Online experiment in pedagogy

– possibilities and limitations of the method

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Abstract

The aim of this article is to show possibilities which are given to a researcher by placing experimental research in the Internet. The use of the Internet in scientific research has become very popular nowadays. However, in case of the method of an experiment, it is still not a form which is often used by Polish scientists. Although the use of this method of experiment may bring science undeniable advantages in pedagogy, it is used seldom even in a "classical" form - *offiine*. In the article basic difficulties related to the metod of an experiment and the possibilities of eliminating them with the help of the Internet were discussed. Also discussed were problematic issues which are especially worth drawing attention to while designing and carrying out scientific research *online*.

Keywords: experiment, pedagogical experiment, online experiment, online research.

Introduction

Experimantal research is not often used in pedagogy - a questionnaire is the most frequently used scientific method. According to Wincenty Okoń, the definition used in *Nowy słownik pedagogiczny* "an experiment is a scientific method typical of induction sciences. It allows for an accurate examination of a certain phenomenon or proces by regulating conditions which influence it or their intentional triggering or modifying" (Okoń, 2004, p. 96). Pedagogy as a science directed mainly to form recommendations for practise undoubtedly requires strong, empirical conclusions. An experimental method could be a source of this evidence. Why, therefore, is this method so rarely used in pedagogy? The ever rising role of the Internet, also as a tool used in education, gives a lot of new possibilities, also for scientisits. In many academic environments, it is becoming more and more popular to use the Internet in experimental research, though this form is not so popular among educators. Could the use of the Internet in experimental research soften or solve some problematic characteristics of an experiment?

As I said before, pedagogy is an empirical study so its base should be contact with *empiria* – experience. The claims about facts (empirical) are fundamental to sceince. Information about the facts may be provided by different methods, those quantitative and qualitative ones, which could be a complement to the raw, numerical results – they could be the icing on the cake. What should be additionally emphasi-

sed is the fact that scientific knowledge differs from unscientific that its rightness can be seen by almost everyone. The criterion differentiating scientific and non-scientific knowledge according to Kazimierz Ajdukiewicz is intersubjectivity (Ajdukiewicz, 1983). Indeed, it is significant that research which is the base to form scientific claims was based on „strong" rules so that another scientist could repeat and modify that research again.

Literature on methodology shows a wide range of methods and scientific techniques which successfully and in an effective way can contribute to the development of science- pedagogy in this case. Certainly, each of the methods (and techniques) is adjusted to certain conditions - subject of research, size of research sample, accessibility of examined objects, etc.

The method described as the source of humanistic science is an observation. Its basic advantage, according to Chava Frankfort-Nachmias and David Nachmias (2001, p. 223), is directness. It allows for obtaining direct data and guards against distortion, which in case of other methods may result from, for instance, unconscious and unintentional scientist activity. The method of observation helps in better understanding of data by putting it in a context. Why am I raising the issue of observation? It is a starting point to an experiment. It is based on an observation which is its way of measuring. As Mieczysław Łobocki claims - each experiment is connected with an observation (Łobocki, 1982). The most important element of observation is manipulation. Władysław Zaczyński defines an experiment as „a method of scientific research of a certain part of reality (methodological), depending on triggering or changing the course of processes by introducing some new factor and observing changes which have appeared under its influence" (Zaczyński, 1968, p. 87). Manipulation is also underlined by Antoni Sułek's definition: "experiment is a continous process depending on a change of certain factors planned by a scientist in an examined situation with the simultaneous control of other factors used with the aim of obtaining an answer to the question, during an observation, about the results of this change" (Sułek, 1979, p. 15).

Jerzy Brzeziński strongly emphasises the empirical value of an experiment for which the next feature - control, plays an important role (apart from those mentioned before). An experiment allows for "the best control of all independent variables, which influence each dependent variable a scientist wants to determine" (Brzeziński, 2008, p. 9). The author, recapitulating the available definitions of an experiment distinguished its three main, basic features differentating this method from other scientific models - manipulation, control and measurement/ observation (Brzeziński, 2004).

Despite different opinions, as Tadeusz Pilch writes, an experiment should be referred as a method of pedagogical research. It is a method which allows us to examine a particular part of reality by its simultaneous stimulation to change. Changes involve methodological processes and are made under the influence of factors introduced into this reality by a scientist. Research is based on observation of these changes. The aim of an experiment is to determine reasons for certain phenomena, situations or behaviour. This method may provide researhcers with some knowledge about the efficiency of research, results of undertaken methodological

or pedagogical initatives or about the value of new teaching methods, or methodo-logical work (Pilch, & Bauman, 1993, p. 44). Experimental method seems to be par-ticularly useful in the case of examining the efficiency of methodological methods or curricula (Jakubowska, 2012). M. Łobocki defines this method of experiment as the most promising in pedagogical research. This form of research realization certa-inly can contribute to credibility of pedagogical research, it allows for a connection of theory with practice, and facilitates an introduction of pedagogical innovations (Łobocki, 2006).

J. Brzeziński even claims that: „the maturity of a certain epmirical field is up to what extent the hypotheses formed within the field are checked by the use of expe-riments" (Brzeziński, 2004, p. 282). Therefore, why despite the undeniable scientific value of experimental method does it not enjoy popularity in pedagogy? M. Łobocki says the reasons for that situation are often time-consuming, difficult and expensive experimental research which may be effectively replaced by other, easier and che-aper methods of pedagogical research. Another barrier which discourages scientists from doing experiments is a belief that if a complete isolation and control of varia-bles are not possible, then in accordance with the methodological requirements used in natural science, it is recommended to refrain from using this method. M. Łobocki states that the awareness of limitations of a method does not shatter the possibilities of its use (Łobocki, 2006).

Pedagogy as a study about upbringing, is mainly focused on the work with a child. Therefore, it becomes the most important "object of an examintaion". And the connection of words "experiment" and "child" is a reason for negative feelings reminiscent of the cruel experiments. Research with children's participation arouses many emotions – maybe this is one of the reasons why for some people pedagogy as a study rarely uses the method of an experiment. However, there are numerous possibilities of experiments with children's participation, as for instance while testing educational programmes.

Certainly, still visible reluctance to the use of experimental method in pedago-gical studies stems from the lack of appropriate knowledge regarding this method, knowledge and experience in working with it (and the possibility of obtaining it), which is actually a subject for more profound discussion. This study focuses on possibilities of the use of the Internet in experimantal research from the perspective of eliminating difficulties connected with it. Moreover, I will present some constra-ints resulting from placing the experimental research in cyberspace as well.

" Technical" limitations of an experiment

Firstly, the basic reason for such a narrow usage of such a "perfect" research method as regards pedagogy, are social sciences, and so pedagogy, which often touch upon areas, which cannot be embraced by an experimental study. It means that the method of an experiment has its limitations, e.g. technical – as A. Sułek (1979) classified them. According to Ajdukiewicz (1975, p. 229) an experiment may only be used for the phenomena, which a scientist is able to trigger or change himself. For historians of education, this method is absolutely useless. But also for

scientists of current phenomena, an experiment cannot always provide an answer. However, not every phenomenon can be embraced by this method. According to A. Sułek it stems from so called structural context. Mutual connections between the social phenomena may be so complex and rely on such highly organised structures, that a a scientist's manipulation, so natural in the method of an experiment, may turn out to be inefficient or unmeasurable. Another problem is the limited power of a scientist who not always has enough knowledge about a certain phenomenon to manilpulate it (Sułek, 1979).

A. Sułek describes the limitations of an experiment, on the scientist's side, stemming from limited power of motivation- a classical experiment allows only for the manipulation of small social structures. Morover, these manipulations have some artificial factor in them because they are created especially for research by a scientist (Sułek, 1979).

The Internet opens new possibilities for a scientist. However, can placing of experimental research in cyberspace or the use of the Internet in the realisation of an experiment solve mentioned problems? For instance, as a long list of the psychologists' online experiments shows (part of subjects touched upon regarding the pedagogical field), posted on the website of *Department of Psychology of Hanower College* (http://psych.hanover.edu/research/exponnet.html), this form of realisation of research is getting more and more popular all over the world.

Advantages of online experiment

Since the Internet became a medium available to scientists they tried to determine, if the research carried out by its use is as accurate as classical - *offiine*. Numerous analyses checking credibility, accuracy and profitability of research automatisation have been made. Thirty years of scientific experience shows that the Internet brings science more advantages than it creates problems (Epstein, & Klikenberg, 2001).

What are the advantages of placing an experiment in cyberspace?

Firstly, an experiment realised through the Internet has a possibility to get to a bigger group of respondents, so a group of participants of an experiment may be much bigger. This way of realisation of the experimental research allows for doing manipulation with much bigger groups - the range of the Internet does literally not have boundaries. The enlistment of participants in this case is much easier. It is possible to post advertisements on many websites, chats, discussion rooms or by email which would encourage people to participate in research. Thanks to modern possibilities, such as search engine optimisation, which professional IT companies deal with, the service created by a scientist may be indexed by the most popular search engines and may be highly placed in the search results.

Additionally, a virtual network does not have geographical boundaries - therefore we have access to the respondents from all over the world at the same time. The Internet has become an ideal medium for crosscultural research.

Thanks to the use of the Internet a scientist saves his time, which in case of complicated analyses is not only the facilitation, but also it sometimes decides the success of the whole project.

Nevertheless, most importantly, the realization of research by the Internet, thanks to much wider possibilities of selection of participants, raises the representativeness of research and the possibility of creating statistical analyses. "Classical" experiments, which are often criticised are mostly carried out on "students" because this is the easiest and often the only possible group of respondents to enlist. In this case, generalization of results to other groups than students becomes a problematic issue. The solution for these difficulties connected with enlistment of participants in research (access and costs) is a global virtual network (Siuda, 2009).

The use of this form of realization of experimental research helps not only to gain access to the wide population – but also it is especially effective in case of examining people or phenomena, which can be defined as specific or narrow (Szpunar, 2010). Thanks to the possibilities of the Internet, some communities of people with similar specific traits or hobbies are being created online – forums for people who suffer from rare diseases, or people who are interested in unusual sports. It gives scientists new possibilities, very limited so far – e.g. getting to know people (or phenomena), which would be difficult or impossible to reach with the use of classical scientific methods.

Classical experiment is as stated before somehow artificial which may distort the achieved results. The participants of such research may not behave naturally because they face new situations, constructed by a scientist (because of a particular research), in a similarly artificial reality (Sułek, 1979).

Realization of *online* research helps to limit the distortions – participants are in a comfortable situation which they are familiar with; they take part in the research in a familiar and often friendly environment – in front of a computer at home, or at work. There are no difficulties and limitations resulting from a respondent's place of living who in case of a classical experiment would be forced to visit a particular place (which may be costly) at a particular and maybe difficult time, for him (and also for a scientist), e.g. clash with working hours.

This almost unlimited access to research, which the Internet gives, could be a source of criticism of *online* experiments, which could lack in control over respondents. However, leaving this issue aside, modern IT possibilities are emphasised. It is possible to limit the access by admitting to the reasearch only people who log in through a special domain, e.g. educational domains (.edu) or from a particular country (.pl,. de, etc..). It may be also determined if a participant should be left or right handed – by defining the way of the cursor movement (Siuda, 2009).

Research carried out in a "classical" way – in reality, as I mentioned, frequently relies on results of the experiments carried out on students whose participation in research may be determined by different motivations, e.g. the desire to pass the classes. For this reason, the reliability of "classically" achieved results may be doubtful. Online research prevents from these distortions. The participants of the online experiment are not under pressure – they take part in it because they want to. What is important about *online research* is that each participant can resign any time by only one click. Thanks to it, the results will not be distorted, even if the motivation descreases, and the one, as in case of classical research, will not give up being afraid of social sanctions or feeling pressured by a scientist (Siuda, 2009). In case of online research, distortions resulting from the influence of the same

scientist (so called Hawthorne effect (see E. Babbie, as cited in Siuda, 2009) is also significantly limited.

Enumerating the advantages coming from the use of the Internet by the realization of experimental research, an issue of costs cannot be missed. *Online* research allow for significant cost reduction - they do not require to rent labolatories, do the shopping or buy equipment and they do not need another documentation of a whole project. In case of research realised by the Internet, their documentation is available to other scientists interested in research, who can freely analyse the whole procedure of research, experience it from the prespective of a respondent, and even analyse its popularity, comparing the number of people taking part in the research with the number of WWW visits (Siuda, 2009).

DISADVANTAGES OF ONLINE EXPERIMENT

Each research method is burdened with inherent difficulties Experiment is a method often criticised not only because of the ethic dillemmas connected with it but also because of different difficulties connected with the realization of experiment. Placing the experiment research online is connected with many previously described advantages and is also an answer for some difficulties resulting from the specificity of the experiment method. However, there are additional difficulties resulting from putting the method of research online.

Firstly, mentioned before as an advantage the representative character of online experiments. Because of the fact that the Internet is still not available to all people from all over the world (but only to 34,3% of population – as Internet World Stats shows [http://www.internetworldstats.com/stats.htm]), generalization of results is frequently not possible to whole population, but only to the part which uses the Internet. Moreover, there are people, social and environmental groups, for which examining by the Internet is still impossible – they are people of so-called digital exclusion (Siuda, 2006) and people who are not computer and internet literate.

With this problem an issue of accuracy of manipulation by the scientist is connected. The users of the Internet use different operational systems, search engines and technical equipment - Internet connection, monitor. The differences resulting from these divergences may significantly influence the reception of research stimuli and therefore distort the achieved results.

Secondly, being simultaneously its advantage - anonimity. However, a control of how many times a particular person takes part in a research is also difficult. One person may participate in an experiment a few times using a computer of a different IP address or using many different computers (Szpunar, 2010) and even if we can eliminate these errors by deleting results of participants of the same IP address, we should remember that there is a possibility that several different people could be logged in on one computer - in this situation a scientist would lose precious data. P. Siuda shows possibilities of solving this problem - a request to fill in personal data, which could be difficult to forge, e.g. ID number, the number of bank account, mail address of people who could confirm the identity of a participant (Siuda, 2009, p. 163). However, these ways seem to clash with the anonimity of a participant.

Certainly, in the case of using the proposed solutions a number of people interested in participating in the research will give up being afraid of losing personal data. A request to give ID number or the number of bank account with certainty would effectively scare away many potential respondents, because it could be read as an attempt to obtain personal data under false pretences.

One more problem connected with conducting *online* research, to which we should draw our attention while planning it, is freedom of choice. As research of Jochen Musch and Ulf-Dietrich Reips shows, about 34% of participants give up in the course of research (1-87% according to the subject and character of research) (U.D.. Reips, as cited in Siuda, 2009, p. 164). There is another problem connected with that issue, to which Joel Epstein and W. Dean Klinkenberg draw attention. Authors underline that in *online* research undesirable pressure of participation which changes results does not exist, but it is difficult to say how many people refuse to take part in research (Epstein, & Klinkenebrg, 2001).

Considering this problem, a sicentist planning realization of online research should initially start up with much bigger research group than is needed, and analyse systematically during research, the number of people who refused. A problem to which J. Epstein and W. D. Klinkenberg pay attention to can be eliminated with the help of a visit counter of a given website.

Research realised by the Internet carries some risk of losing data – also on the advantage of other, dishonest scientists – e.g. as a result of computer virus activity. Research may be distorted by the breakdown of a server, on which it was located, which may lead to an end of experiment and significantly influence the achieved results. The enumerated advantages of the *online* experiments, financial savings is also an issue to discuss – in case of some scientific problems, designing and realization of research online may turn out to be much more expensive than the realization of "classical" experiment, or the use of a different method. Online research may be burdened with the necessity of paying for server, creating a website, or its positioning.

Ethical dilemmas connected with the experimental method

From a point of view of a young scientist, I think that often beside the technical boundaries of conducting an experiment ethical issues play a significant role. Pedagogy, as a science about humans, focused on their development and improvement cannot build its diagnosis on procedures affecting values such as autonomy, dignity and privacy. And the very question of manipulation leaves a lot to be desired.

Ethics forbids making of hypotheses which relate to the phenomena ethically negative in their consequences coming from their verification. The experiment would involve the use of manipulation by the stimuli. This category includes the theory of rewards and punishments, the theory of frustration and aggression, or motivational conflicts (Sułek, 1979). Experimental verification of hypotheses relating to the effects of the negative consequences is also forbidden - the study, which could result in any adverse consequences for its participants or even more. In addition, you should always have in mind the possibility of causing negative consequ-

ences albeit accidentally - the researcher is not always able to predict what are the effects of their manipulations used during the experiment. A. Sułek writes: "on this type of danger many experiments in the field of behavioral science border" (Sułek, 1979, p. 223). Here, John Watson's experiment involving eleven-month Albert B. - an orphan, raised in a hospital ward, may be an example. The boy was shown a white rat while hitting a metal rod - so that the loud sound scared the child. Because of that, the child became conditioned with the fear of a rat and, as it turned out later, also of other animals (Hock, 2003).

The use of the Internet for experimental research does not make it easier for the researcher, allowing him to make hypotheses which give rise to ethical concerns. Moreover, online research requires the researcher to further analyze the possible consequences - as the researcher does not have direct contact with the people participating in the study and cannot keep an eye on and analyze their responses to the stimuli used in the experiment. Great caution should be exercised during the planning stage of the research to predict any possible negative consequences of the researcher's activity, arising out of conducting the online experiment.

Another issue regarding the ethics is the hoax, masking instructions, which undoubtedly allow for expanding the repertoire of experiments. Often the disclosure of the actual purpose of the experiment would prevent its successful conduct. A perfect example of the use of hoax is Stanley Milgram's famous experiment regarding obedience against the authority. There was not any reason (other than keeping the sincerity of the participants in the study) for the actual treating of participants with electric shocks. The author, for the purposes of the experiment, designed a menacing-looking generator of electric shocks. Participants were asked to "punish" a student (Milgram's collaborator) for the incorrect answers to the questions asked by the generator of electric shocks who allegedly had to be connected to the device. And although the study itself may be controversial because there was a legitimate concern that at least some participants would experience mental side effects because of what they experienced, the procedure involved the final explanation of the true purpose of the study and its all procedures (called debrifing), which caused the alleviation of the resulting anxiety. In addition, there was also a discussion concerning the feelings of the participants and symbolic reconciliation with the student (Hock, 2003).

Internet research capabilities in case of masking instructions are greatly reduced because the researcher does not have a real opportunity to inform research participants about its actual purpose - as happens in case of such offline experimental research, shortly after their completion. It must be remembered that in the case of online research its every participant can with one click resign from the participation in the experiment and thus break off the contact with the researcher. The dissemination of information via e-mailing is possible, but you can never be sure that the information reaches all people interested. In terms of information, there is another important ethical issue resulting from the online research. The researcher cannot be certain when it comes to informing the participants about the aims and objectives of the experiment (Siuda, 2009). Despite the placement of this information and the requirement to confirm that you have familiarized with it before the start of the

study, it cannot be assumed that each of the participants carefully read the information presented by the researcher - as it is case of various regulations posted on the forums or auction sites.

This is what from the point of view of pedagogy seems to be the most important. The main subject of pedagogical research is a child - the consent of its participation in the study becomes a problematic issue. And in case of experiments carried out in the classic form - offline, it is possible to obtain consent from a parent or guardian of the child, yet in case of online research a researcher can never be sure whether the parent of an under-age participant even knows about the experiment. Therefore, experimental researches are not really possible online if the respondents are to be under-age. Importantly, online experiment does not give the posibility (while maintaining anonymity) to verify the age of the participants. Thus, in case of online research, in which a participant is to be an adult, the researcher cannot be sure whether the actual participant is not a child.

Placing an experiment in cyberspace regarding some ethical issues is even more difficult - for example, in a situation when someone from the participants of the online experiment could suffer in any way because of this, the researcher is never going to find out. And even though you could suggest providing participants with the possibility of contact with the researcher - by phone or e-mail (Siuda, 2009), it certainly is not an ideal solution.

Yet another problem is the issue of anonymity of research participants. Determining even detailed information about the individuals participating in the experiment is no longer impossible - modern methods allow for a precise determination of an IP address and cookies files of a place from which a person logged in, the time of logging in and thus picking a particular person. Anonymity is also at risk because of the availability of the test procedure. Furthermore, the research project is exposed to being copied by some dishonest researchers (Siuda, 2009).

CONCLUSION

An experiment in pedagogical science is not a popular method, although it undoubtedly entails many undeniable advantages and opportunities. At the same time, this method is burdened, as is every research method, with some disadvantages. Online experiment allows for solving many of these problems but, firstly, not all of them. Secondly, using the Internet for experimental studies also involves new problems - not involving (or not so much) the classical form (offline) of realisation of the research. These are important issues with which the researcher, especially young and inexperienced should be familiar and ought to take into account during planning and designing of the research.

Certainly, the Internet which has become a dominant medium gives researchers a number of new, previously unattainable possibilities. First of all, it allows for the study of a broad population, not limiting participants to students of a given university, as it is often the case with the research conducted in the classical form, and even the study of other cultures "without leaving home." This modern form of the realization of an experiment gives the researcher the current preview of the results,

and thanks to it great flexibility - in the course of the research, the researcher has the possibility of its modification (Szpunar, 2010).

However, even this form of experiment entails the disadvantages described above. The largest of these is the lack of control over the data collection - starting from the self-selection of respondents, through the possibility of multiple participation in the research of the same people, the lack of complete generalization of the results due to the lack of representativeness of the group (the participants of online experiment are in fact only people using the Internet, computer literate).

This study is only a theoretical discussion of a young researcher. Undoubtedly, the online experiment also involves the issues which have not been mentioned here but may be significant for the preservation of the clarity of results.

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