The Synergy project: emotional intelligence to improve motivation and learning

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***Abstract*—le résumé du papier...**
***Index Terms*—emotional intelligence, learning, motivation**

I. Introduction

This Innovative practice full paper presents the Synergy project whose objective is to evaluate the contribution of the emotional intelligence for improving motivation and learning of the first year graduate students. Several groups of 15 students have been considered: some groups follow electrical engineering and industrial computing curriculum and some other come from heterogeneous curriculum. Each group has followed five sessions in emotional intelligence. Each session lasts three hours. The originality of this work is to consider a new paradigm inspired from experimental psychology. Moreover, we have used an evaluation methodology (EVA) which is also an original prototype. EVA is based on experimental psychology and makes it possible to analyze objectively the impact of the teaching practice in two ways. First, the use of pre-test, immediate post-test, and deferred post-test questionnaires related to motivation and subject matters related to the training curriculum helps measure student progress over time. Second, the use of a test group and a control group makes it possible to reinforce the impact of the educational innovation. For each test group, we associate a control group that undergoes an evaluation similar to the test group, but only for modules related to their training (algorithmic and mathematics have been chosen). The assessment of motivational factors is only offered to groups who have attended emotional intelligence sessions. A total of 75 students attended the emotional intelligence sessions. The first results are very promising. The student satisfaction rate is close to 100%. There is a significant improvement in motivation and self-awareness. In fact, students who have difficulty getting to work, learned to identify the levers to manage their own motivation and stress, and students with greater difficulty are able to become aware of the effect this has on their academic results. The rest of the paper is organized as follows. The next section describes the project and its context. Section III presents the material and the method for conducting the study. In section IV we give the first obtained results. At last, we conclude and give some of the next steps and perspectives of the project.

This work was co-funded by ... University and ... ministry of Higher Education and Research

II. Context of the project

Since 2009, our university has experienced a fairly clear decrease in first-year license completion of 27.9% across all sectors. This level is 11.8 points below the national average. The local context is marked by the diversity of courses and frequent unpreparedness of new students, the low success rate in L1 raises many questions. Our university wishes to be a volunteer and a strong proponent to go towards the experimentation of original L1 devices and the student training policy. For this purpose, our university has an L1 Observatory composed of teachers, researchers and administrators responsible for leading the process by calling upon the needs (and as it is the case for the project Synergy) to specialists. The architecture and the observatory's missions were established in spring 2015. The overall objectives are to take into account the diversity of students: fostering success in L1, reduce the failure rate, significantly increase the graduation rate, homogenize the knowledge and relationship to the studies of young people, promote the learning of the "student job" and ensure a good transition from high school to university.
The dimensions of self-awareness and personal development have often been neglected at the University, creating a divide between academic work and self-work, both of which are necessary to build themselves professionally and in life. Several experiments have been conducted in recent years in France (University of Montpelier, University of Toulon, La Rochelle University). In addition, many scientific studies have shown that the explicit consideration of the psychological dimension (especially emotional dimension) in the training courses increases intellectual capacities and increases the success rate. The originality of the SYNERGIE project is to "bet" on interaction and synergy at different levels: students, teachers of different specialties, and coaching professionals.

III. Material and method

A. EVA methodology

EVA methodology provides an assessment guide for educational transformations and innovation[1]. It has been designed by a collaborative team composed by developmental psychologist

[1] www.villebon-charpak.fr/wp-content/uploads/2019/01/Version-EVA-imprimable-compress%C3%A9e.pdf, accessed on April, 1 2019

researchers and education experts (Villebon-Charpak Institute and Canada)[2].

EVA is a professional tool that provides rigorous, encrypted and easily communicable information on the relevance of a pedagogical transformation. This allows a teacher to respond autonomously and without preconditions to the question: which of my usual pedagogical practice (UPP) or my new pedagogical practice (NPP) most favors learning in the short and medium term in my teaching context?

The collected data at the end of the various evaluations can be used to explore more general rules of learning such as: "in which teaching contexts is an educational practice the most relevant?"

EVA comprehends three distinct variants:

1) **One lesson, two years, two groups**: it is to apply a UPP to a first year teaching, to evaluate the impact, then to implement and evaluate the impact of its NPP the next year, when we will offer this same teaching to a new group of learners.
2) **One lesson, one year, two groups**: the same teaching is given in the same year to two groups of different learners which are equivalent and which do not communicate. The impact of the applied UPP with one group and the impact of the applied NPP with the other group is then assessed. This variant is the simplest and fastest to implement.
3) **Two lessons, one year, one group**: UPP and NPP are applied to two different courses with similar difficulty and given to the same group of learners.

Judging and convincing the equivalence of two lessons requires more effort than the equivalence of two groups of learners. But third variant is the most appropriate if one wants both practices to benefit the same learners. In the case of the Synergy experimentation project, we adopted the second variant, mainly for its simplicity of implementation. In order to implement an EVA assessment protocol, we need to proceed in the five steps described hereafter. The italic text corresponds to the instantiation of the step in the context of Synergy experimentation project.

1) Identify a non optimal parameter we need to improve: *learning programming in C language*;
2) Among the various possible causes of this insufficiency, which one should we eliminate? *less of motivation*.
3) What is the NPP that will be implemented to try to eliminate this cause? *Coaching sessions in emotional intelligence in parallel with the C language courses.*
4) What is your UPP? *Learning C language with a classical lessons (courses and supervised work).*
5) Write up the pedagogical question, for example, in the form: is my NPP more relevant than my UPP in favoring the "targeted non-optimal parameter" by eliminating "the cause of this targeted inadequacy"? The Synergy question is: *Is it more relevant to follow E.I. coaching sessions than not to follow E.I. coaching sessions to improve C language learning, eliminating the motivation factor?*

The next section describes the implementation of these steps in the context of the Synergy project.

B. Emotional intelligence sessions

Emotional Intelligence (EI) has been defined by Daniel Goleman ([2]) as the ability to recognize our own feelings and those of others, to motivate ourselves, and to handle our emotions well to have the best for ourselves and for our relationships. EI describes capacities different from, but supplementary to, academic intelligence. Daniel Goleman compiles these capacities into five clusters: Self Awareness, Self-Regulation, Motivation, Empathy, and Social Skills. It has been showed in [3] that the use of IE skills is a determining factor to innovate and develop its performances.

In this paper, we have explored this idea for the first year graduate students in order to study how this skills can help them to improve motivation and learning programming in C language. The concept of collective intelligence which is associated to mirror mirror concept [4] are also strong arguments for the synergy among the students. Cooperation and interaction are at the heart of learning.

The students attend 10 sessions of 3 hours each. It is important that each group does not exceed fifteen members. As shown in figure **??** the spatial arrangement in a circle allows students to see each other.

Our experimentation involves behavioral exploration through collective, thematic, experiential and interactive sessions. We give below some examples of themes worked during the sessions. The choice was made in consultation according to the objectives of the members of the group. However, the first session is always dedicated to the concept of commitment.

- Assessment of his social skills
- codes and fundamentals of emotional intelligence
- assertiveness and leadership
- Self control
- Crisis management and loss of sens
- Oral exam preparation,control of stress and stress management
- To learn for a know-how
- To develop for a knowledge to become

C. Implementation of measures and comparisons performances

To measure the relevance of a pedagogical transformation, we compared the learning achieved with the UPP and those made with the NPP. It is assumed that as a professional in the assessment of knowledge and skills targeted and about its teaching context, the teacher is the most appropriate person to prepare assessment tests of learning. This step is therefore only intended to provide the indications and recommendations

[2]uvre originale EVA est le produit dune collaboration entre lInstitut Villebon - Georges Charpak (Orsay, France) et lEquipe de Recherche en Education Scientifique et Technologique (Montral, Canada). Elle est mise disposition selon les termes de la licence Creative Commons Attribution Partage dans les Młmes Conditions 4.0 International.

necessary for the structuring and rigor of the approach proposed in EVA. We measure the evolution of knowledge and skills in the short term (between the beginning and the end of the education), but also in the medium term (between the beginning of the teaching and a few days to weeks after the end of the teaching). For this, it is necessary to test the knowledge and/or skills targeted by the teaching at three points in time:

- A pre-test is realized before the beginning of the course. It can be proposed at the beginning of the first session or the end of the previous one.
- An immediate post-test is realized immediately after the sessions. At best, it is carried out at the end of the last session, failing this, as soon as possible in the days following the end of the course.
- A delayed post-test is realized sometime later. It can be performed between a few days and several decades after the immediate post-test. A delay of one week to a month seems reasonable in most cases.

The three test are prepared before the beginning of the sessions both for UPP and NPP. EVA gives some helpful recommendations, the most important are:

- These tests are specific to EVA and should not be included in formal assessments of knowledge and skills. This precaution makes it possible to reduce the stress of the learners and to increase the homogeneity of the tests. Indeed, the pre-test can not be evaluated formally since it is given before teaching. The use of a scale prepared upstream must allow each test to be assigned an objective and quantified score. This scale must be common to all six tests to ensure comparison of the scores.
- Tests of ten to fifteen minutes are usually a good compromise between the time taken on the course and the quality of the measurement collected. it is necessary to ensure that there are enough evaluation criteria for each test so that they are representative of the state of learners' knowledge and / or skills. The duration of the tests can be shortened or lengthened if necessary o desired. In any case, the time allowed for the six tests must be respected so as not to introduce any bias in the results.
- In order to improve the statistical quality of the measurements, one can draw randomly whenever one needs to choose elements among a set or in which order to present elements. For example, one can randomly draw the knowledge and / or skills that are evaluated from those targeted in the targeted courses and the order in which the six tests prepared will be proposed.
- The six tests must be equivalent in terms of structure and difficulty.

IV. Results and discussion

For each of the two groups of the study, tests have been conducted as explained earlier using the EVA evaluation methodology. A pre-test has been realized before the beginning of the workshop, with 20 respondents, and a post-test has been realized immediately after the end of the workshop, with 17 respondents. A delayed post-test has also been realized but with too few respondents to be significant, so we won't comment about the corresponding results. We will first analyze the results for the AA group, since it was the most numerous one, and we will then analyze the differences between the two groups. One of the first thing to be noticed is that the students were quite ambivalent about the workshop they were about to begin. They had both high expectations, with 90% of the students hoping that it would help them in their studies (see Fig. 1), while having low confidence that it would indeed be useful, with very mixed feelings about the potential interest of the experiment (see Fig. 2). One possible explanation for this distrust is that the participation in the workshop was not a real choice for most of them, but rather a default choice, or at best the result of curiosity (see Fig. 3).

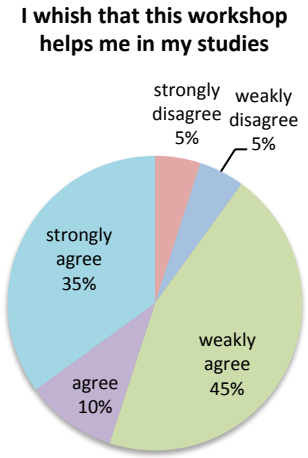

Fig. 1. Initial expectation for the AA group

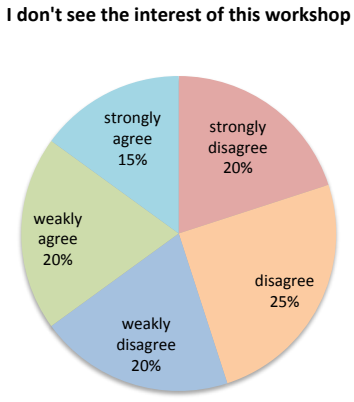

Fig. 2. Pre-test evaluation of the interest for the AA group

A series of questions was designed so as to evaluate the expectations of the students with respect to the way the

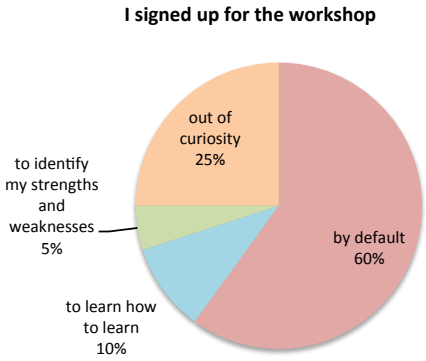

Fig. 3. Reasons for signing up in the workshop

workshop may help them. The questions were formulated as "I wish that this workshop..." and the different propositions were the following (in parenthesis, the label used for the proposition in tables I and II):

- "helps me in my studies" (*studies*)
- "helps me in my personal life" (*personal life*)
- "brings me self confidence" (*self confidence*)
- "brings me a clearer study project" (*clear study project*)
- "brings me a better handling of my emotions" (*emotions handling*)
- "brings me a better handling of my stress" (*stress handling*)
- "the assertion of my personality" (*personality assertion*)

The students were asked to express their feeling using the following scale: *strongly disagree*, *disagree*, *weakly disagree*, *weakly agree*, *agree*, *strongly agree*. Table I synthesizes the results obtained. To simplify the analysis, we grouped the answers into only four categories: *strongly disagree* (SD), *disagree* (D, by grouping *disagree* and *weakly disagree*), *agree* (A, by grouping *weakly agree* and *agree*), *strongly agree* (SA). The various propositions are ordered in the table by decreasing positive valuation (SA + A), than decreasing strong agreement (SA).

Interestingly, the students have the perception that the workshop may be of interest mainly in the context of their personal life (100% of agreement) but not as much in the context of their studies (still 90% of agreement, with more or less conviction). Except for the assertion of their personality, which is rated lower, all the other expectations are given 90% rate of agreement, with a varying rate of *strong agreement*. The students are highly confident that the workshop may generally enhance their self confidence (40% of SA) but a little bit less that the workshop will give them tools or techniques for a better handling of their emotions (30% of SA) and stress (25% of SA). Finally, most of them have the hope that it will help them clarify their study project, which may not be the main goal of the workshop.

The post-test evaluation enables to assess whether the workshop has fulfilled its promises or on the contrary has been

TABLE I
EXPECTATIONS OF THE STUDENTS IN THE PRE-TEST

Expectation	***SD***[a]	***D***[b]	***A***[c]	***SA***[d]
personal life	0%	0%	70%	30%
self confidence	10%	0%	50%	40%
studies	5%	5%	55%	35%
emotions handling	5%	5%	60%	30%
clear study project	5%	5%	65%	25%
stress handling	5%	5%	65%	25%
personality assertion	10%	15%	55%	20%

[a]strongly disagree
[b]disagree or weakly disagree [c]agree or weakly agree
[d]strongly agree

deceptive (see Table II, with the propositions being ordered with the same criterion as previously). In this respect, the main teaching is that, while holding its promises in the context of the personal life, the workshop has also succeeded in convincing the students of its usefulness in the context of their studies (+10% of positive assessment and +12.1% of strong agreement), and in the handling of their emotions (+9.7%). Comparatively, it may have been a little bit deceptive with respect to the handling of stress (-7.1%) and the enhancement of self confidence (-5.3%).

TABLE II
EVALUATION OF THE STUDENTS IN THE POST-TEST

Evaluation	***SD***[a]	***D***[b]	***A***[c]	***SA***[d]
personal life	0%	0%	47.1%	52.9%
studies	0%	0%	52.9%	47.1%
emotions handling	5.9%	5.9%	35.3%	52.9%
self confidence	5.9%	5.9%	41.1%	47.1%
stress handling	11.8%	0%	52.9%	35.3%
personality assertion	5.9%	11.8%	47%	35.3%
clear study project	0%	17.7%	52.9%	29.4%

[a]strongly disagree
[b]disagree or weakly disagree [c]agree or weakly agree
[d]strongly agree

If we look globally, as compared to the pre-test where the students were very doubtfull about the usefulness of the workshop (Fig. 2), it appears very clear that the students have recognized the workshop for being interesting in the end (Fig. 4).

For the second part of the evaluation, students were asked to think about a course that is quite important in their curriculum and to express their feeling about the following propositions using the same grading scale as previously (in parenthesis, the label used for the proposition in tables III and IV):

- "I am curious to know more about this theme" (*curious to know more*)
- "This course will be useful later" (*useful course*)
- "What I learn is in keeping with my values" (*in keeping with values*)
- "I oppose those who want to impose me this course" (*oppose if imposed*)
- "I don't see the point in this course" (*don't see the point*)

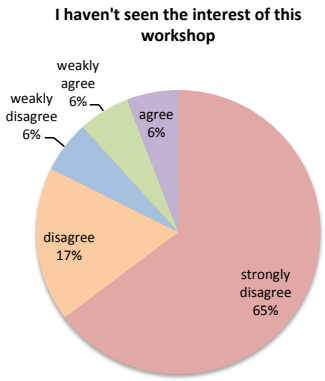

Fig. 4. Post-test evaluation of the interest for the AA group

- "to follow this course is a chore that I can not escape" (*inescapable chore*)
- "I absolutely have to validate this course" (*must validate*)
- "It annoys me that this course is imposed" (*annoyed because imposed*)
- "I want to do better than the others" (*do better*)
- "I am obliged to undergo this course" (*obliged to undergo*)
- "I'm afraid we'll laugh at me if I fail" (*afraid of laughs*)
- "I like that others recognize my abilities" (*recognized abilities*)
- "I find pleasure in learning this subject" (*pleasure in learning*)
- "I look forward to not having to take this course" (*look forward to end*)
- "This course is a waste of time" (*waste of time*)
- "I am anxious about not validating this course" (*anxious about failing*)
- "the ideas presented in this course have the power to improve society" (*improve society*)
- "I would feel ill at ease if I had insufficient grades in this course" (*insufficient grades*)
- "It is important to me to have good grades in this course" (*good grades*)
- "This course helps me to give the best of myself" (*give the best*)
- "I avoid this course as soon as I can" (*avoid the course*)
- "I would feel ashamed that others think I am not able to validate this course" (*ashamed if not able*)

V. Conclusion

The perspectives of this work are numerous. New experiments are in progress with the same evaluation protocol. For the future experiments, the questionnaires are being prepared with the involvement of sociologists to refine the questions. In the longer term, researchers will be able to aggregate data collected in bulk to perform meta-analyzes. This will enable to identify new important reasons of students failures. Then, it will be possible to have another target than *motivation*. We think that classification algorithm will also be helpful.

TABLE III
Appreciation about a specific course in the pre-test

Appreciation	***SD***[a]	***D***[b]	***A***[c]	***SA***[d]
must validate	5%	5%	40%	50%
useful course	0%	5%	55%	40%
good grades	0%	10%	50%	40%
curious to know more	0%	10%	55%	35%
anxious about failing	5%	20%	40%	35%
insufficient grades	5%	20%	40%	35%
do better	15%	15%	40%	30%
recognized abilities	0%	10%	65%	25%
ashamed if not able	35%	15%	30%	20%
in keeping with values	5%	10%	70%	15%
give the best	5%	30%	50%	15%
afraid of laughs	30%	30%	25%	15%
improve society	5%	25%	60%	10%
pleasure in learning	10%	30%	50%	10%
obliged to undergo	10%	35%	45%	10%
look forward to end	10%	45%	35%	10%
waste of time	35%	35%	20%	10%
avoid the course	40%	35%	15%	10%
inescapable chore	20%	30%	45%	5%
oppose if imposed	20%	40%	35%	5%
annoyed because imposed	30%	35%	30%	5%
don't see the point	30%	60%	10%	0%

TABLE IV
Appreciation about a specific course in the post-test

Appreciation	***SD***[a]	***D***[b]	***A***[c]	***SA***[d]
useful course	5.9%	0%	23.6%	70.5%
must validate	0.0%	5.9%	41.1%	53%
do better	11.8%	11.8%	29.4%	47.0%
good grades	0.0%	0%	58.8%	41.2%
improve society	5.9%	11.8%	41.2%	41.1%
curious to know more	5.9%	11.8%	47%	35.3%
recognized abilities	5.9%	0.0%	64.7%	29.4%
insufficient grades	17.6%	11.8%	41.2%	29.4%
give the best	11.8%	29.4%	41.1%	17.7%
pleasure in learning	0.0%	17.7%	64.7%	17.6%
anxious about failing	23.5%	11.8%	52.9%	11.8%
avoid the course	47.1%	23.5%	17.6%	11.8%
in keeping with values	5.9%	0.0%	82.3%	11.8%
annoyed because imposed	29.4%	41.1%	23.6%	5.9%
inescapable chore	23.50%	58.8%	11.8%	5.9%
waste of time	35.3%	47%	11.8%	5.9%
oppose if imposed	41.2%	11.8%	41.1%	5.9%
ashamed if not able	35.3%	29.4%	29.4%	5.9%
obliged to undergo	29.4%	47.1%	17.7%	5.8%
look forward to end	35.3%	41.2%	17.7%	5.8%
afraid of laughs	58.8%	17.7%	17.7%	5.8%
don't see the point	47.1%	35.3%	17.6%	0.0%

Acknowledgment

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