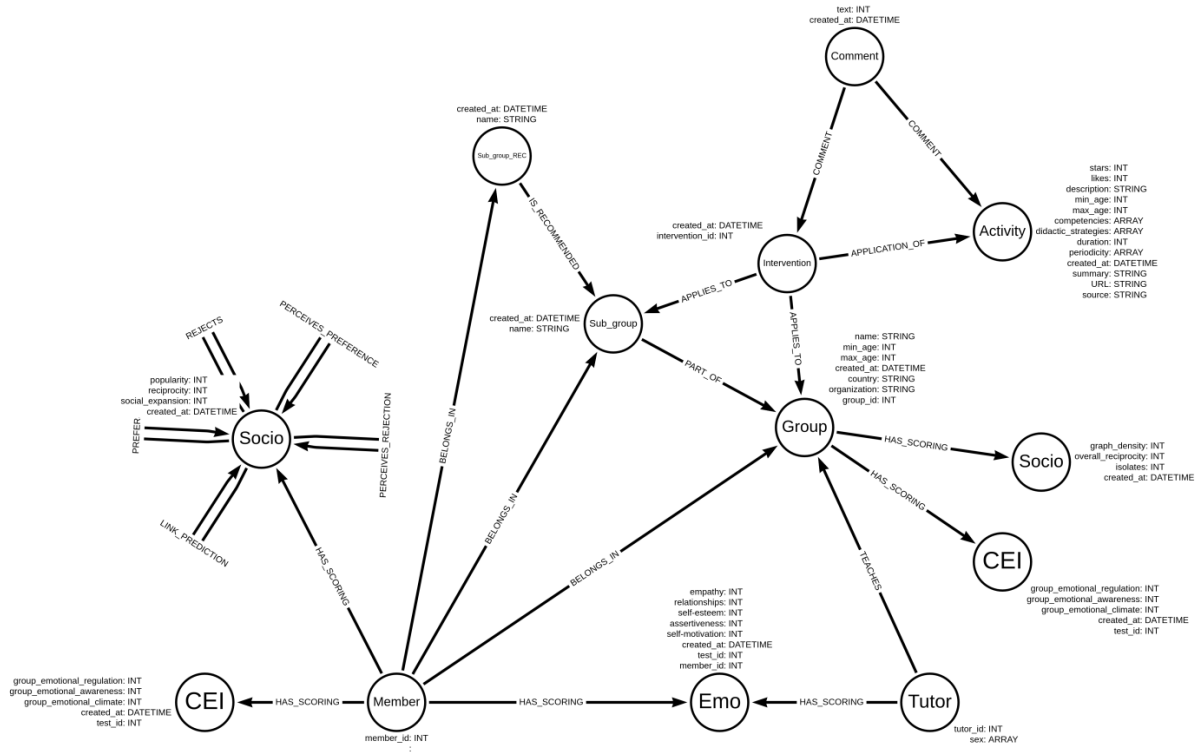

Figure 8: The EmoSocioGraph Schema

The main concepts of the EmoSocioGraph are the 'Member', 'Group', and 'Intervention' nodes. The members can be students in a classroom or any individual who may belong to a 'Group' of people. The Group of members is characterized by specific properties such as the range of age of the members (6-8, 9-12, 13-18, 18+), the country which is important for depicting any cultural differences among the groups, the name of the Group (e.g., Third Grade) and the organization it belongs to (e.g., 1st High School of Athens). Each group may have a set of periodical assessment results in the three dimensions of the EmoSocio model (Emo, CEI and Socio). The 'Socio' nodes contain properties that refer to individual characteristics of the members as well as characteristics of the group in a specific point of time. All 'Socio' properties are produced upon the sociometric analysis of the members' relationships. The members interact between them through five types of relationships. They may 'prefer' each other, which means that they enjoy their social interaction, or 'reject' other members of the same group by avoiding to interact with them or because they feel distant due to lack of common and fruitful experiences. At the same time, members perceive their social status within the group through the relations 'PERCEIVES PREFERENCE' and 'PERCEIVES REJECTION'. These relationships represent the hypothesis made by the individuals about how their mates feel about them. This information is very important at the moment of evaluating the capacity of individuals to understand the social dynamics of their group without underestimating or overestimating their position in it. The fifth type of relationship considers the probability that two members will form a preference relationship in the future.

The 'CEI' nodes represent the Collective Emotional Intelligence of the group at a specific point of time. At an individual level, each member may have a specific scoring that stands for its contribution to the

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group's emotional awareness, regulation, and climate. The 'CEI' at the group level is composed of the average value of all individual contributions of the members.

The 'Emo' nodes represent the individual emotional profile of a member at a specific point in time. Such a scoring includes values from 0-100 in each competence of the EmoSocio model (e.g., empathy, optimism, self-awareness, etc.). In addition to the students, the teachers maintain their own 'Emo' profiles. Such data is very useful for evaluating how the emotional profile of the classroom teacher(s) may affect the capacity of the group to improve the emotional climate between the members, as well as the capacity of the members to improve their emotional profile.

The third major node of EmoSocioGraph is the concept of SEL activity. An SEL activity is designed to be implemented in a specific target age group (e.g., adolescents from 13 to 16 years of age), addresses specific emotional competencies of the EmoSocio model (e.g., empathy and teamwork), and is structured on a set of didactic strategies (e.g., experiential learning and gamification). An activity may have a duration of one to three school sessions and may be implemented one time or periodically (e.g., every trimester). Finally, it includes information for its source, an URL, a detailed description, and a summary. These two last fields are useful for enabling semantic search upon the provided activities to better support teachers that wish to build a learning path of activities adapted to their groups social and emotional needs. Furthermore, the activities are rated based on the likes of the end users and on stars in a range from 0 to 5 where a five-star activity is the most qualitative according to the end users' preferences.

Last but not least, each activity may be related optionally with comments coming from the teachers' experiences. Sentiment analysis of such comments may highlight activities that have a considerable impact on students' social and emotional competencies.

The 'Intervention' node refers to the application of a specific activity to a specific group at a specific point of time, and it may be followed by its own comments on behalf of the teachers. Some of the activities require splitting the classroom into working subgroups. In that case, the intervention applies to specific subgroups composed of some of the members of the classroom. It should be mentioned that student subgrouping can also be automatically recommended based on their emotional profiles and sociometric relationships [9]. This is depicted by the node 'Sub group REC'. The teacher has the option to modify the original recommendation based on his/her perception of the classroom social dynamics and on the pedagogical objectives of the applying intervention. The final match of the student is shown on the 'Sug group' nodes. Possible differences between the 'Sub group' nodes and the 'Sub group REC' may highlight future improvements on the group partitioning algorithm that is used up to now. All the nodes and relationships described up to now compose a holistic data corpus that may be the starting point for many research questions.

Data management in EmoSocioGraph

The data that are hosted on the EmoSocioGraph have passed a strict set of criteria to ensure their scientific validity for further use. More in detail, in EmoSocioGraph are represented only classrooms where more than 80% of the students have completed all three EmoSocio inventories (emo, cei, socio) at the beginning and at the end of the school year. Furthermore, only groups that come from organizations that maintained at least one control group during a school year have been included in the data corpus. The control groups participate in the assessment process, but do not apply any SEL

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intervention during the school year, while the intervention groups implement at least one SEL activity on a weekly basis. In addition, a partnership agreement has been signed between the school's direction and the research team, while parents have been informed and agree with participation of their children in an SEL training program that includes their socioemotional assessment twice per year. Last but not least, all teachers have been trained on the application of a SEL program at the beginning of the year, while all teachers have reported and evaluated all the activities that have been implemented in their classrooms.

The above set of criteria preserves the best quality of EmoSocioGraph data, but scientists and third-party researchers should be aware of biases that may affect any further analysis upon them. First of all, the EmoSocio model is a mixed model where a combination of SEL assessment techniques is applied such as self-report, rating scales and peer nomination. All of them are subject to bias, as students may not always have the ability to objectively assess their competencies. Furthermore, sometimes the control groups may have a greater opportunity to naturally improve their socio-emotional competences, while the application of SEL activities may not always have the expected impact, especially in the case that the teachers perceive the application of the SEL program as an introduced distraction in the execution of the curriculum. This may happen when teachers are not self-motivated regarding their participation in the SEL program but instead try to follow the guidelines of the school center they operate by applying inconsistent implementation. Usually, their comments on the applied activities are characterized with higher levels of criticism and skepticism about their effectiveness.

Another bias that is commonly reported in such initiatives is the expectation bias. In that case, the intervention groups may expect significant improvement due to the SEL intervention but do not experience it. Social and emotional competences are considered to be trained but are not easily changed, since in most cases a 10% improvement is observed in the groups and individuals that participate in such initiatives. However, higher expectations on behalf of the students and teachers may negatively influence their performance in assessing their competencies by the end of the school year. Last but not least, it is interesting to pay attention to the Dunning-Kruger effect. It refers to cognitive bias where people with low ability tend to overestimate their knowledge, while more competent individuals often underestimate themselves. This may have the effect of a higher scoring in the initial assessment of the groups where individuals may be unconscious of their incompetencies, while at the second assessment by the end of the school year they may have lower scoring not because they did not evolve emotionally but because they are more aware about their incompetencies and thus more strict at the moment of self-reporting themselves.

Despite these biases, the EmoSocioGraph data show that the intervention groups as a whole demonstrate better social and emotional competencies after participating in the SEL programs. Regarding the accessibility of EmoSocioGraph, this is available openly [10]. The KG is continuously updated by the end of each school year, upon anonymization of the data and the application of the filtering process as explained above.

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6. Conclusions and Next Steps

The EmoSociograms psychometric tool has followed a continuous development and integration approach during the last three years in order to fulfil all the initial requirements. This is the final version R5.d regarding the design, implementation and maintenance of the psychometric tool of EmoSociograms following the feedback of the end users. Despite the fact that the final release of EmoSociograms is already released in February of 2025, our research team will continue to maintain the software with minor and major fixes for the foreseeable future.

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Annex I - EmoSociograms Teachers Tutorial

EmoSociograms Tutorial for the Teacher

This is a tutorial on how to use the online application EmoSociograms, an open-source tool that supports sociometric and Emotional Intelligence (EI) assessment processes. You can create your group, select and activate evaluation tests from a list of EI and social interaction assessment questionnaires and continuously track the evolution of social and emotional competencies of your group through interactive visualizations. The functionality of EmoSociograms can be summarized in eleven steps.

Step 1: Open EmoSociograms
Step 2: Select the language of your preference
Step 3: Have a look at the landing page
Step 4: Create a new account
Step 5: Login into EmoSociograms
Step 6: Create a new group for your classroom
Step 7: Add members to the group
Step 8: Create a test
Step 9: Respond the test
Step 10: See the results
Step 11: Match your students in working groups
Step 12: Share your experience with us (optional)

Take note of the following general instructions before delving into the details of each step.

Be sure that in your school there exists a computer room or something similar. The software is intended to be used through computers, tablets and mobile phones.

The instrument is presented as an activity to learn more about the students, their strengths and needs. It is important to understand that the results can be improved and that the emotional competences of the students are trainable.

The objective of the evaluation is to become better. The results of EmoSociograms should not count toward student academic grades.

Make use of the software at a quiet place, within class hours. It is not recommended to answer the tests as homework. Give support to the students in small groups, respecting the time they need, ensuring that the questions or items are understood. Maybe you will need different sessions.

In the rest of the document, each step is analyzed thoroughly.

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Step 1: Open EmoSociograms

The first thing to do is to open a browser in your laptop, personal computer or mobile phone and visit https://emosociograms.com. At the first page you will find information about the objective of the application.

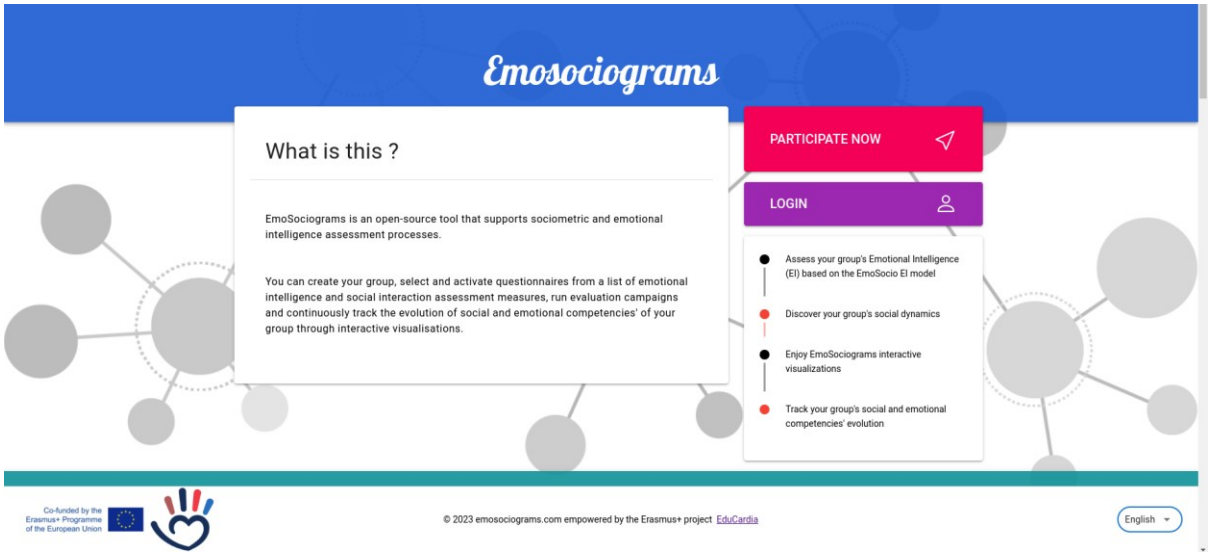

Figure 1: EmoSociograms landing page

Step 2: Select the language of your preference

At the bottom part of the landing page you can find a dropdown menu with all the supported languages. Please select the language that you and your students are more familiar with. Currently, EmoSociograms is available in five (5) languages: English; Greek; Spanish; Catalan; and Romanian.

Step 3: Look at the landing page

By scrolling down at the landing page you can find useful information about the theoretical foundation of the EmoSociograms psychometric tool. EmoSociograms supports three (3) different tests that evaluate the socio-emotional competencies of students in a classroom, at both individual and group level.

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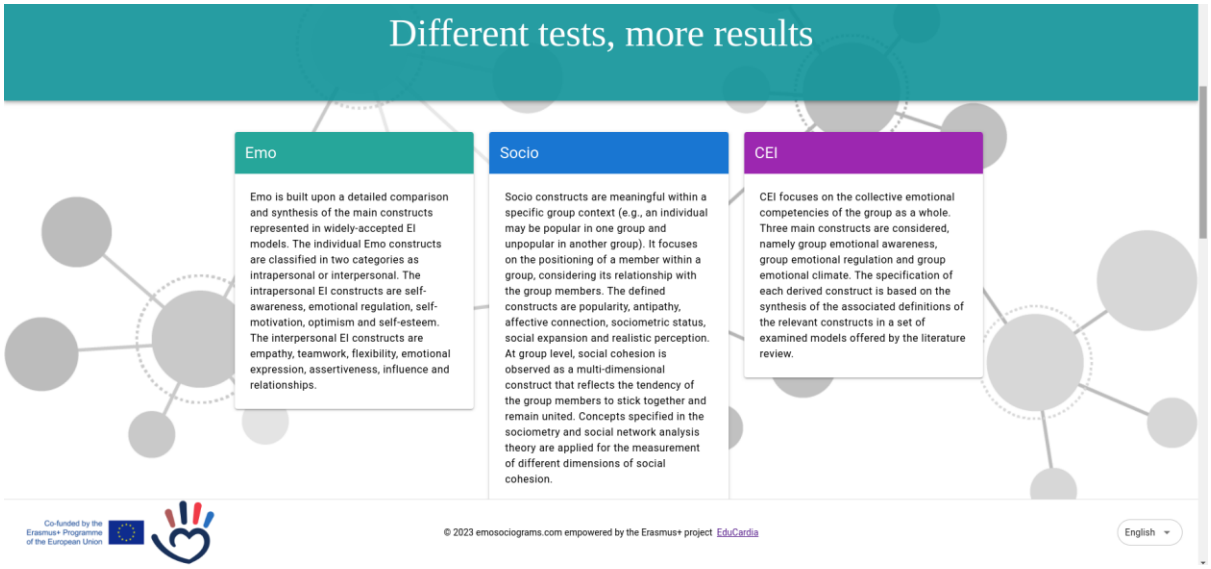

Figure 2: Emo, CEI and Socio Questionnaires

Four age groups can be studied using EmoSociograms. The questionnaires differ depending on the age of the participants. Currently, the EmoSocio Emotional Intelligence (EI) model that is part of the EmoSociograms tool, is designed for adults that are more than 18 years old; adolescents from 13 to 17 years old; children from 9 to 12 years old; and children from 6 to 8 years old.

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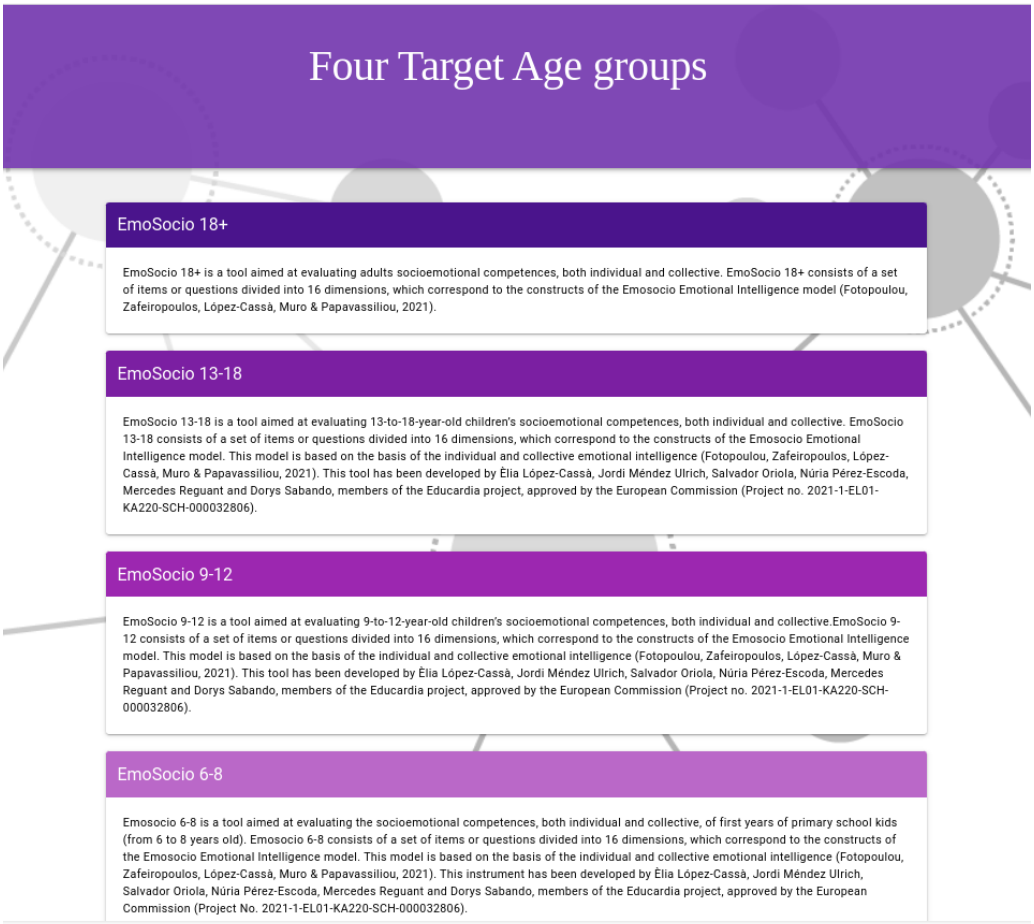

Figure 3: EmoSocio Model

Step 4: Create a new account

Now that you are familiarized with the objectives of the application, it is time to create an account in EmoSociograms. At the end of the landing page you may find the button (REGISTER HERE) to register into the platform. Alternatively, click on https://emosociograms.com/register.

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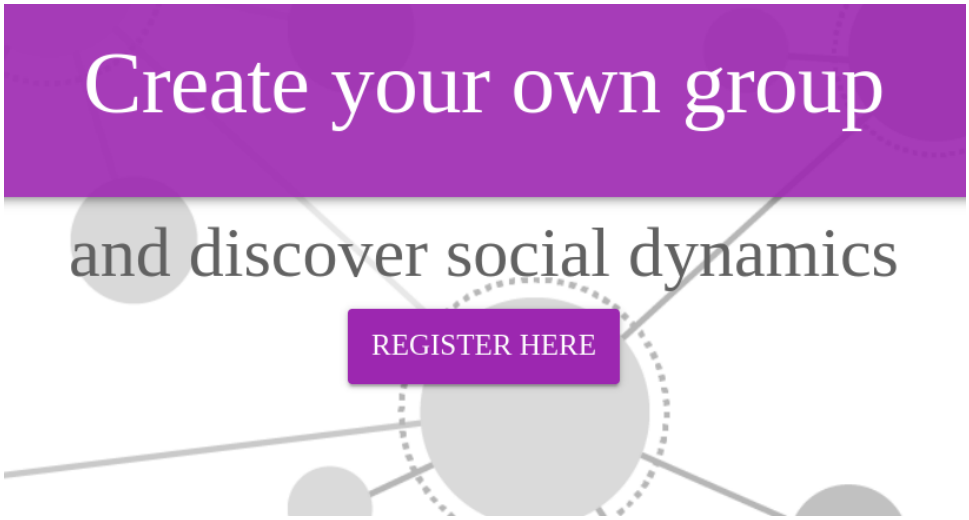

Figure 4: Registration button

The next step is to fill the registration form. Your password should be more than 5 characters, including at least one number, one capital letter, and one special character (e.g., !@#).

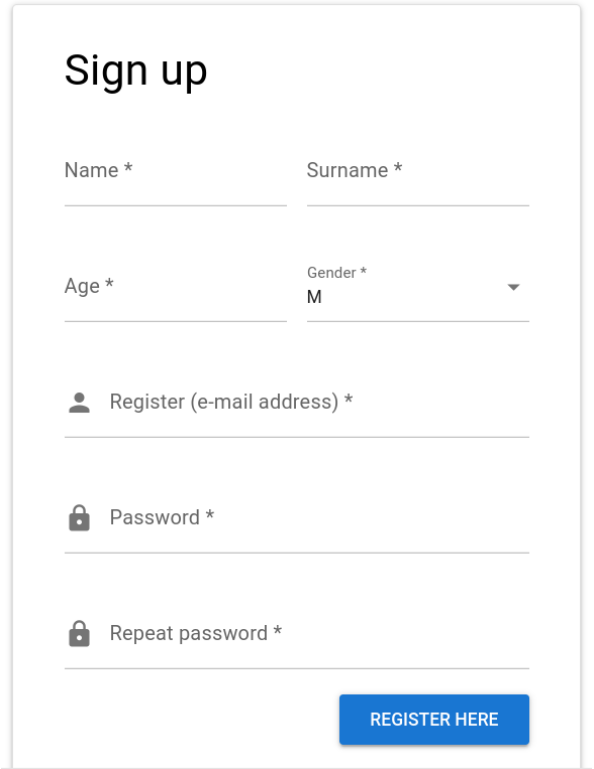

Figure 5: Registration Form

Upon pressing the REGISTER HERE button you will see the following message:

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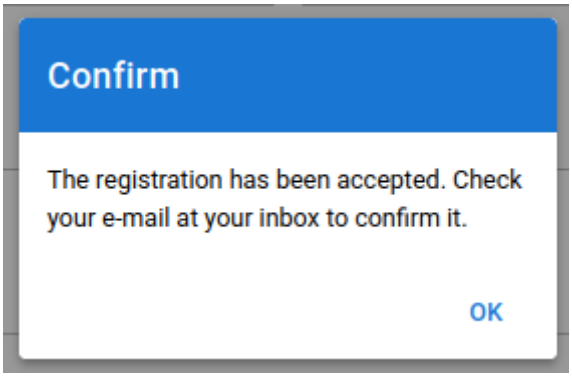

Figure 6: Confirmation message

Go to your email inbox. **In case the email has not arrived within a period of 1-2 minutes, check also your spam folder.** Maybe your e-mail server has placed it there. Upon receiving the email, open it and press the “Confirm” button.

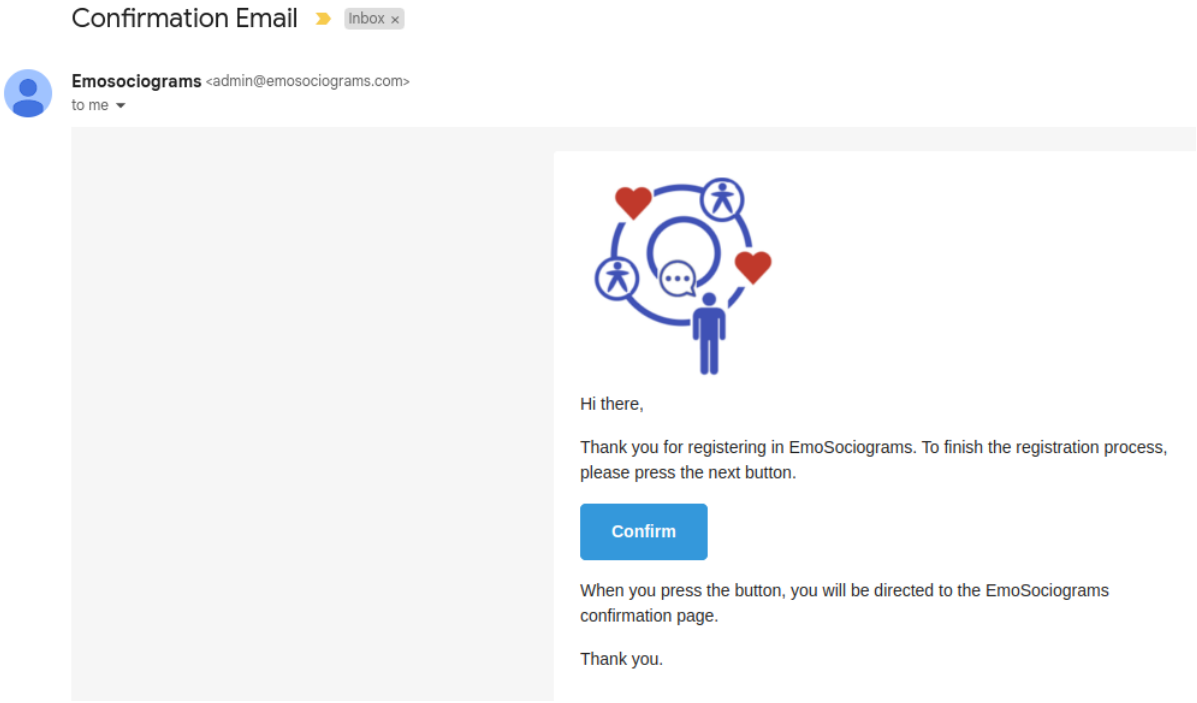

Figure 7: Registration email

Then, you will be redirected at the https://emosociograms.com page:

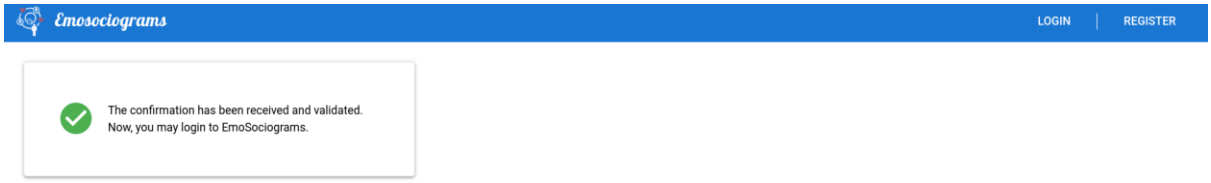

Figure 8: Registration confirmation message

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Step 5: Login into EmoSociograms

Now you are ready to login to EmoSociograms. Press the LOGIN option in the up, right corner or visit the landing page of EmoSociograms.

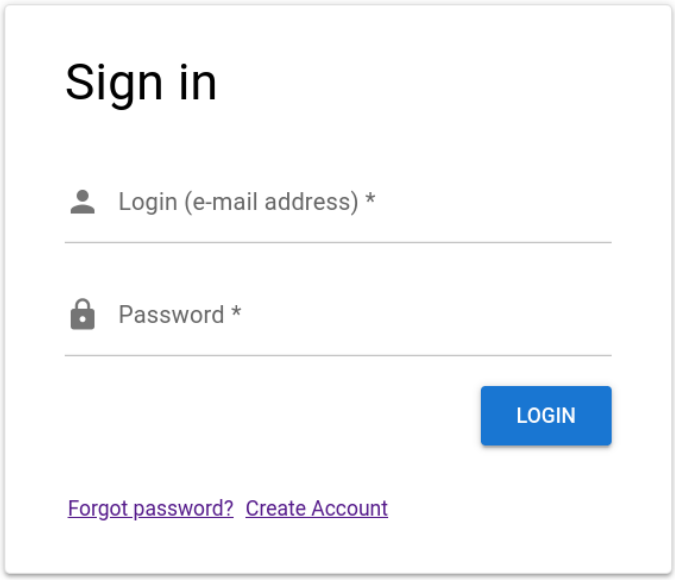

Figure 9: Login Form

Step 6: Create a new group for your classroom

Upon logging into the application you will see a list with your groups/classrooms. At the beginning this list is empty. Let's create a new group. Press the green button "CREATE GROUP".

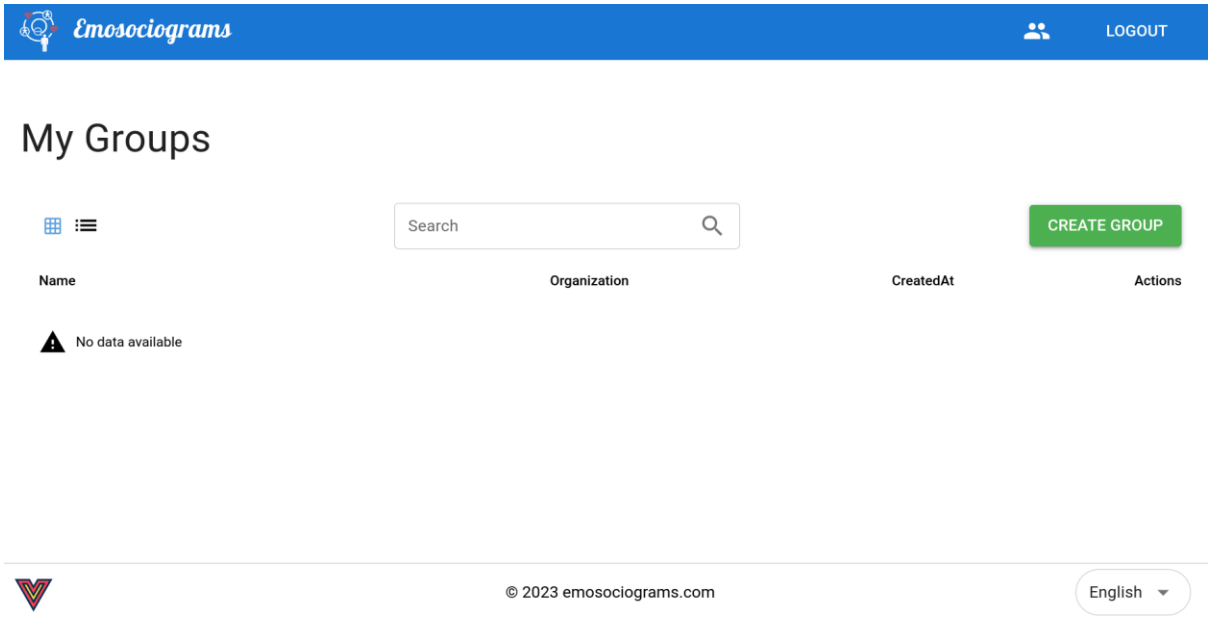

Figure 10: List of Groups

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You have to give a name to your group (e.g., the name of the classroom) and also define the Organization (e.g., the name of the school) that this group belongs to. Moreover, you should select the target age group of your classroom. Finally, you must choose a “password” for the group being created. This password should be something easy and will be asked to the students when they will try to respond to the questionnaires provided in the emosociograms tool.

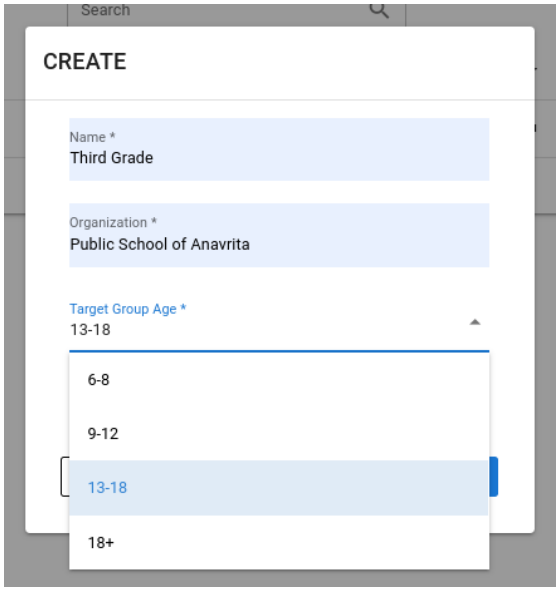

Figure 11: Group creation form (part A)

Upon filling in the form, please press the SUBMIT button.

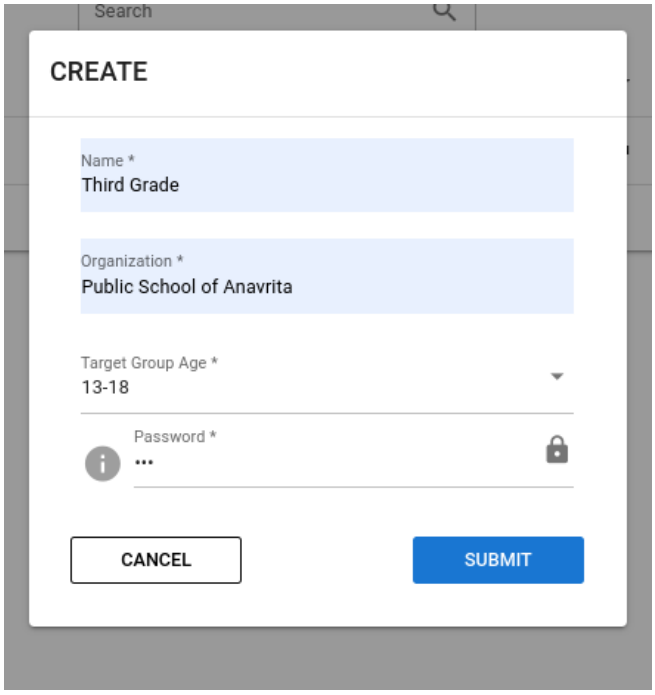

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Figure 12: Group creation form (part B)

Congratulations! Your classroom has been successfully created.

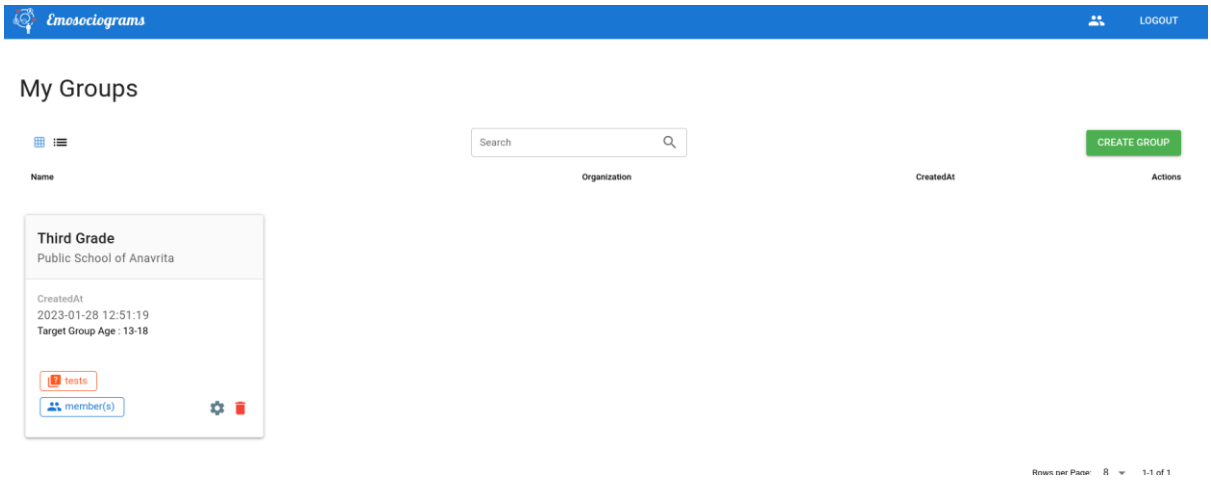

Figure 13: List of Groups

Step 7: Add members to the group

Now let's add your students to the newly created group. To do so, you have to press the "Members" blue button that is placed within your group card. At the beginning there are no members. Press "MORE DETAILS" to go to the page that manages the members of this group.

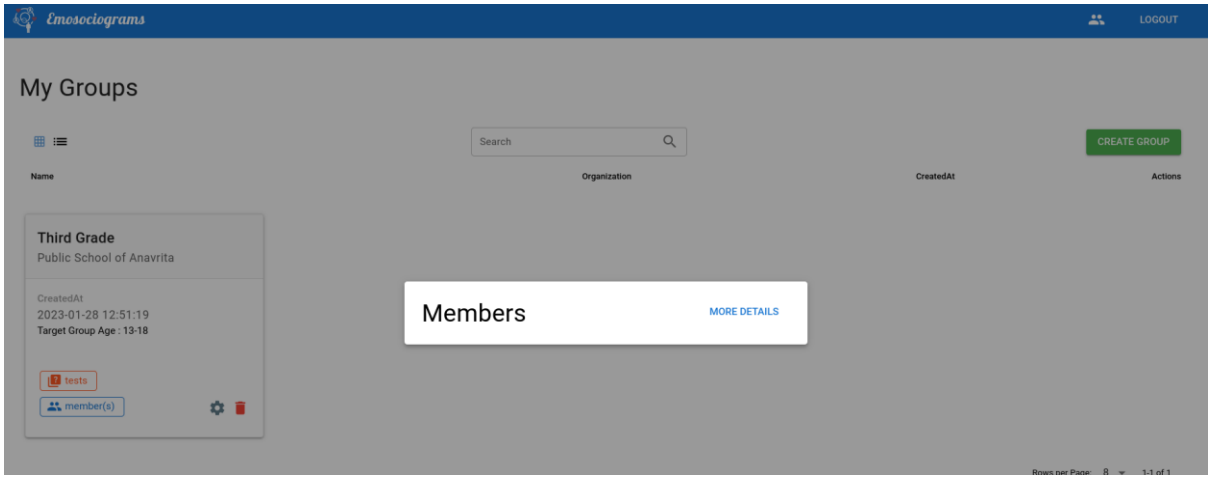

Figure 14: List of Members (empty)

Now you can create the members of your group in two ways.

1) you can add them one by one.
2) you can import them through a csv file.

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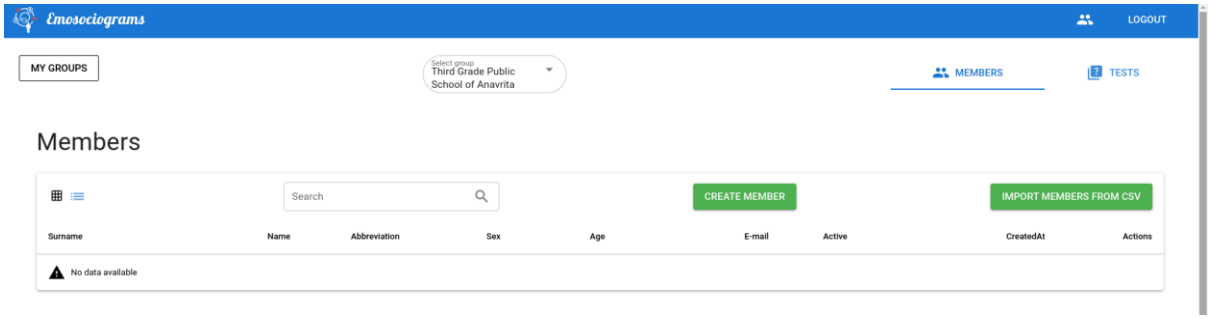

Figure 15: List of Members (empty)

For the first, press the “CREATE MEMBER" button. As seen from the following dialog, you have to enter the name and surname of each student. Also you can enter their email if you wish to receive an invitation to their personal email later on. We'll come back to that point later on. This field is optional. You can also declare an abbreviation for the student. In case you leave this field empty, the default abbreviation of the student will be the first letters of their name. For example if the name of the student is Mary Popins, her abbreviation will be MP. The abbreviations are useful for quick identification of the students at the sociograms of the application. Furthermore, you should declare the age of the student and their gender (M stands for male and F stands for Female). Last but not least, you can declare whether they will participate actively at the questionnaires.

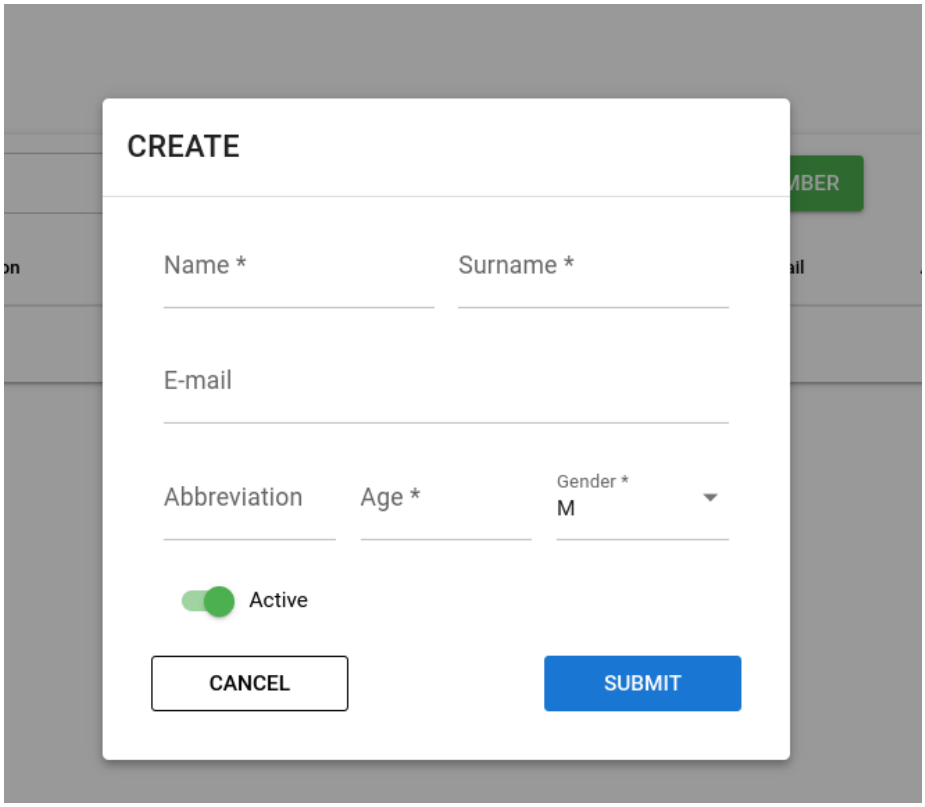

Figure 16: Member creation Form

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An active member can participate in a new test, whereas an inactive member is excluded from future tests. For the time being, it is suggested to leave all of your students active. Upon creating the new student, press the “SUBMIT” button to save the data.

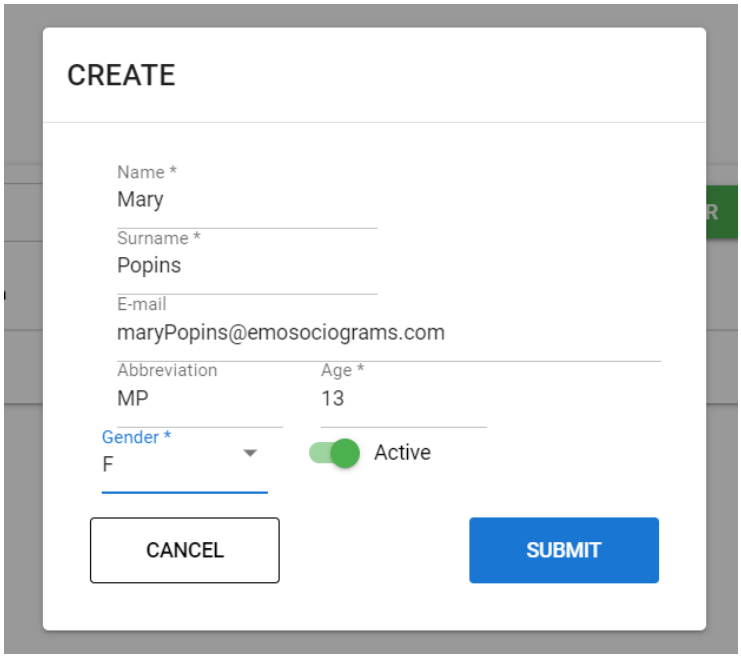

Figure 17: Member creation Form

That’s it! The student has been successfully enrolled into EmoSociograms. You can repeat this step for all your students.

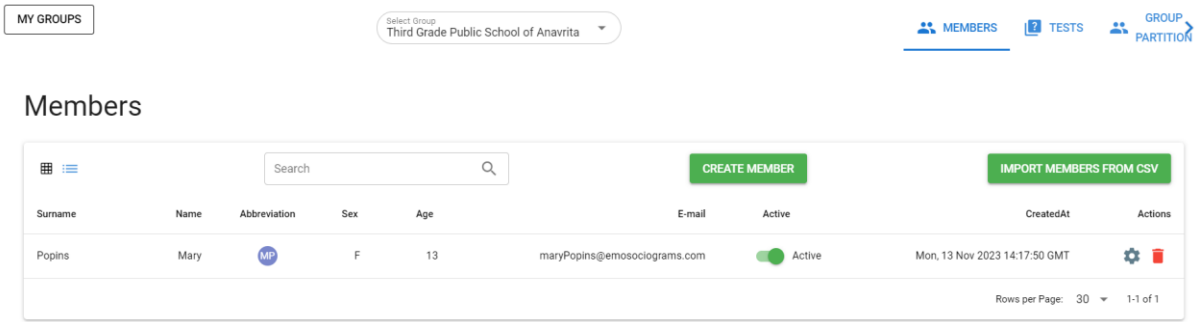

Figure 18: Group Members List

Alternatively, you can import all your students at once by pressing the “IMPORT MEMBERS FROM CSV” button.

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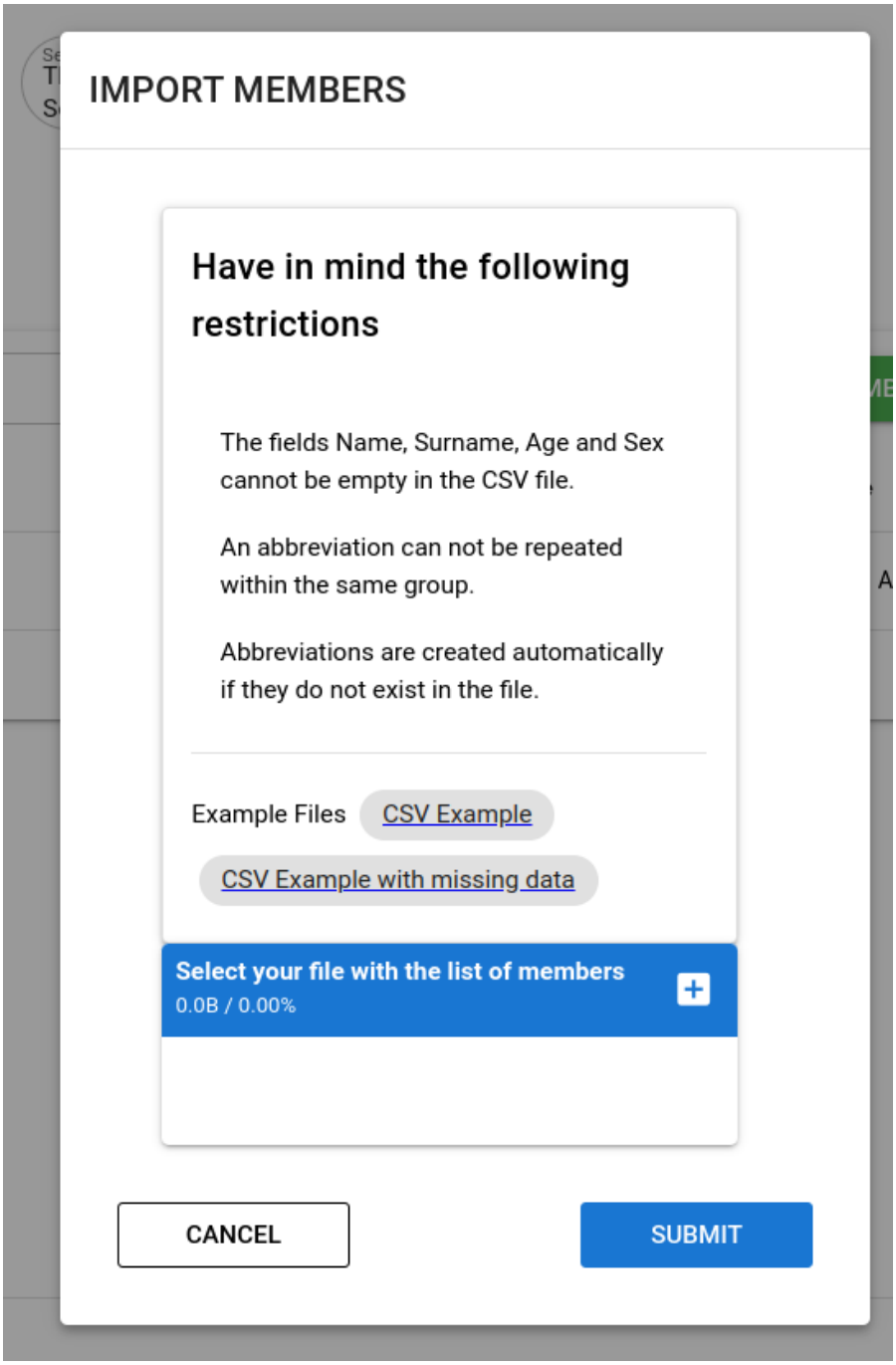

Figure 19: Import members through a csv file

To do so you can download some example files from the dialog. Please read carefully the instructions in the form. Please download the “CSV Example” file and open it.

Email	Name	Surname	Abbreviation	Age	Sex
ada@emsociograms.com	Ada	Lovelace	AL	13	F
albert@emosociograms.com	Albert	Einstein	AE	40	M

Figure 20: Example csv file with members

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This example file includes two students Ada and Albert. You can add students by following the proposed structure, press the + button at the form and upload your csv file.

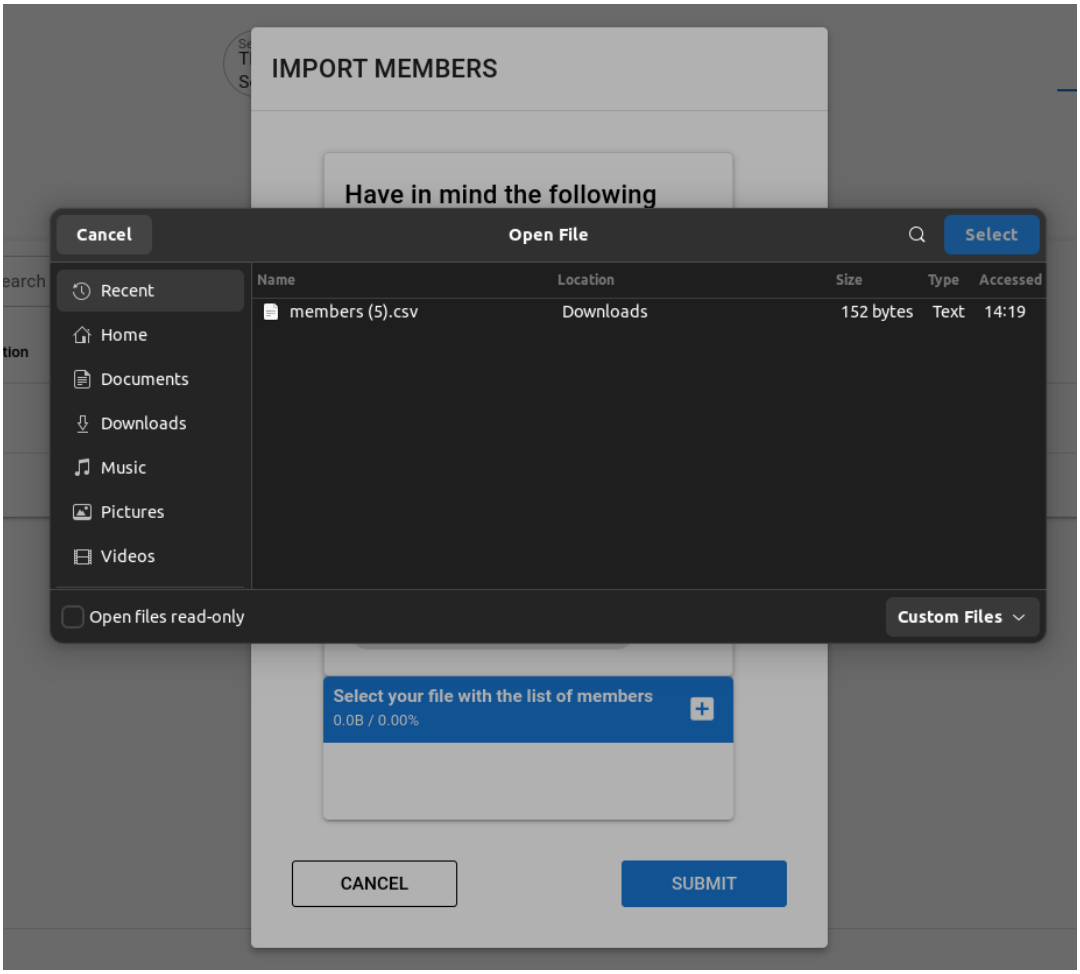

Figure 21: Upload csv file with members

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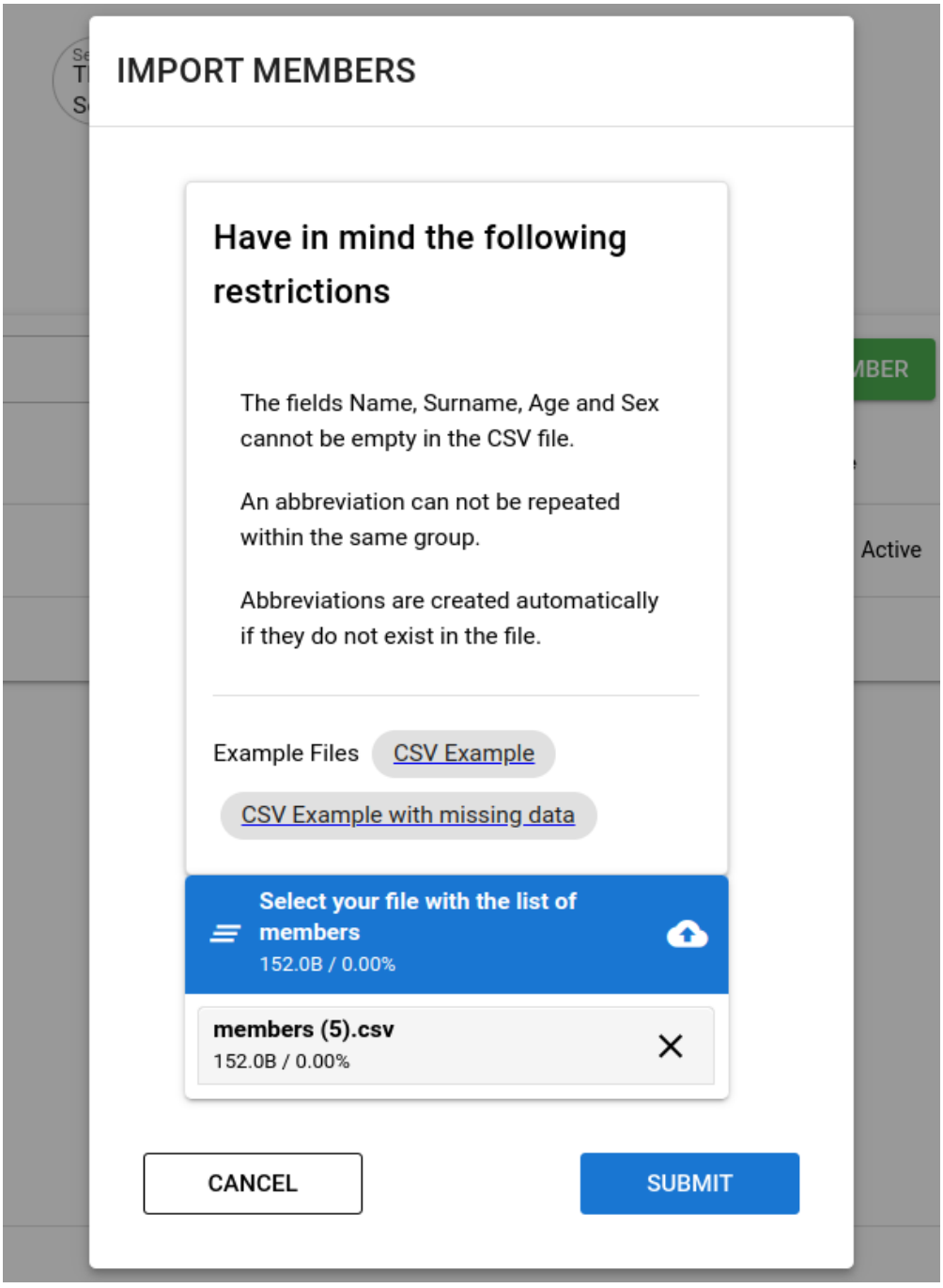

Figure 22: Upload csv file with members

Press the SUBMIT button to import the students at once.

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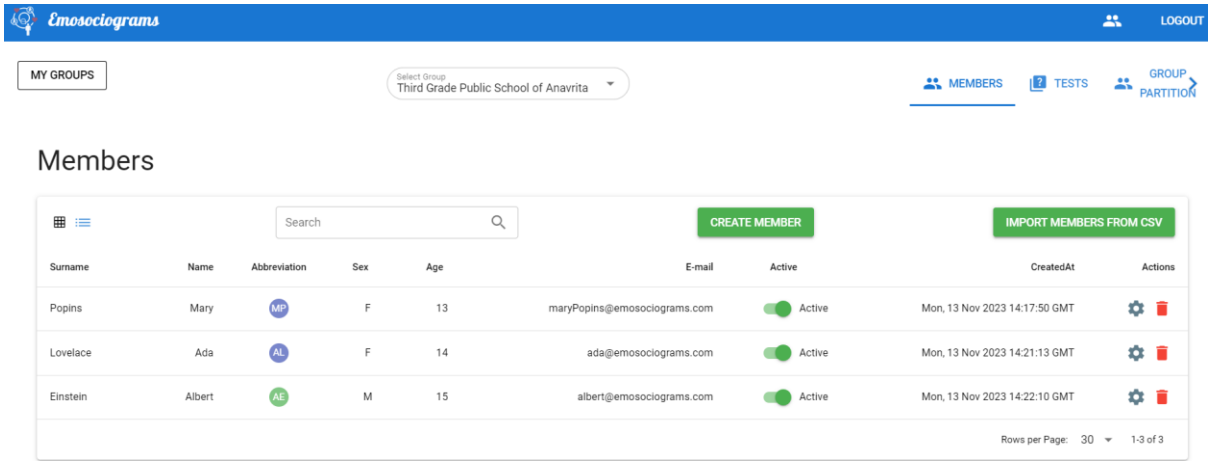

Figure 23: Group Members List

As seen, Ada and Albert have been successfully enrolled as members of your group.

Step 8: Create a test

Hooray! Has it been difficult so far? You have done it great! The next step is to create some tests for your classroom.
Depending on the students' age, EmoSociogrmas will present you with different types of questionnaires to select. The following table depicts the questionnaires you will use per target age group.

Age	Questionnaire	Details
6-8 years old	Emo-Tutor	Observation scale (40 items). The teacher is in charge of answering on behalf of the students. The scale is from 0 to 10 (0=Never, 10=Always) for each item.
	CEI-Tutor	Observation scale (7 items). The teacher is in charge of answering on behalf of the students. The scale is from 0 to 10 (0=Never, 10=Always) for each item.
	Emo-DECREA-EVAL	Observation scale (8 items). The teacher is in charge of answering on behalf of the students. The scale is from 0 to 3(0=Never, 3=Always) for each item.
	Socio(S)-YoungChild	Individual questionnaire with 4 sociometric questions addressed to the students. The students can answer with the help of the teacher.

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9-12 years old	Emo-Child	Answered by students. Individual questionnaire with 39 items scoring between 0 and 10 (0 = Never, 10 = Always).
	CEI-Child	Answered by students. Individual questionnaire with 9 items scoring between 0 and 10 (0 = Never, 10 = Always).
	Socio(S)-Child Socio(W)-Child	Answered by students. Individual questionnaire with 4 sociometric questions. Answered by students. Individual questionnaire with 4 sociometric questions.
	EmoTEIQue-CSF-EVAL	Answered by students. Individual questionnaire with 36 items scoring between 0 and 4 (0 = Completely Disagree, 4 = Completely agree).
13-18 years old	Emo-Adolescent	Answered by students. Individual questionnaire with 44 items scoring between 0 and 10 (0 = Never, 10 = Always).
	CEI-Adolescent	Answered by students. Individual questionnaire with 9 items scoring between 0 and 10 (0 = Never, 10 = Always).
	Socio(S)-Adolescent Socio(W)-Adolescent	Answered by students. Individual questionnaire with 4 sociometric questions. Answered by students. Individual questionnaire with 4 sociometric questions.
	EmoTEIQue-ASF-EVAL	Answered by students. Individual questionnaire with 30 items scoring between 0 and 4 (0 = Completely Disagree, 4 = Completely agree).

To create a test based on one of the above questionnaires, press the TESTS tab that is placed at the top right corner of your screen.

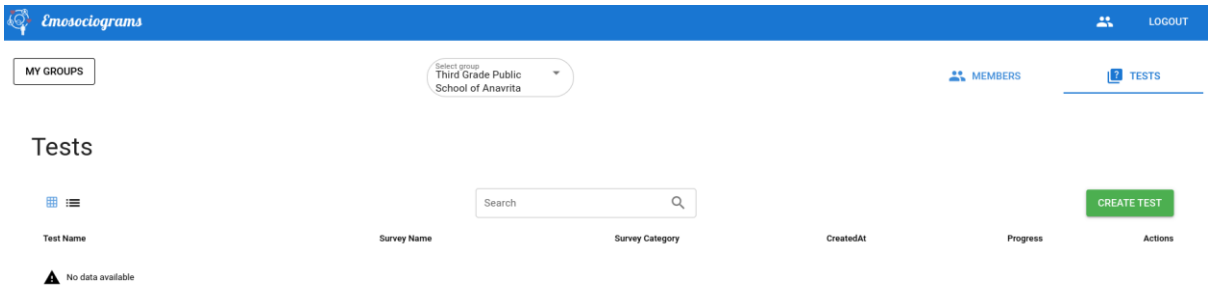

Figure 24: Tests List (empty)

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Your tests are empty for the time being. Let's see the type of the tests you can create. Press the button "CREATE TEST". You should see the following dialog.

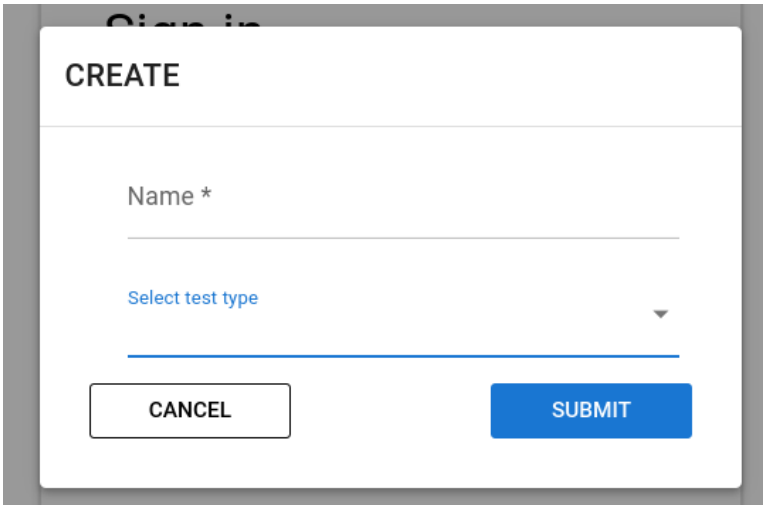

Figure 25: Test Creation Form

Choose the type of test you want to create and give a friendly name. As seen at the drop down type, for the target age of our sample group (13 - 18 years old), 4 questionnaires are available. Each age group has their own psychometric questionnaires. Independently of your classroom's age group, you should create one of each of the available tests.

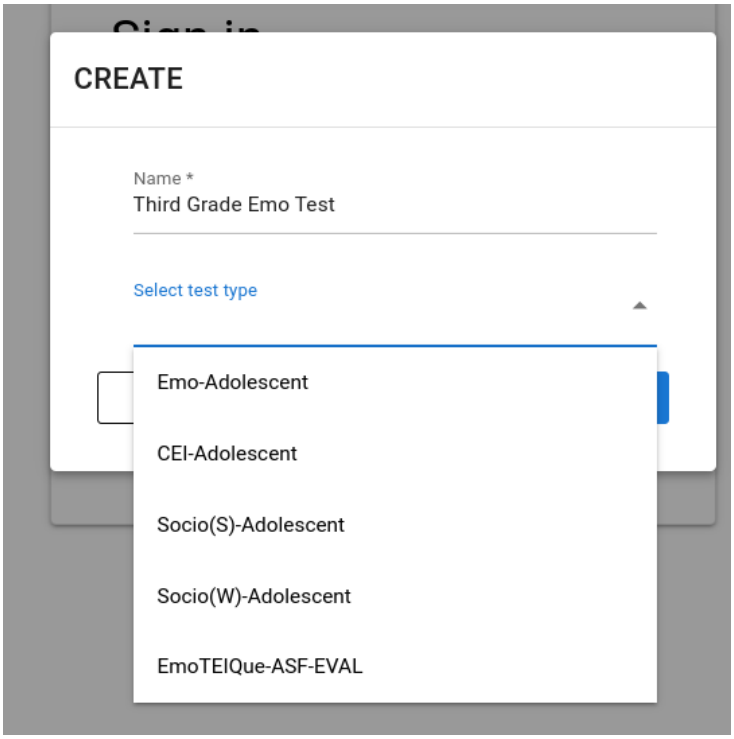

Figure 26: Test Creation Form

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First we can create an Emo test. Select the “Emo-Adolescent” option and press the SUBMIT button.

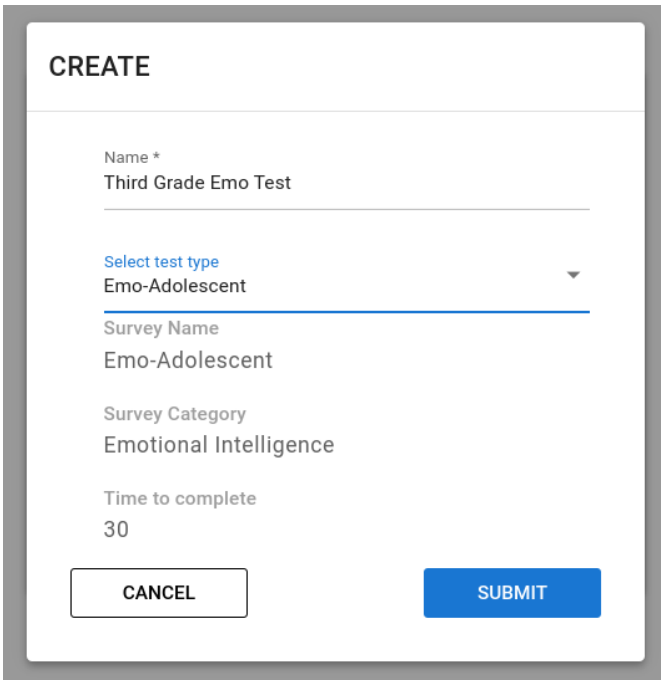

Figure 27: Test Creation Form

You can see the details of the test you created.

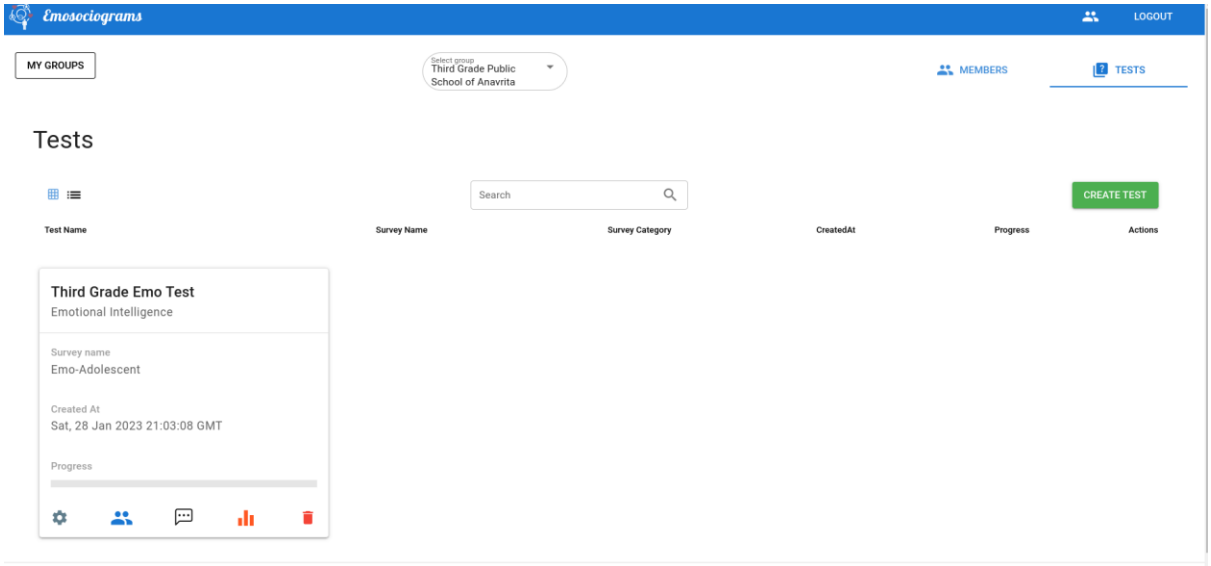

Figure 28: Newly created test

At the bottom part of the test card you can see a set of actions.

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Step 9: Respond the test

Press the option  to explore how to collect the responses for your test. You will be redirected to the following screen.

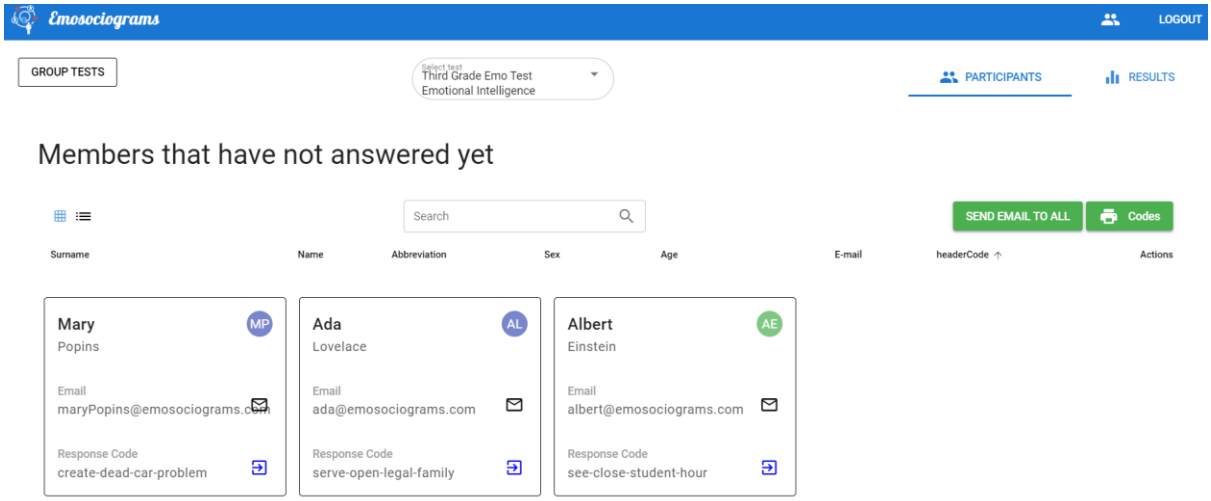

Figure 29: Test participants detailed view

You can see all the participants that have to respond to the created test.

The students can respond to the test in three different ways.

1. By using their participation code.
2. Via the account of the teacher.
3. By getting an e-mail invitation.

Following, these three ways are presented.

Respond by using a participation code

Each participant's card has a response code. This code is generated automatically per test per student. By pressing the button "Codes" 

(as shown in the upper right corner in figure 29) you are presented with a document where all student names are mentioned, as well as their respected response codes (as shown below). You can print this document to hand out the response codes for all participating students, thus making the response of all tests easier.

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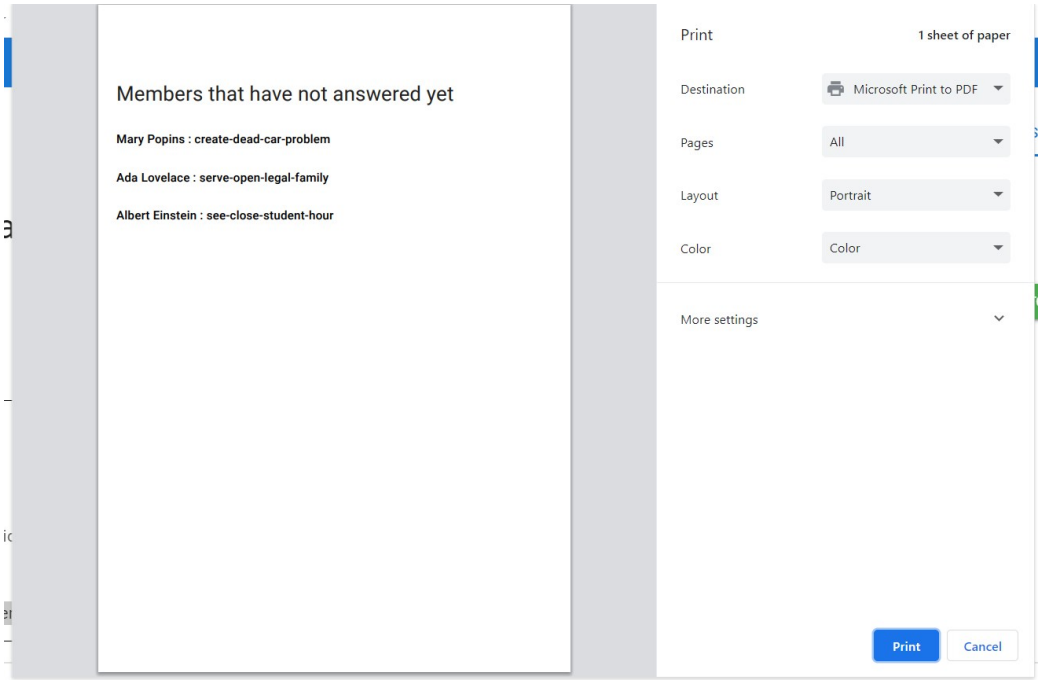

The teacher gives to each one of the students his-her participation code. In the following example, Mary's participation code is *create-dead-car-problem* (as shown in Figure 29).

Mary has to visit https://emosociograms.com and press the button "PARTICIPATE NOW".

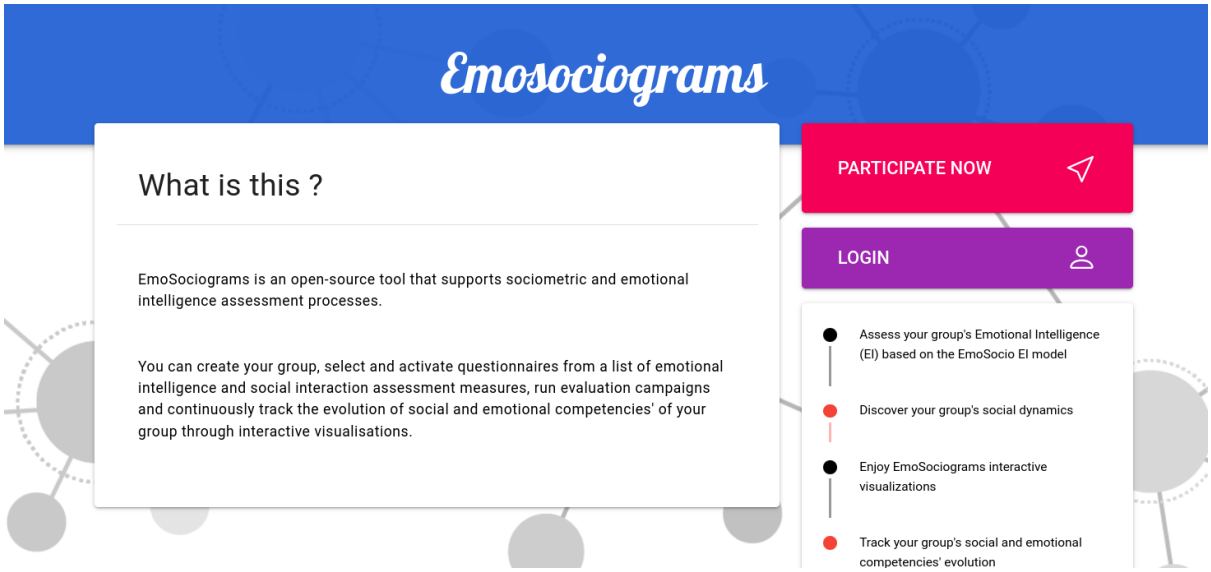

Figure 30: Participate to a test

She will be redirected to the following screen where she has to enter her participation code and press ENTER.

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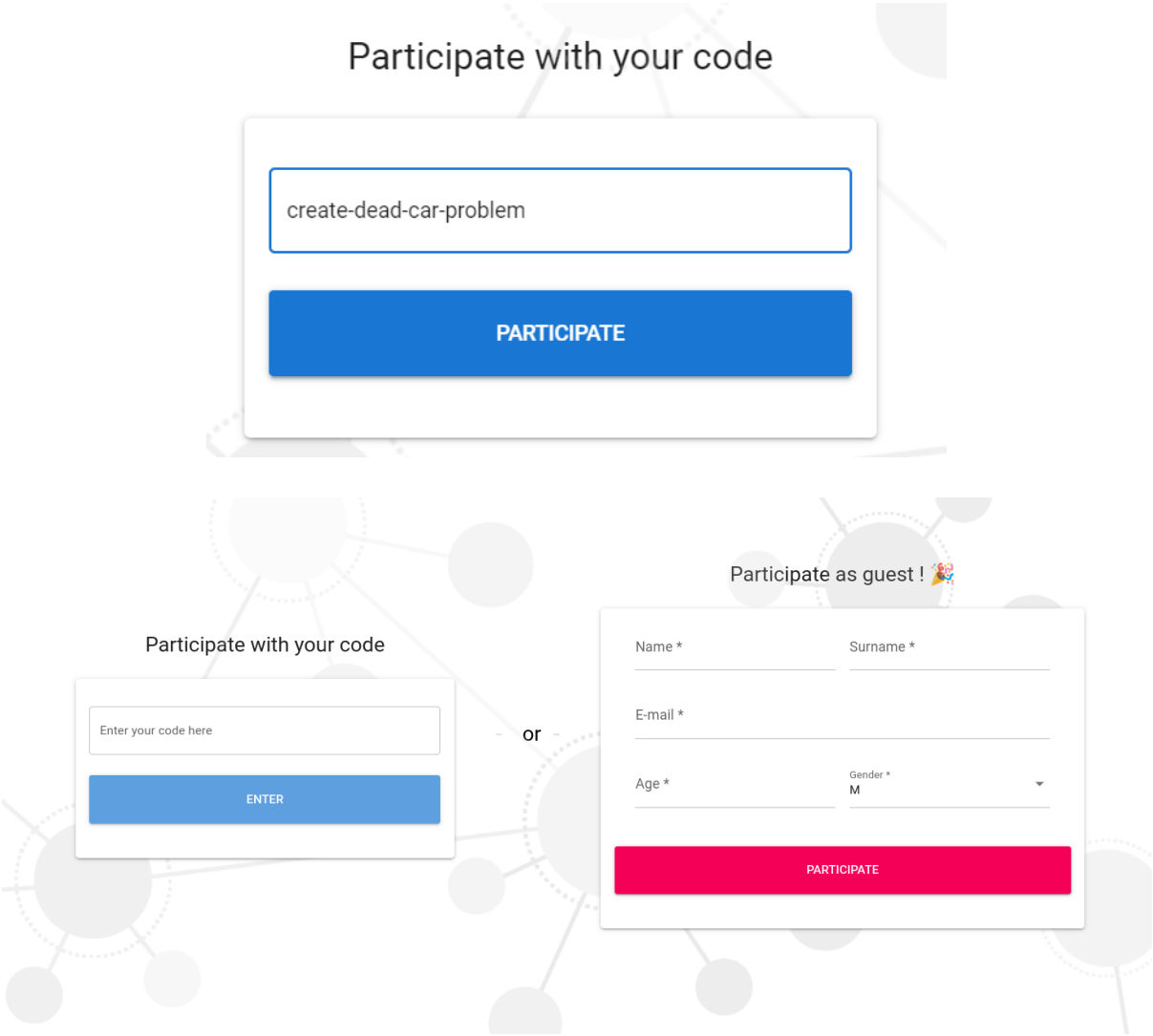

Figure 31: Participate to a test

Once the student enters his/her personal “participation code”, he/she then will be asked for the group code that was set by the teacher in “Step 6: Create a new group for your class”.

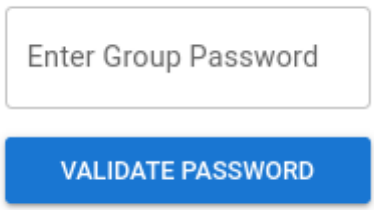

Figure 32: Introduce the group password set by the professor

The student will see some details about the test he/she has to respond to.

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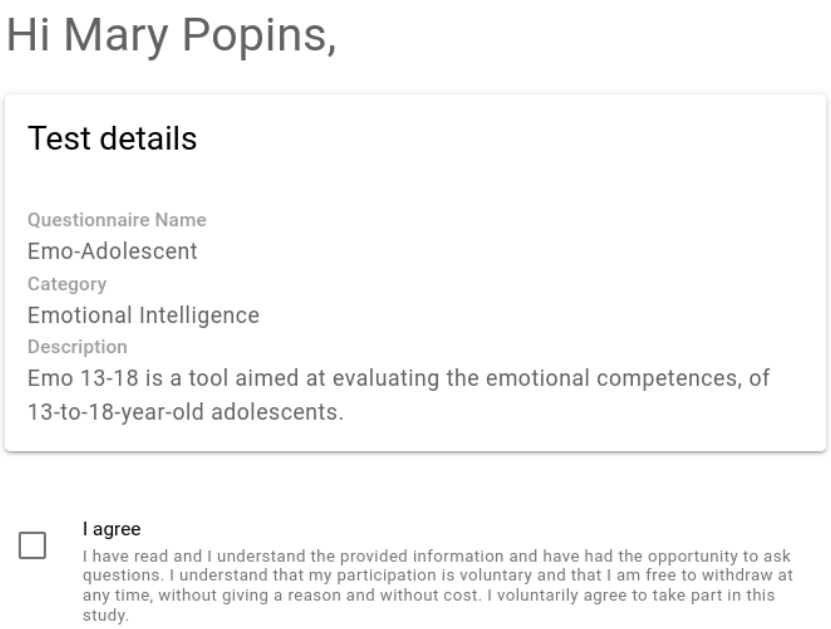

Figure 33: Respond a test

Before proceeding with the assigned questions, the student has to press the “I agree” option. The student should carefully read the instructions before pressing the START button.

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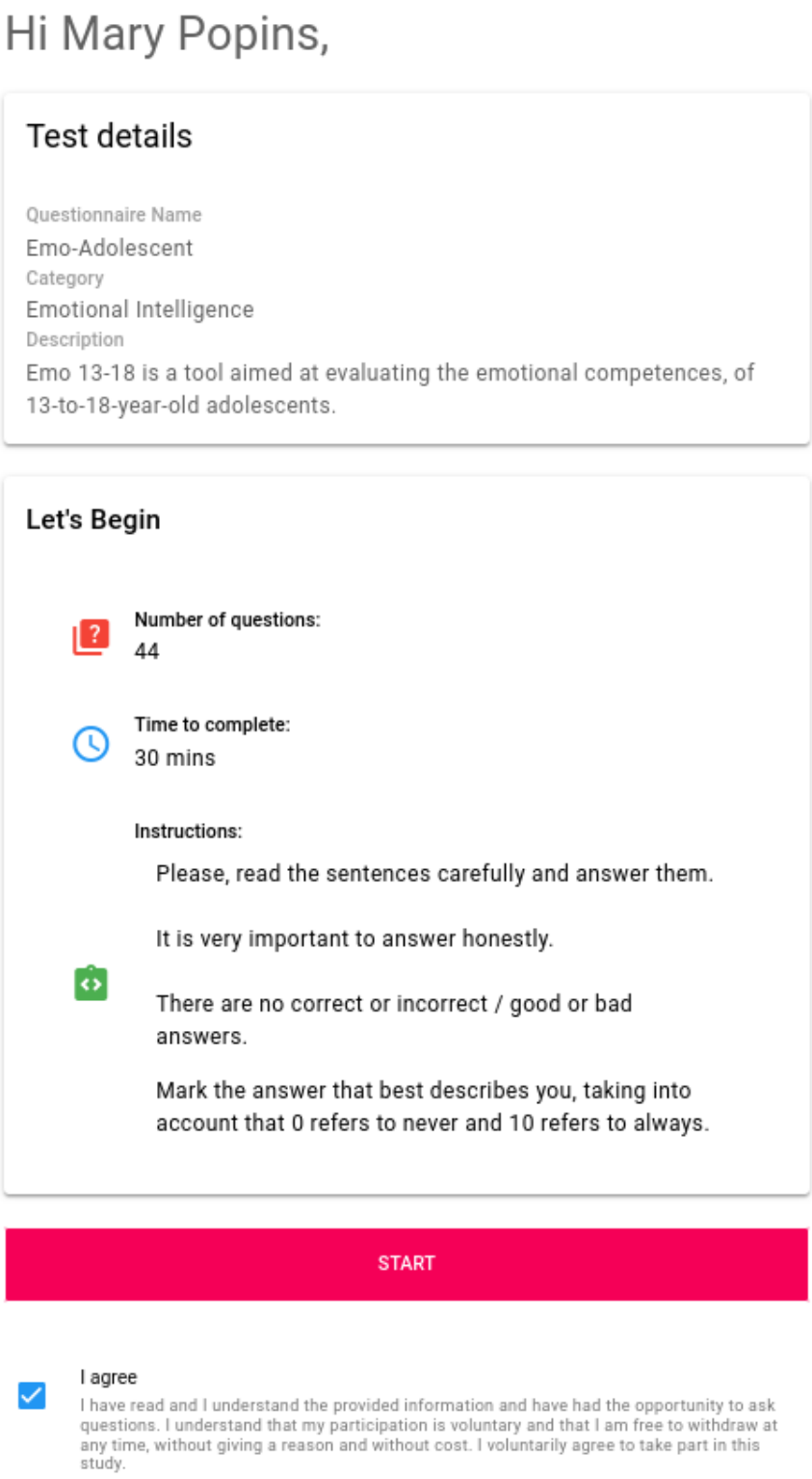

Figure 34: Respond a test

As long as the student presses the START button, he/she can respond to the questions of the test.

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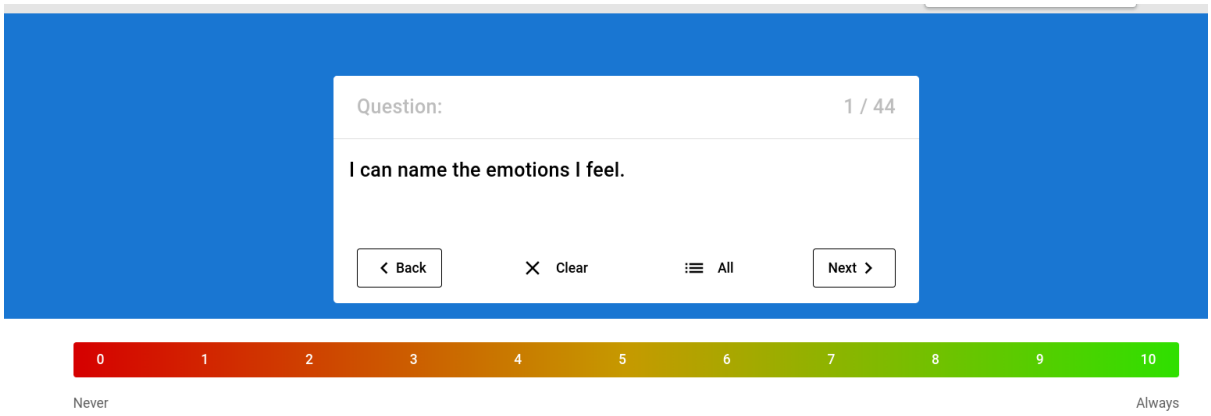

Figure 35: Respond to a test

When done, the student presses the SUBMIT button. it is important to respond to all the provided questions (including the last one). In case the submit button is not active, check in the option “All” to see if there is any question that has not been responded to. If this is the case, you have to respond to it and move with the “next” button (or the option “All”) to the end of the test to press the SUBMIT button.

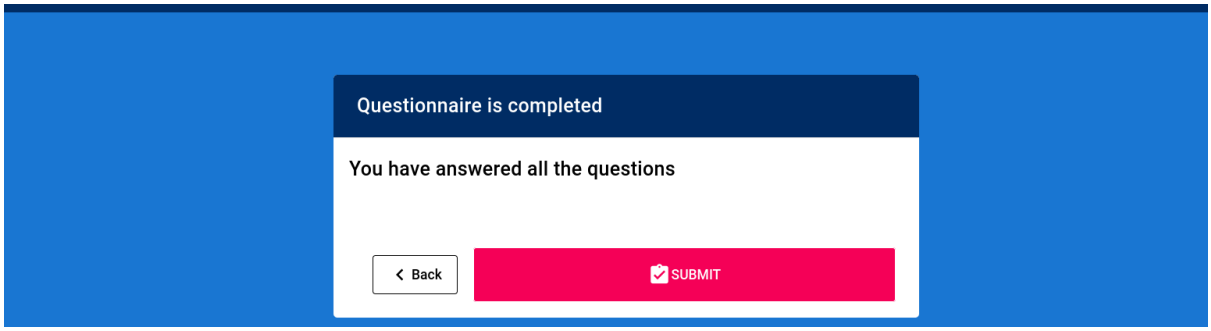

Figure 36: Submit responses to a test

When the student will submit correctly his/her responses, he/she should see the following message.

Figure 37: Successful participation message

This process should be repeated by all students in the classroom. The teacher has to facilitate all students with their participation codes.

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Respond via the account of the teacher

If one student finds it difficult to use his/her participation code, the teacher could facilitate the access to the test via his own account. The teacher can select the blue arrow button from the student card. After that, the student could start responding to the test.

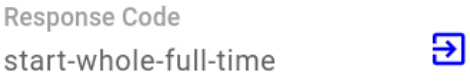

Figure 38: Blue arrow button

This way of responding to a test is ideal for ages 6-8, where the teacher responds to the test on behalf of the students. In that case, the teacher has to visit all the students cards, press the button next to the Response code, and follow the tests instructions.

Respond to a test via an e-mail invitation

The third option to respond to a test is by sending an e-mail invitation to the students. This may be especially useful for the last grades of the primary school and the adolescents. To use this option, the teacher has to assign a valid e-mail per student when he/she adds members to his/her group at step 7. Similar to the previous cases, the teacher has to go to the answers page.

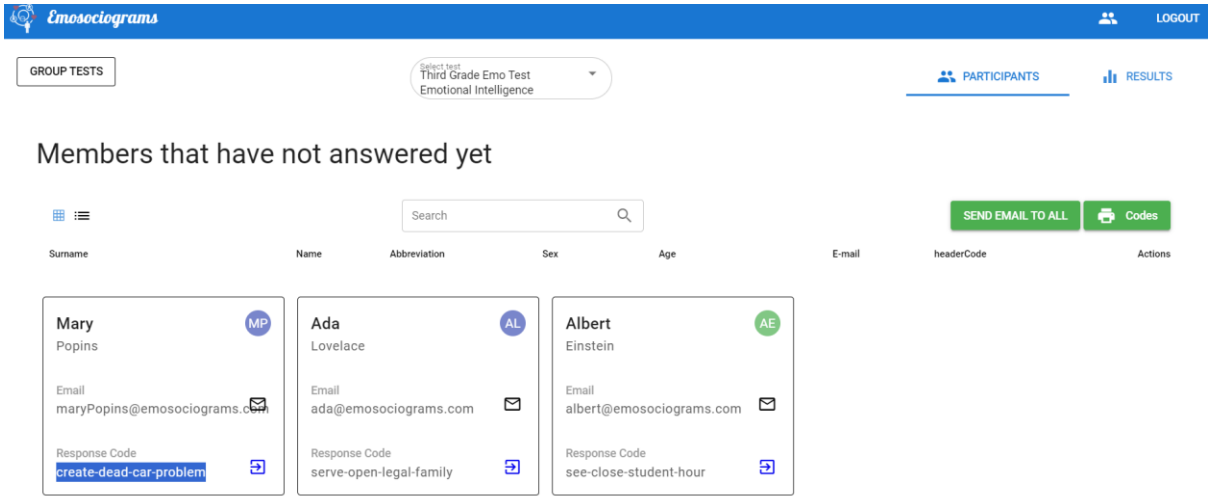

Figure 39: Test answers status

By pressing the button “SENT MAIL TO ALL”, all students with e-mail will receive an invitation from their teacher. The teacher may also send an e-mail individually by pressing the

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“envelope”  button on each student's card. The students will receive an e-mail at their e-mail account that will look like this:

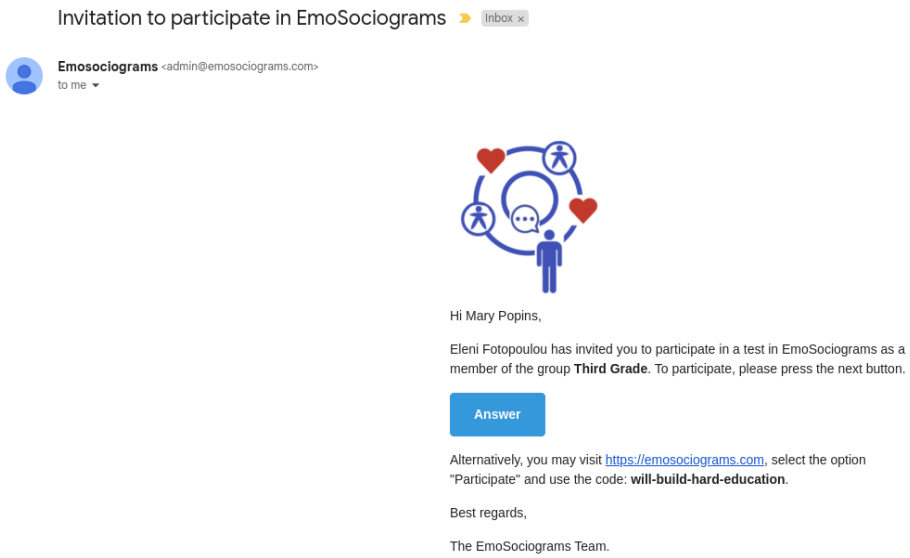

Figure 40: EmoSociograms invitation page

The students have to press the button “Answer”. They will be redirected to a page to respond to the test. In case your students complain about not receiving the e-mail, it is recommended to do two things:

- Check that the e-mail assigned to the student is not misspelled.
- Propose to your student to check also his/her spam folder.

Step 9 has to be repeated for all the provided questionnaires that are available for your classroom. Check out step 8 to see all the available questionnaires per target age group.

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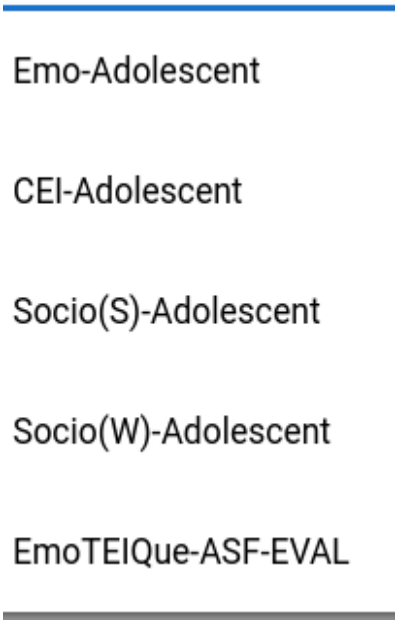

Figure 41: List of questionnaires available for the 13-18 target age group

Step 10: See the results

The teacher can go to the test cards screen and check the progress bar of the tests while the students are responding to them. By viewing the progress bar, teachers can quickly see how many of their students have completed the test.

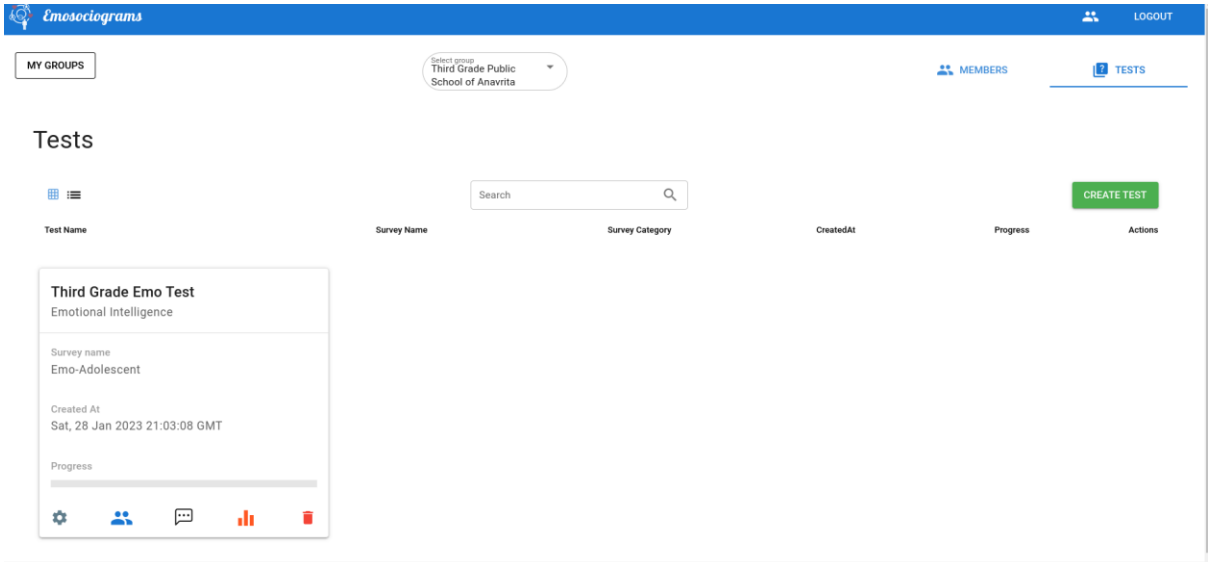

Figure 42: Test cards view

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Furthermore, the teacher can check out the results, by pressing the barplot button . Each test has different results.

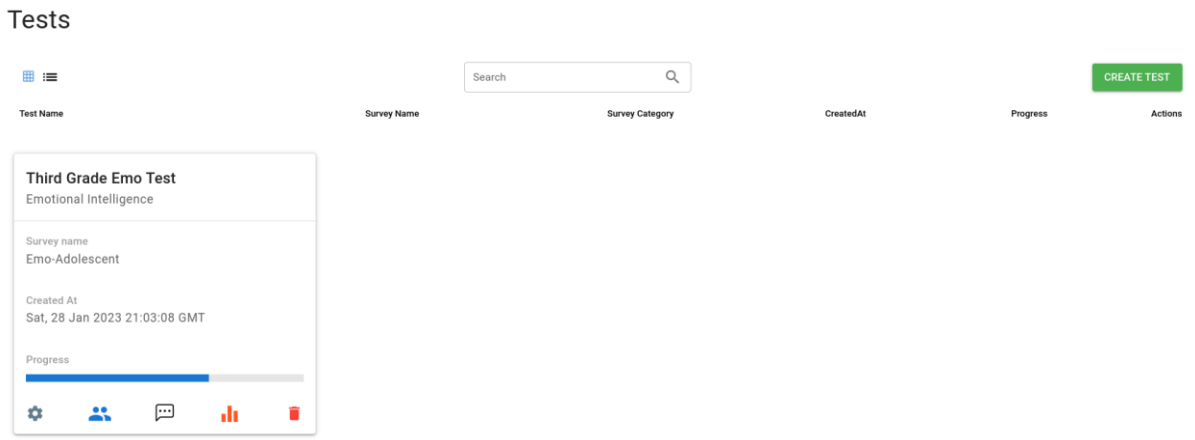

Figure 43: List of tests (with progress bar)

In the Emo-Adolescent test you will see the following screen.

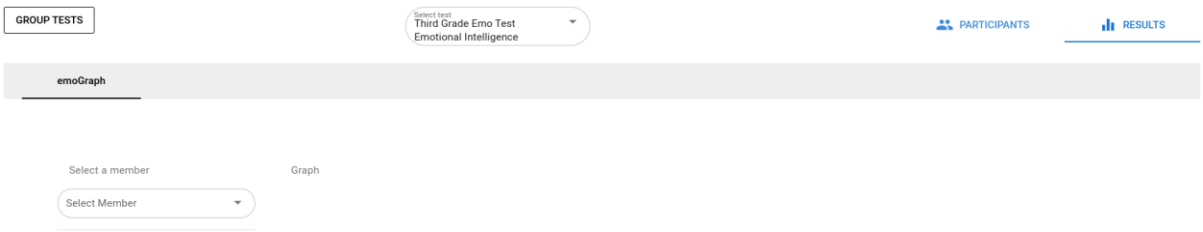

Figure 44: Results of an Emo test

You can select a member and check out the results of their responses.

The results are individual and assess the dimensions of Emotional Intelligence (described above): Self-Awareness, Empathy, Emotional Regulation, Flexibility, Influence, Emotional Expression, Optimism, Assertiveness, Self-Motivation, Relationships, Self-Esteem, and Teamwork.

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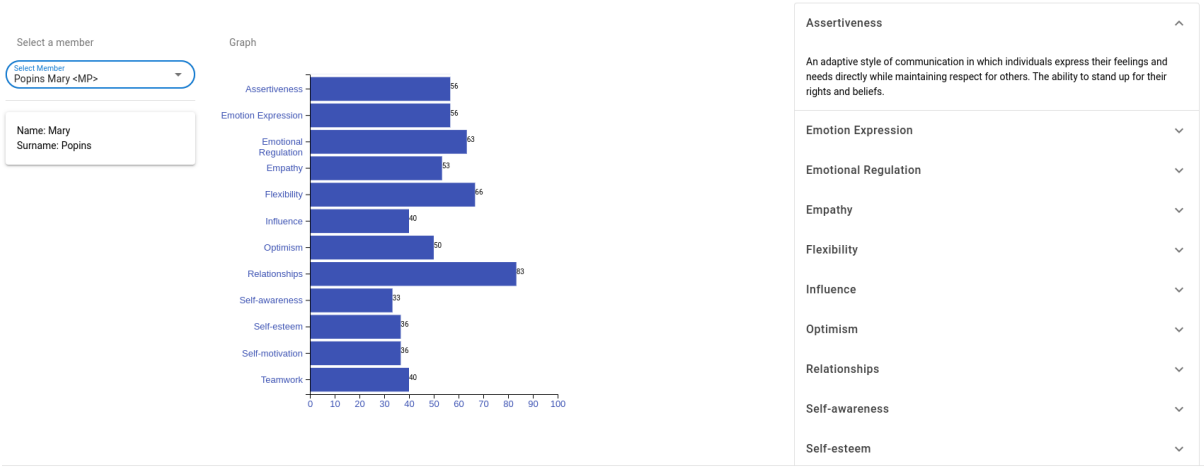

Figure 45: Results of an Emo test

The answers range from 0 to 100, with 0 being the absolute lack of competence in the dimension and 100 being the maximum mastery of competence. In the example presented here, we can see that the lowest score is in the competence of Self Awareness (33) and the highest is in the competence of Relationships (83).

The scores are individual and the subjects are not compared with each other but are evaluated in relation to the scale score and their evolution across time. All dimensions have room for improvement and should therefore be interpreted as aspects that can be developed.

You can also control the students that have responded to the test, or not. Some of them might need a kind reminder to complete their answers. In our example, Mary and Ada have responded to the test, while Albert hasn't.

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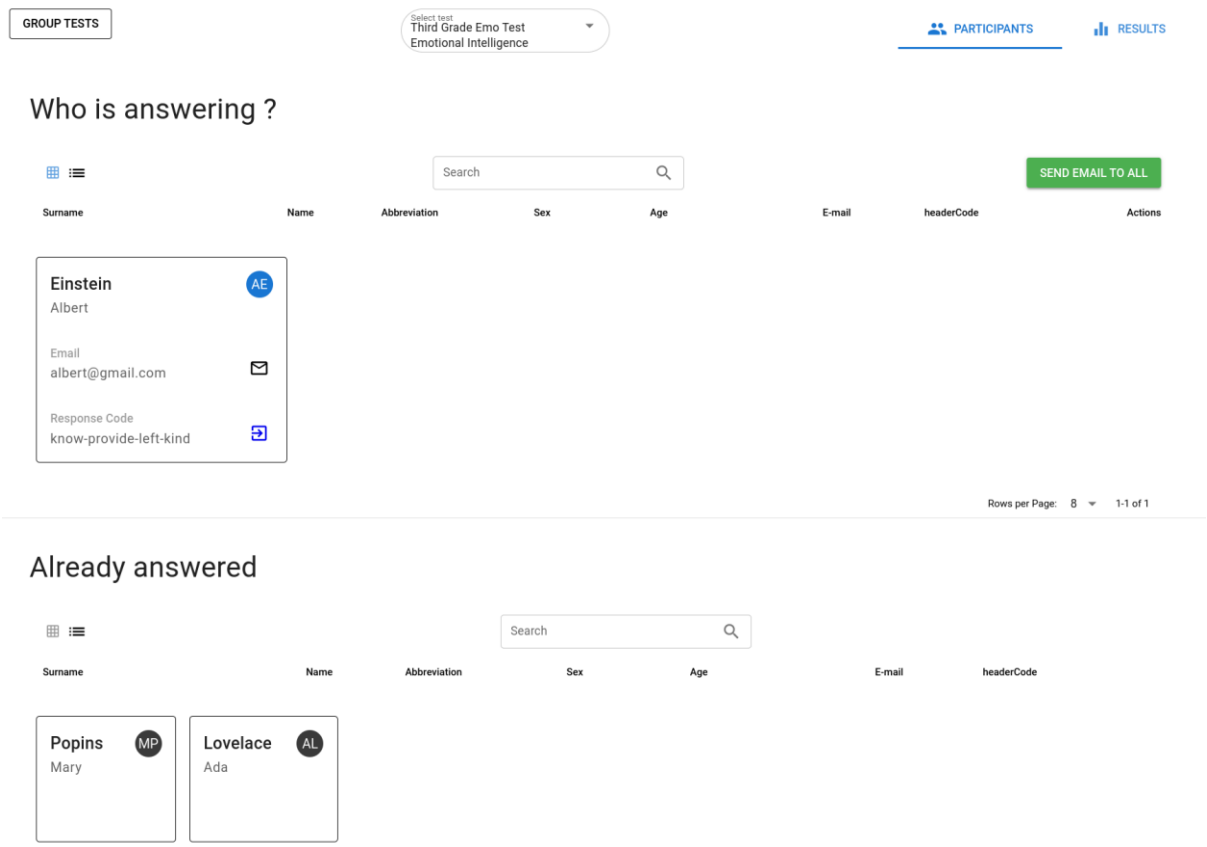

Figure 46: Status of students regarding their responses to a test

As said before, each test has its own results. Following, you may find some examples. Figure 46 depicts the results of a Collective Emotional Intelligence (CEI) test.

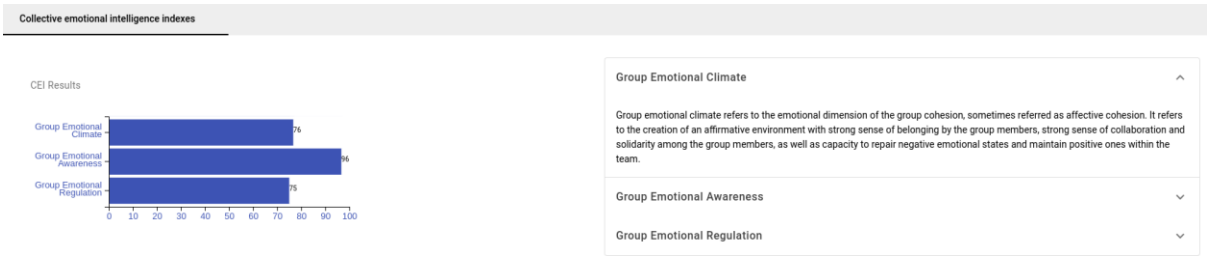

Figure 47: Results of a CEI test

For a Collective Emotional Intelligence (CEI) test the results are group-based and assess the dimensions of collective emotional intelligence: group emotional awareness, group emotional regulation, and group emotional climate.

The answers range from 0 to 100, with 0 being the absolute lack of competence in the dimension and 100 being the maximum competence domain. The results per dimension can be visualized in the Emosociograms tool for the whole class group. In the example presented

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(Figure 46) it can be seen that the lowest score for all three competences is the Group Emotional Regulation (75).

Figure 48.1 depicts the results of a sociometric test. You can zoom in and out the sociometric graph by moving your mouse roller. Check out all different tabs to get more information about the social dynamic of your group (Group Sociogram, Group Sociometric Indexes, Ego-sociograms, Individual Sociometric Indexes).

At the “Group Sociogram” tab, the "Preferences" option, shows the preferences among the members of the group. In figure 48.1, the nodes represent the students, while the edges represent the relationships between them in terms of social preferences. For example, student C7 prefers to interact with C1. If there is any doubt about who is who, on the screen where the students are registered, you can consult the acronyms assigned to the name of each student.

In the preferences graph you can see the level of popularity of each student. It is worth noting the size and color of the nodes. If the nodes are large and light-colored, this indicates that the students to whom they belong have many positive relationships. If the node is smaller in size and bright blue in color, it is interpreted that the student represented is less integrated in the class group. In this sense, it is advisable for the school to pay special attention to this data in order to guarantee the inclusion of all members of the group.

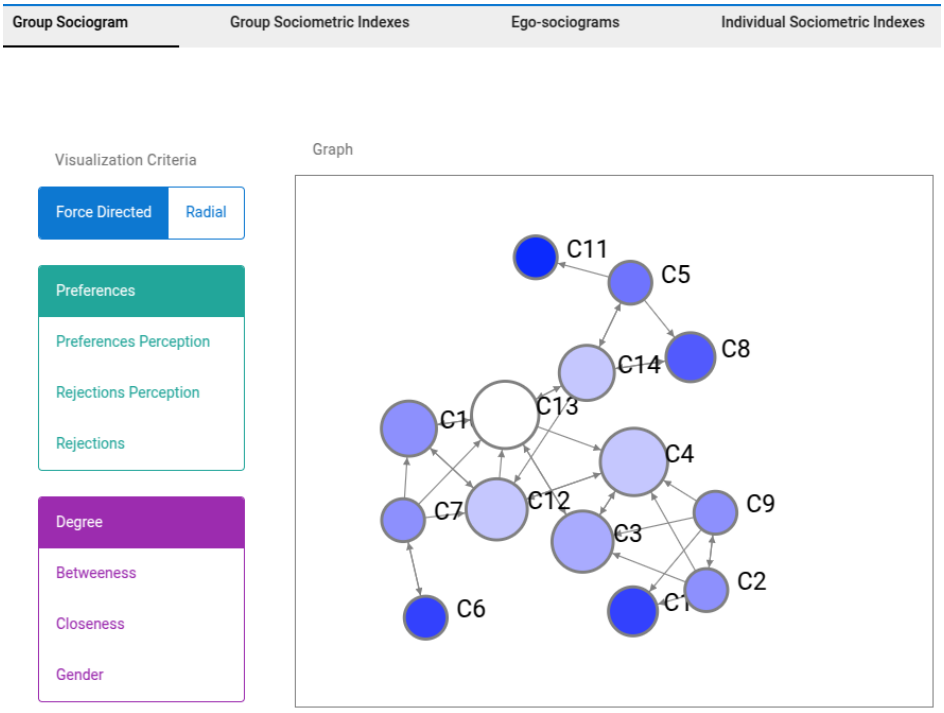

Figure 48.1: Results of a Socio test

In the "Preferences Perception" option, one can see the students' opinions about their positive relationships with others. That is, in the sociogram in Figure 48.2, student C5 considers that

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student C14 "prefers" him/her as a friend. This may or may not be true. In this example, the perception of preference that C5 has is true since it can be seen in Figure 48.2 that C14 also chooses C5 as a friend. Moreover, they seem to have a mutual relationship since they choose each other. It is worth noting that the sociograms of "preferences" and "perceived preference" are often similar but not the same. It is interesting to note that there are students who feel more "popular" than they really are or students who underestimate their positive social position in the group. For example, in the preference sociogram, the C4 student receives a total of 5 selections while in the preference perception sociogram, he/she thinks he/she is preferred by 3 classmates. In this case, the C4 student underestimates his/her positive social position within the class (Figure 47.3).

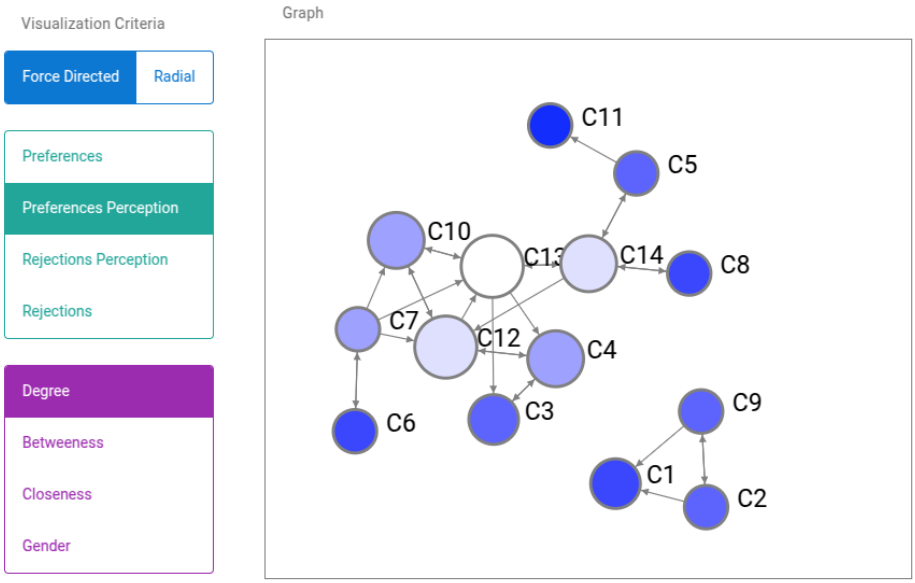

Figure 48.2. Sociogram of preference perception

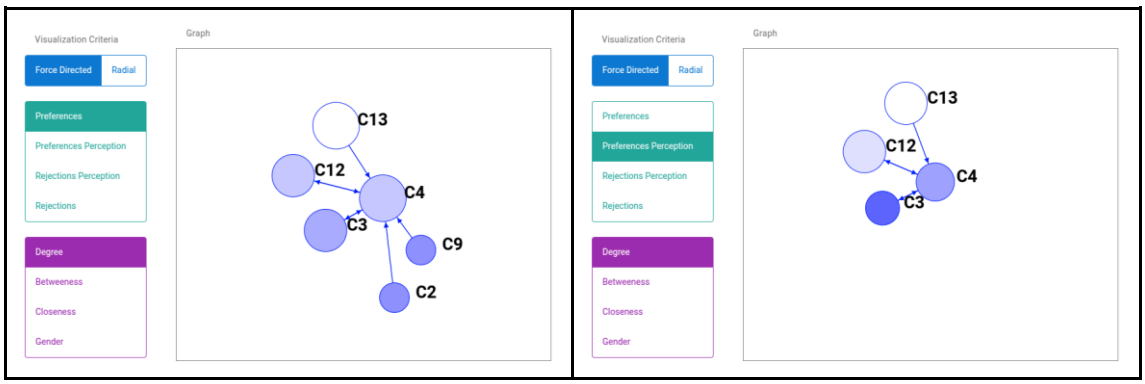

Figure 48.3. Example of positive social underestimation

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In the option "Rejections" and "Rejections Perception" (Figure 48.4), students' beliefs about their rejection relationships can be observed. The interpretation follows the same criteria: the lighter and larger nodes represent the most rejected students while the darker-coloured and smaller ones represent the least rejected students.

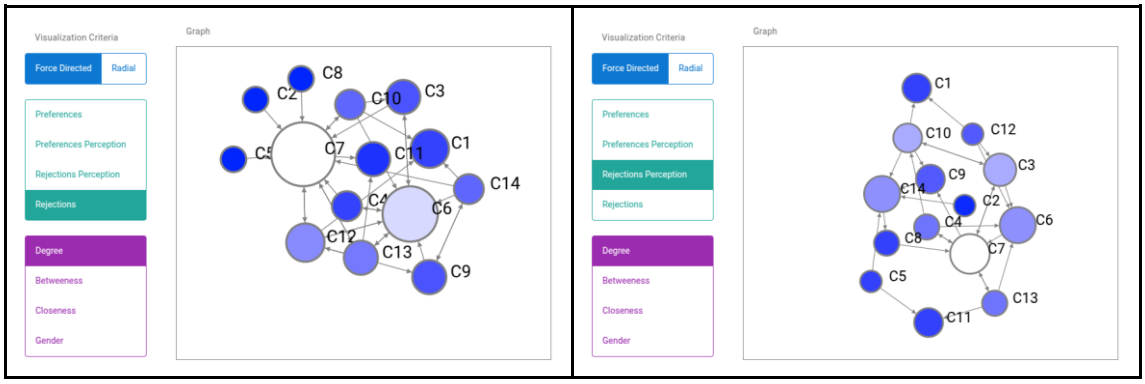

Figure 48.4. Sociogram of Rejections and Perceptions of Rejection

When combined, the four sociograms can reveal important information, especially about the most vulnerable learners in the classroom. It is interesting to observe when there are mutual relationships between pupils. Especially, if mutual rejection is detected, it can greatly affect the classroom climate. The density (links) of the rejection sociogram is usually less dense (fewer links in its totality) but the denser it is, the more "negative" the classroom climate and the social cohesion among pupils can be.

In the purple menu, you can see the different centrality criteria. Popularity, as we have seen so far, refers to the criterion "Degree". For this criterion, a pupil is more popular the more choices he/she receives from his/her peers. In the criterion "betweenness" a pupil is more popular when he/she is more able to connect with the other pupils. This means that this pupil acts as a bridge for the pupils to be more connected in the classroom. The closeness criterion makes it possible to detect students who can distribute information very efficiently to their peers. The sociograms are again similar but can give slightly different information on the basis of each criterion. In the last sociogram, you can see the pupils by gender. Often there are two subgroups between girls and boys. This is more frequent in the primary school age group.

Figure 48.5. Different criteria for the centrality

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Another form of representation is the radial sociogram, in this case, the most popular pupil is placed in the center, and around him/her the rest of the pupils are placed according to their popularity index (see example in figure 48.6). The further from the center a pupil is, the less popular he/she is, and vice versa the closer a pupil is to the center the more popular he/she is.

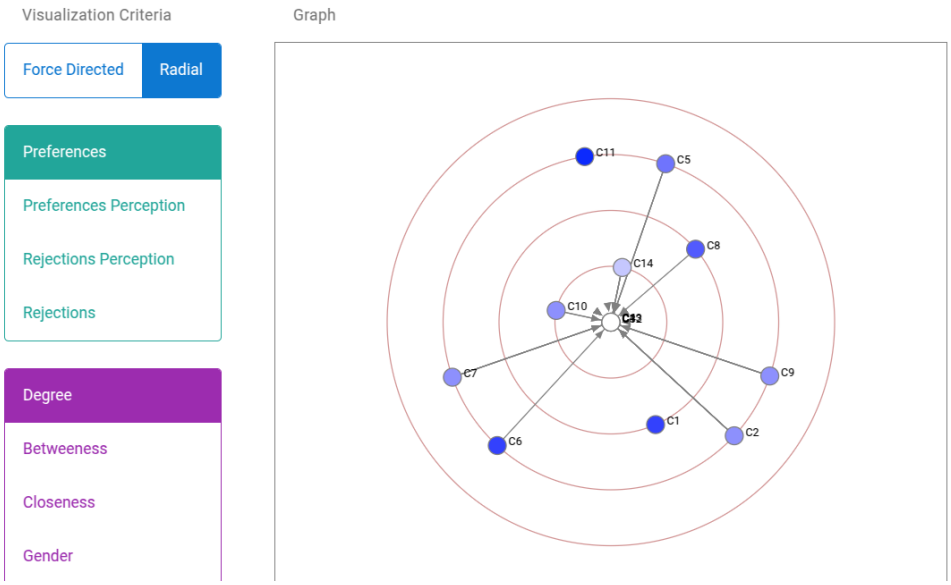

Figure 48.6. Sociogram radial

In the Ego-Sociograms tab (Figure 48.7) you can select which pupil to place right at the center. This way you can examine the relationships and the perception of relationships for this specific pupil. The red arrows represent a rejection and the dashed red arrows represent a perception of rejection. In the case of Figure 48.7 C3 believes he is rejected by C10 and C3 rejects C6. The blue arrows signify preference, whereas the dashed blue arrows signify perception of preference. In the example of the following figure, C3 prefers C13.

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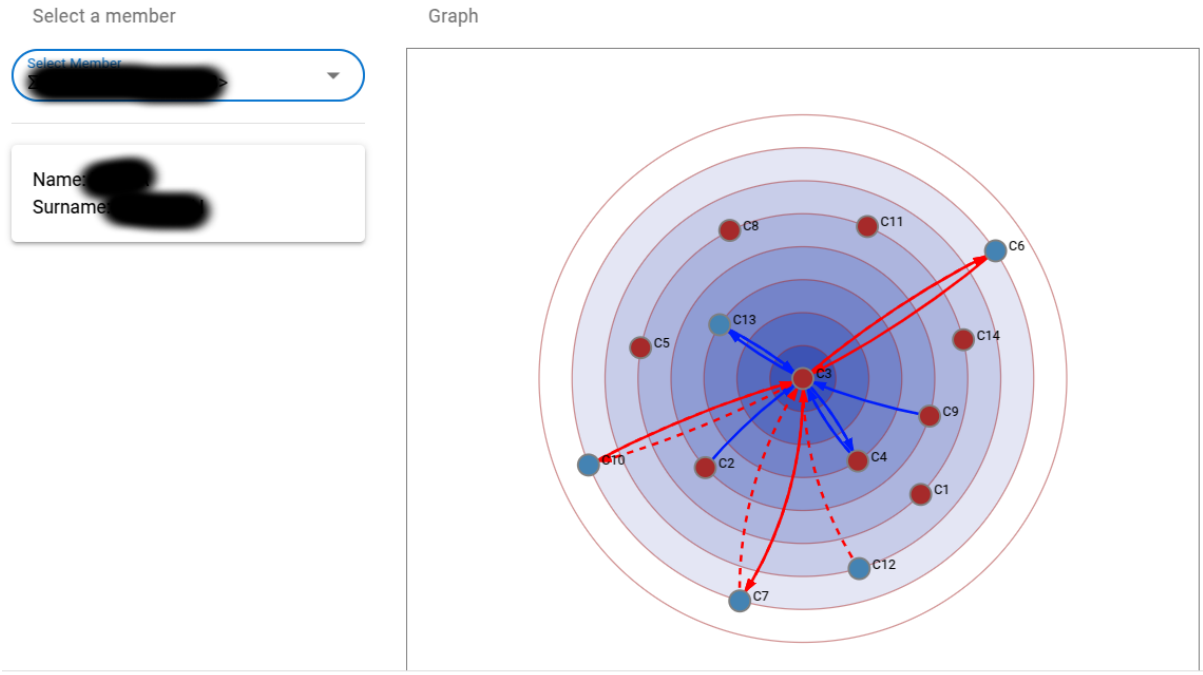

Figure 48.7 Example of individual graph

In the Group Sociometric Indexes tab (Figure 48.8) you can see some indexes that refer to the whole classroom. By hovering on the information option (letter i) you can get a description of what each group sociometric index represents.

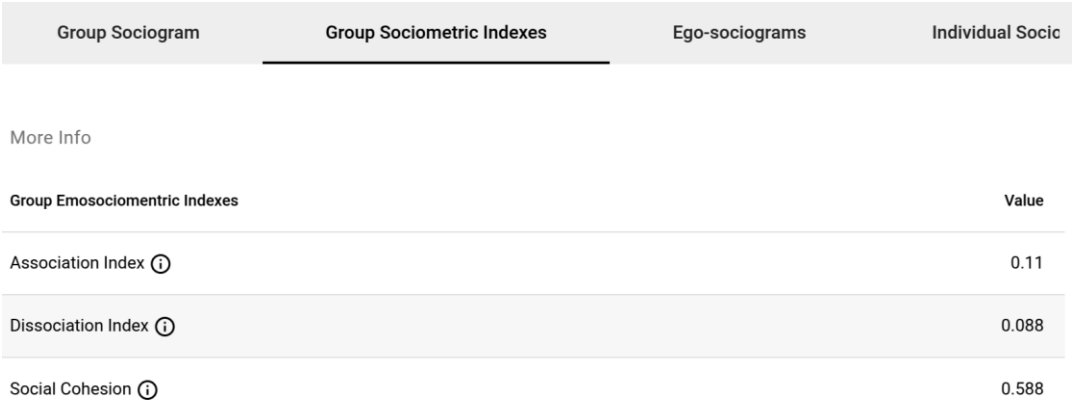

Figure 48.8 Example of group sociometric indexes

The same format applies for the Individual Sociometric Indexes tab (Figure 48.9). There you can see some indexes that refer to each one of the members of the class. The information (letter i) tooltips will guide you to the meaning of each index. At the left part, the “Direct indexes” refer to absolute numbers while the “Compound Indexes” at the right part, range from 0 to 1.

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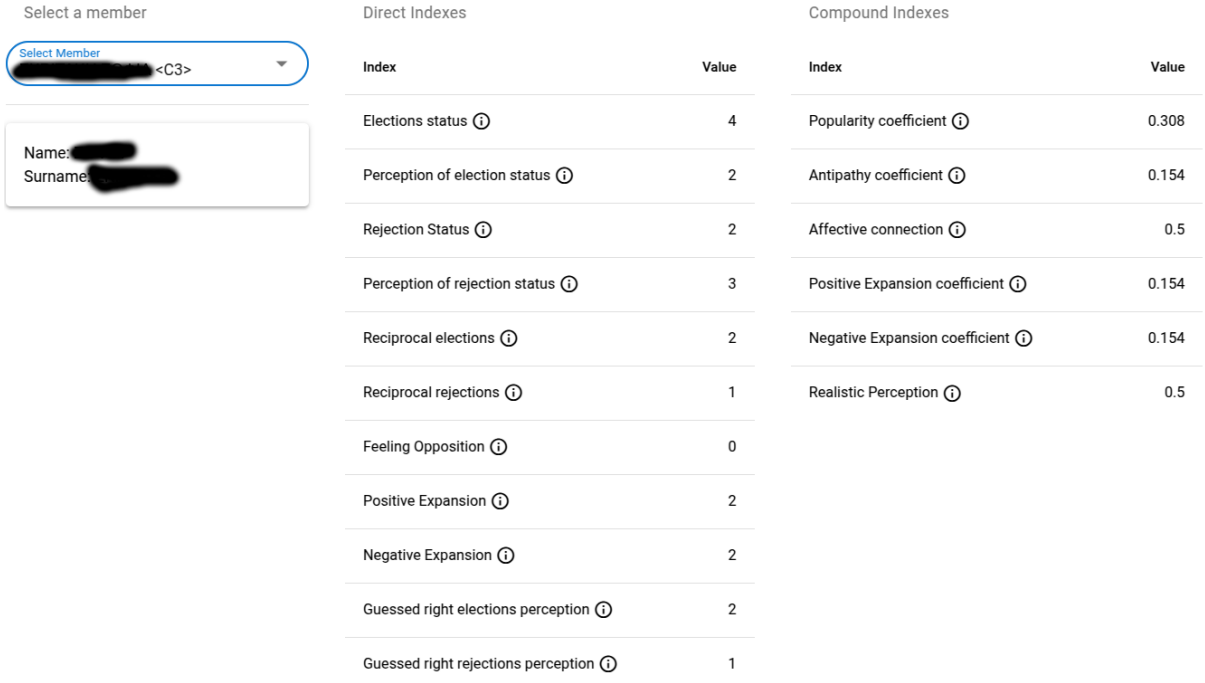

Figure 48.9 Example of individual sociometric indexes

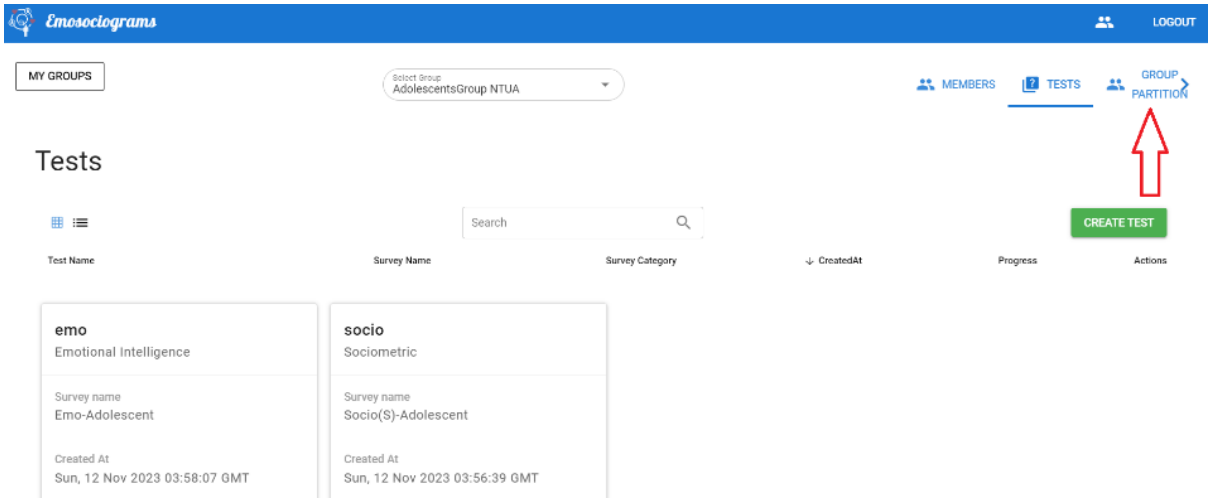

Figure 48.9.1 The Group Partition option

Step 11: Match your students in working groups

The Group Partition option (upper right corner) (figure 48.9.1) is useful if you want to automatically create working subgroups of your students, with which you can implement/realize SEL activities. The goal of this functionality of the emosociograms tool, is to propose a meaningful group partition, in order to improve the sociometric indexes of your classroom, by taking into consideration the existing dynamics of the group and the emotional competencies of the pupils.

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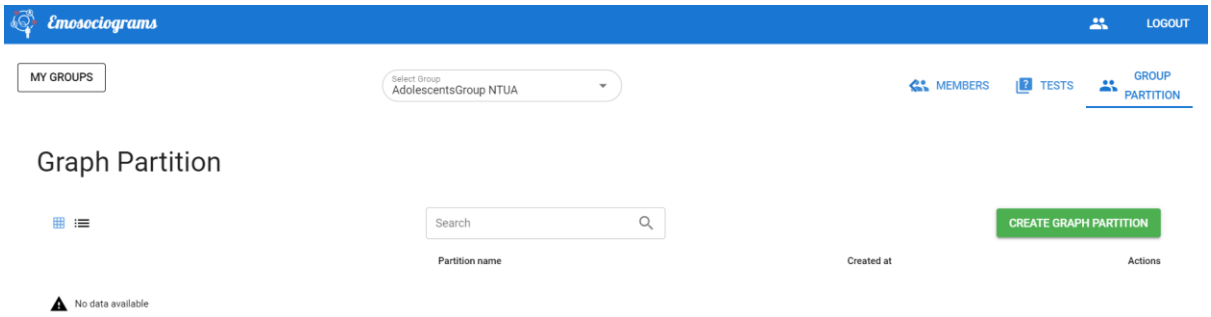

Figure 48.10 The Create Graph Partition Button

Firstly, you have to press the Group Partition button.From this window (figure 48.11) you can select the socio test and the emo test on which you will base your group partition, as well as the number of members you wish to have in each subgroup created. Once you press the “CREATE GRAPH PARTITION” button, you will be presented with the suggested subgroups of your class.

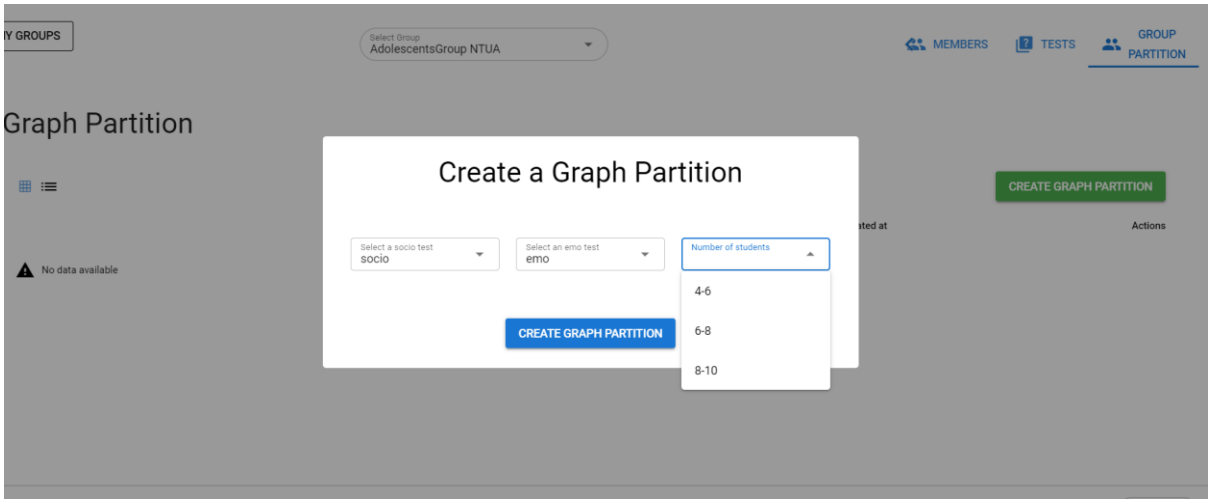

Figure 48.11 The configuration of your group partition

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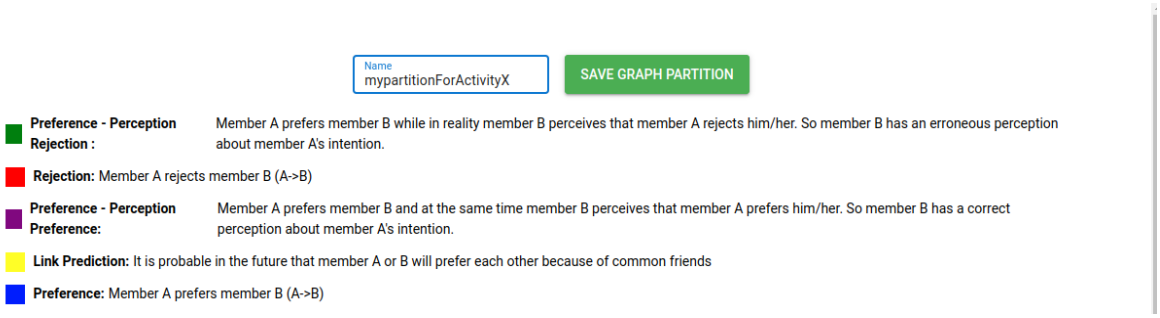

Figure 48.12 Meaning of the different coloured links between the pupil nodes

In the upper part of the group partitioning results, you may find a legend that explains the meaning of the different colors of links between the pupil nodes. This way you can understand why the emosociograms tool suggests to you this specific partition. The group partition algorithm takes under consideration the following type of social dynamics.

- Prioritizes the matching of relationships where member A prefers member B while at the same time member B perceives that member A rejects him. Putting together these two students may help to solve this misunderstanding on behalf of member B.
- Avoids putting together students that reject each other. This is not always possible to be avoided or may sometimes be desired by the teacher. In this case the teacher can modify the proposed groups.
- Prioritizes the matching of relationships where member A prefers member B and at the same time member B perceives that member A prefers him/her. This means that member B has a correct perception about member A's perception and putting them together may lead to a mutual preference.
- Takes under consideration how probable it is for two members to be mutually selected in the future. In case this probability is high, these members are matched to facilitate this possible connection.
- Takes under consideration the preferences of the members.
- Takes under consideration the overall emotional intelligence scoring of all the members and particularly the empathy competence. Students that are not preferred by their peers are mostly matched with peers that have high scoring on empathy. This way it is more probable to feel comfortable in their working groups and build new relationships within them.

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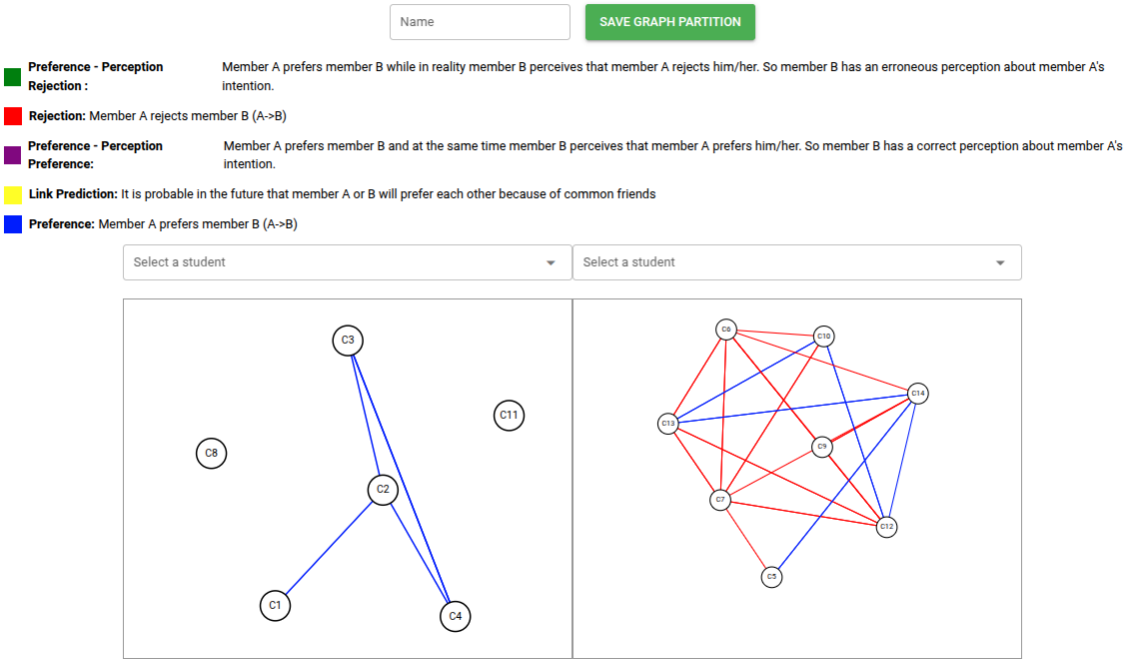

Figure 48.13 The automatically created subgroups of an initial group

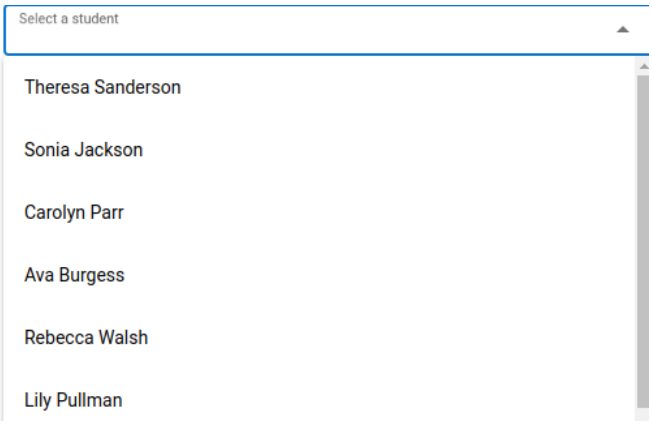

Figure 48.14 Selection of students in order to modify the proposed working groups

Moreover, since as a teacher you may have a better understanding of your class' social dynamics, you can modify the proposed subgroups by adding/removing pupils to them (48.14). This way you can have total control over the final group partition of your class. Once you have finalized your subgroups you can name this group partition and save it by pressing the green button “SAVE GRAPH PARTITION”.

Step 12: Share your experience with us (optional)

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Upon the end of each test, you are proposed to give us your feedback about EmoSociograms. This will really help us to improve the tool in the upcoming period. Your feedback is highly appreciated but remains optional!

Figure 49: Friendly message upon the successful submission of a test response

Students between the ages of 9 and 18 will be shown the screenshot above. For the teachers of classrooms with children from 6-8 years old, the satisfaction questionnaire is available here: https://forms.gle/Yi2TKZgNEr9nvqb96

Here we come to the end of this tutorial. Hope you had a good experience with the EmoSociograms tool and you will find it useful within your classroom!

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