Effectiveness Of Electronic Brainstorming as a Technique Of Creative Thinking «Theoretical Approach »

فعالية العصف الذهني الإلكتروني كتقنية للتفكير الإبداعي « مدخل نظري »

Doctor Krameche Bilel *
Mohammed Seddik Ben Yahia
University Of Jijel.

Publication Date:31/12/2018

Abstract

Electronic brainstorming is a contemporary managerial concept on which creativity process relies. Through this theoretical study, we will try to explore the effectiveness of electronic brainstorming in comparison with traditional brainstorming.

Therefore, we divided the present research paper into four sections: section one is about the historical evolution of electronic brainstorming; section two concerns the types and the tools of EBS, and finally section three and four which we devoted to the advantages and disadvantages of electronic brainstorming.

The study resolved that although its drawbacks, electronic brainstorming is more effective than traditional brainstorming.

Keywords: Electronic brainstorming, traditional brainstorming, creativity, creative thinking, organization.

ملخص

يعتبر العصف الذهني الإلكتروني من بين المفاهيم الإدارية المعاصرة التي ترتكز عليها العملية الإبداعية.

من خلال هذه الدراسة النظرية، نحاول التعرف على مدى فعالية أسلوب العصف الذهني الإلكتروني بالمقارنة مع العصف الذهني التقليدي. تم تقسيم هذه الورقة البحثية إلى أربعة أقسام، حيث يتناول القسم الأول التطور التاريخي للعصف الذهني الإلكتروني، بينما يتطرق القسم الثاني إلى أنوعه وأدواته، وفي الأخير فقد تم تخصيص كل من القسم الثالث والرابع لمناقشة إيجابياته وسلبياته.

* biledge@yahoo.fr Received 23 April 2018, Accepted 29 November 2018

خلصت الدراسة إلى أنه بالرغم من حدود وسلبيات العصف الذهني الإلكتروني، يعتبر هذا الأخير أكثر فعالية مقارنة بالعصف الذهني التقليدي.

الكلمات المفتاحية: العصف الذهني الإلكتروني، العصف الذهني التقليدي، الإبداع، التفكير الإبداعي، المنظمة.

INTRODUCTION

In today's highly dynamic and complex environment, it is important that organizations generate novel ideas of high quality to develop or maintain their competitive advantages.

Therefore, they needed a modern technique to generate creative ideas: **Electronic Brainstorming (EBS).** This technique needs the use of a computer so that group members in a brainstorming session can use it in order to interact and exchange ideas with each other.

The process of generating ideas using EBS is anonymous, thus the members tend to express their ideas more freely and in a greater quantity. It also allows them to define the problem's scope, identify the possible solutions and develop a heuristic classified scheme.

-The study problem:

The main question we try to answer through this research paper is, "Can EBS mitigate problems with traditional brainstorming, or is EBS more effective than traditional brainstorming?"

-The study importance:

The importance of this study emerges from the one of its variables represented in electronic brainstorming (EBS) and creative thinking of human resources in organizations. Furthermore, it seeks as it is aforementioned, to reveal the effectiveness of electronic brainstorming comparing with traditional brainstorming.

-The study objectives:

The study aims to:

- Identify if electronic brainstorming is more effective than traditional brainstorming

- Propose a theoretical framework that the managers of organizations can use.

-The hypotheses:

The study rests on the following main hypothesis:

- Electronic brainstorming is more effective than traditional brainstorming as a technique of creative thinking.

-The methodology:

Within the scope of the current study, its targeted objectives, the suitable methodology is **"the analytic descriptive methodology".**

-The previous studies:

***The study of Denis, A.R and Valacich, J.S (1993), Computer brainstorms: more heads are better than one:**

This article presents the results of an experiment that found the reverse to be true for computer-mediated electronic brainstorming. In this experiment, 12 member electronically interacting groups generated more ideas than did 12 member nominal groups, and there were no differences between 6 member electronic and 6 member nominal groups. The authors attribute these results to the ability of electronic brainstorming to introduce few process losses (production blocking, evaluation apprehension, and free riding) while enabling process gains (synergy and the avoidance of redundant ideas).

***The study of R.Brent Gallupe and William H.cooper (1993), Brainstorming electronically:**

In this research paper, the authors describe the use of networked computers to helps groups generate, disseminate, evaluate and act on ideas. The method is, in essence a technological update of traditional face-to-face brainstorming. The study concluded that traditional face-to-face oral brainstorming is widely used to generate ideas. Despite its drawbacks, it will continue to be used. They also expect to see electronic brainstorming gradually grow in use. This will happen because it is new and will spread, as with all fads. Its enduring value is that it helps groups generate, edit, evaluate, and plan to implement their ideas on topics where it's difficult to get people to share their ideas openly.

*** The study of Gail Kay (1996), effective meetings trough electronic brainstorming:**

The research shows that this technology does improve communication in organizational settings.

Investigations that have been conducted show that electronic brainstorming groups generate more ideas than do verbal brainstorming groups, particularly for larger group sizes . The same studies have found that 12-member electronic groups generated more ideas than did 12-member nominal groups.

*** The study of Susan M. Stevens and others (2007), Assessing the effectiveness of electronic Brainstorming in an industrial setting: Experimental Design Document**:

An experiment is proposed which will compare the effectiveness of individual versus group brainstorming in addressing difficult , real world challenges. Previous research into electronic brainstorming has largely been limited to laboratory experiments using small groups of students answering questions irrelevant to an industrial setting. The proposed experiment attempts to extend
current findings to real-world employees and organization-relevant challenges.

The employees will brainstorm ideas over the course of several days, echoing the real-world scenario in an industrial setting. The methodology and hypotheses to be tested are presented along with two questions for the experimental brainstorming sessions. One question has been used in prior work and will allow calibration of the new results with existing work. The second question qualifies as a complicated, perhaps even wickedly hard, question, with relevance to modern management practices.

*** The study of Sami Fahad Alsenaidi (2012), Electronic brainstorming in Saudi Primary Education:**

The study explores the use of electronic brainstorming in classrooms in primary schools in Saudi Arabia. The main aim of this study is to explore the students interest in Islamic education in primary schools in Saudi Arabia, to improve their creativity skills through electronic brainstorming and to investigate the influence of the pedagogical affordances of the electronic brainstorming method on classroom activity. To this end the researcher compared three groups, electronic brainstorming (EBS), verbal brainstorming (VBS) and the traditional method (T), in different classrooms and with different teachers. The sample consisted of 61 primary school students aged between 11 and 12 years old and three Islamic education teachers. The interview and observation findings indicated the greater student participation, motivation and creativity in the EBS method. The observation and interview fidings revealed positive differences between

EBS on side and VBS and traditional method (T) on the other side in islamic education lessons in primary school in Saudi Arabia. Furthermore, the analysis of the research findings demonstrated how pedagogical affordance of EBS lead to significant improvement of creativity skills, dialogue and engagement in learning environment where EBS has been employed. Finally, this study concluded that EBS method has considerable potential to improve the Islamic education curricula in primary school in Saudi Arabia

-The study plan:

We will try to answer the above question through broaching the following elements: The history of EBS, the types and tools of EBS, and finally the advantages and disadvantages of EBS.

1. THE HISTORICAL EVOLUTION OF ELECTRONIC BRAINSTORMING :

The principles behind brainstorming traced back to century's old Indian religious philosophies, and perhaps to farther ancient Indian ceremonies. In its modern format, the technique of brainstorming began with Alex Osborn who developed the idea of brainstorming in the late 1930's for application to his work in advertising.

In 1957, Osborn published a book called: "Applied Imagination" (2). He believed that engaging in brainstorming, groups would increase the number of originality of the ideas they might otherwise generate. In part of the process of social interaction, would spur individuals to greater creativity (3)**.**

Osborn claimed that in this way, a person could think up more ideas when working with a group than when working alone.

1.1- Traditional brainstorming:

This is the most popular type of brainstorming. A group of people sit together, think of ideas, and voice their opinions to the group (4). This form of brainstorming depends on the four following rules (5)**:**

A. Ruled out criticism: to avoid trouble in the generation of ideas, participants at a brainstorming session should not criticize. This rule follows a central principle of brainstorming: **"The deferment of judgement".**

B. Welcome Freewheeling: unusual and even wild ideas are possible and desired since there will be no criticism.

C. Quantity: one purpose of brainstorming is to gather up a maximum number of ideas, assuming the greater number of ideas, the higher is the probability to find successful ones.

D. Work towards combination and improvement: Participants are encouraged to use the ideas of others by combining or improving them.

In order to take the full advantage of brainstorming, Osborn mentioned that the previous rules were not sufficient. Thus, he provided some suggestions and recommendations on the training and the management of brainstorming meetings (facilitation), participants training, topic nature, group composition, etc…)

1.2- Nominal Group Technique:

This is another form of brainstorming. It was developed in 1968 by Andre Selbsecq and Andrew de Vem who derived the technique from studies of the decision making problems experienced by citizen involvement groups(6).

The nominal group technique (NGT) is a group process involving problem identification, solution generation and decision-making. It involves groups of many sizes who want to make their decisions quickly (7).

NGT is an interview technique where participants work in the presence of each other, but write ideas independently rather than stating them verbally. They use it not only to generate a large number of ideas, but also to prioritize the ideas, and consequently, the ideas that receive the most majority of the votes are selected (8).

NGT includes four phases (9):

A. Generating ideas silently and writing them down.
B. Round robin, or the recording of ideas, usually the facilitator allows putting forth one idea and only one idea per person. When all the participants have given one idea, the next person shares another idea and so forth until all the ideas are on the flip chart.

C. The discussion of ideas.

D. Each person votes for his choice of the top five ideas in order of ranking.

The facilitator or one member of the group may then record and tabulate the results; a list of the top five total votes is generated, then the facilitator asks the group whether they agree or disagree on that vote.

The few problems with GNT brainstorming are: conflict, lack of anonymity, non-participation and redundant ideas.

1.2- Electronic brainstorming:

This is a form of brainstorming; it makes use of computer-meditated electronic communications in order to replace verbal communications (10).

EBS is a computerised version of the traditional (verbal) brainstorming technique, typically supported by Electronic Meeting System (EMS). However, it may conduct simpler forms via E-mail, browser-base or peer to peer software (11).

The rational for electronic brainstorming is that it allows groups generate ideas anonymously. Anonymity may reduce or completely obliterate evaluation apprehension and production blocking. It may also allow the members to challenge one another, and consequently increase process gains.

Furthermore, it may generate a less threatening environment to individuals, because less skilled members can give their input without having to worry about being judged by more highly skilled members (12)**.**

EBS can improve group work, because members work simultaneously. Each participant has his or her computer that permits him or her to contribute his or her ideas equally.

Electronic brainstorming allows the ideas, which were generated in the meeting, to be recorded for use. This record may help reduce redundant ideas and increase synergy, because members can easily refer to and build on others' ideas long after they were first contributed (13).

2-TYPES AND METHODS OF (EBS)

2.1- Types of EBS:

According to Alotham (2006), there are two main types used in electronic brainstorming (14)**:**

A. The one computer type (lonely computer): This type requires using only one computer and it is similar to the traditional method, but it abolishes the blackboard. Participants are motivated to start thinking

creatively by the computer, and every member in the group shares his first ideas. Members are encouraged then to move from the first ideas to practical solutions and to note them, and so, all the ideas will represent an input for the computer.

B. The multiple computers type: every member in the group has a private computer and begins the thinking process around the problem from a different direction. Such a process generates many ideas, and the leader of the group is responsible to put those ideas in order.

2.2- Methods of EBS:

Three methods of (EBS) use programs and websites only (15)**:**

A. Paralleling (synchrony): where members enter their ideas at any moment; then make them appear simultaneously for the entire group.

B. Group memory (asynchrony): where members enter their ideas and then save them.

These two methods reveal the name of each person.

C. Secrecy (synchronic or asynchronic): the ideas are put forward anonymously; this method often produces surprising and excellent ideas. We can say that these sessions must be available for all the participants. Ideas and information must not be censured because this delays the development of the creative environment.

The internet is ideal in distinguishing creative ideas to all participants. By using electronic brainstorming, participants are able to create new ideas and process tasks easily.

3- ADVANTAGES OF EBS:

EBS has many advantages:

3.1-Parallel entry of ideas:

With parallel entry of ideas, as all the participants enter work at the same time, individuals can immediately generate ideas without interrupting anyone. Thus, the input opportunities are evenly available among all the members, and this reduces production blocking (16)**.**

Studies have shown that the EBS does in fact mitigate the negative effects of production blocking.

Valacich and colleagues (1994) had their participants perform two different brainstorming activities: Half of the participants performed tasks in the stand and EBS format. The other half modified the

technology so that only one person could type in a response at a time (thus introducing production blocking).

The researchers found that the stand EBS group outperformed the production blocking EBS groups and concluded that EBS was effective at eliminating production blocking (17).

3.2-Anonymity:

Verbal criticism is a predicament in traditional brainstorming groups. With EBS, the participants can express ideas without having to worry about being criticized. Anonymity shields them from personal comments that fixed the ideas and not the persons voicing them. Anonymity eliminates evaluation apprehension.

In traditional brainstorming, group members fear negative evaluation from other group members which, in turn, supresses original ideas. Anonymity encourages a more open and honest environment (18).

Cooper and Colleagues (1998) had four groups of participants brainstorm ideas about topics of controversial nature. The groups included an anonymous EBS group, a non-anonymous EBS group (in which the participants identify which ideas were their own), a traditional brainstorming group, an individual or a nominal group.

The researchers found that the anonymous groups were the most productive overall; they produced a larger number of highly controversial ideas and reported less perceived production blocking than the non-anonymous EBS group (19).

3.3-Group size:

When it comes to the size of the group, EBS has no limit. It can easily accommodate brainstorming meetings of groups of 12 members or more. In comparison, traditional brainstorming works best with groups of only five to 12 members (20).

Often, there will be a generation as to how effective the participation level remains in large groups.

However, experiments studying EBS have found per-person of the size of the group, suggesting that process losses may remain relatively constant as size increases.

Other experiments have found outcome measures such as effectiveness and member satisfaction to increase with size of the group (21).

When the group is larger, more people from different levels of the organization may participate. As more levels are presented in the decision making, more of the entire organization becomes involved. Also, more individuals from different areas or departments within the company are represented. Thus, there will be a contribution to the meeting from a vast experience, knowledge and skills (22).

3.4-proximxity:

Probably one of the most beneficial aspects of EBS is the fact that groups can meet synchronously while remaining physically dispersed. The members don't have to be in the same place or even in the same time zones to interact. Individuals can even hold meetings on separate continents. They need only computer workstations, the software and a modem (23).

One laboratory experiment found no difference in the number of ideas generated by proximate and distributed groups, but found proximate groups to be more satisfied.

A second study using a similar research design found distributed groups to generate more ideas than proximate groups, with no satisfaction differences (24).

3.5- Memory:

Suppose not all members can meet at the same time, but still would like to know what had occurred in a meeting. With EBS, they have the option of "viewing" the session. Since the session manages are automatically saved, the group no longer need to utilize a person to write down a singular version of what has been ensued in the meeting. The result is more accurate records than the previous ones, when other means of brainstorming were used.

Traditional brainstorming does not offer an option such as saving ideas on a computer disk for future use. Traditional brainstorming sessions have the ideas saved on paper. Ideas often go unused because they cannot be retrieved easily. That is why individuals often end up generating redundant ideas (25).

3.6- Equality:

With EBS, personal and organizational reputation of a particular individual is not influencing factors. No individual can dominate another person through rank, status, or raised voice to exercise power.

A person cannot look down at something someone else said. Since members can input ideas at the same time, no individual can dominate an EBS sessions.

This is a way to ensure equality for the participants. Lower level individuals, who may not be respected because of their jobs or minority status and normally not given a voice, become enabled to voice their opinions with this technology (26).

Since everyone feels equal and can suggest one's own ideas, the quantity of ideas may increase and the variety of suggestions enhances.

3.7- Novelty:

Most consider EBS a new technology, as they have never even heard of the term electronic brainstorming in any case. Because it is a novel mechanism, it tends to generate interest and curiosity.

Group members who apply EBS develop a sense of achievement. They frequently work harder and produce more ideas because it seems there is more participation within the group.

Using EBS makes the process of information go faster than using verbal information channels. Individuals seem to be more concise when working with the keyboard rather than talking or writing.

According to a study, the idea generation worked best (27) when a group of four persons used electronic technology**.**

3.8- Software/Tools:

Once the ideas are generated, they must be evaluated. EBS permits the use of software tools to help sort and evaluate ideas. The "idea organiser" software tool, for example, puts ideas into categories to evaluate them more easily. Each individual member may scan and organize generated ideas by creating categories. These categories can be established using key words identified by group members, which permits the combination or the deletion of similar idea.

All this may be shown on a large screen in front of the room as well as workstations. After the categories have been selected, the "alternative evaluation" tool may rate each idea in each category. As soon as the group members collected all the rating, the results can be reviewed in graphic presentations and /or tabular format (28).

The software in EBS cannot solve problems for the group members, but it can help the members evaluate their ideas; the more the ideas are evaluated, the more effectiveness and efficiency. This can encourage

participation, build consensus, and make the implementation phase run better.

4- DISADVANTAGES OF EBS:

Despite its advantages, EBS has disadvantages too:

4.1 Small groups:

When it comes to EBS small groups, it seems that they do not generate as many ideas as larger groups. For example, one study had found that eighteen member EBS groups generated more ideas than three-member EBS group (29).

Participants in EBS may have problems in small groups; within the limited number of generated ideas, there might be similarities too. Because of those similarities, ideas may not ignite the same synergy as distinct ideas. Thus, the possibility of having redundant ideas by smaller groups makes EBS have more advantages with larger groups compared to the smaller ones (30).

4.2-Keyboard skills:

The most obvious problem is that participants have to be able to type. Those who cannot type or who type slowly, may easily be frustrated and find themselves at a disadvantage to experienced typists (31).

The act of typing becomes a barrier to communication instead of a facilitator. For example, senior managers who are not used to typing may feel ill at ease. Thus, they may produce fewer ideas, all the while concentrating on their typing skills. When the meetings tend to short and involve upper management, the individuals who are not very computer-literate may be less inclined towards using EBS (32).

4.3-Loss of social interaction:

The third drawback is that, although most find the EBS more satisfying than traditional brainstorming, some miss the social aspects of the traditional process and the richness of the spoken language.

There are no prohibitions against talking, but most group members do not talk in order to concentrate on idea generation. This is for some a disadvantage because it reduces the opportunity for personal interaction. One potential response to this absence is that people can comment on the idea. They see it on the screen, laugh, and otherwise react to the ideas they generated. As no two people are looking at the same set of ideas, it

also introduces some useful uncertainty about what is going on. If talking works for a group, there is a little reason to discourage it (33).

4.4-Loss of power:

With EBS, high status individuals may feel a loss of control. Anonymity is a drawback for some; they can suffer in the evaluation stages.

This means that individuals in upper ranks in the organization may have a more arduous time to get their ideas accepted as they used to with traditional brainstorming. A feeling of loss of control may occur then, which was not the case with the traditional brainstorming groups (34).

4.5-Cost:

An EBS team requires not worked computer hardware and software. This technology is still relatively expensive, especially for small firms, although the cost is rapidly shrinking. Several organizations such as IBM and Texaco (as well as many universities) have EBS centres that could be used by outside groups. As the price comes down, more organizations will establish their own facilities (35).

Organizations must take all aspects of cost into consideration in order to have an effective meeting. The cost of appropriate management structure, facilities, software and training may be too much to handle, especially for small companies (36).

4.6-Overload of ideas:

Generating too many ideas is another drawback that results in idea overload. This is particularly true for the idea pools generated by large groups. While some people do not consider it as a problem as they are generating ideas, others feel frustrated by the effort required to edit, select, and evaluate so many ideas. This problem should be reduced as the software tools for editing and evaluating ideas become more useful and sophisticated.

Nevertheless, it is the part of the process in which groups most often bog down, and this will probably continue to be true(37).

4.7-No credit:

Since EBS is anonymous, credit cannot be given to the person who came up with the idea that was later implemented since the promise of a

reward or recognition is often the strongest motivation, individuals might start holding back on their ideas.

As EBS is anonymous too, this means no monitoring. When individuals are less monitored, they might feel less motivated, because group members expect their ideas to be pooled and analysed at the group level only, they may feel tempted to free ride on the efforts of others. On the other hand, individuals who are involved in traditional or nominal brainstorming anticipate their generative input to the group to be monitored. Thus, they see who is monitoring the group (38).

4.8-Manipulation of the technology:

Some individuals will find a way to manipulate the technology to accommodate their own intentions. “A dominator” may want to direct everyone in his or her own way. Since there is no verbal participation, the individuals may type comments on the keyboard, utter remarks, start discussions, and change the topic. This might disturb the concentration of the group and lead everyone down a different path.

Another drawback with the technology is that one person may be the only one typing ideas very quickly on the keyboard, or that the individual can pretend to be more than one person by typing ideas very quickly on the keyboard, or typing ideas that suit his or her personal agenda.

Another factor to consider is that not all meetings can be conducted with EBS, particularly those which require visual presentations. EBS concentrates on generating ideas through text; there are no visual presentations such as brochures or dimensional projects that can be given by individuals through the software (39).

CONCLUSION

In conclusion, it is claimed that electronic brainstorming has the potential to eliminate some perceived barriers encountered with traditional brainstorming. Notwithstanding, these barriers related to either electronic or traditional brainstorming, brainstorming itself is considered a popular method of group interaction in both educational and business settings.

There are many reasons for management to consider whether their organizations should institute the use of electronic brainstorming:

- Organizations should consider reducing problems associated to group work. This include the pressure to conform to another person's viewpoint, the fear of suggesting a "bad" idea, the need to compete for time to speak, the domination of the meeting by one individual and the damaging effects of group think.
- Organizations should look at EBS as a tool that might help in the structure and consequences of meetings. Also as a means to enhance the quality and quantity of ideas and as a way to decrease time spent in traditional meetings.
- EBS is also recommended for: meetings with complex or long discussions; organizing information before, during, and after a meeting; geographically, separated people who need to be communicated and small to large groups which need to distribute new information faster.

Finally, we recommend organizations to use EBS through providing the appropriate platform of this kind of brainstorming.

References:

1- Tudor Rickards, Brainstorming revisited : a question of context, IJMR, March, 1999,p 92
2- Gail Kay, effective meetings trough electronic brainstorming, Journal of Management Development, Vol 14, N°6, 1995, P:4
3- David Dryden Henningsen, Mary Lym, Miller Henningsen; Generating ideas about the uses of brainstorming: Reconsidering the losses and gains of Brainstorming groups relative to nominal groups. Southern Communication Journal, Vol 78, N°1, January-March 2013.
4- Gail Kay, op cit,p4
5- Hassan Ait Haddou , Guy Camilleri, Pascal Zaraté, Prediction of ideas number during a brainstorming session, Group decis Negot, 2014, p.273
6- Gail Kay, op cit, p5
7- https//on.wikipedia.org/wiki/Nominal-group-technique.
8- Mohamed Madi Bin Abdullah, Rafikul Islam, Nominal group technique and its applications in managing quality in higher education, pack J. Commer. soc. Sci, Vol 5, N°1,2011,p82
9- Gail Kay, op cit, p5
10- Gail Kay, op cit, p5
11- Sami Fahad Alsenaidi, Electronic brainstorming in Saudi Primary Education, Phd thesis,University of Exeter, August 2012, p57
12- Gail Kay, op cit, P.5
13- Denis, A.R and Valacich, J.S, Computer brainstorms: more heads are better than one, Journal of applied psychology, Vol 78, August 1993, p53
14- Sami Fahd Alsenaidi, op cit, pp 63, 64
15- Sami Fahd Alsenaidi, op cit, pp 66,67
16- Gail Kay, op cit, pp 8,9
17- Susan M. Stevens and others, Assessing the effectiveness of electronic Brainstorming in an industrial setting: Experimental Design Document, Sandia National Laboratories, September, 2007, pp 8,9
18- **G**ail Kay, op cit, p 9
19- Susan M. Stevens and others, p 9
20- Gail Kay, op cit,p10

21- J.F. Nunamaker and others .Electronic Meeting System to support group work, communication of the ACM, Vol 34, N° 07, July 1991, P 56
22- Gail Kay, op cit,p10
23- Ibid, p10
24- J.F. Nunamaker and others, op cit, p 57
25- Gail Kay, op cit, pp 10,11
26- A. Laplant, Brainstorming, Forbes, Vol 152, October 1993, p 48
27- Gail Kay, op cit, p 9
28- Ibid, p11
29- Gail Kay, op cit,p13
30- Sami Fahad Alsenaidi, op cit, p 69
31- http://freetipsonline1.blogspot.com/2015/08/electronic-brain-stroming-advantages.html
32- Gail Kay, op cit, p 14
33- http://sloanreview.mit.edu/article/brainstorming-electronically/
34- Gail Kay, op cit, p14
35- http://sloanreview.mit.edu/article/brainstorming-electronically/
36- Gail Kay, op cit p16
37- http://sloanreview.mit.edu/article/brainstorming-electronically/
38- Gail Kay, op cit, pp 14, 15
39- Gail Kay, op cit, pp16,17

Bibliography:

-Articles

1- A. Laplant, Brainstorming, Forbes, Vol 152, October 1993
2- David Dryden Henningsen, Mary Lym, Miller Henningsen; Generating ideas about the uses of brainstorming: Reconsidering the losses and gains of Brainstorming groups relative to nominal groups. Southern Communication Journal, Vol 78, N°1, January-March 2013
3- Denis, A.R and Valacich, J.S, Computer brainstorms: more heads are better than one, Journal of applied psychology, Vol 78, August 1993.
4- Gail Kay, effective meetings trough electronic brainstorming, Journal of Management Development, Vol 14, N°6, 1995
5- Hassan Ait Haddou , Guy Camilleri, Pascal Zaraté, Prediction of ideas number during a brainstorming session, Group decis Negot, 2014.
6- J.F. Nunamaker and others .Electronic Meeting System to support group work, communication of the ACM, Vol 34, N° 07, July 1991

7- Mohamed Madi Bin Abdullah, Rafikul Islam, Nominal group technique and its applications in managing quality in higher education, pack J. Commer. soc. Sci, Vol 5, N°1,2011.
8- Susan M. Stevens and others, Assessing the effectiveness of electronic Brainstorming in an industrial setting: Experimental Design Document, Sandia National Laboratories, September, 2007.

9- Tudor Rickards, Brainstorming revisited : a question of context, IJMR, March, 1999,p 92
Gail Kay, effective meetings trough electronic brainstorming, Journal of Management Development, Vol 14, N°6, 1995.
Thesis:
10- Sami Fahad Alsenaidi, Electronic brainstorming in Saudi Primary Education, Phd thesis,University of Exeter, August 2012.
-Web sites:

11-http://freetipsonline1.blogspot.com/2015/08/electronic-brain-stroming-advantages.html (Accessed 20/04/2018 at 16:00)
12-https//on.wikipedia.org/wiki/Nominal-group-technique. (Accessed 22/04/2018 at 21:30)
13-http://sloanreview.mit.edu/article/brainstorming-electronically/ (Accessed 23/04/2018 at 17:25)