

STEM Education Program Evaluation Survey

A report of experience

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Abstract—Manaus, the capital of Brazilian Amazon state demands a rapid increase in the number of highly qualified professionals, mostly for its Industrial Pole. Hardware and software development for the consumer electronics and telecommunication sectors are the most challenging areas, due to the amount of open positions contrasting with the quality of local educational Institutions. To address this issue a local higher education organization (Institute of Computing of the Federal University of Amazonas) started, in partnership with Samsung da Amazonia Ltd. (the local subsidiary of the Korean conglomerate), a large scale program based on the so called multiple vortices, and comprising of set of involving activities, including training in classroom, and enrolling students in initiation or graduate projects. After three year of running program, the authors proposed a survey to verify the results achieved so far, more specifically on those two mentioned activities. The survey is designed to answer two questions: A) How mature is the participant in understanding his career; B) How is the participant's perception of the program efficiency in meeting his expectations. The survey is composed by 41 yes/no questions covering five different topics: 1) Perception about career and marked demands; 2) Information about the program purpose and objectives; 3) Changes in the career plan and expectations of the future; 4) Perceived relevance of the program; 5) Strength and weaknesses of the running program. Anti-redundant questions (i.e. two answers leads the same conclusion when one is yes and the other is no) were used to reduce bias and to assign a confidence level to the respondent, afterwards used to weight the student's contribution to the final statistics. The survey was applied to current and former program participants. The paper will detail the results, and the corrective actions suggested by the students' answers. Furthermore, the survey itself, the design and application methodology, which was based on a pilot group of students, will be part of the results presented in this paper.

Keywords—*component; formatting; style; styling; insert (key words)*

I. INTRODUCTION

The availability of highly qualified personnel is a critical success factor for a sustained technology driven economy, and this not different for Brazil. The lack of professionals is considered a major risk to the Industrial Pole installed in Manaus, the large and isolated capital of the Brazilian state of

Amazonas. Preparing students to the market is a challenge as there are few undergraduate courses related to technology and the typical dropout rate is very high. Science, Technology, Engineering, and Mathematics (STEM) education is intricately difficult and if the student is not well involved, supported and motivated, the chances of success are very low, which can be verified by the 25% to 30% dropout rate per semester.

Brazilian government strategies [5] tend to take time to show results, and some industries in Manaus have urgent needs. Therefore, we have proposed an approach that can be seen as complementary to long term government strategies. To step in the issue, a group of researchers and professionals conceived, in the form of an Industry and Academy framework program to fulfill the demand of hiring a few hundreds of professionals in a three-year timeframe. This approach is a program called PROMOBILE (Large Scale Qualification PROgram on MOBILE Technologies) [4] and it has been applied at the Institute of Computing at the Federal University of Amazonas.

The proposed program fundamentals lay down on an approach denominated “multiple vortexes of know-how” to simultaneously address three aspects: i) involve students on learning activities to reduce student dropout; ii) reach the largest number of students and people from the community as possible; iii) offer different levels of knowledge, related to a specific topic, but also working on building a competitive professional profile.

After three years (it started on August 2013) we decided to evaluate the program results. As researches we understand that expected benefits are only valid if they are measured, analyzed and reported. To do so, we adapted the approach proposed by [1] and detailed in [2] and [3]. Due to the unprecedented nature of our program, we decided to adapt the survey approach, including some intrinsic indexes and comparison standards. The resulting approach proved to be effective in assessing the relevance perception of PROMOBILE, as we will detail in the following pages.

The main contribution of this paper is two-fold: an approach to design, apply and analyze a learning program comprising of several activities, and a report of experience of PROMOBILE survey, with a set of remarks and

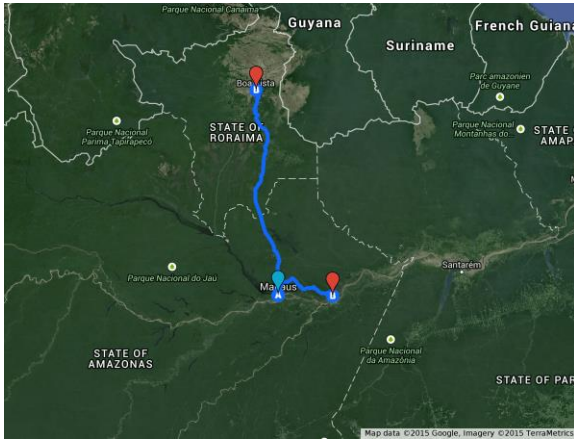


Fig. 1. Manaus, in the middle of the Amazon Rain Forest is located in the north margin of the Black River, the largest subsidiary of the Amazon River. The others red arrows point to the two largest cities with road connection to Manaus: Itacoatiara and Boa Vista.

recommendations that might be reproduced on several other contexts.

The remainder of this paper is organized as follows: Section II presents a short context of the issue and the actors involved with the proposed solution; Section III summarizes the survey approach used in this paper; Section IV presents the adaptations and improvements that resulted on the present survey methodology; in Section V we analyze and report the survey results; and finally, on Section VI we conclude the paper with a few important remarks.

II. THE EDUCATIONAL PROGRAM IN QUESTION

A. Problem Contextualization

In The Brazilian federal government created a set of incentives [5] for R&D investment by companies located in the industrial pole of Manaus city, the capital of the Amazonas states.

As a consequence, the demand for highly qualified personnel, mostly from STEM related areas, increased dramatically. However, the education figures in the region are worse countrywide and typical actions to improve the qualification of local professionals contrast with the poor background of undergraduate students.

Unfortunately, the common sense option of filling the gap by bringing people from other cities is not feasible. Despite the appeal of being in the middle of the Amazon rain forest, Manaus (Fig. 1), the 2 million inhabitant capital of Amazonas, is isolated, having easy access to few cities, and no road connection to southern Brazil. Moreover, the city has profound infrastructure problems, including education and medical services, poor public transportation, high urban violence records, high living cost, all-year hot and humid weather typical of the Amazon rain forest.

To address this issue, the authors proposed, in the context of a partnership between the Industry and Academia, a large scale learning program. Defined to work with local students and professionals, the program is summarized in the next sections. Please, refer to [1] for a detailed description.

B. Vortex: The Cyclic Interconnected Learning Activity

The proposed program, named PROMOBILE, was conceived in the basis on Tinto's model of student departure and the importance of academic and social integration on student persistence [6], and Astin's theory of student involvement and its role in student development [7].

Both studies point out that some effort should be addressed to first year's students to promote his involvement on his own career development. In our context, one has to add to this natural issue, the poor educational background of the average student.

The authors extended the concept of involving activities [7] by grouping and interconnecting them under the same context, in cycles. The activities have to contribute to a common goal: building a professional profile out of students that are, with few exceptions, unmotivated, under-skilled, and immature [8].

The modified involving activity, a gear in the main Program, is called *Learning Vortex*, formally defined as "an activity occurring in one or more cycles, with a self-contained subject, and connected to another Vortex in such a way to contribute either in depth of knowledge or in number of persons to the whole Program" [1].

To be considered a Vortex, the learning activity has to contribute with the program objectives in terms of measurable attributes:

- Depth: A vortex addresses a specific subject in different levels of details. This attribute is related with the quality of the acquired knowledge;
- Quantity: A vortex have the capacity to reach different number of students at given cycle;
- Cycle: A vortex is repeated in given cycles, and endures a given period of time;
- Skills: Three states attribute. A vortex addresses hard skills, soft skills or both.

A Vortex based program is conceived to work out specific competences, not to replace the whole curriculum. PROMOBILE, specifically, was built around the following ones:

- Software development for mobile platforms. We selected Android, and some aspects of it: programming, automatic test, security, Web/cloud interoperability, location based services and IoT/Robotics. The last one to promote low-level programing, and mission critical systems aspects;
- Software development process. In this case we tailored an agile method (SCRUM), adopted on all PROMOBILE projects [8];

- Soft-skills: Writing, reading and accountability, naturally embedded in the SCRUM related vortex.

Given the target competences, we designed PROMOBILE on top of four vortexes (Fig. 2), briefly described in the sequel:

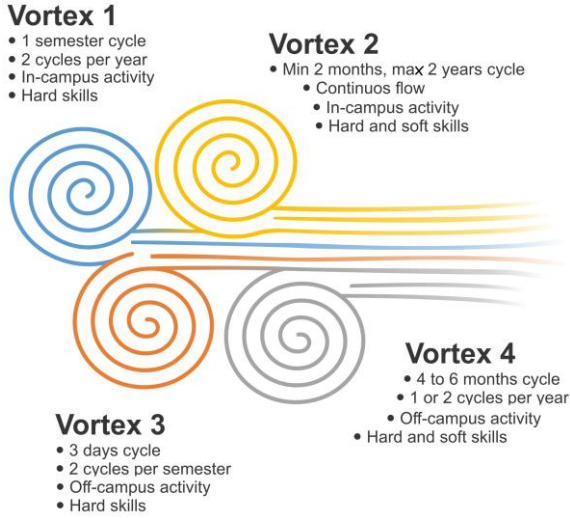


Fig. 2. Four vortexes cooperate to increase the qualified personnel in both quantity and quality in a specific area.

Vortex 1 was initially defined as a set of subjects included in the computer science curriculum as optional disciplines. We prepared a catalog of two undergraduate and two graduate subjects (total of four). Each subject has a number of incentives to students to promote participation and performance. Such incentives include open ranking, prizes, and the offering of research scholarships, which are the best available scholarships in the university. For not to jeopardize the other subjects in the curriculum, to be eligible to receive a prize the students are not supposed to fail in any discipline, even if he is top ranked.

Vortex 2, the New Talents Development program, was defined as participation in research projects. The students will receive scholarships, with clear granting and maintenance requirements. The candidates enroll in cycles of off-class project activities with different degree of challenges in different aspects. Students with distinctive performance get a leadership coaching (along with an addition in the monthly value).

Vortex 2 is also the chosen one to host the soft skills development activities, as the project environment naturally promotes communication and writing skills.

Vortex 3 comprises a series of short-term events, implemented at the beginning and at the end of each school semester. In the beginning event the activities are focused on motivation speeches, workshops and hackathon. The ending event has the purpose of evaluate and praise the best projects and students. Additionally, this vortex has an important

objective to evangelize the community to the Program and attract more participants to enroll in future vortexes.

Vortex 4 was conceived to enroll the participant in a deep learning experience. Defined as a project-oriented activity, the Advanced Training vortex aims to bring the participant to a point as close as possible to the industry's desired profile. The vortex is applied in a yearly cycle, and it is realized in four modules distributed on six months. Target participants of Vortex 4 are senior students, or alumni, of different universities.

Table I Summarizes the Learning Vortexes defined for the PROMOBILE program. The attributes give an overview of the contribution of each vortex in the program as a whole.

TABLE I PROMOBILE's Learning Vortexes, and their respective attributes.

#	Vortex	Depth	Quantity	Cycle	Skills
1	Optional Subjects	medium	medium	semester	hard
2	Talent Devel. Progr.	high	medium	year	both
3	Short-term events	low	high	semester	hard
4	Advanced Training	high	low	year	both

C. The Importance of Evaluation

This initiative only can be regarded as a contribution for the educational field after the expected results is confronted with the actual outcomes. However, given the unprecedented nature of the Vortex based program, we could not find a ready to use evaluation method.

Of course we can always measure the number of students that finished the higher education program, and their respective scores. These two metrics has two issues, though: i) we observed that PROMOBILE indirectly promoted a change in others tracks of the curriculum, for a very positive reason: other teaching groups had to step out from their comfort zones and improve their own activities; ii) Part of PROMOBILE participants are not part of our university community. They come from other institutions or they are candidates already in the market looking for new opportunities.

Thus, the authors proposed a methodology to assess the perceived quality of the whole program. This methodology is described in the next sections.

III. FUNDAMENTALS OF AN EFFECTIVE SURVEY

According to [1] a survey is not just the instrument for gathering information, but "it is a comprehensive system for collecting information to describe, compare or explain knowledge, attitudes and behavior".

In this paper we basically followed this approach [1-3]. The process to prepare and apply an effective survey usually should include the following activities:

1. Setting specific measurable objectives: in our case, the objective was to measure the perceived relevance of PROMOBILE among the target population (program participants);
2. Planning and scheduling the survey: the survey was planned to be applied in two phases, during the beginning of 2015 and 2016, benefiting from the starting of the school year;
3. Ensuring resources are available: the survey was prepared to be applied via an online form, therefore, no specific resources besides an Internet connection was necessary;
4. Designing the survey: this activity is detailed in the next sections;
5. Preparing the data collection Instrument: implemented as an online Google docs form;
6. Validating the Instrument: to ensure validation we prepared a pilot run of the survey, and confronted it with two defined standards (the Ideal Participant and the Credibility index);
7. Selecting Participants: in this case we selected participants for the pilot run, but for the second time we did an open call to all participants;
8. Administering and scoring the instrument: see details in the next sections;
9. Analyzing the data instrument: see details in the next sections;
10. Reporting the results instrument: see details in the next sections.

In the present work, we designed the survey using yes/no question, keeping most recommendations (e.g. make it short, scramble the questions). Although it was not recommended to use redundant questions, we included what we called anti-redundant questions, as they are less obvious to be recognized by the respondents. We also included only two redundant questions, as we thought they would not damage the survey, and they are necessary to estimate the Credibility index (see next sections for further details).

IV. ASSESSING THE IMPACT OF PROMOBILE

The hypothesis behind this evaluation methodology is:

Effective evaluation information is provided by those who participated in a full cycle of at least two different vortexes.

This hypothesis is justified by:

- The participants are those who experienced the benefits of the program. They are the first hand sources of information. Moreover, they are easily reachable wherever they are;
- To participate in a full cycle means the participant can judge the activity from its beginning to the end, even if the participant failed;

- More than once means they can filter impressions based on a specific instructor or any other aspect not directly related with the learning activity;
- Two different vortexes are fundamental to capture the interconnected aspect of the vortexes, which is one of the most important aspects of the given program.

On the other hand, this kind of survey is prone to bias and subjective answers. Therefore, to acquire information from the participants we designed a survey divided into two main parts:

1) Profiling the participant regarding his career expectations. In our context, students do not have the same concept of career or future. Moreover, they have different backgrounds. The result of this part is to estimate the *maturity index* of who is giving opinion about PROMOBILE;

2) Measure the satisfaction level of the participant about the program. The objective is to assess what we called *relevance perception index*. Or, in other words, we intend to estimate the participant experience from their perspective.

Moreover, the proposed evaluation methodology is based on a series of quick questions, so that we could apply statistics and data mining tools to get the outcomes. This specific survey is composed by 41 yes/no questions covering five different topics:

- A) Perception about his higher education course and his overall current qualification (9 questions);
- B) Changes in the career plan and expectations about the future (6 questions);
- C) Information about the program purpose and objectives (12 questions);
- D) Perceived relevance of the program (7 questions);
- E) Strength and weaknesses of the running program (7 questions);

where topics A, B and C addresses Part 1, while D and E addresses Part 2. Topic C was included to help the student to bridge his expectations with the program expectations. It is considered a maturity issue as we understand that the student is responsible to develop his opportunities.

A. The Ideal Participant Reference

Although, some questions lack a clear correct answer, we are convinced that some answers might indicate a person capable to provide a better evaluation. For instance, we asked if the respondent reads more than 300 pages per years (not counting HQ, newspaper, magazines or technical books). Despite the fact that anyone has the right to choose his reading habits, we believe that a good reader has a better evaluation capability. Moreover, although 300 pages (average of two books) is not much, it is consistent with the 2.48 books per

year of the average Brazilian student that is considered a book reader [9].

Therefore, authors defined the *Ideal Participant* reference, whose answers would lead to the highest score with 100% confidence. All other respondents are measured with respect to the Ideal Participant.

One may argue that such kind of evaluation of the participant is subjective. We are proposing a methodology to quantify something based on perception, which is subjective in essence. Furthermore, in focusing all lack of objectiveness in the Ideal Participant we are containing in this entity any bias originated from the proposers (i.e. the authors). Also, it allows an interactive refinement based on the respondent answers. For example, we first defined the Ideal Participant to answer “no” to the following question:

Do you think knowing how to program to Android platform is important for your career?

Because, from our perspective, Android is a specific (and transitory) platform, and there are a sort of expertise that the students should be much more concerned about. However, more than 90% of the respondents answered yes. Then, we realized that the context of PROMOBILE (a learning program to promote mobile platform know-how having Android as background) induced them to that conclusion. Thus, we also changed the answer of our Ideal Participant.

One has to be very careful with this kind of refinement, for not be tempted to change the Ideal Participant answers to fit the respondent answer. This is like to promote a better evaluation by adapting the correct answers. The rule is just to adapt the Ideal Participant in the Part 1 (Maturity part), and always if it is really necessary. If one has any doubt about it, it is better either to leave as it is, or to exclude the question. Finally, never, ever, change an answer of Part 2 (Satisfaction level).

B. Relevance Perception, Maturity and Confidence Indexes

The index that is in the core of this work is the Relevance Perception Index (the result of part 2), which in this survey is defined as the number of similar answers with respect to the Ideal Participant for topics D and E divided by the number of question in each topic. The overall Relevance Perception index is the arithmetic mean of Topic D and E Relevance Perceptions.

The comparison of answers of topics A to C with respect to the Ideal Participant will result in the respondent’s maturity index (Part 1). The index is computed as the rate of similar answers over the number of question of each topic A to C. The overall Maturity index is the arithmetic mean of Topic A to C Maturity indexes.

Our intention is to verify if there is difference on the Relevance Perception index among difference Maturity levels.

Another important feature of this survey is the inclusion of two redundant, and eight anti-redundant questions (i.e. two answers leads the same conclusion when one is “yes” and the other is “no”). These redundancies were applied to avoid bias and to reduce distortion due to answers without careful reading or distraction. Conflicts in the answers of redundant and anti-redundant questions are used to assign a confidence level to the participant answers. Examples of anti-redundant questions are:

Would you participate in the program even if it were to be only as a volunteer?

After you leave the program, do you have the impression that the only thing worthy was the scholarship you received?

The reader might not confuse this two metrics (Maturity and Confidence):

Maturity: The distance with respect to the answers of the ideal respondent. The definition of the ideal participant might be subject to the proponent desires, however, the metric is objective;

Confidence: This is a rather objective metric, and it is computed as the rate of correct answers with respect to the total number of redundant and anti-redundant questions.

C. Survey Metrics

The objective of the survey is to assess the perceived relevance of the Program from the participant perspective. To do so we estimated the Relevance Perception index as a function of the Confidence index.

A secondary parameter is the Relevance Perception index compared with the Maturity index. The goal is to assess the perceived relevance among participants with different maturity levels.

Although we did not planned to compare the Confidence index against the Maturity index, we did so. The goal was to reinforce (or not) the assumption that the respondent maturity and the ability to provide confident answers are correlated.

D. Applying the Survey

The survey was applied online and anonymously. The questions were scrambled to avoid answers without thinking. We also included three open questions. Due to the lack of space, the survey was not reproduced here, but the reader may access it at Google Docs under request.

We run the survey on two different moments. On 2015 we requested to 15 students, that we knew participated actively in

the program, including 9 undergraduate and 6 graduate students. The objective was to do a pilot run and review the survey if necessary. On 2016 we called the PROMOBILE participants involved on research projects of all levels. Table II summarizes the outcomes, where:

- The column “Topic” is the results for the five topics defined in the previous section;
- Confidence level is the percentage of correct answers to redundant and anti-redundant questions;
- Maturity and Relevance Perception indexes are the percentage of questions answered in accordance with the Ideal Participant, for each Topic.

In the next Section we comment in details the survey results.

TABLE II. Overall result of the survey per year.

Topic	Year 2015 Respondents: 15 Confidence level: 68.66%		Year 2016 Respondents: 31 Confidence level: 73.79%	
	Maturity	Percep.	Maturity	Percep.
A)	68.89%		74.55%	
B)	86.06%		86.51%	
C)	57.78%		74.19%	
D)		84.76%		84.33%
E)		75.00%		76.21%
Overall	71.24%	79.88%	78,42%	80.27%

V. RESULTS DISCUSSIONS AND RECOMMENDATIONS

One may notice a regularity during both years, with small variation in all figures, with the exception of Topic C (Information about how PROMOBILE works). This is quite understandable, as it is expectable more students are aware about the objectives of the running Program.

Still about topic C, it is notable that our typical student still waits for information to come to him. We will work harder to convince the students that opportunity is strongly dependent on information, and they are the ones that have to fight for it.

A higher Topic B level, when compared with Topic A, shows that the students have, in general, a better view of his future. This also indicates a maturity growth during the academic years.

Topics D and E indexes (related to the core objective of this paper) were better than expected. Showing up to 84% of relevance perception (when compared to our ideal participant) is a very good outcome. The 75% of strength and weakness does not mean a worse perception. Rather, it means that they did not agree in 25% with the Ideal Participant of what should

change, or not. The purpose of topic E is to do a better alignment of perception between participant and proposers. In both cases the average relevance perception is of around 80%.

We got also interesting information when looking into the details of each participant answers. Knowing that the survey captured the same population profile at each year, the next analysis will concatenate the respondent of both years (in a total of 46 respondents).

Comparing the relevance perception with the respondent maturity level (Fig. 3), we verified that 38 out of the 46 respondents on 2015/2016 assigned a high (above 73%) overall relevance perception.

Although we expected higher relevance perception among the less mature participants (and, thus, more benefited ones), we did not observe decisive trend on this matter. In fact, the least square linear regression led to a line inclination of 7.28° , which is a non-conclusive direct relation. This might indicate that mature participants get better outcomes from the program’s opportunities. And indeed, the vortexes were designed to fit to any maturity profile.

However, when we compare the Confidence levels, we did observe a direct relation with the Maturity index (the higher is the Maturity, higher is the Confidence), and a direct relation with the Relevance Perception (the higher is the Confidence, higher is the Relevance Perception). Figs. 4 and 5 show the index relationships. In Fig. 4 one has the plot of Maturity times Confidence with a trend line computed by the least square method with 38.91° of inclination, and in Fig. 5 the plot of Relevance Perception times Confidence, with a trend line of 24.70° .

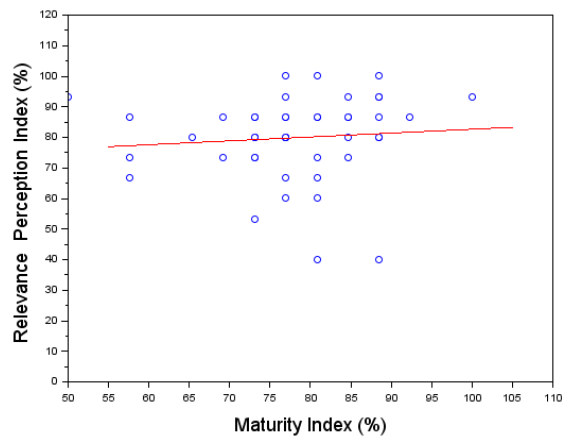


Fig. 3. Relevance Perception index times Maturity Level index for the 46 respondents (2015 and 2016). As some entries have the same values, corresponding dots are superimposed. Nevertheless, no clear trend is observed.

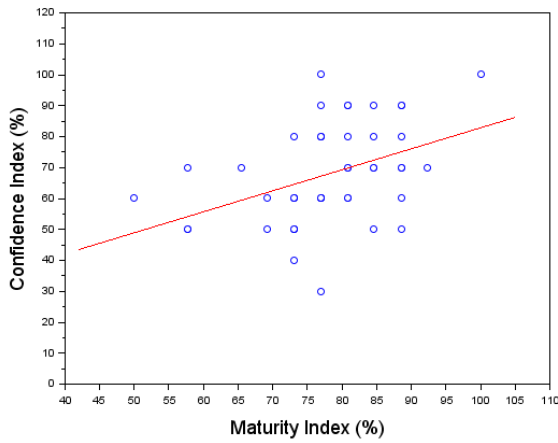


Fig. 4. Relevance Perception times Confidence index for the 46 respondents (2015 and 2016). As some entries have the same values, corresponding dots are superimposed. Red line represents the trend curve, computed by the least square method, showing a direct relationship between the two indexes.

Both trend behaviors indicate that the actual Relevance Perception should be higher, as it is reasonable to weight the respondent's scores with his corresponding Confidence index.

This is perfectly aligned with the common sense, as one expects that a mature respondent provides more consistent answers. As a consequence, the Confidence index proved to be useful to reduce the impact of issues in the survey answers. It can be applied to filter distortions caused by a sort of reasons, including answers in hurry, or a deliberate attempt of a participant to hurt the Relevance Perception index.

Some answers provide interesting insights about the program impact, highlighted in the sequence.

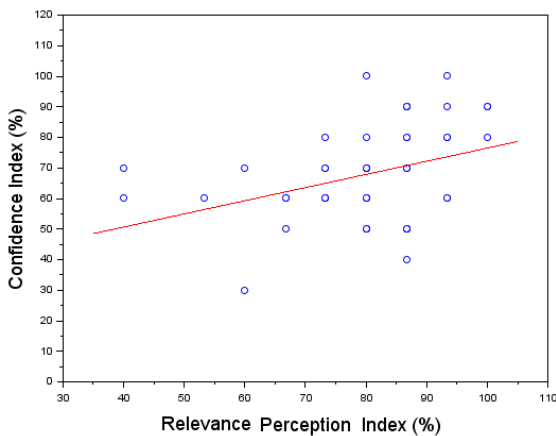


Fig. 5. Maturity index times Confidence index for the 46 respondents (2015 and 2016). As some entries have the same values, corresponding dots are superimposed. Red line represents the trend curve, computed by the least square method, showing a direct relationship between the two indexes.

A. Professional profile

100% have a better perception of his course and career now than when they started, 100% are fully identified with the career of informatics, and 96.6% knew what they were doing when they choose the informatics career, 96.6% would choose informatics again, and another 96.6% considers starting a graduate program in informatics. But, 27.6% intends to try a public service career opportunity not related with informatics. The reader might think this is a contradiction, but it is not. In a country struggling with high unemployment rates, and an unprecedented economics crisis, the stability of a public service job will always be an option. Interesting to note that for 82.8% the Program had a positive influence on their career decision.

90.7% agreed that English proficiency as a foreign language is important for their career; however, only 41.4% can sustain an English conversation via Skype. Only 48.3% reads more than 300 pages of books per year and 18% confessed severe issues with writing in Portuguese (the native language).

These figures are not new to anyone involved with higher education in Brazil. And they just reinforce the importance of learning programs like this one.

B. Program Relevance

100% of the respondents agreed that the Program objectives do not conflict with the course objective, which is correct. However, 75% think that the Program was created to send professionals to the private company that funds it, which, technically, would conflict with the course objective to prepare professionals to the market, and not to a specific company. This is something that we will have to clarify among the students: PROMOBILE is indeed an Academia-Industry partnership with the purpose to promote critical mass on a specific know-how. Any company can benefit from it, including, of course, the sponsor.

96.6% agreed that PROMOBILE was somehow beneficial to his professional skills, 89.7% said they are better prepared to the market after participating in the program. For 79.3% their employability improved due to PROMOBILE, and 79.3% would participate again even for free (PROMOBILE scholarships are the best available in the University). These are the most indicative statements about the relevance of PROMOBILE. For 34.5%, anyone out of the Program will necessarily have lower employability. Given that this was prepared to be an overstatement, we were expecting something around 20%.

96.7% would take PROMOBILE to others university in our region, 89.7% would like to see others researchers as part of the Program (currently we have 8 out of 25 researchers),

and 86.2% would like to see the Program promoting others subjects in the curriculum.

These figures confirms the statistics presented before, that the Program was considered relevant to the participants, and they agreed to change so that it will reach other universities, research areas and course subjects.

From this experience we collected few important recommendations:

1. Work out on information, making sure the participants are aware of the program goals, opportunities and participant's responsibilities;
2. Promote a better interaction with the industry HR departments, as we would like to improve the evaluation methodology by the experience of HR personnel;
3. Classify the respondent groups according to the grade (undergraduate, master and doctorate students) to have a better view of the maturity impact in the program;
4. Evaluate the program on a year basis. Know that we are confident the survey captures the participant experience; we will apply the survey yearly and for each vortex.

VI. CONCLUSIONS

This paper presented a survey methodology to assess the relevance perception of PROMOBILE, a learning program based on a set of vortexes (interconnected and cyclic involvement activities).

Given the characteristics of the program: a diversity of activities, to a diversity of participants at different time-cycles, we proposed a new survey methodology to acquire relevant information from the participants.

The methodology used the concept of the Ideal Participant, to encapsulate subjective judgments, and defined three indexes, the Relevance Perception, the Participant Maturity and the Confidence index (based on the redundant and anti-redundant questions). The Confidence index proved to be an interesting metric to reduce bias, and distortions due to distractions and even deliberate attempts to hurt the results.

The survey was applied in two different moments, 2015 and 2016, and provided the same trends for all metrics, even though the redundant questions changed. This is an indication that the methodology is robust, providing that the redundant and anti-redundant questions are well defined.

The authors concluded that the new survey approach could indeed assess the relevance perception of a given sample of participants. And, also, that the program was considered highly relevant.

ACKNOWLEDGMENT

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