On the affective profiling in mathematics e-learning

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Abstract. This paper is concerned with the personalisation of teaching/learning paths in mathematics education. Such personalisation would exploit the research results on the connection between the affective experience of the student learning mathematics and its failure in mathematics. We present a study aimed at recognising the learner affective profile in mathematics. A questionnaire based on the analysis of the student's attitudes towards mathematics has been studied.

Introduction

The development of ICT in education, especially the advent of e-learning platforms, has much more brought the attention of researchers to be focused on the personalisation of teaching and learning paths. This is more important for students with learning difficulties and it cannot leave the research results in the specific knowledge domain at stake for learning out of consideration. Starting from recent researches in mathematics education, we aim to give some hints to be used in e-learning platform in order to offer students personalised learning path in mathematics, especially for those students who usually experiment difficulties in their impact with mathematics. Such personalisation would exploit the research results on the connection between the affective experience of the student learning mathematics and its failure in mathematics (Zan, 2000).

Currently available platforms are often used as Learning Content Management Systems, i.e. as managers of teaching resources which are labelled according to standard parameters such as kind of resource, school level, degree of deepening, size of the resource and so on. A key challenge of e-learning is the chance of personalisation. We want to emphasize that personalisation should take into account both specific content-related troubles and the student's affective profile. In our opinion almost all the current research streams do not explicitly deal with the emotional aspects of learning nor with the need for designing a wide range of learning paths according to the 'affective profile' of each student. As pointed out by Di Martino & Zan (2002), different attitude's profiles with respect to mathematics can be associated to a different affective experiences with mathematics and they require different teaching actions. Moreover, it seems essential to recover some "negative" affective experiences in order to recover difficulties in mathematics.

In this work we present initial studies aimed to identify the mathematics' affective profile of a student, based on Zan's study. The recognition of the affective profile will be founded on a model which interprets the attitudes with respect to mathematics. Such a model is based on the analysis of the attitudes with respect three dimensions:

- the emotional disposal associated to the mathematics, reflected in the judgment "I like/I don't like";
- the view of mathematics held by the learner;
- the view which the learner has of his/her relationship with the mathematics (sense of self-efficiency).

Then a questionnaire has been studied taking into account these dimensions, to be submitted to the learner in order to assign him an affective profile. The rationale of the various questions will be presented, together with hints on how to manage the corresponding answers in an e-learning platform. The questionnaire has been submitted at the beginning of October to Engineering freshmen and the results of their analysis has been presented.

Theoretical background

One of the most important and at the same time critical issues in instructional practice is the individualisation/personalisation of teaching. It is well known that some instructional strategies are more or less effective for particular individuals depending upon their specific abilities. The individualisation at the teaching level means the adjustment of the teaching to the individual students' characteristics, by means of specific and concrete teaching practices Baldacci (1999). Instead the personalisation of the teaching is considered as the set of activities directed to stimulate each specific person in order to achieve the maximum of his/her intellectual capability. In this view the personalisation is at higher lever w.r.t. the individualisation and this is why it represents an educational goal in

technologies environment. To plan an educational path taking into account the personalization means to single out those learning characteristics of the individual such as the motivation, the needs, the emotions, the feelings, the attention, the memory, the language, the thought, the creativity, the cognitive and intellectual styles, the own knowledge, the educational goals, the social relations, so to be able "to take them where they are and to bring them where we want" (Wittgenstein, 1978).

The technologies at the basis of e-learning offer unique opportunities to personalise the learning process and to single out the learner's needs and profile, and moreover they offer many and many flexible and accessible learning paths. Particularly interesting in this framework are the "intelligent web based educational system", which are be used «*not only to carry information by technologies enabling collaboration, but as means able to elaborate data in an intelligent manner, supporting the management of dynamical learning processes, adapting them according the individual cognitive differences*» (Adorni et al., 2007, Albano et al. 2007). They starting from an implicit and explicit learner model and from the knowledge model, allow to create a personalised learning path.

On the other hand, research on education has widely shown the complexity of teaching and learning processes, and thus the inadequacy of one-dimensional models, including the belief that the simple addition of some technology to standard teaching practices could provide considerable improvements of the outcomes. The learning process in fact is «*a process with emotional features and of self perception, success in learning is not due only to cleverness and rationality, but an important role is also played by emotional and meta-cognitive aspects associated to this process*» (Rogers, 1961). In particular any model for education has to consider that students' performances are affected by factors belonging to at least three different levels (Di Martino & Zan, 2003): the cognitive level, which involves the learning of the specific concepts and methods of the discipline, also related to the obstacles recognized by research and practice; the *meta*-cognitive level, which involves learners' control of their own learning processes; the *peri*-cognitive level, which involves beliefs, emotions and attitudes, and all affective aspects, which are most often critical in shaping learners' decisions and performances. Each of these levels has impacted by technology (Albano & Ferrari, 2007) and has to be taken into account in order to offer and manage personalised learning path to students in e-learning environment. This means to manage a student profile which includes these levels and influence the choice of suitable learning activities and learning objects to be offered to the student.

Most of e-learning platforms which manage a user profile, mainly refer to a cognitive state of the student (that is what the student "knows") and to his/her learning preferences (that are his/her preferred modalities of learning). This information are used in the intelligent web based educational systems to create personalised learning paths (Albano et al., 2007). The peri-cognitive, that is affective factors, of the learning process are not really considered, Some news in this direction comes from the field of affective computing (Picard, 1998), that aims to give computers the ability to recognize, understand, and even to have and express emotions.

For instance, (Anolli et al., 2005) aim to design an e-learning platforms endowed with affective computing capabilities. In particular they refer to a 3D virtual tutor provided with emotional expressive synthesis abilities and to a multimodal emotional recognition system able to provide to the platform information about the emotional and motivational state of the user (such as interest, curiosity, frustration, satisfaction, enjoyment, tiredness,…), providing coherent feedback. Actually, in these works only some generic motivational aspects of the peri-cognitive level are considered, but the importance of the emotions in the teaching/learning process couldn't be exhausted by the motivational factors.

Surely the motivational aspects are important and the use of the e-learning strongly impacts on the motivation as shown by the questionnaires results on the expectations of the students about the use of an e-learning platform in mathematics (Albano, 2005). Anyway the recent researches on the emotional aspects show that to consider the only motivational factor is too restrictive: «*a child learning to walk falls, gets up, tries again, even if he falls again and hurts, he gets up to try again to walk, even if he have not positive stimulus, but only hurt from falls*» (Guidoni, 1985).

In mathematics education, Zan (2000) has been interested in emotional aspects in their global vision, especially in order to prevent and recover difficulties in mathematics, and she has shown in her studies how much they are linked to the knowledge domain at stake, in a so strongly manner to state the failure of to state the ineffectiveness of an "not contextualised affective recovering".

From this viewpoint, some remarks particularly meaningful can be found in Zan (2000): there is a strict connection between the "ability" of feeling emotions and the ability of taking decisions (which is obviously involved in problem solving activities and it is considered a key ability in mathematics education); according the cognitive psychologists, the origin of an emotion is due to the interpretation of an event rather than to the event in itself, so it has an essential cognitive component. The didactical implications of such ideas are particularly relevant to the recover learning path. Under these assumptions, Zan concludes: «*the emotions associated to the mathematics, the most "negative" ones as well, do not constitute "uncontrollable" obstacles to the learning process, but on the contrary they are some "signals" which give information on how the student interpret the mathematical experience. According to this viewpoint the mathematics teacher, exactly as "mathematics' teacher", can use those messages in order to know which interpretation of the mathematics the learner has constructed and so to structure suitable didactic situations which modify such interpretation*».

According to Zan's investigations, it is the interpretation of the mathematical experience to put the basis for an attitude more or less positive towards mathematics, and in most case it is the main cause for the starting a negative attitude. Many studies have been conducted on the meaning of attitude and how this can be useful in educational context. The first studies have regarded the relation between attitude and choice of university faculty presenting a mathematics

course (Di Martino & Zan, 2002). The implicit definition of attitude of the cited studies refers to the emotional disposal, which is explicit in the sentence "I like/I don't like". Such simple definition of attitude is not sufficient to foreseen suitable recovery activities. In literature many different meanings of attitudes can be found (Di Martino & Zan, 2001). They can be split into two categories: one, named simple, which identifies the attitude with the emotional disposal (I like/I don't like) towards mathematics; and another one, named multidimensional, with three components: cognitive, affective and behavioural (Eagly & Chaiken, 1998). A multidimensional definition of attitude towards mathematics is given by Zan (2006), connecting the emotional disposal to the vision of mathematics and the interpretation of the mathematical experience. It is based on three aspects: "Mathematics is…", "I am/I am not successful" and "I like/I don't like". These correspond to three interrelated dimensions: the view of mathematics, the sense of self-efficacy and an emotional disposal.

The methodology

To the aim of analysing the "affective factors", we have decided to create a questionnaire, whose questions will be described in details in the following section and which reflect the definition of multi-dimensional attitude proposed by Zan. Such definition is in fact needed in order to have a personalised e-learning intervention in mathematics.
The questionnaire we propose takes into consideration the following three items:

- the learner emotional disposal, revealed by the expression "I like/I don't like";
- the learner's view of the mathematics, reflected by his/her beliefs "The mathematics is …";
- the view which the learner has of his/her relationship with the mathematics (sense of self-efficacy), revealed by the expression, "I'm successful/I'm not successful".

More than the previous aspects, the questionnaire has been enriched to better explore the interpretation that the learner gives to his/her mathematical experience, in order to better intervene to recover.
At first we have decided to analyse each of these aspects w.r.t. the two faces of the mathematics, that is the instrumental one and the relational one[1]. In fact, very often the failure in mathematics, its vision or the emotional disposal in doing mathematics do not regard the topic in its global vision, but just one or the other aspect. In many compositions, reviewed by Zan, students expressing low preference for mathematics connect it to the instrumental idea of mathematics, that is in general to the rules sequence to be mechanically applied, and the same occurs for the vision of mathematics and for the sense of auto-efficacy. Thus we have considered indispensable for a complete picture of the leaner attitude of mathematics to analyze each factor w.r.t. instrumental and relational mathematics.
With respect to the emotional disposal, we have introduced an explicit question on the feelings associated to doing mathematics. This is because, as pointed out by Zan, they are sensors useful to understand the interpretation of the learner mathematics experience, as they are generated exactly by the latter, and then they are useful to choose the right intervention.
With respect to the sense of auto-efficacy, particularly meaningful are the causal attribution, that are the beliefs constructing and elaborated by a person trying to interpret his failure. Thus we have decided to introduce in our questionnaire a question aimed to investigate these aspects.
Weiner (1978) have outlined that the causes ascribed to the success or the failure can differ according to various dimensions:

- locus: he distinguish between external and internal causes (e.g. "to be able" has been considered an internal cause, whilst the "help obtained by other people" is an external one);
- steadiness, w.r.t. time: e.g. "to be lucky" is not steady;
- controllability: the engagment is considered controllable, whilst the difficulty of a task is not).

These distinction appear fundamental to the aim of modifying the output of a person: it is sufficient to bring on changes in the causal attributions and the effect will be, by suitable interventions, to move the causes from internal and steady ones (e.g. to "be not able") to external, not steady and controllable ones (e.g. the engagement), so to increase motivation and persistence w.r.t. the objective. The best way to intervene and remove the causes of such failure is to "suitably" develop the meta-cognitive skills, i.e. management of own cognitive resources (Zan, 2000).

We can schematize the methodology underlying the questionnaire as shown in the following figure (Fig. 1.):

[1] According to Skemp (1976), we distinguish instrumental mathematics which is characterised by formulas, to keep in mind, exercises, products; relational mathematics, which consists in reasoning, thinking, problems, processes;
which is reflected by a corresponding difference of "comprehension": instrumental understanding, which means to know rules and to be able to apply them; relational understanding, which is to be aware of connections and reasons.

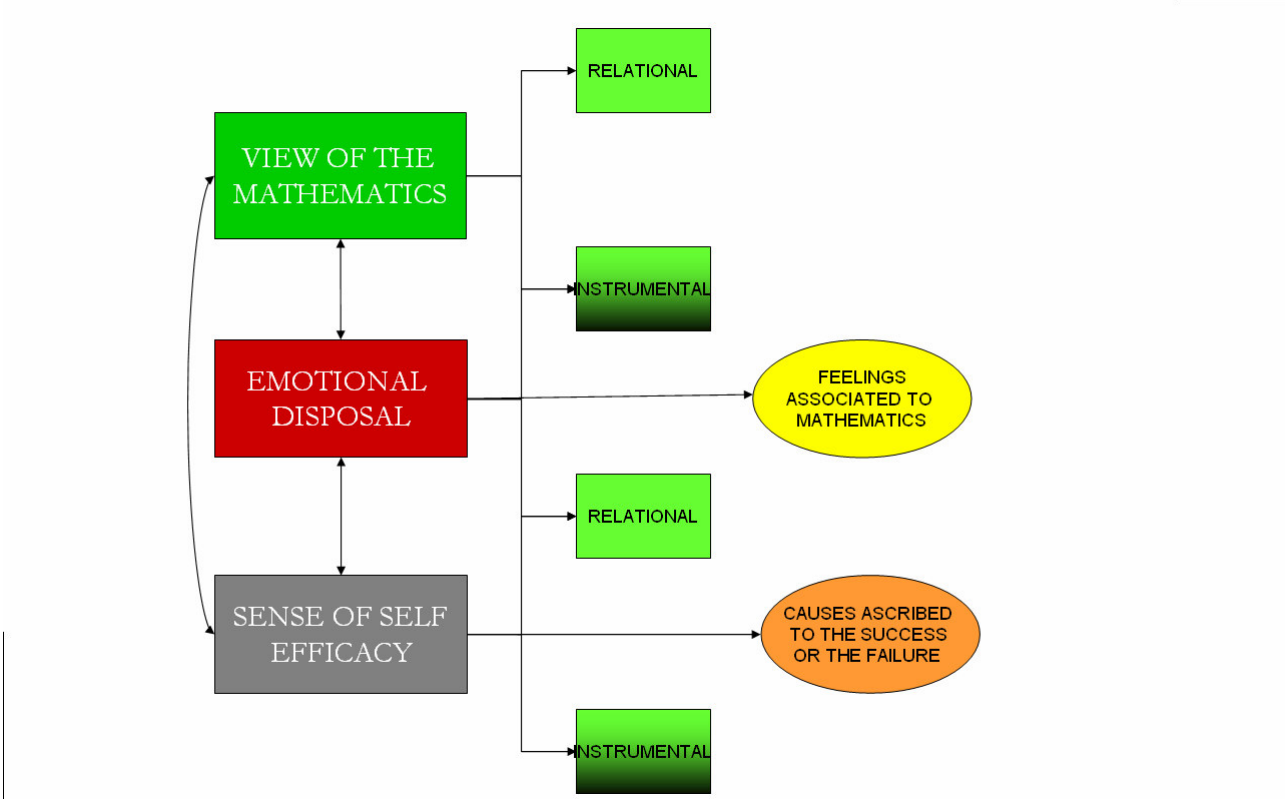

Fig. 1. Scheme of the learner's affective profile in mathematics

All the information obtained by the questionnaire will contribute to create what we call "affective profile in mathematics". It will be used on one hand to individuate the interpretation of the mathematical experience in order to have some indications to be used in the recover/prevention learning activities, and on the other hand to have a picture of the learner's attitude towards mathematics and the it can be used during the learning process to evaluate the effectiveness of the intervention on the affective aspects.
Regarding the kind of the questions, we decided to have a mixed questionnaire with some close questions, whose answers can be easily foreseen and classified, and some open questions. In fact, even if it is simpler to manage close questions in an e-learning platform, there is the risk of forcing an answer in one or another direction chosen by the researcher (Di Martino et al., 2007). Following this idea, we have decided to have both close and open questions. We have already submitted the questionnaire to about 600 freshmen students at Engineering Faculty in order to explore the possible answers to the given open questions. They will be used on one hand to have a partially automatic management (by means of database containing the already collected items) and on the other hand they will give an adjustment factor for the close answers.

The questionnaire

In this section we are going to present a questionnaire to be submitted to the learner in order to set the values of the affective profile. As written above, the questionnaire is constituted of both close and open questions.

According to the theoretical background, the questionnaire reflects the three cited dimensions: the emotional disposition associated to the mathematics (questions 1 – 5); the view of mathematics held by the learner (question 14); the view which the learner has of his/her relationship with the mathematics (questions 6 – 12).
Let us give a detailed look at the questions. The following two questions concern respectively the dimensions 1 and 2:

1. *Do you like mathematics?*
    a. *No, not at all!*
    b. *No… just a little bit.*
    c. *Yes, I do enough.*
    d. *Yes, I do very much!*
14. *Choose three adjectives to describe mathematics.*

The first one will allow to split the students into four groups according to different emotional disposals: VN (very negative), N (negative), P (positive), VP (very positive). The open analysis of the open answers to the second one will be used to confirm or not the previous assignment. This will be done exploiting the categorization of the adjectives with respect to the emotional groups made by Di Martino et al. (2007). The e-learning platform will contain a database of the adjectives collected by Di Martino et al. and the related categorization. It is obvious that some few new adjectives could be arisen, so a tool able to recognise the similarity will be used to assign a categorization label to those ones. This will allow an automatic management of the open question.

As written in methodology, In order to better investigate the emotional disposal, we pose the following question:

5. *Which sensations do you feel when you do mathematics?*

This question is relevant to single out negative emotions associated to mathematics, and this is important to avoid the causes that generated those choosing the most suitable learning activities. Examples can be found in Zan (2000).

Going more in depth, we have the questions, that are specifically related to relational and instrumental knowledge[1]:

2. *When you do mathematics how much do you like the following activities?*
    a. *To carry out exercise: not at all, not so much, enough, much*
    b. *To solve problems: not at all, not so much, enough, much*
    c. *To learn theory: not at all, not so much, enough, much*
3. *What sort of exercise do you prefer?*
4. *What sort of exercise do you like less?*

The questions 3, 4 analyze the same factors of the question 2, but are open and in this way they seems to be useful to confirm or not the assignment given by the question 2. We suppose that to the answers "*No… just a little bit"* or "*Yes, I do enough"* to the question 1 will correspond to a preference of istrumental/relational mathematics.

Then the following questions aim to investigate on the learner's sense of self-efficiency. Let us consider:

6. *Are you successful in mathematics?*
    a. *Yes*
    b. *No*
    c. *Partially*

Question 6 allow to get a first splitting into three groups according to the given answer. The third option refers to those students who consider themselves able to make exercises (due to some mechanical application of rules) but not able to study theory, or conversely able to study theory (due to learning by heart) but not able to make exercise.

7. *What do you deduce that you are/are not good at mathematics from?*
    a. *I get …*
        i. *good marks*
        ii. *bad marks*
    b. *when I do mathematics*
        i. *I understand*
        ii. *I don't understand*
8. *(in case of answer ii to 7a) What are your bad marks due to?*
    a. *Lack of enough time to complete the examination questions or problems*
    b. *Made mistakes*
    c. *Worry of making mistakes*

Questions 7 and 8 go into depth in investigating the learner's beliefs about his/her perception of self-efficiency sense. In particular, they allow to know "from which clues the student becomes aware he or she is not being successful", thus representing an evidence of the causes he/she ascribes to his/her success or not. According to Zan, knowing the causes attributed by the learner to his/her failure allows to set up suitable learning activities in order to recover the profile. In particular, for the question 7 we suppose that students who answer partially to the question 2, will state to have good marks but to not understand or to have bad marks and to understand.

13. *Your failure in mathematics is due to:*
    a. *The subject*
        i. *Why?*
    b. *The teacher's didactical approach*
        ii. *Why?*
    c. *Your difficulties*

iii. *Which ones?*

We can note that options 7.a.ii together with 8.a may indicate some external causes of failure (for instance, the teacher); whilst options 7.a.ii together with 8.b or 8.c or 7.b.ii may indicate some internal causes (to be "not able"). The three options for answering to question 13. refer respectively to external causes (a and b) and internal ones (c) and the related data will be compared with the ones related to the questions 7 and 8. In particular, question 13.b could be linked to the relation 'I take good marks / I do not take good marks', whereas answers to 'Which ones?' of question 13.c provide data that could be linked to either question 9 (errors, lacks of knowledge') or to question 6 (emotions).

Finally we report four questions focused on the relation of the self-efficiency sense of the learner with the issue of instrumental and relational knowledge:

9. *Do you remember the rules?*
   a. *Yes, very much*
   b. *Not so much*
   c. *Enough*
10. *Are you successful to apply the rules when suitable?*
   a. *Very much*
   b. *Not so much*
   c. *Enough*
11. *In your opinion is it important to know the reasons underlying the rules to be studied?*
   a. *Very much*
   b. *Not so much*
   c. *Enough*
12. *Estimate (giving a mark between 1 and 3) your skills in:*
   a. *Carrying out exercises*
   b. *Solving problems*
   c. *Learning theory*

In particular, questions 9, 10 and 11 are related to relational understanding, whilst question 12 is related to both instrumental and relational one[1]. Moreover, being related to the I am successful / I am not successful polarity, their results will be compared with the ones to the question 6.

Results of the questionnaire

In this section we want to sketch the main results of our investigation. The investigation has been performed using the method of the *self-fulfilling interview* (Brusati, 2003). The questionnaire has been distributed to freshmen Engineering students during a class. The students have been asked to fulfil it promptly and give it back by an half of an hour. We have collected 623 questionnaires.

At first, as we have *open* questions it has been necessary to codify the collected answers, that is we have given a look at the answers and make a list of the more frequent answers *type*. In most of the cases (questions 3, 4, 5 and 14) the codification has been simple, as the answers were collections of single words (e.g. integrals, derivatives, satisfaction joy, beautiful, important, etc.) and has brought to the construction of a vocabulary. Whilst for the question 13, we noticed that students have adopted a narrative style, thus we had some more work to associate answers with similar meaning. The previous remarks mean that for the first cited questions, it is possible and simple to foreseen an automatic management of the answers, by the use of the vocabulary and some suitable software to recognise similarity. This is not true for the question 13, and maybe some different approach has to be further investigated in order to automate the process.

In the following we are going to present some data from the analysis of the answers and some interpretations that can be deduced.

Starting from the first question, we have the following distribution of the population into four group (Fig. 2.), named VN (Very Negative), N (negative), P (Positive), VP (Very Positive) according respectively to the four options *No, not at all!*; *No… just a little bit*; *Yes, I do enough*; *Yes, I do very much!*:

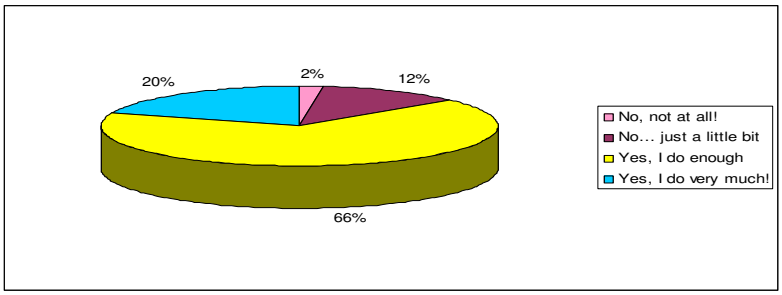

Fig. 2. Distribution of simple emotional disposal towards mathematics

The fact that most of the students have a positive emotional disposal towards mathematics is in line with the expectation, as the population is composed by Engineering students.
Going on to the question 2, we have analysed the correlation between the students who have chosen intermediate answers, that are *No… just a little bit* and *Yes, I do enough*, to the question 1 and the possible answers to the questions 2.a and 2.b, which represents respectively the emotional disposal towards relational and instrumental mathematics. The 80% of students are in the cited situation. We have found the following data:

	Answers VN or N	Answers N	Answers P	Answers VP or P	
Question 2.a				x	21%
Question 2.b	x				
Question 2.a	x				10%
Question 2.b				x	
Question 2.a		x	x		72%
Question 2.b		x	x		

Table 1. Matrix of correlation between questions 2.a and 2.b

From the previous table, we deduce that most of the students who have not extreme positions w.r.t. to the emotional disposal towards mathematics, have the same position w.r.t. relational and instrumental mathematics. Probably this is the case of those students who are not very interested or are uninterested in mathematics, but simply they do because they must. This hypothesis needs to be further investigated, choosing different populations. In fact, as we have interviewed Engineering students, we have to take into account the most common belief that "mathematics is in service of more technical and characterising Engineering topics".

Let us consider the correlation between problems and theory. From the analysis of the answers to the question 2 we noticed that the 43% of the sample have chosen both "*Yes, I do enough"* or *"Yes, I do very much!"* for the question 2.b and *"No, not at all!"* or *"No… just a little bit"* for the question 2.c. We deduce that for a great percentage of students learning theory means "learning by heart", for this reason this question does not seem to be significant to analyze the relation between relational/instrumental mathematics and emotional disposal or sense of self-efficacy.
So we present only the percentage of the questions 2.a and 2.b, corresponding to students preferring respectively instrumental (Fig. 4.) and relational mathematics (Fig. 5.):

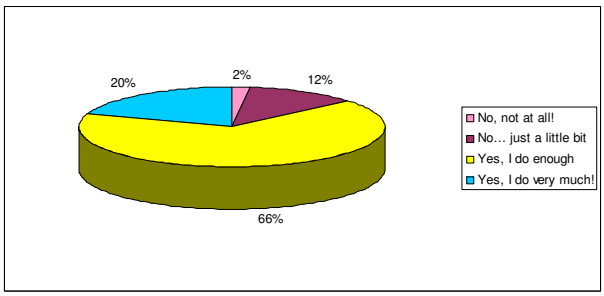

Fig. 3. Distribution corresponding to question 2.a

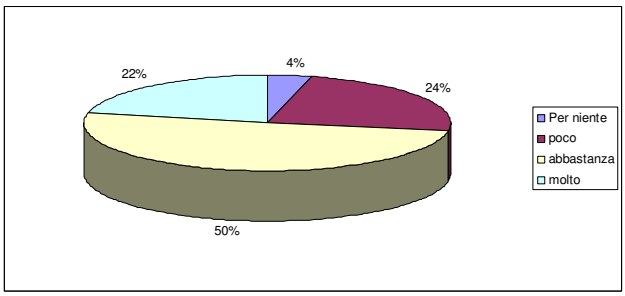

Fig. 4. Distribution corresponding to question 2.b

One more remark regards the questions 5. We have classified 37 positive feelings and 14 negative ones. The presence of more positive feelings is in line with the kind of population (Engineering students are usually "well inclined" to

mathematics).We want to underline that 46% of the students stating positive feeling assume them only "sub conditione", that means they feel good *if they are successful*.

Regarding the learner's sense of self-efficacy, from question 6 we have found that 42% of the population have stated that *he/she is partially successful in mathematics*. Then we have analyzed the corresponding possible answers to the questions 7.a e 7.b and the related correlations, as shown in the following table:

	I understand	I don't understand	No answer
Good marks	39%	2%	5%
Bad marks	20%	11%	5%
No answer	5%	11%	2%

Table 2. Matrix of correlation corresponding to question 7.a and 7.b

As the highest percentage corresponds to a very positive situation (a student who understands mathematics and has good marks) and it is in contradiction with the statement of the question (that was focused on failure), the obtained results are not meaningful and maybe the question has not been understood and it has to be better reformulated.

Let us now consider the questions related to the investigation on the causes of the failure.
First of all we notice that the question 8 goes in this direction, in fact some students have added new boxes writing more causes. Thus we have concluded that it has to be included in the question 13.
The figure below shows the distribution of the causes (Fig. 5.):

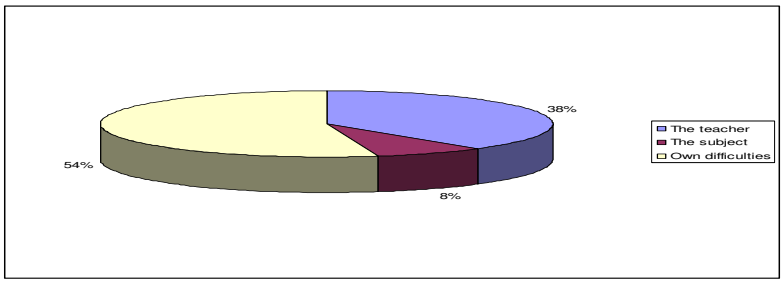

Fig. 5. Distribution of the failures' causes

As we can see, few students have ascribed their failure to mathematics. Further, even if the cause has been identified as "the subject" , actually their answers make evident a correlation with their own difficulties (e.g. "mathematics requires much study" can be also read as "I do not study enough", so moving from difficulties due to the subject to personal difficulties). Anyway, a good part of the population ascribe the failure to the latter ones. From the analysis of the answers, we have found that almost 24% of them can be classified as *peri-cognitive* difficulties: for instance, "not be able to learning theory by heart" or "not to be able to apply in daily life" are related to the vision of mathematics (in the first case there is the belief that "theory has to be learning by heart" and in the second case "mathematics is important because it is useful in the real life"); "insecurity" or "fear to make errors" are related to emotional aspects (in both the cases activities aiming to revalue the mistake in its positive role are needed). Finally, the causes ascribed to the teacher can be split into four main groups, as shown by the above table:

Mismatching between learning and teaching styles	57%
Problems in interpersonal relationship between teacher and student	21%
Lack of motivational aspects	9%
Teacher considered not up to the task	21%

Table 3. Distribution of the causes ascribed to the teacher

Most of the problems related to the teacher are because the teaching style of the teacher is different and not suitable to the learning style of the students. This can be overcome in an e-learning context, due to the flexibility of the learning

path that can be adapted to the student's learning style and preferences. Further the e-learning modality allows the students to take *their learning time*, in fact many students have reported the fact that the teacher, in face-to-face context, is in a hurry to complete the programme, not taking into account the students.

Future trends

We plan to go on with research on personalisation of teaching for students with learning difficulties in mathematics. Recent research in mathematics education has shown that personalisation should take into account both specific content-related troubles and the student's affective profile. Currently platforms do not take into account affective factors, except motivational ones. As pointed out by Di Martino & Zan (2002), different attitude's profiles can be associated to a certain belief and they require different teaching actions. The questionnaire we have presented in this paper would be a first step to introduce in a much more effective way the affective factors in the e-learning process.

Starting from the analysis above, in more details we plan:

- to investigate the possibility of implementing the questionnaire on the platform making its management automatic as much as possible;
- to schematize an affective profile deriving from the answers to the questionnaire;
- to associate an affective profile to each student;
- to design and experiment learning activities suitable to different profiles, in particular useful to recover "negative" profile and then difficulties in mathematics;
- to investigate how to monitor the evolution of the affective profile of a student and its relation with the overcoming of difficulties on one hand and with the cognitive and meta-cognitive level on the other hand.

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