Observational Research Social Network
Interaction and Security

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Keywords: Preschool Education, Observational Research, Social Networks.

Abstract: Quality in education depend heavily on the teachers' professional development, as a mean for pedagogical methodologies and practice improvement. In this sense, learning is enhanced by sharing and working in a community of practice, a learning organization that generate knowledge and allow members to innovate. In this context, children observation is fundamental, allowing a sound basis for reflection and action around learning experiences and teaching environments. Specific guidelines and programs, such as the EEL/DQP, can help reducing the inherent subjectivity, providing a common base for teachers and the preschool education community. In this paper we propose an online, web based community to improve the observation process as well as the communication between researchers. The social relations are identified and the security issues are discussed.

1 INTRODUCTION

The literature about teachers' professional development shows that communities of practice constitute centers for professional growth (Sheridan et al., 2009; Evans et al., 2006). In this sense, communities of practice are groups of people who gather from common professional interests and a desire to improve their practice, sharing their knowledge, ideas and observations. A community of practice can be understood as a social system for learning because, like other social systems, provide: i) a structure where they develop complex and dynamic relationships; ii) ongoing negotiations between members; iii) shared meanings and cultural identity (Wenger, 2010).

In this perspective, communities of practice can constitute itself as an opportunity for learning about what really matters, about epistemology, ontology and methodology that can sustain the praxis. Communities of practice are conceived as learning organizations which investigate their situation and their relationships and generate praxeological knowledge that allows teachers to innovate.

The Effective Early Learning (EEL) Project (Bertram and Pascal, 2004), known in Portugal under the designation *Desenvolvendo Qualidade em Parceria* – DQP (Bertram and Pascal, 2009) propose the creation of communities that develop a collaborative action, focused on shared purposes and in a sustained process of pedagogical mediation by an external supervisor. This intends to improve the quality of early childhood education contexts, through an active involvement of participants. It is a monitoring process that uses several observations tools requiring that professionals build knowledge and skills about the underlying processes that allow them to reflect with the peers about their action.

Observations in the EEL/DQP are used to assess children physical, emotional, social, and intellectual development, focusing on specific areas, such as social interaction, learning experiences, space management and creations, and others. They can also help to better understand how different areas of development are interrelated, as well as helping recognizing what behaviors are typical of various age groups. In turn, this understanding will help the teacher to improve as a person and as a professional.

Each observation process depends heavily on the sensibility and experience of the teacher. It is very difficult to get consistent results if the observers diverge in the way they interpret the setting. Although natural and inherent to the process, it is important to minimize this subjectivity. In order to do so, the observations are performed simultaneously by more than one teacher in a democratic way. The external supervisor also has a thorough perspective on the whole project

Pedro Lopes R. and Mesquita C..
Observational Research Social Network - Interaction and Security.
DOI: 10.5220/0004837800570064
In *Proceedings of the 6th International Conference on Computer Supported Education* (CSEDU-2014), pages 57-64
ISBN: 978-989-758-022-2
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and may participate in some or all observations. The bottom line is that to be able to get meaningful information, the communication between all the teachers and researchers is fundamental, as a way to foster reasoning and action building.

In this paper we propose the design and development of an online, web-based, regulated community, providing:

- A central and secure repository of observation data, results and annotations;
- A computer mediated social network.

This service allows each teacher to manage the observation process, sharing information with authorized colleagues and improving their experience and knowledge.

2 EVALUATION PROCESS IN EEL/DQP

The evaluation of quality of early learning in the scope of EEL/DQP requires obtaining a considerable amount of data through several techniques, including detailed observations of children and adults, interviewing parents, practitioners and children, documentary analysis and others. This complex and somewhat subjective process requires well-trained teachers and researchers. In particular, the EEL/DQP initiative defines a four phase/thirteen steps procedure (Figure 1).

Data is gathered and systematically organized in research portfolios, that will be used in a cyclic process of thinking-do-thinking to research and create change (Mesquita-Pires, 2012). This process is enhanced by the utilization of observation techniques which measure the effectiveness of the learning and teaching processes, such as the Child Tracking Observation Schedule, to gain a snapshot of the childs day and providing information of learning experiences (Bertram and Pascal, 2006), the Child Involvement Scale, an observation technique which measures the level of a childs involvement in an activity, the Adult Engagement Scale, to evaluate the interaction between the practitioner and the child (Laevers, 1994).

The application of the procedure has a broad set of difficulties and challenges. Initially, it is necessary that the research group learn about participatory pedagogies as theoretical foundations about EEL research techniques and the practicalities of their use. The application of interviews come soon after, which lead the participants to reflect on the ethical issues involving its use. Learning to observe is another challenge, because the signs are not always evident and

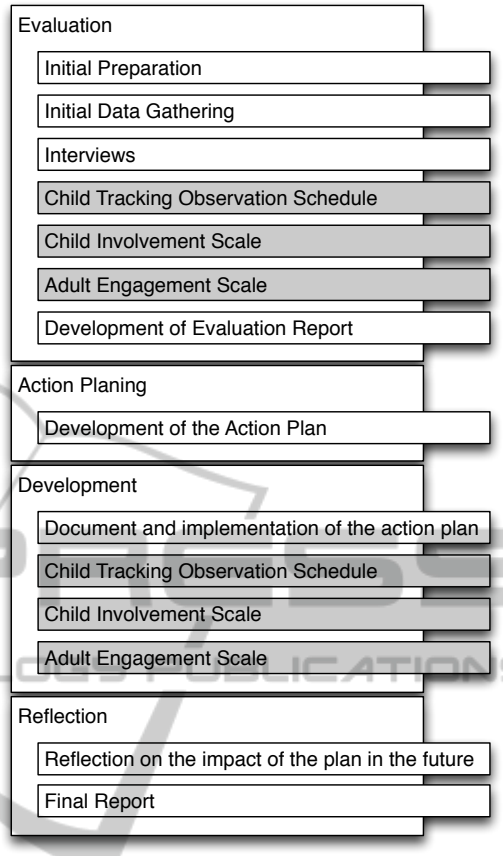

Figure 1: EEL/DQP phases and steps.

observers must be well trained to identify them. Besides, the observation process should be systematic requiring that kindergarten teachers find time in their daily routine to observe the children and understand how they are learning.

2.1 EEL/DQP Procedure

The EEL/DQP overall procedure follows the four phases described above. It starts by an initial orientation of the work to be performed, in which all the process is prepared and all the participants informed in detail. Initial data gathering follows, where the institution is characterized, including the interior and exterior spaces, its education philosophy, the different learning activities, and others.

The third step includes performing interviews to the dean, staff (about 50 %), children (20%), and parents (20%). It is very important that all the stakeholders are well informed and understand the process. The teacher records the interviews and take notes of key phrases, to support the written report. In the end, access to interview transcripts must be given to participants.

The fourth step requires an observation process, using the Child Tracking Observation Schedule, with the main purpose of understanding the child's daily routine. This technique gives information about the learning experiences, the level of choice, his involvement, the group organization and interaction with adults.

The Child Involvement Scale seeks to measure not only the learning outcomes but also the underlying processes. Essentially, it gathers information about the participation in activities and projects, thus giving indicators of concentration and motivation as well as of satisfaction (Laevers, 2005). When lacking, chances are that the children development will stagnate, and all the actors in the education process should do everything in order to create an environment in which children can engage in a wide variety of activities. The details are registered in a specific form.

The Adult Engagement Scale evaluates the interaction between the practitioner and the child (Laevers, 1994). It targets the effectiveness of the teaching-learning process through observation of adult-child interaction. The quality of the adult's intervention is a critical factor for the child's knowledge building. Up to a maximum of 5 adults should be observed, paying special attention to the sensibility, stimulation and autonomy categories.

2.2 Ethical Behavior

Ethical behavior is fundamental in the whole process, since it tackles professional behavior, privacy, and confidentiality concerns (always keep in mind that the observer is representing his school as well as himself). Children, parents and professionals should be treated with courtesy, always respecting the privacy rights of children and family.

All the participants in the project, including children, should be informed about all the details of the project and their role in the whole process, giving their consent. This will ensure that all of them are comfortable and willingly, contributing to better results.

During observations, teachers may gather sensitive information, such as details about child's development and behavior, as well as videos or pictures. Children and their parents must know that this data is restricted and will not be used in other contexts. Even with adequate permission to observe and record these details, the information must be stored appropriately, to avoid misuses and eavesdropping.

2.3 Community Use Case

The procedure described in the previous sections is traditionally paper-based, requiring a lot of written material. In a typical set of 24 children, of which only 50% are observed, as much as 48 to 72 pages of forms are filled. In a kindergarten, this procedure is repeated in all the rooms, totaling more than 200 pages of gathered data. Moreover, all the visual and audio details are lost.

The subjectivity inherent to this process also requires that all the observers, usually the kindergarten teachers, receive an uniform training, allowing them to achieve similar interpretations of similar situations. This is only possible if the communication between them is open and regular, requiring several in person meetings.

Moving this information to an online service, such as a social network, will allow the observers to store and organize all the observation data in a single profile, combining video, audio and text data in the same observation procedure. This also makes it possible to communicate asynchronously with other observers, providing a valuable tool for subjectivity reduction and better overall learning.

3 THE TEOBS SOCIAL NETWORK

The interactions between observers (kindergarten teachers) is fundamental to provide a stimulating environment for reflection and discussion, essential to ensure low levels of subjectivity and to improve observers' skills. The EEL/DQP process expects several, face-to-face, meetings to discuss about the data gathered in all of its steps.

The social relationships established between the participants in this process (friendship, co-working, information exchange, ...) can be mediated by computers through the TeObs social network. Computer-mediated communication (CMC) gives the possibilities for asynchronous exchange of information, regardless of where participants are. The community is no longer defined as a physical place, but as a set of relationships where people interact socially for mutual benefit (Garton et al., 2006). However, this does not preclude face-to-face meetings, should the community decide accordingly.

MySpace, Facebook or Twitter are remarkable examples of social networks, connecting millions of people around the world. TeObs intends to be an audience specific social network, connecting kindergarten teachers and providing a constantly updated memory

of experiences and previous knowledge. This can result in connections between individuals that would not be made otherwise and that can prove valuable for the overall process as well as for each participant training (Boyd and Ellison, 2007).

3.1 Social Interactions

TeObs is a web-based service that allow individuals to construct a public or semi-public profile within a community. Connections among participants are articulated through a list of other users, keeping in mind the ethical behavior and security concerns. Under this restrictions, each user is allowed to traverse their list of connections and those made by others within the system.

Each user can be in two broad status:

- Idle: the user is not currently participating in an observation project, having access to specific connections and to previous notes and contents;
- Active: the user is participating in an observation project, with mandatory connections to peers and to the external advisor (the supervisor).

Each role the user can have is associated to his experience level (Figure 2). The bottom layer is populated with members unable to perform observations without undergoing a training process – dotted circles. After acquiring basic skills, the member gets the observer status, able to perform observations autonomously (as long as following the predefined guidelines).

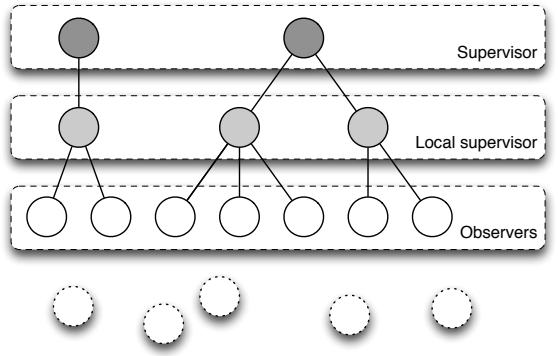

Figure 2: Community.

With increasing experience, the status may be elevated to experienced observer and, later on, to local supervisor. Finally, with complete domain of the observation process and with several successful projects, the teacher can become a full supervisor (Table 1).

An observation process starts with a supervisor creating a community and adding a number of kindergarten teachers. Usually, the community corresponds to an institution, although it is not mandatory. Next, the supervisor establishes the relationship between the community elements, granting or removing access to the data collected by each observer (Figure 3).

Table 1: Observer level.

4	Supervisor
3	Local Supervisor
2	Experienced
1	Basic training
0	No training

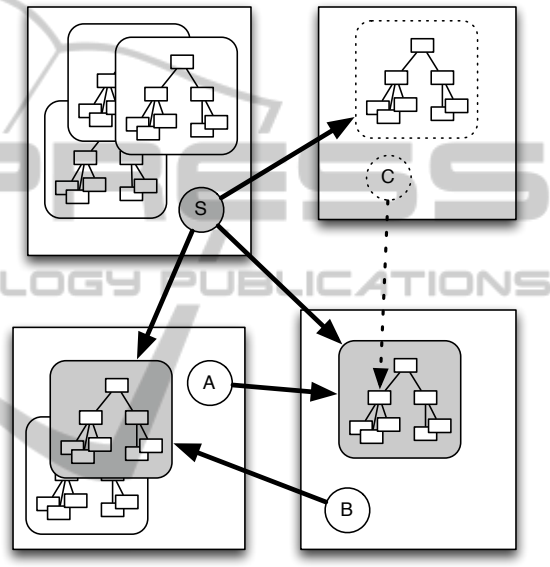

Figure 3: Social relations in an observation process.

Each observer, identified by a circle, collects and organizes information, stored in his personal area (the large rectangle). The observation data is structured as a tree, enclosed in a round rectangle. Each observer has full access to his area and all the data elements within. To reduce subjectivity, it is important that the data is shared with a peer and with a supervisor, to ensure similar criteria among observers. Sharing is configured by the supervisor, granting access to some information. In figure 3, the supervisor 'S' has access to the current procedure (gray round rectangles), the observer 'A' has access to the data collected by 'B' and vice-versa.

Each observer can also have data from previous procedures (white round rectangles). This is private information and is only shared with the supervisor and the observers of the same community at that time – 'B' and 'S' may not have access to it.

When starting a new community, the supervisor can invite a non-trained observer (dotted shapes in the figure). He is not able to contribute with observation

data without acquiring basic skills so, the first step is to go through a training process. Other than "brick-and-mortar" training, observer 'C' may have access to specific data from other observations, granted by the supervisor, as well as other materials. He must be familiar with the team members, their perspectives and pedagogical practices so that among peers could be developed positive interactions.

The data, the social relations as well as the experience level is instantiated in a web-based, online application, which we call TeObs.

4 STRUCTURE AND IMPLEMENTATION DETAILS

TeObs is built in Java Enterprise Edition, following an multitier architecture structured in three functional layers (Figure 4):

- Data Model – responsible for data persistence and structure;
- Business Layer – library of actions available to upper layers and external applications, such as web browser, smartphone or desktop user interface;
- Web Layer – Web browser interface with the user.

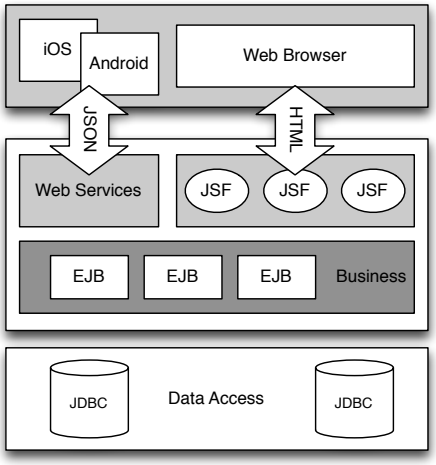

Figure 4: Multitier architecture.

Each layer is self contained, allowing the encapsulation of functionality and the distribution of resources to better cope with peak usage patterns or the increase of the number of users. This approach allows to build large-scale, scalable, reliable, and secure applications as well as simplifying the development of complex, distributed applications. The existence of a representational state transfer (REST) communications API allows integrating external applications, running in smartphones, for example (Mesquita-Pires and Lopes, 2014).

4.1 Data Management

As mentioned above, the observation process in the EEL/DQP project is implemented in three procedures: the Child Tracking Observation Schedule, the Child Involvement Scale and the Adult Engagement Scale. The observation details are registered in forms, structured according to the type and nature of each field. The EEL/DQP defines several fields, such as the institution and the observer name, the date, time, and the child's name, sex and age. In addition it also records the number of children and adults present during the session, the child's level of initiative (1 to 4), learning experiences, involvement (1 to 5) and interaction, among others (Mesquita-Pires and Lopes, 2014).

At a macro level, the procedure is structured hierarchically, in which an observation has several sessions and each session has many activities. Considering the structure and the nature of each data field as well as the associations between data entities, the structure of information in this situation is represented as five entities (Figure 5). The AES prefix indicates Adult Engagement Scale specific data.

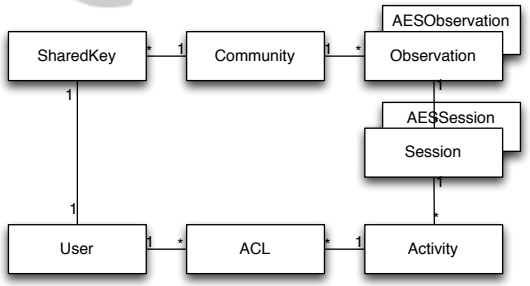

Figure 5: Entity diagram.

4.2 User Management

All the actions and data in the TeObs Social Network are associated to and belong to a specific user. In this context, users represent human agents that use a network service. He has to be identified, through a username, and authenticated using a password. This information is organized in specific entities (Figure 6).

The password is stored in the database in the form of a unidirectional hash, so that even if the password table is compromised, the attacker will not be able to decipher it. The entity `Certificate` stores the user's certificates, containing the public key necessary to protect the information he gathers.

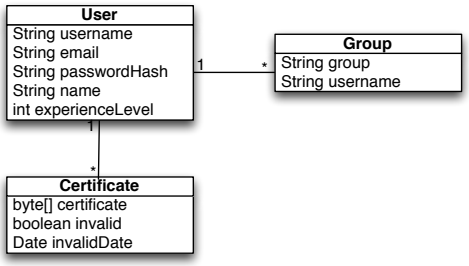

Figure 6: User elated entities.

5 SECURITY ISSUES

The ethical behavior inherent to all observation procedures demand rigorous security measures. In particular:

- Users must be authenticated;
- Data must be kept private;
- Users must be authorized to perform an action.

Each of this points depend on different mechanisms. Authentication is performed through the identification of a user and verification. Privacy is ensured through cryptography, both symmetric, to cypher data, and asymmetric, to deal with the key distribution. Finally, authorization depends on access control, through an Access Control List.

5.1 Authentication

Before any user is allowed to perform any action, he has to be authenticated or, in other words, his identity has to be confirmed. This is performed in three possible ways: using something the user has, something he knows or something he is or does. We chose to authenticate the user through something he knows – a password.

To make password cracking more difficult, we add a salt to each password (Wagner and Goldberg, 2000). The salt is a sequence of characters, generated through a Cryptographically Secure Pseudo-Random Number Generator (CSPRNG), that causes the hash to be different even is situations where the password is the same. The salt is stored in the user table alongside the hash (Figure 6).

The procedure to store a password requires that a random salt is generated, using a CSPRGN. Next, the salt is concatenated to the password characters and the hash is computed, using the SHA256 algorithm. Finally, both the salt and the resulting hash are stored in the database.

When accessing the social network, the user is requested a password. Since only the hash is stored in the database, password validation require:

1. Retriving the user's salt and hash from the database;
2. Prepending the given password with the salt;
3. Computing the SHA256 hash;
4. Comparing the resulting hash with the one from the database.

If both hashes match, the user is authenticated. Otherwise, the password is incorrect. To ensure privacy, users also store their certificates in the system, making the public keys available to other users and to the system.

5.2 Privacy

Data has to remain confidential, regardless of where and how it is stored. The nature of the TeObs Social Network requires the existence of a rigid privacy policy as well as a verifiable consent from a parent towards the protection of children's privacy and safety online. In this situation, privacy is achieved through cryptography.

All the observation material is cyphered before storing, so that it remains protected against disclosure. However, data should not be prevented to be shared between authorized members, although it should be completely protected to a third party.

Traditional cryptography falls under symmetric, where the same key is used to cipher and to decipher, and asymmetric, also knows as public key cryptography. This uses two keys: a private and a public. One of the keys is used to cipher and the other to decipher. In TeObs we use symmetric cryptography to cipher data and asymmetric to distribute the shared key (Figure 7).

When starting a project, the supervisor (the gray circle with a 'C') creates a new Community. The process starts by generating a key, which will be ciphered to the supervisor's public key (black key from the Certificates repository), and stored in the KeyStore. Only the supervisor (or another element through delegation) has the possibility to add members to the community, automatically creating a relationship with him.

When a new observer is added to the community, the shared key is deciphered (using the supervisor private key), ciphered to the public key of the new observer and stored in the KeyStore. Prior to data gathering, the observer retrieves and deciphers the shared key from the KeyStore. All the data is then ciphered

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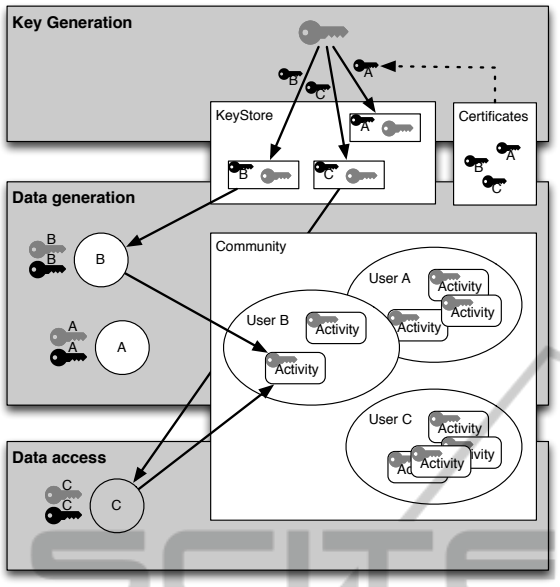

Figure 7: Key management.

and stored in the Community, ensuring that only the members have access to the content.

In other words, each community will have a single, specific, shared key. Although simple, this reduces the risk of compromise the keys, since no key exist before the start of the procedure and it changes with the community. At the same time, the data is secure from eavesdropping, even if all the database and all the stores are attacked.

To protect data against unauthorized or improper modifications, each community member digitally signs the piece of information submitted to the Community with his private key. This allows confirming the ownership as well as the integrity of the data.

5.3 Authorization

Cryptography protects privacy and integrity of information, as described above. However, enforcing protection also requires that every access to a system and its resources be controlled and that all and only authorized accesses can take place (Samarati and de Vimercati, 2001).

Access control models are generally concerned with whether subjects (any entity that can manipulate information), can access objects (entities through which information flows through the actions of a subject), and how this access can occur.

In the TeObs Social Network, the concept of Community defines the members with privileged access to information. However, further, fine grained, access control policies are necessary. Considering the previous social interactions, we have several access profiles (Table 2).

Table 2: Access profiles.

N	No access
R	Can read
W	Can write
R/W	Can read and write
D	Can delegate access

Considering a community member as the subject and the data as the object, the possibilities of access include reading, writing or delegating control, as summarized above. The relation between the subject, the object and the associated actions define the access control policies, which will have to be met by the security mechanism.

This approach is designated by Discretionary Access Control (DAC), based on the identity of the requester and on access rules stating what requesters are (or are not) allowed to do. This is instantiated in an Access Control Matrix, a three dimensions matrix relating subjects, objects and actions (Lampson, 1974). However, since this matrix is very sparse, it is not very efficient to be stored directly. An alternative implementation allows storing the matrix by column, defining Access Control Lists (ACL).

ACL are associated with the objects, registering who has access to it and how. In TeObs this is stored as an entity associated with the `Activity` and the `User`, in a many-to-many association (Figure 5). The ACL will have an entry for each user with access as well as the authorized action (Table 3).

Table 3: Access Control List.

Activity 1	
User A	R
User B	R/W
User C	R/W/D

The ACL builds on top of the privacy mechanism to further define the security policy. This allows restricting the possibilities within the community, allowing or denying specific members specific actions. For example, an user may read, write or delete information although another may only read it.

Each user is responsible for defining each activity's ACL. However, he can also delegate this function to other user, allowing the supervisor, for example, to update it.

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6 CONCLUSIONS

Quality in education depends on the teachers' professional development, enhanced by observational research in preschool environment and sharing and working in a community of practice. Traditionally, this community is based on face-to-face discussion and exchange of experiences. This learning organization can be instantiated in an online social network, where communication is mediated by computers.

A web based community allows enhancing communication processes between members, particularly out of regular teaching periods. Moreover, it allows the integration of professionally isolated teachers.

In this paper we propose an observational research social network for preschool education, where the interactions between members are maintained and extended with the possibility for asynchronous communication. Moreover, a database of previous knowledge is also available, allowing better training and further studies.

Ethical behavior is fundamental, particularly privacy and access control. Cryptography is used for ciphering information and for key distribution and discretionary access control is used to specify the information each user can access and associated actions.

This social network is complemented with smartphone application for gathering and exporting data, as well as web pages for overall process management.

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