

# QLIM

## A tool to support collective intelligence

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**Abstract** - Creativity and capabilities of innovation are often desirable goals of interactions between people. This involves actors to be open, receptive as well as communicative. In this paper we propose a tool named QLIM that aims to support collective intelligence through tailorability, by allowing participants to continue the construction of a questionnaire while being used. After a state of the art, we present QLIM features and architecture, then we present the experiments we conducted and the hypotheses that they inspired to us. The main goal of this paper is to show how QLIM helps us to understand the group interactions and how it can help to support collective intelligence.

**Keywords:** *Interactive questionnaires, eBrainsorming, collective intelligence, tailorability.*

### I. INTRODUCTION

In the New Yorker (2012-01-31), Lehrer tells the story of “the home to a variety of research labs, academic departments, student clubs, machine shops, and administrative offices”: the M.I.T.’s Building 20, built in 1943 for radar research and development, a temporary construction supposed to be demolished at the end of the war. The construction was quick and cheap with a lot of underdesigned things, “regarded as a failure”, but hyperflexible in such a way that the occupying researchers felt free to modify and reshape it according to their needs. Lehrer says Building 20 has become an interdisciplinary lab and a legend of innovation, one of the most creative spaces in the world.

Science is no more a solitary work. Researchers have become experts because the scientific fields are more and more complex; from different locations, different labs and universities, they have begun to collaborate using interdisciplinary and transdisciplinary approaches because solutions do not stem from a unique discipline or a unique person. Wuchty [1] suggests that the process of knowledge creation has fundamentally changed. “Our results show that teams now dominate the top of the citation distribution in all four research domains (sciences and engineering, social sciences, arts and humanities, and patents)”, “For example, a team-authored paper in science and engineering is currently 6.3 times more likely than a solo-authored paper to receive at least 1000 citations”.

More broadly, innovative places where we have to keep informed, to solve problems, and the progress of knowledge itself, are very concerned with collective intelligence. Collective intelligence is the interactive pooling of knowledge to achieve a

goal, by asking questions and by looking for answers together. Indeed, to deal collectively with a problem, we often begin with a questionnaire; however, static questions may be too general or poorly worded so they do not provide good results. This rigidity and the lack of involvement also result in low response rates [2]. A better way is to introduce interactivity as in face to face meetings but this solution is sometimes difficult to manage. To collaborate more effectively we have designed an original tool to support collective intelligence, to help creativity, to take advantage of the interactions inside a group and to understand what’s happening inside. We call it “QLIM” which stands in french for “Questionnaire en Ligne Interactif et Malléable” that is to say: interactive questionnaire, online and malleable (meaning tailorable). This tailorability is made possible since each participant can add new questions and new answers to existing questions in an initial online questionnaire. QLIM enables people from different backgrounds to work on a subject for a long time. It allows questions and answers to be exchanged, bringing up new ideas and reactions; it increases the ways to tackle problems, to find solutions or to go further in the reflection.

In this article, first we present a state-of-the-art of questionnaires design, traditional-static and interactive. The traditional questionnaires are mostly used for surveys. In this state-of-the-art, we can see that traditional questionnaires are both difficult to design and difficult to use. As a result, for collective intelligence activities, like brainstorming for example, interactive questionnaires are needed. Then, we describe the features and the architecture of QLIM. Finally, we relate the experiments we conducted.

### II. STATE-OF-THE ART OF QUESTIONNAIRES

#### A. Traditional questionnaires

A questionnaire is not so easy to implement because many concerns exist about the elements to gather. Fricker [3] shows that recruitment is a key point and he explores the topic of sampling. Coverage error, sampling error, non-response error and measurement error are the four classical errors [4, 3, 5]. A mode is defined by the channel of communication: oral, visual, paper, computerized, and with or without interviewer [6], mixed modes surveys are the norm these days. Questionnaires are administered, when led by an interviewer, or self-administered [5, 7, 8]. Response rates have been declining over the years, in official statistics as well in academic research [9, 2],

although some techniques to improve it [10]. The question of the correctness of the response rate is discussed by Johnson and Owens [11]. Two new modes have appeared since the questionnaires were computerized (e-mail and web). The web mode allows designing a large amount of possible surveys.

Traditional questionnaires use check boxes, radio buttons or yes/no systems, scales systems, textboxes, etc. This is regulated, framed, constrained. In addition, it is not possible to go back to modify its answers and obviously, it is impossible to know what the other respondents answered, which is normal. In our case, the main drawback of traditional questionnaires is that they are static: there cannot be “ping-pong” game between the participants, i.e. no interaction is made possible.

### B. Interactive questionnaires

Respondents have things to say, they respond willingly when they are given the opportunity and the web mode also appears to be easier for this: open-ended questions by e-mail collect longer answers and more information than in paper survey [12, 2, 13]. Students write more comments online than on paper when they are surveyed to evaluate teaching in Murdoch University (Australia). Keyboarding can be easier than handwriting [14].

A dynamic and interactive questionnaire which would allow people to express themselves in a debate, could collect lots of valuable information. An interactive questionnaire provides a structuring frame to express, formalize and reformulate ideas. We have noticed two other questionnaire-based collective intelligence tools: the e-Brainstorming [15] and the Real-Time Delphi [16]. Roughly speaking, the e-Brainstorming relies on multiple-choice questions as first interaction mode and the Real-Time Delphi (RT Delphi) is a web-based variant of the Delphi method [17] that we will remind.

#### 1) The eBrainstorming

The eBrainstorming is an initiative from the Orange Labs in Caen [15], it is a computerized system of close-ended questions, a multiple choice questionnaire system (MCQ), intended to simplify and synthesize the opinions of a group. The system allows the respondents to add new questions and possible answers, and they can leave a comment in a free comments zone inside a question. This is a way to get rid of some limitations (lack of cooperation, not enough choice) introduced by the static questionnaires. The idea relies on human intelligence: to solve a problem, much of the solution lies in the wording of the question. There is no moderator, the group has to be self-moderated. The questionnaire is scripted using a simple and easy tagged language. It is written in a form, on a mobile phone application for example [18], then sent to a web server. The server generates the questionnaire, then a return mail is sent to the author with the URL of the web questionnaire, to be distributed to the chosen participants. The participants can access the synthesis (statistics, graphics), the system uses traces to evaluate the collective intelligence phenomenon, and data can be exported. This is another example demonstrating that technology can change spatiotemporal interactions between individuals [15].

The “Brainstorming” was an idea of A. Osborn [19] in the nineteen-forties when he was working in an advertising agency (BBDO, in New York) to make his company more creative. According to Osborn, a Brainstorming is using the brain to storm

a problem “in a commando fashion, each stormer audaciously attacking the same objective”. In a Brainstorming, every idea is accepted and often the most shifted and unexpected ideas are the most fruitful. During the process, there must be no criticisms, no discussions in order to not hinder creativity, so any idea can be a starting point for creative development from other participants. The brainstorming is an incentive to free association of ideas. So, the creativity of the group is greater than the sum of its members. In terms of data collection, a brainstorming gives a raw list of ideas in a short time.

Many variants of the brainstorming have been proposed; one of them is called the Brainwriting (group passing technique), where each participant writes his solution to a given problem, then gives the paper sheet to his neighbor who writes either a new solution or develops the previous idea, then, gives the sheet to the next participant in a loop. In the end, each one read the solutions and tries to synthesize. Asking questions is a natural, simple and effective way to exchange ideas; the question wording helps to identify the problem, which is a first step to solve it. The writing of the ideas has an important structuring impact.

#### 2) Delphi, Real-Time Delphi

In the 1950s, on demand of the US Army, RAND (a thinktank) created the Delphi method to make forecasts from the opinion of experts about the possibility of an enemy attack during the Cold War. The Delphi method is a structured communication technique, which is an iterative administered process of questionnaires where the participants are experts on the topic of the study (they are not required to meet physically). In a first questionnaire, the experts are asked to provide their judgment. Data collected are analyzed, synthesized and the next round begins with the sending of a new questionnaire, expecting the experts to be more accurate [17]. There are multiple rounds where questionnaires allow experts to revise their answers. The process stops when a pre-defined criterion has been reached. Gordon says that in the end, more often than not, the group of experts moves towards consensus. The reasons and arguments (for consensus or not) can be highly valuable and useful. However, the Delphi takes time and requires a good time management, and can be found long, expensive, tedious and requires a lot of efforts [20]. The Delphi method try to get the opinion, the judgment and a justification of the participants, it seeks a consensus (if possible), with a predefined set of questions carefully prepared, but the creativity is there controlled and contained.

The Real-Time Delphi [16] is a computerization of the Delphi method, where Artificial Intelligence and Natural Language were introduced during the analysis phase of non-numerical answers. It works “roundless”: every participant can come at anytime to update its inputs. Each presented question comes with some information (the average/median response of the group, the number of responses, the reasons). Respondents have got spaces to respond and justify it. The process can be applied in synchronous (the forms on the screens are updated in case of new answers) for small groups in a room or asynchronous from remote locations.

### III. QLIM

QLIM is an interactive questionnaire management tool. As a web technology (see figure 1), QLIM doesn’t require



Figure 1. QLIM's page, to respond, add questions and answer choices, with guides.

participants to gather or see each other. Some important features of QLIM need to be introduced. First, it allows adding questions and answer choices. The sample size should be limited, like in the Delphi method, to about twenty aware and motivated people; we believe that too many participants could cause confusion but this point needs further studies. On the one hand, QLIM allows expression and creativity: as it is said in the eBrainstorming, "to solve a problem, much of the solution lies in the wording of the question" [15], it helps participants to formalize their subjects of interest in a structured frame (unlike online forum open debate). QLIM is based on a questions and radio buttons system, designed to encourage the participants to make a precise choice or to ask some new questions or to add new answer choices to react, to criticize or to develop; it is designed to be creative and to give an open direction to the discussion unlike traditional questionnaires. The goal of QLIM is not specially to lead to a consensus, it is a creative space: the ending question can be off-

topic of the first question. On the other hand QLIM captures what is exchanged in a group. The problem in common brainstorming systems is the lack of structuration, the structuration allows easy exploitation. A regular brainstorming is not specially structured (it returns a raw list of ideas) but QLIM is: to be able to use the frame (textbox, radio buttons) the participants have to identify and break down what they want to say, to be synthetic, so they structure their thoughts. This way, all interactions can be logged and these traces can be exploited to understand the behaviors, the developments, and influences.

QLIM's first aspect is the use of questionnaire, with two kinds of people, the creator which initiates the questionnaire and the participants. The second aspect is the use of the logged traces of the participants' interactions.

#### A. First aspect: the QLIM usage.

##### 1) From the creator's point of view

Figure 2 summarizes the process. The "New questionnaire" button is available from the creator home menu. Creating a new questionnaire is simple, only four textboxes to fill: the heading of the first question, some answer choices (if desired), the

Figure 2. Creation principle

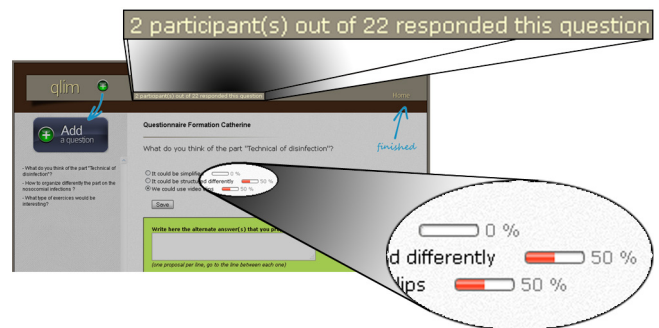


Figure 3. The distinctive elements of a question -with- scores



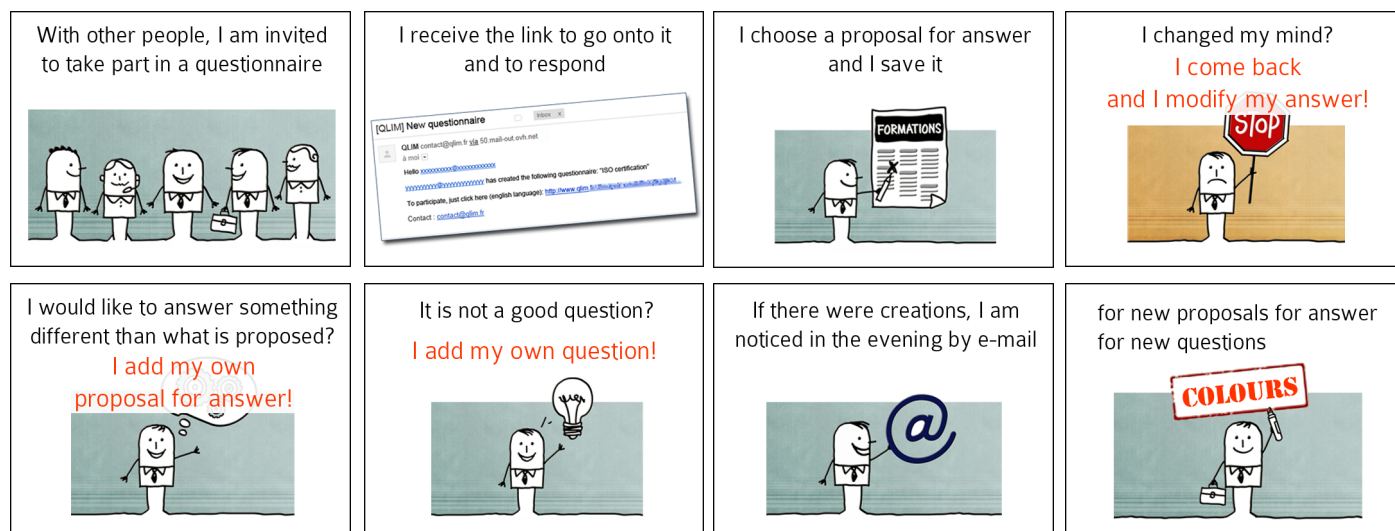


Figure 4. Extract from the video “Participation”, in the help page; to explain the original features

participants’ e-mail addresses and a name for the questionnaire (for more questions, enter the questionnaire and press the “Add a question” button). Before pressing the Save button, one important thing remains to do: to choose “With” or “Without” the scores. Figure 3 shows the distinctive elements displayed when “With” is chosen: the number of participants who responded the question and a percentage at the end of the line of each answer choice (the “score”). It represents the success rate of each answer choice among the participants who answered the question. If present, these data may influence the participants, because it becomes possible to know the trend of the group.

An Administration menu gives access to reserved functions to manage participants and questionnaires: the creator is able to list, to add or delete a participant to/from one of his questionnaires; he is also able to delete, to disable or enable a questionnaire. A disabled questionnaire will not appear in the list of the available questionnaires, it becomes impossible to respond.

## 2) From the participant's point of view

When a questionnaire is created, each participant receives a bot generated e-mail; this is an invitation to participate in a QLIM questionnaire, inside the message a link leads to it. After clicking this link, the participant reaches directly the web page with the first question. The question is set out, the answer choices are radio buttons. The participant makes a choice and saves it by clicking the Save button. All the questions are listed in column on the left side; the participant clicks the question he wants to answer (see Figure 1). He answers in the order he wishes. If he changes his mind, he can go back to a question to modify his answer, at any time and as many times he wants. If the proposed answers do not suit him, if he isn’t satisfied or he thinks that one should be able to answer something else, the participant can add one or more answer choices. If he wants to ask a question to know the opinion of the others, to fuel the debate, or if he finds “it’s not a good question?”, or relevant, or he wants to complete or to correct, he can add a question by a click on a big button “Add a question” (see Figure 1). He puts the heading and some answer choices if he wants, then clicks the Save button. It is possible to add a question without any answer choices, to arouse the questioning and to see the answers brought by the

others. Every evening, a bot counts the new questions and the new answer choices. If there were some creations, it sends the summary of the day by e-mail to every participant.

Participants are helped: like unread messages in a mailbox are highlighted with a bold font, what is new in a QLIM questionnaire is colored (Figure 5). A question that did not exist the last time the participant came appears in a red font and a question with new answer choices appears in an orange font. This is to draw attention to what’s new to encourage the participation. The main menu gives access to the help (Figure 4 shows some pictures drawn from the “participation” video clip) and enables every participant to know the results.

## B. Second aspect: the usage of the logged traces of the participants’ interactions.

Like traditional questionnaires, QLIM returns a snapshot; it saves the participants’ responses, so data collection allows making statistics that give information to understand the respondents’ opinion like a poll does. But QLIM also offers another type of results; it gives a temporal view of the activity of the participants. From the beginning, QLIM has been designed to log the interactions: save an answer (respond), add question(s), add answer choice(s), modify, simple visit. This storage method is inspired by the six Ws (who, what, where, when, how, why, with what) [20]. When one of the above interactions happens, the executed code adds a new record in the database and each column is filled with values that matches the meaning of the column name: Who is filled with the participant’s e-mail address, What with the type of interaction, Where with the web page name, When with date and hour, the others columns are filled

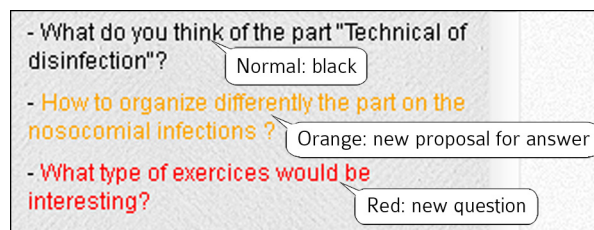


Figure 5. Highlighting

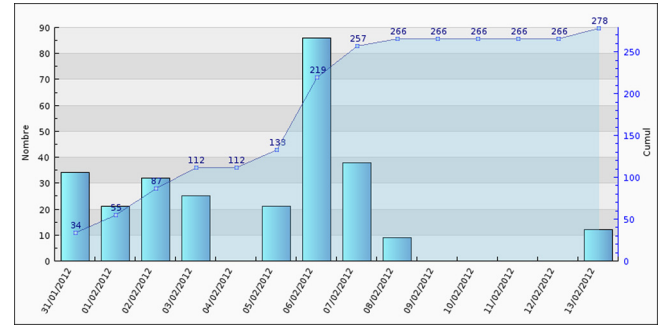
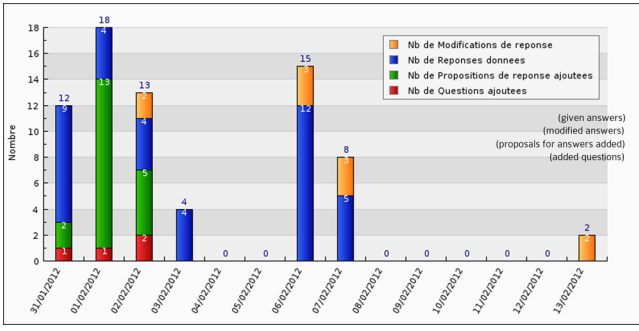


Figure 6. Examples of charts from the statistics pages

with context data (nature: “questionnaire”, “question”, the value of id, etc.). This standardized definition for a record has several advantages: we always use the same function to fill it, only the last columns are used to store different types of data depending on the context; and queries for statistics are highly facilitated, only parameters change.

As the activity schedule is stored, it is possible to build some charts that represent variation over time for the whole questionnaire, the questions and the participants. These charts may also reveal presence of causality relationships between activities. QLIM offers several types of charts (see Figure 6): combined bar and line plots (bars for the number of a particular interaction per day, and line for the cumulative), grouped bar plots (to put interactions side by side, per day), accumulated bar plots (to have one bar per day with all interactions on one bar), pies plots (to represent the interactions per participant). These statistics are available to the creator in dedicated pages, grouped by category (the whole questionnaire, the questions and the participants). Seeing the evolution of the interactions inside a group allows reconstitution and understanding of the results. It is possible to read trends: does this sample often change its mind? for example. This gives access to information difficult to get when having only the final results: the influence of one question, of one person in particular (a person who adds often or a lot); the respondents could have made a choice and the arrival of a new question could reverse their opinion; the new questions may have been all asked by only one person; new questions may have been asked after a certain event, or instead, no more new questions after a certain event, etc.

### C. System architecture

QLIM is currently running on a shared hosting, it has a domain name and its own mail address. QLIM has been implemented using PHP/MySQL, CSS, HTML without Javascript. The files take about 60 MB of disk space.

The database is built with a table for every group of data: questionnaires (called Fingers), participants, questions, answer choices and a table to store the responses. Two more tables are needed for the traces: “Registre” to log the visits, for the colors and “Traces” to log the interactions that are used for the statistics and charts.

### D. Experiments

Unlike traditional questionnaires, a QLIM questionnaire is not a definitive or frozen questionnaire with refined and prepared questions, in order to verify an hypothesis. One of its

features is its “malleability”, its participant-driven tailor-ability. With QLIM, the participants are given a malleable tool and we were curious to see what they could do of it. Do they seize this malleability? To observe the participants behavior, we made a set of experiments on sample made of six populations of students ranging from ordinary to Master degree. All the students have followed Information Technology courses or Organization in Information Systems courses. The questionnaire title was “How to improve your training?”. There were two questions: “What do you think about the rhythm of the courses?” and “Is the balance correct, between theory and practice?”. Their answer choices were deliberately incomplete, respectively: “The rhythm is correct” and “That progresses too slowly”, and “There is not

TABLE I. Results of our experiments

	A	B	C	D	E	F	G	H	C/A	D/A	E/A	G/A
g01*	12	9	9	6	2	2	4	8	75%	50%	17%	33%
g02*	12	10	9	2	1	3	2	3	75%	17%	8%	17%
g03*	7	7	5	2	1	1	2	2	71%	29%	14%	29%
g04*	8	8	7	1	1	2	0	0	88%	13%	13%	0%
g05	10	3	2	1	0	0	1	1	20%	10%	0%	10%
g06	11	3	3	2	1	1	1	1	27%	18%	9%	9%
g07	12	2	0	0	0	0	0	0	0%	0%	0%	0%
g08	12	3	1	1	0	0	1	1	8%	8%	0%	8%
g09	11	2	1	1	0	0	1	4	9%	9%	0%	9%
g10	12	1	1	1	0	0	1	1	8%	8%	0%	8%
g11	12	7	6	2	0	0	2	3	50%	17%	0%	17%
g12	12	5	5	1	0	0	1	1	42%	8%	0%	8%
g13	21	7	6	2	0	0	2	2	29%	10%	0%	10%
g14	21	4	4	2	0	0	2	3	19%	10%	0%	10%
g15	16	8	7	1	0	0	1	1	44%	6%	0%	6%
g16	16	6	5	1	0	0	1	1	31%	6%	0%	6%

Codification of the first line:

- A : Nb of invited people to participate to the questionnaire
- B : Nb of people who came
- C : Nb of people who came and responded to at least one question
- D : Nb of people who came and added something
- E : Nb of people who came and added a question
- F : Nb of questions added
- G : Nb of people who came and added an answer choice
- H : Nb of answer choices added

C/A : Participation rate

D/A : Percentage of participants who added something

E/A : Percentage of participants who added at least a question

G/A : Percentage of participants who added at least an answer choice

TABLE II. Two kinds of groups in Table I, summary of differences

	<b>The first four</b>	<b>Rest</b>
<b>High participation rate</b>	Yes	No
<b>Training finished</b>	No	Yes
<b>Invitation sent</b>	During	a posteriori
<b>Invitation mode</b>	By the teacher	By e-mail
<b>High number of creations</b>	Yes	No
<b>Problem during the training</b>	Yes	No
<b>Type of behaviour</b>	"Involved"	Classic

enough theory to understand the practice" and "The practical part is not useful for us".

The students who had finished their training received an invitation e-mail to participate to a questionnaire, while the others (with star, in Table I) were invited by their teacher, in that case, the teacher explained them in a face to face meeting, how QLIM operates. Table I presents the participation of the invited people and their involvement; a participant who adds at least a question or an answer choice is said "involved".

#### IV. DISCUSSION

Table II summarizes the differences between the two kinds of groups: it is possible to distinguish the first four groups (g01 to g04) from the others (g05 to g16). Note some observations about these first four groups: the experimentation took place during their training time so they were invited by a teacher who met them regularly; they have had some troubles during their training (classroom, timetable, program of courses). The others had finished their training and were contacted by mail without any monitoring. The first four groups have a high participation rate and are the most "involved". Generally, this involvement is coming from a small number of participants. From these observations, it seems to be a categorization in users activity. First, we see people who do nothing, those who participate occasionally and those, very few, who are very "involved", active, but we surely need to conduct more experiments.

Unlike traditional questionnaires or a classic brainstorming, QLIM shows the construction, the process. The "time" factor allows more than a mere snapshot. Furthermore, allowing participants to add questions or answer choices introduces a feedback loop in the group process. This systemic feature may introduce emergent phenomenon interesting to study. Leadership or propagation of influences, for example, can be observed as well as their weight on the group creativity process.

As we said before, our experiments are in a preliminary stage but we have planned several other studies in education and in industrial context in order to support creativity and enhancement processes. QLIM was tested and works pretty well but we think that improvements are possible and we are looking to add some features. For example, we expect to add links to external contents which could be useful when a question needs to be detailed (What design would you prefer for the new desk? Three answer choices with links to pictures). The dilemma we are confronted with is to add only necessary features while keeping easy going interface. Without this usability constraint the tool will grow in complexity and certainly discourage potential users.

#### REFERENCES

- [1] Wuchty Stefan, Jones Benjamin F., Uzzi Brian, "The Increasing Dominance of Teams in the Production of Knowledge", *Science*. 316(5827): 1036-1039. 2007.
- [2] Sheehan, K., "E-mail survey response rates: A review", *Journal of Computer-Mediated Communication*, 6(2), 1-20. 2001.
- [3] Fricker, R.D., "Sampling methods for web and e-mail surveys", in N. Fielding, R. M. Lee & G. Blank (Eds.), *The SAGE Handbook of online research methods* (pp. 195-216). Los Angeles, CA: Sage. 2008.
- [4] Groves, Robert M., "Survey Errors and Survey Costs", New York: John Wiley & Sons. 1989.
- [5] de Leeuw Edith D., Priority Programme Survey Methodology, February 18th/19th, 2008: "First Conference in Bremen", [http://www.survey-methodology.de/en/index\\_en.html](http://www.survey-methodology.de/en/index_en.html) & <http://edithl.home.xs4all.nl/Present/PPSM09.pdf>
- [6] Lynn P., "Telephone, Face-to-Face or Self-Completion Survey: Horses for Courses", OSUAH Seminar, August 11th, 2008. [http://www.osuah.cl/Telephone\\_Face\\_to\\_Face\\_or\\_Self\\_Completion\\_Survey\\_Peter\\_Lynn.pdf](http://www.osuah.cl/Telephone_Face_to_Face_or_Self_Completion_Survey_Peter_Lynn.pdf)
- [7] Biemer, P.P. and Lyberg, L.E. "Introduction to Survey Quality", New York: John Wiley & Sons. 2003.
- [8] Bishop B., & Cooper A., "Innovative Survey Methodologies for the Study of Attitudes Toward Terrorism and Counterterrorism Strategies", 2009. [https://www.ihssc.org/portals/0/Bishop\\_Cooper\\_Hillygus\\_SurveyMethodsLitReview.pdf](https://www.ihssc.org/portals/0/Bishop_Cooper_Hillygus_SurveyMethodsLitReview.pdf)
- [9] de Leeuw, E. D., "To mix or not to mix: data collection modes in surveys", *Journal of Official Statistics*, 21, 233-255. 2005. <http://igitur-archive.library.uu.nl/fss/2011-0314-200305/EdL-to%20mix%202005.pdf>
- [10] Brennan, M., "Techniques for improving mail survey response rates", *Marketing Bulletin*, 3, 24-37, Article 4. 1992.
- [11] Johnson, T.P., Owens, L., "Survey response rate reporting in the professional literature", Paper presented at the 58th Annual Meeting of the American Association for Public Opinion Research, Nashville, May 2003. <http://www.amstat.org/sections/srms/proceedings/y2003/Files/JS2003-000638.pdf>
- [12] Bachmann, D., & Elfrink, J., "Tracking the progress of e-mail versus snail-mail", *Marketing Research*, 8(2), 31-35. 1996.
- [13] Paolo, A. M., Bonaminio, G. A., Gibson, C., Patridge, T., & Kallail, K., "Response rate comparisons of e-mail and mail distributed student evaluations", *Teaching and Learning in Medicine*, 12(2), 81-84. 2000.
- [14] Collings, D., & Ballantyne, C. S. (2004, November 24-25), "Online student survey comments: A qualitative improvement?" A paper presented at the 2004 Evaluation Forum, Melbourne, Victoria.
- [15] Lancieri, L., Lavallard A., Manson P., "E-Brainstorming: Optimization of collaborative learning thanks to online questionnaires", *Proceedings of CELDA IADIS International conference*, 2005.
- [16] Gordon, T. & Pease, A., "RT Delphi: An Efficient, 'Round-Less' Almost Real Time Delphi Method", *Technological Forecasting and Social Change*, 73, 321-333. 2006.
- [17] Gordon, T. J., "The Delphi method", in J. C. Glenn & T. J. Gordon (Eds.), *Futures research methodology - V2.0*, Washington, DC: American Council for the United Nations University. 2003.
- [18] Hamadache, K., Manson, P., Lancieri, L., "Pervasive Services, Brainstorming in Situation of Mobility", *ICPCA 2008 (International Conference on Pervasive Computing and Application)*, Alexandria Egypt, october 2008.
- [19] Osborn, Alex, "Your creative power", New York, Charles Scribner's son, chap. 33, p. 265. 1948.
- [20] Booto, J.P., Bernard, P., Plaisent, M., "Consensus par la méthode Delphi sur les concepts clés des capacités organisationnelles spécifiques de la gestion des connaissances", in: *Recherches Qualitatives - Vol. 29(3)*, pp 168-192. 2011.
- [21] The six Ws: [http://en.wikipedia.org/wiki/Five\\_Ws](http://en.wikipedia.org/wiki/Five_Ws)