

# Meneduca – Social School Network to Support the Educational Environment

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**Abstract—** Information and Communication Technologies (ICTs) have changed the way of interacting and how knowledge is transmitted. In addition, the last decade represented a revolution in the way the society interacts, due to the intense use of social networks. Social networks could also be considered a Big Data application due to the volume, variety and velocity of data that are created on them.

Meneduca, a social network focused on educational environments, is intended to increase communication among teachers, students and parents in order to improve students' performance. The system also aims to provide data to help to form groups for school tasks, based on the students' personalities; for this, the Big Five Test is used. The results of the application of the Big Five allows forming working groups, whose members have heterogeneous personalities, i.e., with greater variety of ideas and skills. In addition, teachers can propose different themes for academics works, based on the preferences of their students captured from networks such as Facebook. The Meneduca was proposed to investigate two aspects about social networks: (1) as a data source for other applications, as recommender systems; (2) as an educational aid tool.

**Keywords—** social networks; Facebook; Big Data; personality tests; human personality; Big Five test.

## I. INTRODUCTION

The last decade represented a revolution in the way society interacts, due to the intense use of social network. This interaction has become a powerful analysis and knowledge discovery tool regarding its users and the way they communicate with each other.

According to Adali and Golbeck [1], individuals' behaviours and the way they interact with each other are guided by personality. Even considering that sometimes the environment may affect people's behaviour, when individuals need to make a decision, they usually act by themselves. Adali and Golbeck gathered a group of 80 people to prove that the hypothesis is true; for this, they applied The Big Five, a personality test to outline the profile of a person. Next, they analysed those individuals' twitter and, applying statistic algorithms, they concluded that the results were closer to those from the Big Five test.

Marhan et al. [2] applied a similar idea, based on result data, to form teams for academic works in the educational environment. According to them, each person is unique and has different traits. However, even though each person shows different characteristics, individuals usually interact and understand each other. The authors affirm that the work done by a team is the fundamental base of interaction among the individuals within organizations and it is important to guarantee that all of them follow the same objective and that the personality profiles are complementary and compatible.

Starting from the premise that success could be more certainly achieved by a team of people with different skills, successful academic work could be achieved by a group of students with different and complementary abilities. Individual personality traits can be used to identify personal abilities.

For a few years, Information and Communication Technologies (ICT) have been consolidated in the educational environment, modifying the way students and teachers interact and in which knowledge is transmitted among them. In addition, social networks have become a fever, mainly among the younger ones. Hence, these phenomena would be used to enhance interest and engagement in academic activities.

Depending on the purpose of the social network, the behaviour of their users is different. For example, LinkedIn and ResearchGate are associated to professional occupation and research and their users only post information connected with these aspects, while Facebook and Twitter are not associated to a specific context and their users usually post general information.

Considering all those aspects, a social school network, called Meneduca, is proposed to support the educational environment. It is expected to maintain focus on academic context, differently from a general-purpose social network, in which posting and commenting on general subjects and activities are common. Meneduca would therefore be a tool to bring teachers closer to students to achieve better academic results. Furthermore, it would work as another way for parents, students and teachers to communicate. Hence, this article introduces the social school network Meneduca and the objectives are: (1) to improve students' performance in

academic tasks, (2) to kindle students' interest in the academic tasks or activities proposed by teachers, (3) to facilitate the integration among teachers, students and parents.

In addition, the work described herein was conducted to enhance the experience with the social networks as part of the research related to recommender systems and big data.

This paper presents the main aspects of Meneduca and it is organized as follows. Section II introduces some aspects about social networks. Section III discusses human personality and how it defines our characteristics, besides presenting tests that might be employed to identify individuals' personality traits. Section IV shows the UML class model and implementation option for Meneduca. Finally, section V concludes and presents future works.

## II. SOCIAL NETWORKS

Social networks are a kind of service offered by the web that allow its users to exchange information. Each social network has a scope or characteristic. For example, professional information is the focus of LinkedIn, whereas Twitter and Facebook focus on general information. Particularly, short messages are usually posted on Twitter, while a variety of message types is posted on Facebook, besides personal information.

Two social network aspects are considered here: (1) the success of its use, confirmed by the number of users, which have constantly increased, mainly among younger people; (2) information posted by its users, which might be easily obtained.

The social network proposed should be attractive to kindle the academic interest and to bring students closer to teachers. A natural decision regarding the Meneduca interface would be making it similar to a social network in use. Therefore, the Meneduca interface was based on Facebook because it has the largest numbers of users [3]. Additionally, the Facebook API (Application Programming Interface) is well documented and users' data could be used under their permission in other applications [4]. In doing so, students could link their Meneduca profile to their Facebook profile and information such as "pages liked" could be obtained.

Students are not often interested in the tasks proposed, and the reason for it could be related with the tasks theme. With this in mind, Facebook-like categories (ex. music, sport, politics, etc.) given by students will be recovered and presented to teachers for suggesting new academic task themes. The result expected is raising students' interest in the tasks proposed. It is worth highlighting that the personal students' identification will not be revealed to their teachers.

In addition, Facebook-likes stored in the Meneduca database are updated every 2 months to maintain the information about students' interest updated. Thus, the list of themes for suggesting academic tasks will always be updated.

The other important aspect is the great volume and velocity, besides the variety of data created on social networks [5] [6]. These data could be used as a source for other applications [7][8][9]; particularly, data extracted from social networks

could be used to solve the cold-start problem in recommender systems. This proposal is being investigated by one of the authors in another work. Hence, the Meneduca development provided valuable experience to the other research.

## III. PERSONALITY

Personality is the set of traits defining each person. Personality profile has been studied for a long time. Probably the first theory about personality was the Four Temperaments, or Four Humours, and Hippocrates introduced it in medical theory in 4 BC. According to it, personality is composed of four fundamental personalities: sanguine (optimistic leader-like), choleric (bad-tempered or irritable), melancholic (analytical and quiet) and phlegmatic (relaxed and peaceful) [2]. Since then, other studies have been developed.

Carl Jung, who create the school of analytical psychology, defined that extrovert and introvert human attitudes are explained by a four-part structure: thinking and feeling (the rational function); intuition and sensation (the irrational function) [2] [10].

### A. MBTI (*Myers Briggs Type Indicator*)

Based on Jung's work, Katharine Briggs and Isabel Myers developed the four dichotomies of personality: extroversion and introversion, sensing and intuition, thinking and feeling, judging and perceiving. The MBTI model is used to identify the students' personality and introduces sixteen types of personalities, which are the result of combination of those four dichotomies or dimensions [11]. MBTI needs an authorization license from *Myers & Briggs Foundation* to use and a professional authorized to interpret its result [11]. For this reason, it was not employed in Meneduca. However, the system is prepared to apply it as long as the educational institution has the license and a professional authorized to use it.

### B. *Big Five*

The Big Five was initially proposed by Tupens and Christal in 1961 and is based on five domains of personality: neuroticism, extroversion, openness, agreeableness and conscientiousness. These domains define the personality traits and allow representing all the basic structure of human personality. The Big Five Model was defined by several independent sets of researchers [12] [13].

Goldberg [14] developed a test based on the Big Five Model to describe individual personalities. The test is a questionnaire formed by a set of sentences. Each sentence is related to human behaviour and assesses a single Big Five domain. Each sentence has a set of standard options with a predefined value. That is, candidates must read each sentence and choose the option that better describes their feeling related to the behaviour described. The options for each sentence are: (1) "highly inaccurate" – value 1; (2) "partially inaccurate" – value 2; (3) "neither inaccurate nor accurate" – value 3; (4) "partially accurate" – value 4; (5) "highly accurate" – value 5. Therefore, one value is obtained for each sentence. Hence, the final result is achieved considering all the sentences.

Most personality tests are restricted instruments; thus, a direct authorization from its owners is necessary to apply it.

Consequently, in Meneduca implemented a free test [14]. However, this option should be reconsidered for effective use, a professional being required to better assess the results from the test.

Therefore, "IPIP (International Personality Item Pool) Big Five" [14] test was implemented in Meneduca. The individual answers given by students are stored, but are not accessible by teachers or others users. The final results of the test are presented to teachers, for them to suggest groups of students for academic tasks.

Furthermore, a tool is also exclusively provided to psychology researchers. Using it, they can cross-reference personality profile information with the performance data about student groups. The result of this study would be used to prove the method.

### C. Work Groups

The system not only aims to provide data to form groups for school tasks, but also to improve both students' performance and interest in the discipline. The results of the personality test applied to students are used to achieve this objective.

The group performance is influenced by the personality of those who participate in it [2] [15]. According to [15], in groups formed by a variety of personalities, advances in creativity, innovation and flexibility could be observed. In addition, [2] introduces different methods to find a new member for a group. In one of them, the choice is made based on the idea the better candidate is the one would complement the group personalities, i.e., the ideal candidate should have a different personality from the others. Therefore, Meneduca assumes that better groups are formed by a set of different personalities. Hence, the suggestions given by the system follow this assumption once the goal is to maximize the variety of personalities of each group in order to enhance performance.

### D. Algorithm to structure work groups

- Premise: work groups with great diversity of personalities show better performance than groups with little diversity.

The algorithm in [17] was created to form groups representing a function with two parameters, a set of students and the number of groups to be formed, and returns a set of students (called "formation").

The result of the personality test implemented in the system provides 5 traits of personality.

Considering the premise adopted, the diversity of personalities of a group could be defined as follows.

$$diversity(G) = \sqrt[5]{\prod_{i=1}^5 (max_i(G) - min_i(G))} \quad (1)$$

where:

- Diversity (G) represents the diversity of a group G;

- $max_1(G)$  represents the highest value for neuroticism found in a group and  $min_1(G)$ , the lowest;
- $max_2(G)$  represents the highest value for extroversion found in a group and  $min_2(G)$ , the lowest;
- $max_3(G)$  represents the highest value for agreeableness found in a group and  $min_3(G)$ , the lowest;
- $max_4(G)$  represents the highest value for conscientiousness found in a group and  $min_4(G)$ , the lowest;
- $max_5(G)$  represents the highest value for openness found in the group and  $min_5(G)$ , the lowest.

Diversity was defined as the geometric average among the differences between the highest and lowest value of each trait found in members of a group. When one of the differences is very small, the value calculated with the geometric average is lower than the ones calculated with the arithmetic average, even if the other differences are great. Conversely, using arithmetic average, any significant influence in the final result would not be found for traits with great or small differences.

Considering that the diversity function returns not one group, but a formation, it is necessary to have only one grade for formation, which is defined as follows. As a result, the comparison is possible.

$$grade(F) = \sqrt[g]{\prod_{i=1}^g diversity(F_i)} \quad (2)$$

where:

- F represents a formation, i.e., a set of groups;
- $F \square$  represents a group of formation (the order does not matter);
- g represents the number of sets in F;
- grade (F) represents the grade of G formation.

Similarly, the geometric average of diversities of each group was used to define a grade for a formation. Again, the geometric average was chosen because the arithmetic average would not consider the formation having both very high and very low diversity, i.e., grades as low as desired would not be obtained from the arithmetic average.

In addition, two more functions were implemented to form groups: the first creates groups using all possible formations with the number of groups introduced and the second randomly checks formations up to a time limit (defined as 2 seconds) to be achieved. The second function was implemented due to the sharp increment in the number of possible formations. Moreover, valid formations for both functions must have: (1) all groups with the same number of students (if the total

number of students is a multiple of the number of groups), or (2) the variation is very small (only one student).

IV. COMPUTABILITY OF ALGORITHM FOR FORMING GROUPS

Considering a class with n students, in which the intention is to form g groups with the same length or, in case n is not a multiple of g, varying by one student, the number of possible groups (t) is given by equation (3) [17] as follows:

$$t = \frac{n!}{(n \div g)!^{g-n \bmod g} \cdot ((n \div g + 1)!^{n \bmod g} \cdot (n \bmod g)! \cdot (g - n \bmod g)!} \quad (3)$$

where:

- “÷” represents the integer division (without decimals)
- n represents the total number of students;
- g represents the number of groups to be formed;
- t represents the total number of possibilities to form the number of groups desired.

Fig. 1 shows examples of formations of groups.

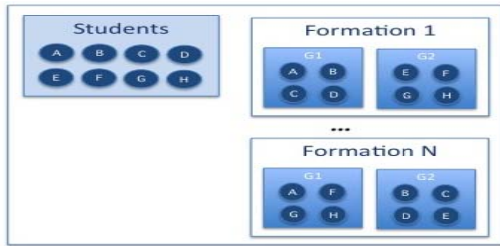


Fig. 1. Fig. 1. Example of formations

In relation to equation (3), Table 1 introduces the total number of possibilities to form groups for class with 10, 20 and 30 students. The table shows that, for a class with 30 students, in case 12 groups are desired, for example, this totals 171.359.270.948.665.800.000 possibilities. Hence, even if the time wasted is 1 picosecond (which is impossible with the current technology) for individual analyses considering one group, the computing for all possibilities would take up to 171,359,271 seconds, i.e., approximately 5 years and 5 months.

For this reason, not all possible combinations were calculated. Hence, the random formation was used up to a limit of 2 seconds to be achieved.

TABLE I. COMPUTABILITY – GROUP GENERATION

|        | N° of students (n) | N° of groups desired (g) | Possible Groups (t)   |
|--------|--------------------|--------------------------|-----------------------|
| Line 1 | 10                 | 4                        | 6300                  |
| Line 2 | 15                 | 6                        | 21021000              |
| Line 3 | 20                 | 8                        | 203693490000          |
| Line 4 | 30                 | 12                       | 171359270948665800000 |

A. Meneduca – Modelling and Implementation

Fig. 2 introduces the UML (Unified Modelling Language) domain class diagram [18] [19] for the Meneduca system, in which attributes and operations are omitted to improve visibility.

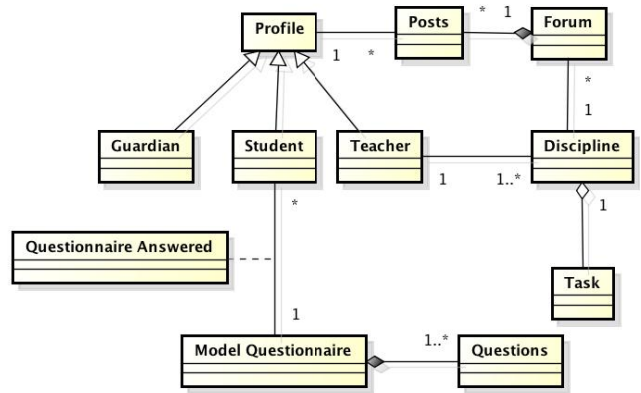


Fig. 2. Domain Class Diagram

The Django Web Framework [20] was used to implement Meneduca. The programming language is Python and it is based on the DRY (Don't Repeat Yourself) concept, which facilitates the implementation. Domain classes were mapped to Django Framework classes.

Dajngo framework has components and some of them are: Object-Relational Mapper - allows communicating with the database; Templates – presents a language to build dynamic pages; URL dispatcher – manages URLs.

The following reasons guided the choice of Django:

- 1) open source framework that can be modified without restriction;
- 2) can be incorporated into commercial products;
- 3) easy to use.

The Postgre SQL DBMS (Database Management System) was adopted because it is open-source and developers already

knew it. Furthermore, using the Object-Relational Mapper makes it extremely easy to change to other RDBMS (Relational DBMS) in case it is made necessary.

Fig. 3 introduces the Meneduca interface for teacher profile.

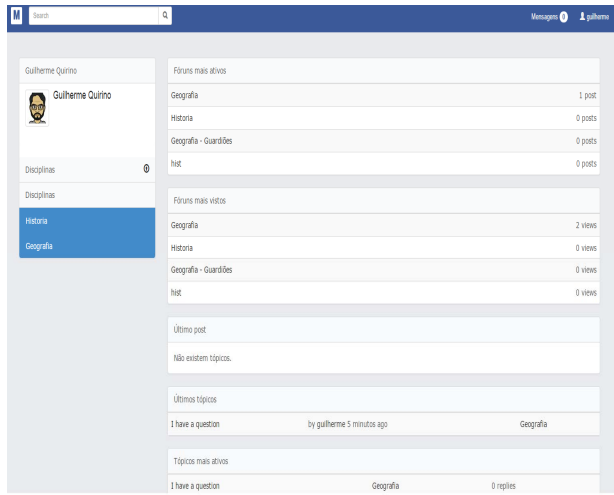


Fig. 3. Meneduca Interface – teacher's profile

## V. CONCLUSION

This work presented the main characteristics of Meneduca, which is a social network to support educational environment, especially for students aged between 9 and 17. Meneduca could improve:

(1) student's performance in academic tasks; the results of the personality test would allow forming more appropriate groups;

(2) students' interest in tasks proposed by teachers; data extracted from social network (Facebook) would suggest themes for tasks.

(3) interaction among students, teachers and parents.

Unfortunately, it was not possible to finish the tool in time to perform real tests in a school to assess Meneduca.

On the other hand, the experience with Meneduca to investigate the use of social network as a source of data for other applications was a success and some aspects should be highlighted:

(1) the migratory process among social networks could occur, then the application could lose its usefulness if it only depended on data extracted from the social network in disuse;

(2) it is common for the authorization APIs license of use to change over time.

(3) the extraction of data from social networks, not only facilitates, or makes a product that uses these data more attractive, but also allows using these data to discover further

information or to solve problems in other systems or applications.

Considering these issues, the software architecture should be modular and prepared to replace the source of data easily if the application has data extracted from social network.

In conclusion, people do not usually keep in mind that when they allow the application to use their data, they are giving permission to use it without specifying what will exactly be done with it. Then, the application or system needs to provide clear information to users, specifying what will be done with their data.

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