LEARNING ANALYTICS TO IMPROVE STUDENT LOW-PERFORMANCE IN MATHEMATICS

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(1) How the authors frame the problem being addressed,

The Program for International Student Assessment of the year 2012 (PISA, 2012) promoted by the Organization for Economic Co-operation and Development (OECD) named Low-Performing Students to the students who presented a lower score of level 2 on the PISA scale, considering this assessment as the basic reference level in the development of a functional mathematical competence (Coronado-Hijón, 2017a, 2017b). Subsequently, the OECD (2016) produced a report entitled Low- Performing Students: ¿Why They Fall Behind and How To Help Them Succeed? An agenda to reduce the incidence of low performance can include several actions: Identify low performers and design a tailored policy strategy and Provide remedial support as early as posible.

Different researches by Snowling et al. (Snowling & Hayiou-Thomas, 2006; Snowling & Hulme, 2006; Snowling & Maughan, 2006; Snowling, 2013) confirm that formative educational evaluations are evidence-based interventions for improving low performing schools.

Recent researches (Fletcher, Lyon, Fuchs & Barnes, 2018) insist on the necessary feedback of a criterial and formative evaluation that informs teachers about the errors and learning disabilities of their students.

Relevant investigations have verified the existence of consistent patterns in errors, arithmetic at the individual level, which were identified in the original researches by Young and O'Shea (1981) from the contributions of Brown and VanLehn (1980). Regarding the collective level, the consistency of arithmetic errors has also been verified in students of different age strata and educational level, especially in the basic or primary education stage (Coronado-Hijón, 2014, Socas, 2007). Therefore, the identification of systematic arithmetic errors is being considered a promising line of research (Siegler, 2003).

The identification and dimensionalization of specific errors (Coronado-Hijón, 2018a) from a criterial and formative evaluation, must be based on the methodology of systematic observation and valid and reliable learning analytics available for use by teachers.

(2) summary of some of the major research finding

Two researches (Coronado-Hijón, 2014, 2015) with learning analytics to identify and dimension arithmetic errors, from the educational neuroscience, have been carried out with the EVADAC analytical test (Coronado-Hijón, 2017c) due to their degree of validity. and reliability, as well as for its simplicity of use for teachers since it can be inserted in the development of the teaching-learning process, through the following materials;

- An arithmetic calculation test (PCAP), formed by 40 operations with arithmetic contents of the mathematics curriculum of the Primary Education stage, sequenced in order of difficulty, configuring with this procedure an analytical test for the identification and dimensionalization of arithmetic learning difficulties. This test is divided into two subtests, adjustable to the student's curricular level, through its modular or total application, depending on the academic and curricular situation of the student to which it is applied.

- An observation grid as a checklist where the most widely used registration system in education is applied: the category system. These categories are those related to the difficulties with the highest prevalence in the calculation of the four basic arithmetic operations.

- Exemplifications of each type of difficulties to be identified, which accompany the evaluation process as a guide.

- Double entry Record Sheet in relation to the types of difficulties, sequenced according to their curricular complexity.

- Descriptive and dimensioning report in order to guide the design of measures and teaching responses to address the specific needs of educational support presented by the evaluated students. These reports can be individual or group. The group application modality allows a contextualized and normative evaluation regarding to the group of students in question. In this case, it is proposed as a diagnostic criterion of the risk of specific learning difficulties (DEA) of arithmetic calculation, obtaining a percentile lower than 25 in relation to the correct answers of its reference group, or a percentile equal to or greater than 75 regarding to the wrong answers.

With this analytical test, the concepts of additive structure were identified as the main components of the difficulties in arithmetic calculation. These data confirmed similar results from previous studies (Carpenter, & Moser, 1983). What is most relevant from the perspective of educational neuroscience is that the results on arithmetic cognitive factors identified that 65.194% of the total variance could be due to additive or subtraction errors.

The usefulness of this interest in neurocognitive identification is further supported by the results of the other study cited, in which the existence of consistent patterns of errors was observed, both individually and collectively. Regarding to individual consistency, the original observation of bug algorithmic made by the first researchers was confirmed. But the consistency of collective errors was also found in age and level cohorts, especially in the basic or primary educational stage (Coronado-Hijón, 2014; Socas, 2007).

(3) summary of some of the implications for practice

The identification of the learning difficulties of the arithmetic calculation of the students can be carried out by the teachers through indirect observation methods, such as the analysis of errors and defragmentation of the different components of internal processing of a cognitive nature (EVADAC; Coronado-Hijón, 2017c). Using case study methodologies, we can adequately identify individual idiosyncrasies at the cognitive level (Träff, Olsson, Östergren & Skagerlund, 2017).

With the aim of made interventions for improving low performing schools, the use of Learning analytics - it is highly advisable because they are easily usable by teachers - the implementation of a criterial and formative evaluation, which has shown evidence-based interventions to be more effective than tests of performance in the analysis of arithmetic learning errors (Geary, Hoard, Nugent & Bailey, 2013).

(4) specification of the primary and secondary audiences that would be addressed

In order for schools with low performance in mathematics to improve these results, learning analytics are simple and functional instruments as well as valid and reliable for the necessary identification by teachers of the specific errors of their students with a criterial and formative methodology inserted within the teaching and learning process.

(5) the author(s)' qualifications for writing the brief

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