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REVIEWS

Pedagogical considerations regarding the synoptics of variables with disruptive influence in a pedagogical experiment

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Abstract

The "system" approach of the variables that govern a "functional unit" of experimental nature evidences the fact that in pedagogical research, effects are changed not only by causes, but also by other variables, susceptible of generating knowledge errors. An experimental result, unaffected by *gross errors* or *systematic errors*, can be affected by *random errors*. Unrecognizing the types of errors that may influence the research, the conditioning relationships between these and the variables that trigger them can seriously affect the experimental strategy, with easy-to-understand consequences on the objectives pursued. The same undesired effects may occur when the negligence of the researcher manifests by omitting the "(re)calibration" of experimental conditions at certain time intervals. Identification of disruptive variables that can appear in pedagogical research is an indispensable "prophylactic measure" as early as the pre-experimental phase.

Keywords: disruptive variables, pedagogical experiment, *random errors, systematic errors, gross errors.*

Introduction

Any didactic approach (of experimental or other nature) should lead to the formation, development and valorization of the motor and spiritual potential of an individual, regardless of the complexity of the pursued objectives, the sample size, the bio-psycho-information and time resources allocated to pedagogical investigation (Cristea, 2017; Gherasim & Butnaru, 2013).

An inventory of the types of errors from a philosophical or statistical-mathematical perspective (areas in which the knowledge of truth and differences between people revolves around truth and falseness) is part of the subject approached only as far as we reject the fact that error is the null result in the field of knowledge - Descartes and we accept as a hypothesis the fact that there is no *tabula rasa*, as knowledge cannot start from scratch - Karl Popper (Marcus, 2011; Lupșa & Hacman, 2012; Schopenhauer, 2012; Popper, 2017).

Beyond the connotations taken by the relationships: "unsuccess – failure – error – defect – falseness/progress – efficiency – performance – success – truth" or "adaptation – development/evolution – progress", in didactic activity all these terms revolve around subjects and the educational act. Today, the conditions of potentiation of subjects' skills are easier to predict, because the determinants of success do not generate as many controversies as those causing unsuccess or failure (Minder, 2011). This aspect is due to the two approaches complementary to the "pedagogy of success": "preventive pedagogy", which develops "anticipation and regulation procedures" (Grangeat & Meirieu, 1997), and "supporting pedagogy", which proposes "*a priori* help" (Tardif & Couturir, 1993).

Functional particularities regarding the cause-effect relationship, in a pedagogical experiment

Prefiguring the most effective methodical route to be taken by the subjects included in an experimental program, the initiator of the approach will follow the sequence of concrete teaching-learning and/or evaluation situations, designed to eliminate randomness and ambiguity, to prevent undesired events and the appearance of errors. From these coordinates, an experimental setting will be based on a series of interconnecting elements that influence and condition each other, which will directly impact the cause-effect relationship (Fig. 1).

The matrical nature of the "functional unit", generated by the cause-effect relationship, has in its structure: input components (cause), state components (x, y, z), and output components (effects). Effects (consequences), i.e. system output variables (dependent variables), change if causes also change (input variables or state mechanisms). It follows that the effect will always be dependent on

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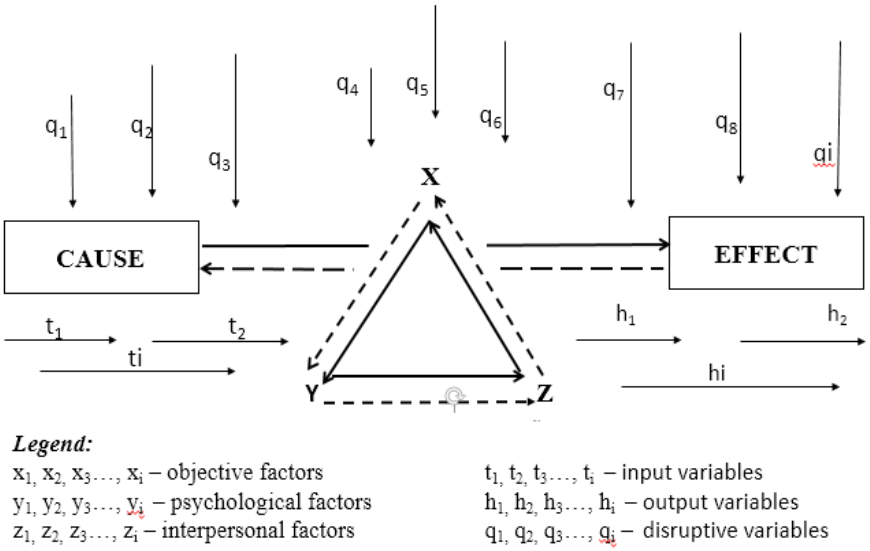

Fig. 1 – The "functional unit" of the cause-effect relationship in a pedagogical experiment.

the cause and cannot be controlled by the initiator of the pedagogical experiment. Thus, the initiator of the experimental approach becomes the observer of the cause-effect relationship and not its initiator (Gagea, 1999; Tofler, 1997).

By particularizing, it could be estimated that the performance of the didactic process (output variables: $h_1, h_2, h_3, ..., h_i$) would be constant at the pre-established values of input variables ($t_1, t_2, t_3, ..., t_i$) unless a number of disruptive variables acted on the pedagogical experiment ($q_1, q_2, q_3, ..., q_i$), which are susceptible to cause errors in the measurement result.

Synoptic picture of variables with disruptive influence in a pedagogical experiment

Significant or without influence, systematic or random, errors are determined either by variables generated by subjects or by the leader of the experimental process.

If *random errors* are caused by the brutal action of external factors, other types of errors that may occur are *systematic errors*. These can be caused either by subjects or by the negligence of the researcher – by omitting the "(re)calibration" of experimental conditions at certain time intervals. The corroborated influence of several *systematic errors* may determine a *gross error*.

The results of measurements affected by *gross errors* cannot be used, being excluded from the set of observations, but the results affected by *systematic errors* can and will be used after their correction (through their elimination). Ideally, these errors should be highlighted more concretely, by repeating the experiment, as it is known that such errors have a *Student distribution* (Fan, 2001; Vasile, 2016).

Unlike a technical experimental setting, pedagogical research is constantly marked by either a *systematic error* or a *random error* (most frequently created by a psychophysiological factor). Systematic errors have the highest frequency, they are surprising, they cannot be always intuited and they directly leave their mark on the pedagogical experiment.

If *random errors* are haphazard and cannot be predicted, *systematic errors* must be detected early, eliminated or carefully monitored, because the corroborated action of several *systematic errors* can lead to *gross errors*.

However, a *gross error* can also be diminished – by reducing its severity or even suppressing it – if adequate procedural resources are available to act directly on the cause (Fig. 2).

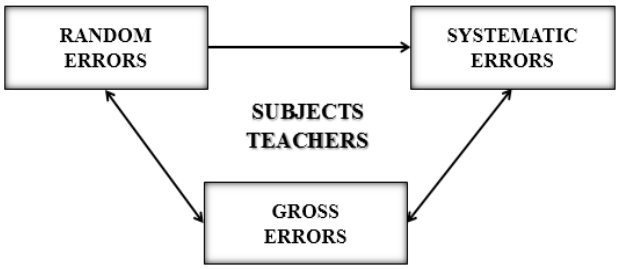

Fig. 2 – The conditionality relationship of errors in a pedagogical experiment

The "cold" statistical characteristics, objective only from the outside, can only provide an incomplete picture of the researched phenomenon – strictly to confirm or refute the hypothesis (Cucoș, 2017). From a psycho-pedagogical perspective, the application of a canonical research methodology would involve the detachment of the researcher from the subjects, which is impossible to achieve 100%, this percentage remaining an ideal "in the clear, semantic meaning of the word" (Neagu, 2018). Under these circumstances, understanding the subjectivity behind the "answers" objectively externalized by the subjects increases the complexity of the analysis and interpretation of the collected data (Iluț, 1997).

Conclusions

1. The permanent, uncontrolled or tolerated action of disruptive variables confers a random characteristic to the results of the experiment, the output variables determining errors in the measurement result.

2. In all research stages, a didactic "prophylaxis of errors" is necessary. This measure will ensure scientific accuracy in assessing the results obtained.

3. The management of the pre-experimental and post-experimental error elimination process in a study should not remain a random concern or, worse, an intention, because this would make the research obsolete.

4. Even if the inventory of variables with disruptive influence on the pedagogical experiment is not at all effaced, the synoptic view of the system (regardless of its size) and the constant (re)calibration of experimental conditions remain the only guarantee of the validity of the data obtained and their extrapolation in the field of knowledge.

Conflicts of interest

There are no conflicts of interest.

References

Cristea S. Sistemul de educație/ învățământ. Vol. 5. Ed. Didactică. București, 2017.

Cucoș C. Educația. Reîntemeieri, dinamici, prefigurări. Ed. Polirom. Iași, 2017.

Fan X. Statistical significance and effect size in educational research: two sides of a coin. J Educ Res 2001;94(5):275-282. DOI: 10.1080/00220670109598763.

Gagea A. Metodologia cercetării ştiinţifice în educaţie fizică şi sport. Ed. Fund. „România de Mâine". Bucureşti, 1999.

Gherasim LR, Butnaru S. Performanța școlară. Ed. Polirom, 2013.

Grangeat M, Meirieu P (coord.). La métacognition, une aide au travail des élèves. ESF. Paris, 1997, 312.

Iluț P. Abordarea calitativă a socioumanului. Ed. Polirom. Iași, 1997, 41.

Lupșa E, Hacman G. Filosofie. Manual pentru clasa a XII-a. Tip A. Ed. Did Ped RA. București, 2012.

Marcus S. Paradigme universale. Ed integr. Ed. Paralela 45. Pitești, 2011.

Minder M. Didactica funcțională. Obiective, strategii, evaluare, cognitivismul operant. Ed. ASCR. Cluj-Napoca, 2011.

Neagu N (coord.). Noi tehnici de predare și evaluare în disciplinele medico-farmaceutice. Vol I - Manual. Ed. Univ Press. Târgu Mureș 2018, 184.

Popper K. Societatea deschisă și dușmanii ei. Vol. II. Ed. Humanitas. București. 2017.

Schopenhauer A. Lumea ca voință și reprezentare. Vol. I, II. Ed. Humanitas, București 2012.

Tardif J, Couturir J. Pour un enseignement efficace. In: Vie pédagogique 1993, nº 85:312-313.

Tofler A. Powershift (Puterea în mișcare). Ed. Antet, București 1997.

Vasile AS. Statistica psihologică și prelucrarea informatizată a datelor. Manual universitar. Ed. Pro Univ. București. 2016.