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Research into Technology Enhanced Learning: Do we Really Need a Control Group?

Dear Readers,

Educational research into digital technology is often criticized for its lack of scientific accuracy and voices raised to emphasize the superiority of experimental methods for tackling this issue. Experimental treatment is therefore considered as a necessary "standard of practice" for "evidence-based reform in education" (Slavin, 2013). The same voices even deny any value to methodological paradigms that, in order to evaluate the effects of an educational technology, would not proceed by comparing an experimental group (the one that uses the technology in question) with the control group (the one that does not use it) (see for example Dehaene, 2011). Within this context, it is important to recall some important results produced by epistemologists, sociologists and educational researchers.

Education is a "total social fact" in the sense of Mauss (2007). Its study involves taking into account the physiological, psychological, anthropological, historical and sociological dimensions of human nature. This complexity renders illusory the design of pure and reproducible learning contexts and thus the inclusion of research in a single experimental paradigm to the exclusion of other approaches. Laboratory work, conducted by psychologists or neuroscientists, that allows for comparative approaches is useful and necessary, but the science-like criteria of the knowledge produced by educational research are not limited to those of randomized studies. Epistemologists have long argued that, in science, evidence should be examined in relation to the theory to which the work belongs (Khun, 2012). It is not relativistic to consider that there are no facts per se, but observed, chosen and selected facts. Any statement of observation is fallible and depends on a theory (Bachelard, 2002). The science-like-criteria vary according to the epistemological choices of the researcher (Drapeau, 2004) and the value of a given scientific research is highly dependent on the researcher's ability to demonstrate the credibility of his or her findings. Many disciplines are not part of the experimental paradigm (Earth sciences, history, sociology, biology of organisms...). As complex systems involving human beings, technology enhanced learning contexts must be studied by adopting an epistemological stance that places the actor at the heart of the research (Le Moigne, 2012). For example, in the field of education, collaborative research is conducted to design, implement, evaluate and improve educational technologies with the teachers and learners concerned.

Education is not a treatment whose effects would result from a simple causality between educational decisions and their consequences. This *treatment paradigm* (Sensevy, et al. 2018) tends to deny that learning is a non-deterministic process in the sense that there is no simple causal relationship (an "impact") between what a student learns and an educational decision. The subjectivity of the actors (students and teachers) must be taken into account and scientific reductionism leads to blindness (Morin, 1990). The study of the "impact" of an educational method should take into account that the actors will translate, interpret and adapt this method during its implementation. The so-called *Hawthorne effect* in an example of how the subjectivity of an actor might have an influence on the results of the research. Originally coined by to explain the productivity increase of workers involved as subjects into a research project, the Hawthorne effect is "a phenomenon characterized by an awareness on the part of the subjects of special treatment created by artificial experimental conditions" (Cook, 1962).

It is not possible to evaluate a pedagogical tool without taking into account the contexts of its use. Educational technologies must be regarded as instruments, i.e. composite entities that comprise an artefact and the schemata for its use (Rabardel, 1995). Users of educational technologies are therefore also co-designers of the instruments they use and the quality of an educational technology depends on the involvement of its potential users from the earliest stages of design. Thus, the question of uses and practices is central when it comes to evaluating a technology. How can anyone believe that the use of the same device can always be done in the same way and produce similar effects? Each user, parent, teacher, student, evolves in his own system of activity (Engeström, 1999) and has to deal with his own material possibilities, his working rules, but also his beliefs, representations and experience. The links between educational research and field actors cannot be reduced to an ancillary relationship from practice to theory. Teachers are not mere implementers of methods developed by "experts". Work on teaching professionalism shows that educational efficiency depends on the ability to translate expert knowledge into professional actions that take into account the context. They have also long shown that an effective teacher is a reflexive teacher (Schön, 1987), a researcher on his own practices, capable of evaluating and revising his educational decision by taking into account the scientific knowledge available in the fields of didactics, educational sciences, psychology or neurosciences.

The definition of science-like criteria is part of a power struggle in the scientific field (Bourdieu, 2001). Because of the important issues at stake from the point of view of the improvement of education systems, this power struggle should not be an obstacle to the taking into account of the results of educational research by the actors in the field. The difficulties encountered in transferring research results to users, teachers and students, but also in promoting the technologies developed to educational managers, are now well documented (Turvey & Pachler 2020). One of the main problems put forward is precisely the excessive predominance of quantitative methods and the implementation of decontextualized research. There are alternatives to experimental research and they be explored: strengthening relationships between educational research and educational practice by building the epistemological foundations of a methodological paradigm based on the collaboration between practitioners and researchers, shifting from an

evidence-based practice to a practice-based evidence paradigm, and nurturing a new generation of educational researchers. These researchers should be capable of overcoming disciplinary quarrels and developing multidisciplinary educational research to meet the major educational challenges of the twenty-first century.

Sincerely,

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