

THE CONTRIBUTION OF COLLECTIVE INTELLIGENCE FOR THE ANALYSIS OF THE PHENOMENON OF STUDENTS OVERCROWDING

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ABSTRACT

This paper presents a method aiming at analyzing a problem of overpopulation at the university of Lomé (Togo). In this perspective, we associate the teachers' perceptions with that of students through two kind of questionnaires, static and interactive. We describe this methodology to survey large groups of students. The results allows to better understand the teaching context of students, their difficulties but also the hidden potential of their situation. In background the feasibility of distant learning is also analyzed through this method of investigation.

KEYWORDS

Interactive questionnaires, context analysis

1. INTRODUCTION

The understanding of complex problems escapes to traditional rational methods of investigation. In organizational contexts for example, when political, economics or technological factors interplay, the behavior of individuals may appear out of control. In such cases, collective approaches of analyze such as brainstorming have been introduced in the last century but methodologies are still discussed. One of the problem is to decide who should participate to these collective investigations. A second question is to identify an easygoing method that facilitate the contribution of participants including online. In this paper, we developed this reflexion in an educational context.

For several years, the university of Lomé (Togo) faced various problems related to a large and growing population. For example, the number of students enrolled in mathematical analysis was 3778 in 2015 against 3612 in 2014 (+ 4.6%). Given that no amphitheater of the university can accommodate this enrollment, the first solution was to create two groups and to do the course twice a week. Unfortunately, the organizational problem has not been resolved because the largest amphitheater can only contain 1500 students and because students do not comply with rules and often switch groups. Moreover, for logistical and cost considerations, it is not possible to create more than 2 groups at the moment. Various other solutions are being studied (distance training, construction of a new amphitheater, ..) but, due to strong economic constraints, it is vital to carefully analyze the effectiveness of envisaged options. Not only the administration and the educative staff should agree with the final choice but also students. Without this overall consensus, the risk of being ineffective and losing money remains high. But how can we take all perspectives into account in a practical and productive way?

In order to investigate the depth of this consensus and better understand the reality on the ground, we developed a method exploiting, in a complementary way, two forms of online questionnaires. The first one, fairly classical, consists of 38 multiple-choice questions designed by the teaching staff who has made a first analysis of the problem of overcrowding. Students, therefore, only answer the problem (i.e. the questions) as

analyzed by teachers. The objective of this first survey is to better understand the conditions of students' training, their feelings and their rates of equipments, in particular, to measure the feasibility of distance learning. The second questionnaire is based on the idea that the problem should be analyzed by students. It should be up to them to find the questions that express their situation and to propose answers. The interest of this second questionnaire, therefore, lies not only in answers but equally in the formulation of questions (words used, ..) (Lancieri et al, 2015). The rate of participation also gives a good indication on how the situation impacts students.

The device used for this second survey was conceived as an interactive adaptation of online multi choices forms where each student can interactively add questions, suggest answers and vote. In order to simplify as possible these operations, a special effort was done to keep the user interface basic and user friendly. Initially, teachers identify one or two generic questions in order to initiate the process of interaction between students. At the end of each day, the system automatically ask, by e-mail, all participants to reply to new questions or to add other questions (or answers) if they deem it necessary. Students may also change their initial answers if new choices of responses, provided by others, seem more appropriate. The analysis of these changes of opinion is key to understand the problem complexity as well as the process of consensus building. This e-brainstorming system has previously been used in several online experiments with small groups (20 individuals) (Veilleroy et al, 20013). This study is the first attempt to target large groups (225 individuals).

2. ANALYSIS OF FIRST RESULTS

The first questionnaire, formulated by teachers, was submitted to 501 students enrolled in a class of first year of university (400 of them answered). The population of students was in majority composed with male (69,7 %) and have from 18 to 26 years old (21 on average).

The responses show that, because of the plethora of students, 81.9% of respondents came early to university to find a seat (39.2% at 4 am, 35.6% at 5 am). When the amphitheater is full, 61.4% of students declare they must regularly stand and 95% feel they can not follow the course. The given reasons were: noise (according to 77 %), heat (82.7%), distraction (49.1%), lack of interaction with the teacher (70.4%). At the same time, the survey shows that a significant proportion of students could take part in distance learning. Indeed, some of them connect to the Internet from their home (38.8%, against 72.7% in cybers) and are rather equipped with nomadic tools (laptop 41%, smartphones 45%). In addition, 77% of students have a positive opinion on distance education.

To complement this "static" vision, the interactive questionnaire was submitted to two groups of students (a total of 225 individuals) with two startup questions on the topic: "How to facilitate the follow-up of courses when students are numerous? ". After two weeks of interactions, students proposed 31 (group 1) and 35 (group 2) new questions. The average number of responses per question is of 4 for the first group and 3 for the second. The response rate is lower than for the static questionnaire. Of the 225 students, 95 were connected but only 66 responded to at least one question. However, the participation rate of 29.3% is higher than what is usually the case when individuals are invited by e-mail to respond to an on-line questionnaire (24,8%).

We observed a clear difference from users' viewpoint between the static questionnaire produced by teachers and the interactive one produced by students. While the former "describes the situation" as it is perceived, in the second, students tend to express the perceived "causes of the situation". We observed that new questions and answers are often politically oriented. For example: "Why the state does not multiply universities? For 58.33% of students, the state lacks of teachers. Furthermore, 100% of participants blamed the lack of follow-up in the management of students. In reality, university administrations are unable to manage the overwhelming number of students due to a lack of resources and because information and communication technologies are not there. This lack of resources is also reflected in the fact that courses are more theoretical than practical (lack of equipments). Students indicate spontaneously their preference for activities in autonomy, 78% prefer practical work and projects rather than lectures.

We also noted that 29 participants (near to a half of respondents) modified at least one of their responses during the survey period. This is a sign that the causes of the overpopulation problem are not clear for all students. The contributions (new questions and answers) from the group make students to have a wider view of the situation and then call in question their first opinion. Let us remark that the capacity to monitor the

change of opinions within the group over the time is one of the most important feature of this tool. It allows to better understand how works the collective intelligence.

This study allows us to have a first vision of a complex training context. While distance learning seems to be the most practical solution to the overpopulation problem, it can not be deployed yet in a massive way. Regardless of the lack of equipment, the limited monitoring capacities may penalize the less autonomous students. In an other hand a sub group with the most motivated and autonomous students could certainly take benefit from distance learning. But how to identify these students ? In further works we will tackle this difficult question.

3. DISCUSSION

Several studies focus on the consequences of universities overpopulation in Africa. In other more developed countries, this question is little mentioned probably because consequences are, at the moment, more limited.

In most of the cases, these situations are analyzed by a core team of education specialists who proposes consensual solutions. However, studies show that this approach is not always the best. In his book, "The wisdom of crowds", J. Surowiecki gives many examples showing that merging different skills, even with basic qualifications, is often more creative and productive than a team of specialists (Surowiecki, 2005). In this domain, questionnaires and polls are a way to exploit the collective intelligence in computer mediated environments (Lancieri, 2016). But traditional questionnaires are very regulated and constrained (check boxes, radio buttons, etc.), impossible to go back (later) to modify answers. At the other end, open questionnaires allow interactivity and creativity but the final result is very hard to exploit due to the heterogeneity of the responses textual structure. A difficult and time-consuming human analysis is necessary in most of the cases.

Interactive multi-choices questionnaires are a solution between these 2 extremes modes (open and closed surveys). In this perspective, the Delphi method, introduced in the 1940s and later the RT Delphi is a structured communication technique, which tries to get opinions, judgments and justifications from the participants. It seeks a consensus, with a carefully predefined set of questions, but here the creativity is controlled and contained. There are multiple rounds where questionnaires allow experts to provide their judgment, then to revise their answers (Powell, 2003). But Delphi may be found long, expensive, tedious and requires a lot of efforts (Ekionea et al, 2011). Furthermore, this method is not adapted for a survey of a large population. Inquiry based learning that put ahead the role of questioning is also a new trend in modern education (Baron et al, 2008).

The method we proposed in this paper is a way to adapt a brainstorming process to a large population while monitoring users interactions during the survey. This allows to better follow and explain the dynamic of collective behaviors such as opinion leaderships, change of mind or consensus building. In further works we will increase the surveyed population. We will also study the effect of a larger implication of teachers in the e-brainstorming process. At present, they only provide startup questions. What would be the effects if they add more oriented questions during the survey process ?

Finally, our method consists in trying to turn a problem into a solution. Indeed, the large number of students is a problem in the sens that it hampers the education system. In the other hand it turns into a solution in the sens that collective intelligence provides insights for solving the problem. Of course, this is a preliminary work and we don't yet answer all of our questions. But, trough our 2 combined modes of survey, we obtain a kind of "stereoscopic" picture and a more precise view of our education context. For example, we imagined that some students have to come early in the morning in order to find a seat but not at 4 am. We also imagined that some students have a computer but probably not 41%. In addition, combining the outcomes of both questionnaires, we see that the overcrowding situation is perceived as critical by students. We also see that in our context, the distance learning is perceived by all actors (teaching team and students) as a real potential option. Of course, this feeling is one thing but implementing a large scale distance learning system is another thing. Outside economic questions, a key problem is to identify autonomous and motivated students who have the most chances to succeed through distance learning.

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