



Trends in formative and summative student assessment in Web of Sciences

Tendencias de la evaluación formativa y sumativa del alumnado en Web of Sciences

-  **Pedro César Mellado-Moreno** is studying a PhD at Universidad de Castilla-La Mancha (Spain) (PedroCesar.Mellado@alu.uclm.es) (<https://orcid.org/0000-0001-8982-2120>)
-  **Dr. Pablo Sánchez-Antolín** is a professor at Universidad de Castilla-La Mancha (Spain) (pablo.sanchez@uclm.es) (<https://orcid.org/0000-0001-9715-7044>)
-  **Dra. Montserrat Blanco-García** is a professor at Universidad de Castilla-La Mancha (Spain) (montserrat.blanco@uclm.es) (<https://orcid.org/0000-0001-7752-3828>)

Received on: 2021/01/12 / Revised on: 2021/05/24 / Accepted on: 2021/06/10 / Published on: 2021/07/01

Abstract

A professional point of view about student's assessment requires to think about a conventional method of assessment, which has remained the exams and tests conducted paper based as the main reference to assessing and qualifying the knowledge of students. In recent decades, has emerge alternatives to this model on educational research at the strategical, technical, temporal, and instrumental level. The objective of the study is to know the scientific production of the formative assessment research, related with a social and complex assessment model, in front of a summative assessment research, related with an operational and individual assessment model. To achieve the objective, the investigation uses a mixed methodology of quantitative and qualitative analysis of the scientific literature about formative and summative assessment on the last decade, comparing their principal bibliometrics indices and using Web of Science scientific data base. The results show a substantial difference on the number of investigations between formative and summative evaluation, a prevalent of the investigations of English-speaking countries and a relation between the scientific production on evaluation with other research fields. Conclusions of this article confirms the student's assessment as an object of research with a long historical overview on developed countries, but still remains to be a current interesting field with a relevant technology transfer to the rest of research areas.

Keywords: Educational assessment, examinations, teaching methods, systematic review, bibliometrics, education.

Resumen

Abordar desde una perspectiva profesional la evaluación del alumnado implica reflexionar sobre el modelo educativo tradicional, que ha empleado las pruebas de evaluación consistentes en la reproducción escrita de los contenidos como el referente fundamental para evaluar y calificar los conocimientos del alumnado. Sin embargo, en las últimas décadas la comunidad científica educativa ha planteado alternativas a esa evaluación en el plano estratégico, técnico, temporal e instrumental. El objetivo de la investigación es conocer la producción científica sobre la evaluación formativa, relacionada con un modelo complejo y social, frente a la evaluación sumativa, de carácter más operacional e individual. Para ello se ha utilizado una metodología mixta que analiza cuantitativa y cualitativamente la evaluación formativa y sumativa en la literatura científica a través de una revisión bibliográfica de las investigaciones de la última década, comparando sus principales indicadores bibliométricos y usando para ello la base de datos Web of Science. Los resultados arrojan un número de investigaciones sobre evaluación formativa notablemente superior a las investigaciones sobre evaluación sumativa, un dominio de la investigación anglosajona y una relación de la investigación sobre evaluación de la educación con otras áreas científicas. Entre las conclusiones se observa que la evaluación del alumnado es una línea de investigación con larga trayectoria histórica que continúa siendo un objeto de investigación de actualidad y generador de transferencia tecnológica entre las distintas áreas de conocimiento.

Descriptores: Evaluación del estudiante, examen escrito, método de enseñanza, revisión sistemática, bibliometría, educación.

1. Introduction and state-of-the-art

The decisions made about student assessment reflect the epistemological positioning on the teaching-learning process as a whole. These positions have been varied throughout the twentieth and twenty-first century, with disparate theories and pedagogical visions that confront what to evaluate, what to do, and how to do it (Acosta-Baldivián & De la Cruz, 2016; Ballano-Olano et al., 2011; Escudero-Escorza, 2003; López-Pastor & Pérez-Pueyo, 2017), getting to elaborate about 50 different models distributed among those that employ a positivist paradigm oriented to the qualification (which we characterize as evaluation from the pedagogical framework of the technical rationality or summative assessment) or a qualitative paradigm oriented to learning (which we characterize as an evaluation from the pedagogical framework of critical rationality or formative assessment) (Gros-Salvat & Cano-García, 2021; López-Pastor & Palacios-Picos, 2012; Luzuriaga, 1985; Negrín-Fajardo & Vergara-Ciordia, 2006).

These pedagogical frameworks (technical rationality and critical rationality), which give rise to evaluative practices (summative and formative) and that make up the topic under study, are understood as different theories whose historical development explains their conceptualization, but they are not necessarily exclusive and can be integrated in a complementary way into educational practice, since, as presented below, they meet different needs.

1.1. Evaluation from the pedagogical framework of technical rationality: summative assessment

Based on Taylor's production model (Sancho, 2017), the positivist educational evaluation adopts an administrative and economic model with references such as Henry Fayol (Rodríguez-Laguía et al., 2010), a classical theorist of the functional administration approach

(Hernández-Palma, 2011), who established in 1916 a method of administrative evaluation based on segmenting and decomposing the elements of the whole, distinguishing between forecasting, organization, direction, coordination and control for its analysis, planning and subsequent evaluation (González-Díaz, 2010). These principles of business assessment were applied to education through the summative assessment to analyze student performance, controlling the proposed objectives and the time spent as a guarantee of objectivity and rigorous collection of evidence (Casanova, 2019).

For this reason, summative evaluation usually involves simple, scarce student assessment tools and techniques focused on experimental design, using standardized tests or personal interviews (Stufflebeam & Shinkfield, 1985), which are instruments that measure student performance, and that seeks evaluation to play a positive or negative operational reinforcement role that allows to observe the result of a finished product and that does not take into account the transformation process and the initiation conditions, thus simplifying human behavior (Pérez-Gómez, 2004).

It continues its historical journey by focusing on the curriculum development of Ralph Tyler, who proposes in his work *Basic Principles of Curriculum and Instruction* (1949) a model based on the design of objectives, indicating that teachers are guided by intuitive knowledge through which criteria are established on which materials to select, what content is appropriate, what procedures to perform and what to examine. While it admits the existence of a controversy around teaching the same thing and evaluating the students in the same way, it defends that there are common needs in students, or at least among American students at a specific historical moment of great schooling expansion in USA, characterized by a lack of systematic planning for the design of teaching practice (Wraga, 2017). Therefore, Tyler designs an evaluation for equal objectives for all, drawing up a double-entry



table that crosses the objectives proposed for the achievement of the subject with seven behavioral items, marking those that are considered to be satisfactorily achieved by the evaluator.

Years later, Bloom (1956) with his taxonomy of educational objectives deepens on Tyler's base approach (Tian et al., 2018) taking as precedent the taxonomic organization of species in biology, and trying to make a classification of learning similar to the classification of the species, and which is currently still used to classify knowledge from multiple disciplines (Bedford et al., 2017; Brewer & Brewer, 2010; Sisson & Mazzuchi, 2017; Sönmez, 2019). In the evaluative field, Bloom (Amer, 2006; Shugert, 1968) makes a more rational classification of Tyler's operational objectives and items in designing written tests that continue to evaluate student learning. Perhaps the most novel is William's notion (2006) of Bloom's work; stating that the intention of the evaluator should be considered as the differentiator that can overcome the nature of the instrument, since the same test can be used to perform both a summative and formative evaluation according to the objectives and evaluative strategy set by the teacher.

The next step in the evolution of summative evaluation is provided by Mager (1973), whose objective is to achieve maximum objectivity in the evaluation. For this reason, the author proposes to reformulate any objective that requires teacher interpretation or requires adaptation to the specific needs of the group or context, reformulating those objectives that are considered ambiguous. Thus, learning that cannot be observed clearly and unequivocally and evaluated by a questionnaire is problematic and must be replaced by another.

In the eighties, Stufflebeam (1985) stands out, which, in line with the Joint Committee on Standards for Educational Evaluation (Diamond, 1985), establishes a curricular evaluation model called Context-Input-Process-Product (CIPP) that determines the usefulness of what is taught and evaluated on what the "customer" wants

rather than the evaluator, basing the reliability of the evaluation standards on their applicability to the real world, its convenience in its ethical and constitutional character, and its accuracy in the acceptance it deserves through a technical judgment (Stufflebeam, 1985). Thus, it is essential to determine the decisions about what to evaluate and how to know the expectations of the student's families, the contributions of learning and evaluation to society, determine to what extent it is necessary, and whether the resources it requires are viable.

In the 90s and the third technological revolution in the field of information and communication emerges the so-called knowledge society (Barroso-Jerez, 2013; Taberner-Guasp & García-Marín, 2013), which has implications in the way we learn (Zambrano-Farias, 2017), the way we should teach (Muñoz-López et al., 2018), and the way we should evaluate (Juárez-Hernández & Ponce-López, 2020). But while the transformation and digitization of the economy and society takes place, hegemonic psychology and philosophy embrace behaviorism and positivism, which drive the approach from an evaluation of student learning that is objective, scientific and fragmented (Forde et al., 2016), to a scheduled and taxonomy-based teaching of operational learning objectives (Torres-Santomé, 2017) and a new boom in standardized evaluation tests (Rizvi & Lingard, 2010; Robinson & Aronica, 2016).

Under the pedagogical framework of technical rationality, summative assessment of student learning is defined as the search of objectives for results through the obtaining of evidence with a mainly accrediting and operative function of positive and negative reinforcements. The result of the summative assessment determines the distance between what the established standard considers acceptable and the measurable position the student is with respect to it. The operational objectives must be concrete, classifiable and fully understood by both the teachers and the students. Tests must be standardized,



universal, procedurally simple and designed on a large scale for the entire educational system, so they will preferably adopt the test format.

1.2. The evaluation from the pedagogical framework of critical rationality: formative assessment

Along with the development of the evaluation from the approach of technical rationality, different ideas of critical renewal arise in the face of traditional teaching based on authority, the teacher-center view, the passivity of students, the reproduction of social inequalities and the objectivity of teachers examining summative evaluations (Álvarez-Méndez, 2003; Barrios-Graziani, 2005; Campdepadrós-Cullell & Pulido, 2009). These are pedagogies that can be framed in both idealism and pedagogical materialism, according to the theoretical sources and bases used in each case for criticism (Murillo-Torrecilla & Hernández-Castilla, 2015; Vilanou-Torrano, 2015; Zuleta-Medina & Chaves-Torres, 2009) and that arise as a reaction to positivist pedagogy, understanding that learning and its evaluation are very complex processes as to reduce them to standards (Clarke & Moore, 2013), since learning is considered to be fundamentally practical elements, socially and historically constructed (Tapiero-Vásquez, 2000) where the student's interest in learning is thought as the main element (Wiliam, 2011) within an environment and family background that determines student outcomes more closely than the school itself (Chomsky, 2014).

Although Scriven (1967) created the term formative assessment, along with other American authors such as Stake (1967) or Stenhouse (1975), it is understood that summative assessment was a constraint to innovation and progressive improvement in education, since alternatives to traditional summative evaluation are rooted in the American progressive current that combined educational reform with social reform, in which Dewey is the most influential

professor (González-Monteaudo, 2001). Dewey (2002) relates the concept of evaluation to that of valuation, and does so in a twofold sense. He states that an assessment is to estimate something, to appreciate it, but also to issue a judgment that allows to compare it with another. In the first case, we face an intrinsic assessment, where things have value in themselves, are not subject to judgment and are therefore invaluable. In the second, we make an extrinsic assessment, whereby we can establish comparable and sortable categories to determine what is better and what is worse.

In Spain this movement is replicated through the Unified School, with Krausist and Ortegaian inspiration, being Giner de los Ríos involved in pedagogy. According to Giner de los Ríos, exams are perceived by students as a questionnaire (García-Velasco, 2015), which distort the sense of education, causing ephemeral and apparent learning; thus, exams are not tools that help education but the opposite (Giner de los Ríos, 1894).

The alternative to evaluate students from a critical perspective acquires more theoretical power with the Freirean pedagogy, where punishment and suspense are left behind (Araújo-Freire, 2017) or to the banking education that is limited to the mechanical repetition of the content that has been presented to the students in class (Gomes-Arelaro & Martins-Cabral, 2017), trying to find out, through the evaluation, whether the students are able to access a certain knowledge by themselves (Delbosco, 2018) that will be useful for the social life of the human being (Gauterio- Cruz et al., 2014).

The Freirian view of the evaluation agrees with the critical analysis carried out by materialistic pedagogy, which relates education to work and analyzes pedagogy from a historical-cultural point of view (Barros-Ferreira & Vicentini, 2017). This is the case with Basil Bernstein (1975), who reflects on the need to examine the social implications and power relationships underlying the student assessment process and defines the role



of evaluation as the determination of content that must be socially transmitted and is conditioned by the ideology of the teacher, which causes a high difference between what each teacher teaches and what students learn. Apple (1994) agrees with the same approach, but understands that in addition to the economic one, it must be considered the influence of culture, so that it does not place the middle classes in terms of economic exploitation but of cultural subordination. These power relationships between classes set limits to what is possible in the educational system, where discourse and identity play a crucial role.

Thus, it is defended from the critical pedagogy a formative assessment with subjective (Becerra-Hernández & Moya-Romero, 2008), contextualized, permanent, heterogeneous, communicative, dialectic and designed characteristics to give timely information on the evolution of each of the individuals who are part of the teaching process (Antón-Sancho & Sánchez-Domínguez, 2020; Borjas, 2014; Fonseca, 2007; Maureira-Cabrera et al., 2020; Molina-Soria et al., 2020). An integrated formative evaluation in educational practice (Allal & Pelgrims Ducrey, 2000) with flexible objectives adapted to the personal needs and interests of each individual as a way to satisfy a public interest: educational inclusion (House, 2000). This formative evaluation aims to broaden the assessment toward skills and attitudes (Acebedo, 2016; Puiggali-Allepuz & Tesouro-Cid, 2021) to reorient the learning process focused on improving the pedagogical help provided to students (Valero-Flores, 2017).

From the pedagogical framework of critical rationality, formative assessment is defined as the individual and personal subjective search, and the evolution that each individual has experienced through educational intervention. The operative function of summative assessment creates the reporting function of the formative evaluation that is intended not to value knowledge, but to improve the teaching-learning process. The outcome of evolution is not deterministic and comparable, but it has an intrinsic and descriptive

value about the achievements obtained through flexible objectives adapted to each individual. The evaluation instruments are heterogeneous, permanently employed, contextualized and varied.

2. Methodology

The methodological approach of the study is the same of bibliometric studies, performing an analysis by means of descriptive statistics, focusing on the frequency analysis of the production of articles and their main bibliometric indicators such as the year, citations received, subject area, journal, institution of affiliation of the author and country in which each publication has been made (González et al., 2015), understanding that these are the most relevant indicators to the objectives of the study (Molas-Gallart & Ràfols, 2018), and studying the existence of positive or negative correlations (Reguant-Álvarez et al., 2018) between the scientific production on formative and summative assessment and the citations received in these studies over the last decade.

The initial quantitative analysis was performed using SPSS v.26 software. The Atlas ti software v.7.5.4 was then used for analyzing the five studies with the highest impact on formative evaluation and the five studies with the highest impact on summative evaluation in the period 2010-2020, assuming an impact definition associated with the number of times the item has been quoted (Belter, 2015).

The sample has been obtained by searching the research available in the scientific database Web of Science due to the high number of high-impact research available (Cuervo-Carabel et al., 2018) and which includes, in addition to its own database, search results in the City Colleges of Chicago (CCC), Derwent Innovations Index Database (DIIDW), Korean Journal Database (KJD), Medline, Russian Science Citation Index (RSCI), and SciELO databases. Two types of search have been performed, one with the Boolean operators TS=(“ evaluación formativa” OR “formative evaluation” OR “formative



assessment”) to find the formative assessment studies, obtaining 7609 results; and the other with the Boolean operators TS=(“ evaluación sumativa” OR “summative evaluation” OR “summative assessment”) to find the summative evaluation studies, obtaining 2664 results.

Subsequently, the date of publication has been applied as an exclusion criterion, limiting the search to the range 2010-2020. This has reduced the results of the search for publications on formative assessment to 5904 and those on summative assessment to 1921, thus constituting our final sample (N=7825).

All the data analyzed were obtained on January 1, 2021 at 12:00.

3. Results

On the total sample (N=7825), research on formative assessment (N=5904, 75.45 %) is superior than summative assessment (N=1921, 24.55 %), a distribution between the two types of evaluation whose difference increases later in the number of quotes received by the formative assessment (N=36 234, 78.31 %) versus the summative (N=10 035, 21.69%).

Table 1. Summary of publications

Year	Publications on formative assessment	Quotes to publications on formative assessment	Citations on publications of formative assessment	Citations on publications of summative assessment
2010	301	4868	96	1032
2011	330	4993	124	1127
2012	382	4534	122	1148
2013	453	4775	172	1342
2014	518	4265	160	1126
2015	574	3888	219	1122
2016	609	3084	220	1280
2017	670	2604	221	962
2018	738	1971	201	508
2019	695	975	199	325
2020	634	277	187	63
N	5904	36 234	1921	10 035

The evolution of publications on formative assessment has been much higher than the evolution in the number of publications on summative assessment. However, both are at a lower position than the peak reached in previous years, and still remain above the number reached in the starting year (2010) in both cases.

As for citations received by these publications, we can see how the number of citations obtained by publications on formative evaluation increases as we go back over time, while

publications on summative evaluation remain relatively stable since 2016.

These trends in the number of publications and citations show a significant positive correlation between the number of formative and summative assessment publications (0.888), a significant negative correlation between the number of publications in formative assessment and citations received (-0.830) and another significant negative correlation between the number of publications in summative assessment and the citations received (-0.603).



Table 2. Correlations between types and number of publications and citations

		Publications on formative assessment	Publications on summative assessment	Citations on publications of formative assessment	Citations on publications of summative assessment
Publications on formative assessment	Pearson correlation	1	.888**	-.830**	-.575
	Sig. (bilateral)		.000	.002	.064
	N	11	11	11	11
Publications on summative assessment	Pearson correlation	.888**	1	-.603*	-.239
	Sig. (bilateral)	.000		.050	.479
	N	11	11	11	11
Citations on publications of formative assessment	Pearson correlation	-.830**	-.603*	1	.892**
	Sig. (bilateral)	.002	.050		.000
	N	11	11	11	11
Citations on publications of summative assessment	Pearson correlation	-.575	-.239	.892**	1
	Sig. (bilateral)	.064	.479	.000	
	N	11	11	11	11
**. The correlation is significant at 0.01 (bilateral).					
*. The correlation is significant at 0.05 (bilateral)					

In terms of the areas of knowledge in which research is framed, although with certain alterations in the order, the five main areas agree in both cases: educational research, psychology, computer science, medicine and behavioral sciences.

To learn about the research interest of countries with more publications on formative and summative assessment, in Table 3 we present a

comparison between the frequency of publications of one type of publication and another compared with their publications in any other scientific field during the same period of study. In this way we can observe the relative weight of the research on formative and summative evaluation, separately and as a whole, compared to its total national production of scientific literature (Figure 1).

Table 3. Publications on Formative Assessment (EF), Summative Assessment (ES) and percentage of total publications (P)

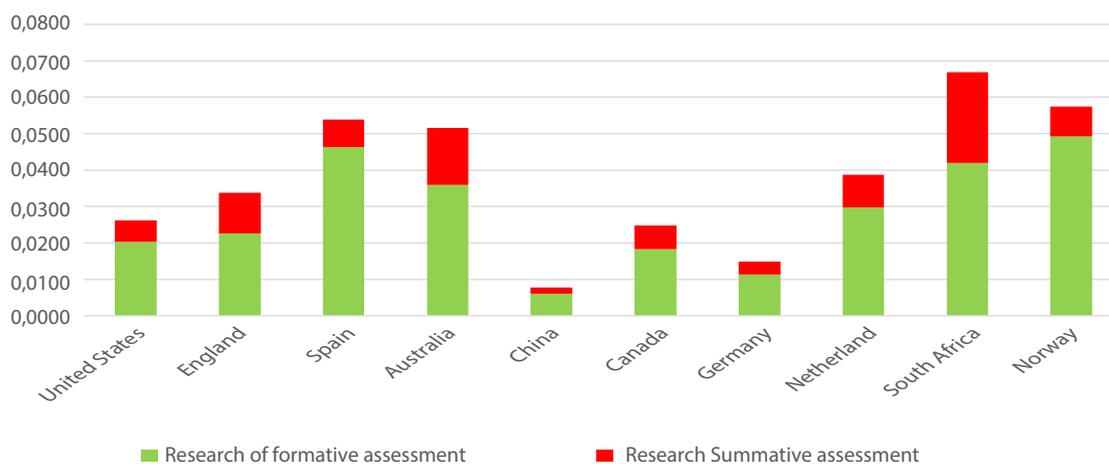
	N	EF	P (EF)	ES	P (ES)	EF+ES	P (EF+ES)
USA	8 075 028	1633	0.0202	482	0.0060	2115	0.0262
England	2 069 459	468	0.0226	232	0.0112	700	0.0338
Spain	1 108 936	513	0.0463	84	0.0076	597	0.0538
Australia	1 096 645	394	0.0359	171	0.0156	565	0.0515
R.P. of China	4 577 317	274	0.0060	83	0.0018	357	0.0078
Canada	1 247 935	228	0.0183	82	0.0066	310	0.0248
Germany	1 902 147	215	0.0113	68	0.0036	283	0.0149
Netherland	691 213	206	0.0298	62	0.0090	268	0.0388
South Africa	240 616	101	0.0420	60	0.0249	161	0.0669
Norway	231 515	114	0.0492	19	0.0082	133	0.0574



An Anglo-Saxon domain (USA and England) occurs mainly when observing the absolute data, but if they are relativized according to the total scientific production of each country, the data can be viewed by eliminating the effect that these countries are the most research-producing countries in all scientific

fields. In this way, we can see that there are Anglo-Saxon countries where research in this field has greater interest, as is the case in South Africa and Australia, but also other non-Anglo-Saxon countries have an interest that can be considered relevant as Norway, Spain and the Netherlands.

Figure 1. Publication rate of formative and summative assessment on the total scientific production



For the most relevant evaluation studies, we have included in the following table the five studies with the greatest impact on

formative assessment (Table 4) and the five studies with the greatest impact on summative assessment (Table 5) of the decade.

Table 4. Studies (E) on formative assessment classified by author and year (A), country (P), keywords (PC), thematic area (AT) and sorted by a greater number of citations (NC)

A	E	P	PC	AT	NC
Curran, G.M. et al. (2012)	Effectiveness-implementation Hybrid Designs Combining Elements of Clinical Effectiveness and Implementation Research to Enhance Public Health Impact.	USA	Mental health services, collaborative care, bipolar disorder, clinical trials, efficacy, interventions, application science.	Psychology	861
Boud, D. & Molloy, E. (2013)	Rethinking models of feedback for learning: the challenge of design	Australia	Feedback, sustainable assessment, impact on learning; curriculum design.	Educational Research	421
Sadler, R. (2010)	Beyond feedback: developing student capability in complex appraisal.	Australia	Formative evaluation, feedback, qualitative evaluation; peer evaluation, evaluation criteria	Educational Research	381
Bennett, R.E. (2011)	Formative assessment: a critical review.	USA	Evaluation formative, Evaluation for learning.	Educational Research	372
Nicol, D. (2010)	From monologue to dialogue: improving written feedback processes in mass higher education.	Scotland	Dogo, feedback, workload.	Educational Research	361



Regarding the content of these research, trends in formative research point feedback as an essential element in formative assessment. A greater satisfaction is obtained with written feedback than with oral feedback when the protagonist of teacher feedback is moved to students (more dialogic), when more than one teacher (more collective) and more than one student (less academic burden) participate in the same process and when they are better sequenced (more cohesion). The feedback needs to provide information on evaluation criteria, work quality, and improvement tips to perform similar tasks in the future (feedforward).

Certain limitations are detected, such as the possible limited interest in participating

in the feedback. Therefore, it is identified as a need to improve the professional development of teachers through further research on the use of formative assessment, as well as to create learning environments that work effectively and improve the understanding of tasks, the quality of the responses and the assessment criteria established. It should be mentioned the research on the improvement of public health which, despite addressing a non-educational field, it provides evidence of some transfer of knowledge from the educational area to other scientific areas and how formative assessment helps provide a context that explains the results of summative evaluations.

Table 5. Studies (E) on summative assessment classified by author and year (A), country (P), keywords (PC), subject area (AT) and sorted by greatest number of citations (NC)

A	E	P	PC	AT	NC
Victoria, C.G., et al. (2011)	Measuring impact in the Millennium Development Goal era and beyond: a new approach to large-scale effectiveness evaluations.	Brazil	Childhood diseases, medical interventions, indicators, mortality.	Medicine	146
Veneable, J. et al. (2016)	FEDS:a Framework for Evaluation in Design Science Research.	Australia	Scientific research design, research methodology, evaluation systems, usefulness of evaluation.	Computer science	128
Wistone, N.E., et al. (2017)	Supporting Learners' Agentic Engagement with Feedback: A Systematic Review and a Taxonomy of Recipience Processes.	England	Medical students, higher education, peer review, summative assessment, feedback.	Educational research. Psychology	120
Boud, D. & Soler, R. (2016)	Sustainable assessment revisited.	Australia	Sustainable assessment, assessment purposes, self-assessment, assessment for learning.	Educational research.	106
Gogalniceanu, P., et al. (2010)	Is Basic Emergency Ultrasound Training Feasible as Part of Standard Undergraduate Medical Education?	England	Medical students; education; ultrasonography; general surgery.	Educational research. Medicine.	92

In turn, trends in summative assessment demonstrate a high efficacy of this type of assessment to collect large-scale data, allowing broad geographical coverage and obtaining results that provide far-reaching evidence. Summative assessment tools and techniques are

very important in the field of applied sciences for evaluating design and product results or for detecting effective work strategies. It allows to be combined with formative assessment as an early assessment strategy that can correct errors of the initial approach.



It can also be applied to the evaluation of student learning in which training strategies can be employed to ensure that students know the criteria in a task and then evaluate it in a summative way. The evaluation limited to the grade can also improve the process because it can be completed with informed judgments that reorient student learning. Thus, it is understood that using summative assessment exclusively is a reductionist approach and that it may be compatible with other non-summative elements, such as self-assessment, ongoing evaluation or intermediate evaluations to improve a flexible design process or use feedback at the end of the educational period.

4. Discussion and conclusions

Considering the 7825 scientific publications found in the Web of Science on formative and summative assessment, we can conclude that formative dominates summative, which is translated into a scientific impact that is even greater, with a multiplier effect between production and impact that explains that the difference in the percentage of citations is greater compared to the difference in the percentage of productions. A clear correlation has been found between publications of one type of evaluations and another, suggesting that there is interest in investigating one and the other, which is corroborated in the content analysis of summative evaluation investigations, in which the combination of summative assessment tools and techniques appears recursively with others of formative evaluation.

The mastery of scientific production on both types of evaluation corresponds to the Anglo-Saxon world and although they are carried out in education, it is not exclusive, as it can be applied to areas related to education such as psychology or behavioral sciences, but also others like computer science or medicine, by the existence of research using diverse evaluation methods and by the study of the academic performance of higher education students in these

areas. This shows that research in evaluation is not only increasing in education, but can also lead to advances in other branches of knowledge.

In short, the formative and summative assessment of students, in addition to having a long history as presented in the paper, turns out to be a line of research of interest that is present in the international academic field that publishes more research at the end of the decade than at the beginning, generating a large and relevant scientific production, with information between its different variables and that generates technology transfer with other areas of knowledge in their most practical contexts.

References

- Acebedo, M.J. (2016). La evaluación del aprendizaje en la perspectiva de las competencias. *Revista Temas: Departamento de Humanidades Universidad Santo Tomás Bucaramanga*, 11, 203-226.
<https://doi.org/10.15332/rt.v0i11.1756>
- Acosta-Baldivián, B.A., & De la Cruz, E. (2016). Evaluación del programa social de lactancia materna ofrecido a madres adolescentes(OSMAN) bajo el enfoque de Stufflebeam. *Investigación y Postgrado*, 31(2), 95-115. <https://bit.ly/3dJ6Jo>
- Allal, L., & Pelgrims-Ducrey, G. (2000). Assessment of -or in- The zone of proximal development. *Learning and Instruction*, 10(2), 137-152. <https://bit.ly/3pv2Lcq>
- Álvarez-Méndez, J.M. (2003). *La evaluación a examen: ensayos críticos*. Miño y Dávila.
- Amer, A. (2006). Reflections on bloom's revised taxonomy. *Electronic Journal of Research in Educational Psychology*, 4(8), 213-230. <https://doi.org/10.25115/ejrep.v4i8.1217>
- Antón-Sancho, Á., & Sánchez-Domínguez, M. (2020). Metodología mixta Flipped Classroom y Aprendizaje Basado en Proyectos para el aprendizaje de la geometría analítica en Secundaria. *Enseñanza & Teaching: Revista Interuniversitaria de Didáctica*, 38(2), 135-156. <https://doi.org/10.14201/et2020382135156>
- Apple, M. (1994). Educación, cultura y poder de clase: Basil Bernstein y la sociología neomarxista de



- la educación. *Revista de Educación*, 305(305), 157-177. <https://bit.ly/3u5EZHn>
- Araújo-Freire, A.M. (2017). La actualidad de Freire: educación, política y ciudadanía. *Rizoma Freireano*, 23, 1-2. <https://bit.ly/3s4jhSg>
- Ballano-Olano, I., Llorián-González, S., Carbó-Marro, C., Martínez-Baztán, A., Vila-Mendiburu, I., Luna-Arcos, F., Villalba-Martínez, F., Francos-Maldonado, C., Garay, U., Etxebarria, A., Gaminde, I., & Larrea, K. (2011). *Evaluar la competencia lingüística del alumnado inmigrante*. Universidad de Deusto. <https://bit.ly/3qtVRW4>
- Barrios-Graziani, L. (2005). Visión crítica de las teorías postracionalistas de la educación. *Revista Iberoamericana de Educación*, 36(2), 1-7. <https://doi.org/10.35362/rie3622824>
- Barros-Ferreira, M.S., & Vicentini, D. (2017). A pedagogia socialista como possibilidade de superação da pedagogia toyotista: contribuições do materialismo histórico-dialético. *Revista Ibero-Americana de Estudos Em Educação*, 12(2), 1056-1068. <https://doi.org/10.21723/riaee.v12.n2.9095>
- Barroso-Jerez, M.C. (2013). Sociedad del conocimiento y entorno digital. *Teoría de la educación; educación y cultura en la sociedad de la información*, 14(3), 61-86. <https://bit.ly/3s0GkgQ>
- Becerra-Hernández, R., & Moya-Romero, A. (2008). Una perspectiva crítica de la evaluación en matemática en la Educación Superior. *Sapiens. Revista Universitaria de Investigación*, 9(1), 35-69. <https://bit.ly/3pyJ3wm>
- Bedford, D.A.D., Georgieff, M., & Brown-Grant, J. (2017). Lifewide, lifelong comprehensive approach to knowledge management education-emerging standards. *VINE Journal of Information and Knowledge Management Systems*, 47(4), 467-489. <https://doi.org/10.1108/VJIKMS-12-2016-0068>
- Belter, C.W. (2015). Bibliometric indicators: Opportunities and limits. *Journal of the Medical Library Association*, 103(4), 219-221. <https://doi.org/10.3163/1536-5050.103.4.014>
- Bernstein, B. (1975). *Class, codes and control, Volume I: Theoretical studies towards a sociology of language* (Vol. 1). Routledge & Kegan Paul Ltd. <https://bit.ly/2OOeLsX>
- Bloom, B.S., Engelhart, M., Furst, E., & Hill, Walker-Krathwohl, D. (1956). *Taxonomy of educational objectives*. Longman.
- Borjas, M. (2014). La evaluación del aprendizaje como compromiso: una visión desde la pedagogía crítica. *Rastros Rostros*, 16(30), 35-45. <https://doi.org/10.16925/ra.v16i30.816>
- Brewer, P.D., & Brewer, K.L. (2010). Knowledge Management, Human Resource Management, and Higher Education: A Theoretical Model. *Journal of Education for Business*, 85(6), 330-335. <https://doi.org/10.1080/08832321003604938>
- Campdepadrós-Cullell, R., & Pulido, C. (2009). La sociología de la educación desde la pedagogía crítica. *Education in the Knowledge Society (EKS)*, 10(3), 57-73. <https://bit.ly/3qC84bw>
- Casanova, M.A. (2019). *Manual de evaluación educativa*. Muralla.
- Chomsky, N. (2014). *La (des)educación*. Crítica.
- Clarke, M., & Moore, A. (2013). Professional standards, teacher identities and an ethics of singularity. *Cambridge Journal of Education*, 43(4), 487-500. <https://doi.org/10.1080/0305764X.2013.819070>
- Cuervo-Carabel, T., Orviz-Martínez, N., Arce-García, S., & Fernández-Suárez, I. (2018). Technostress in Communication and Technology Society: Scoping Literature Review from the Web of Science. *Archivos de Prevención de Riesgos Laborales*, 21(1), 18-25. <https://doi.org/10.12961/aprl.2018.21.01.4>
- Delbosco, R. (2018). Educación, persona y política. Intuiciones y tensiones en P. Freire. *Revista Cultura Económica*, 95, 36-50. <https://bit.ly/2N6BrnR>
- Dewey, J. (1998). *Democracia y educación: una introducción a la filosofía de la educación*. Morata.
- Diamond, E.E. (1985). Development of the Joint Committee Standards for Evaluations of Educational Programs, Projects, and Materials. *Measurement and Evaluation in Counseling and Development*, 18(2), 51-57. <https://doi.org/10.1080/07481756.1985.12022790>
- Escudero-Escorza, T. (2003). Desde los tests hasta la investigación evaluativa actual. Un siglo, el XX, de intenso desarrollo de la evaluación



- en educación. *RELIEVE - Revista Electrónica de Investigación y Evaluación Educativa*, 9(1), 11-43.
<https://doi.org/10.7203/relieve.9.1.4348>
- Fonseca, J. G. (2007). Modelos cualitativos de evaluación. *Educere: Revista Venezolana de Educación*, 38, 427-432.
<https://bit.ly/3b9NFUA>
- Forde, C., McMahon, M.A., Hamilton, G., & Murray, R. (2016). Rethinking professional standards to promote professional learning. *Professional Development in Education*, 42(1), 19-35.
<https://doi.org/10.1080/19415257.2014.999288>
- García-Velasco, J. (2015). Taller de ciudadanos. La educación integral en la Institución Libre de Enseñanza. *Participación Educativa Segunda Época*, 4(6), 63-71. <https://bit.ly/37pa3bl>
- Gauterio-Cruz, R., Vinhas-Bigliardi, R., & Minasi, L.F. (2014). A dialéctica materialista de Paulo Freire como método de pesquisa em educação. *Conjectura: Filos. Educ.*, 19(2), 40-54.
<https://bit.ly/37lOngw>
- Giner-De los Ríos, F. (1894). O educación o exámenes. *Boletín de La Institución Libre de Enseñanza*, 257-263. <https://bit.ly/37ogn37>
- Gomes-Arelaro, R. L., & Martins-Cabral, R.M. (2017). Paulo Freire: por uma teoria e praxis transformadora. *Rizoma Freireano*, 23, 1-15.
<https://bit.ly/37oH9Z1>
- González-Montegudo, J. (2001). John Dewey y la pedagogía progresista. En *El legado pedagógico del siglo XX para la escuela del siglo XXI*. Graó. <https://bit.ly/3bdN7gy>
- González-Díaz, J.E. (2010). Taxonomía de las funciones administrativas y las habilidades del líder empresarial. *Saber, Ciencia y Libertad*, 5(1), 155-164.
<https://doi.org/10.18041/2382-3240/saber.2010v5n1.2549>
- González, M.J.P., Guzmán, M.F., & Chaviano, O.G. (2015). Criteria, classifications and tendencies of bibliometric indicators in the evaluation of the science. *Revista Cubana de Informacion en Ciencias de la Salud*, 26(3), 290-309. <https://bit.ly/3bic61Z>
- Gros-Salvat, B., & Cano-García, E. (2021). Procesos de feedback para fomentar la autorregulación con soporte tecnológico en la educación superior: Revisión sistemática. *RIED. Revista Iberoamericana de Educación a Distancia*, 24(2), 107.
<https://doi.org/10.5944/ried.24.2.28886>
- Hernández-Palma, H. G. (2011). La gestión empresarial, un enfoque del siglo XX, desde las teorías administrativas científica, funcional, burocrática y de relaciones humanas. *Escenarios*, 9(1), 38-51. <https://bit.ly/3beCiL8>
- House, E.R. (2000). *Evaluación, ética y justicia*. Morata.
- Juárez-Hernández, L.G., & Ponce-López, I. (2020). Construcción y validación de un instrumento para evaluar el abordaje de la sociedad del conocimiento en docentes. *Apuntes Universitarios*, 10(1), 40-65.
<https://doi.org/10.17162/au.v10i1.417>
- López-Pastor, V.M., & Pérez-Pueyo, Á. (2017). *Evaluación formativa y compartida en educación: experiencias de éxito en todas las etapas educativas*. Universidad de León.
<https://bit.ly/3bgBEfX>
- López-Pastor, V., & Palacios-Picos, A. (2012). Percepción de los futuros docentes sobre los sistemas de evaluación de sus aprendizajes. *Teoría de la Educación. Educación y Cultura en la Sociedad de la Información*, 13(3), 317-341. <https://bit.ly/3k6414M>
- Luzuriaga, L. (1985). Ideas de la educación nueva. In *Textos de pedagogía: conceptos y tendencias en las ciencias de la educación*.
<https://bit.ly/2NC1O4C>
- Mager, R.F. (1973). *Formulación operativa de objetivos didácticos*. Marova.
- Maureira-Cabrera, O., Vásquez-Astudillo, M., Garrido-Valdenegro, F., & Olivares-Silva, M.J. (2020). Evaluación y coevaluación de aprendizajes en blended learning en educación superior. *Alteridad*, 15(2), 174-189.
<https://doi.org/10.17163/alt.v15n2.2020.04>
- Molas-Gallart, J., & Ràfols, I. (2018). Why bibliometric indicators break down: Unstable parameters, incorrect models and irrelevant properties. *BiD*, 40(40).
<https://doi.org/10.1344/BiD2018.40.23>
- Molina-Soria, M., Pascual-Arias, C., & López-Pastor, V. M. (2020). El rendimiento académico y la evaluación formativa y compartida en formación del profesorado. *Alteridad*, 15(2), 204-215.
<https://doi.org/10.17163/alt.v15n2.2020.05>



- Muñoz-López, I., Cuervo-Gamboa, L.M., González-Hernández, C.A., Bacca-Rozo, J.E., & Garzón-Gallego, K.J. (2018). Sociedad del conocimiento, revolución educativa y transformaciones de los paradigmas del modelo educativo. *Revista Electrónica en Educación y Pedagogía*, 2(3), 108-124. <https://doi.org/10.15658/rev.electron.educ.pedagog18.09020308>
- Murillo-Torrecilla, F.J., & Hernández-Castilla, R. (2015). Esperanza Crítica en educación para la justicia social. *Revista Internacional de Educación para la Justicia Social (RIEJS)*, 4(2), 5-9. <https://bit.ly/2NyEd4Y>
- Negrín-Fajardo, O., & Vergara-Ciordia, J. (2006). *Teorías e instituciones contemporáneas de educación*. Editorial Universitaria Ramón Areces.
- Pérez Gómez, A. (2004). *La cultura escolar en la sociedad neoliberal*. Ediciones Morata.
- Puiggali-Allepuz, J., & Tesouro-Cid, M. (2021). Influencia de variables contextuales en el enfoque de enseñanza: relación entre enfoque de enseñanza y estilo de aprendizaje. *Aula Abierta*, 50(1), 481-490. <https://doi.org/10.17811/rife.50.1.2021.481-490>
- Reguant-Álvarez, M., Vilà-Baños, R., & Torrado-Fonseca, M. (2018). La relación entre dos variables según la escala de medición con SPSS. *REIRE. Revista d'Innovació i Recerca En Educació*, 11(11 (2)), 45-60. <https://doi.org/10.1344/reire2018.11.221733>
- Rizvi, F., & Lingard, B. (2010). Globalizing education policy analysis. In *Globalizing education policy*. <https://doi.org/10.4324/9780203867396>
- Robinson, K., & Aronica, L. (2016). *Escuelas creativas*. Debolsillo.
- Rodríguez-Laguía, F.J., Herraiz-Gascuña, M., & Martínez-Cano, A. (2010). *Las competencias básicas y la programación didáctica*. Universidad de Castilla-La Mancha. <https://bit.ly/3s2P99R>
- Sancho, J.M. (2017). Discourses and Practices around the Competencies in Education. *Fonseca, Journal of Communication*, 15, 127-144. <https://doi.org/10.14201/fjc201715127144>
- Scriven, M. (1967). The methodology of evaluation. In Tyler, R. W., Gagne, R.M. & Scriven, M. *Perspectives of curriculum evaluation*. Rand McNally
- Shugert, D.P. (1968). *A Rationale for Curriculum Decisions*. <https://bit.ly/3asJK5X>
- Sisson, P.W., & Mazzuchi, T. (2017). Organic and fundamental functions: New perspective on the multidisciplinary nature of knowledge management. *Proceedings of the European Conference on Knowledge Management, ECKM*, 2(September), 1296-1300. <https://bit.ly/2OJ5S3H>
- Sónmez, H. (2019). Examination of the reading comprehension skill according to revised Bloom's taxonomy. *International Journal of Language Academy*, 7(June), 127-147. <http://dx.doi.org/10.18033/ijla.4101>
- Stake, R. (1967). The countenance of educational evaluation. *Teachers College Record*, 68, 523-540
- Stenhouse, L. (1975). *An introduction to curriculum research an development*. Heinemann.
- Stufflebeam, D.L., & Shinkfield, A.J. (1985). Introducción a la Evaluación. In Paidós (Ed.), *Evaluación Sistemática. Guía teórica y práctica*. (pp. 17-63). <https://bit.ly/3atGO9m>
- Taberner-Guasp, J., & García-Marín, J. (2013). La sociología de la educación ante la sociedad del conocimiento. *Praxis Sociológica*, 17, 47-66. <https://bit.ly/3dnHYoE>
- Tapiero-Vásquez, E. (2000). La evaluación crítica: dispositivo para la transformación escolar. *Pedagogía y Saberes*, 14, 51-55. <https://doi.org/10.17227/01212494.14pys51.55>
- Torres-Santomé, J. (2017). *Políticas educativas y construcción de personalidades neoliberales y neocolonialistas*. Morata.
- Tyler, R.W. (1949). *Basic Principles of Curriculum and Instruction*. The University of Chicago Press.
- Valero-Flores, F.M. (2017). La evaluación formativa desde el enfoque por competencias en educación básica. *Educando Para Educar*, 32, 41-50. <https://bit.ly/2NFqJUX>
- Vilanou-Torrano, C. (2015). Pensamiento pedagógico en el idealismo alemán y en Schleiermacher, por José María Quintana Cabanas. *Historia y Memoria de la Educación*, 1(1), 497. <https://doi.org/10.5944/hme.1.2015.13206>
- Wiliam, D. (2011). What is assessment for learning? *Studies in Educational Evaluation*, 37(1), 3-14. <https://doi.org/10.1016/j.stueduc.2011.03.001>



- Wraga, W.G. (2017). Understanding the Tyler rationale: Basic Principles of Curriculum and Instruction in historical context. *Espacio, Tiempo y Educación*, 4(2), 227.
<https://doi.org/10.14516/ete.156>
- Zambrano-Farias, F.J. (2017). Sociedad del conocimiento y las TEPs. *INNOVA Research Journal*, 2(10), 169-177.
<https://doi.org/10.33890/innova.v2.n10.2017.534>
- Zuleta-Medina, A., & Chaves-Torres, A. (2009). La educación bajo el lente de la teoría crítica. *Plumilla Educativa*, 6(1), 50-61.
<https://doi.org/10.30554/plumillaedu.6.558.2009>

