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Systematic Reviews on In-Service Training Effectiveness. A Prior Comparative Analysis of the Used Terms

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Abstract

The professional development of teachers has a definite impact on the improvement of the entire educational system (OECD, 2018; Darling-Hammond, 2017). For this reason, the main international organization - OECD (2013), European Commission (2012) - ask countries to establish feedback and accountability procedures for in-service training (ITT), for the 'process by which teachers engage in further education or training to refresh or upgrade their professional knowledge, skills and practices in the course of their employment' (UNESCO, 2019). Researchers state that here are numerous factors to be considered in carrying out this work: the type and quality of training, school climate, students' skills, knowledge domain, etc. (Lipowsky & Rzejak, 2015).

After a brief presentation of how the most recent systematic reviews on the topic have been conducted (Filges et al, 2019; Egert et al, 2018; Kalinowski et al., 2019), this article presents the results of a study on the terms and constructs in use in the context of the researches into in-service teacher/continuing professional training, impact/effect, and programs/instructions. The data and information collected offer a comparative analysis (Esser & Hanitzsch, 2012), based on systematic reviews (Polanin et al., 2019) and a meta-analysis, useful for setting up further meta-analytical investigations on the topic especially in terms of the disambiguation of terms and the narrowing of the field.

The training of in-service teachers in many countries has been made compulsory and structural and is conceived as an opportunity for growth and professional development for the entire school community, and a strategic and functional logic for improving the quality of the school system (Perla, 2019). However, ministries of education do not yet have a univocal model and shared procedures capable of describing and analysing the impact that the training provided has in the terms set out in the European Commission (2020): *output* - results achieved immediately, i.e. increase in skills-focus subject to training; *outcome* - wider benefits for involved teachers - improvement of teaching practices of teachers involved in training; *outreach* - effects on the institutional and social context of the school where and of the territory within which the teachers involved in the training.

Keywords: quality, professional development, evaluation, feedback.

Систематический обзор эффективности обучения на месте работы. Предварительный сравнительный анализ используемых терминов

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Аннотация

Профессиональное развитие учителей оказывает влияние на совершенствование всей системы образования (OECD-TALIS, 2014; Darling-Hammond, 2017), по этой причине основные международные организации, ОЭСР (2013) и Европейская комиссия (2012), обратились к странам с просьбой разработать процедуры обратной связи и отчетности для обучения на месте работы. Под обучением на месте работы понимается «процесс, в ходе которого учителя получают дополнительное образование или обучение с целью усовершенствования своих знаний и навыков в процессе трудовой деятельности (UNESCO, 2019). Согласно результатам исследований, для реализации обучения без отрыва от производства необходимо учитывать множество факторов: тип и качество обучения, школьный климат, навыки учащихся, область знаний и т. д. (Lipowsky & Rzejak, 2015). После краткого описания систематических обзоров по этой теме (Filges, 2019; Egert, 2018; Kalinowski et al., 2019) статья представляет результаты исследования, направленного на изучение терминов и конструктов, используемых в контексте рассматриваемой проблемы: преподаватель, непрерывное профессиональное обучение, влияние/эффект, программы/обучение. Собранные данные позволили провести сравнительный анализ (Esser & Hanitzsch, 2012), основанный на систематических обзорах (Polanin et al., 2019) и метаанализе, необходимый для организации дальнейших метааналитических исследований по теме, особенно с точки зрения устранения неоднозначности терминов и сужения области исследования. Хотя повышение квалификации учителей во многих странах стало обязательным и задумывалось как возможность роста и профессионального развития для всего школьного сообщества в стратегической и функциональной логике повышения качества школьной системы (Perla, 2020), министерства образования пока не имеют однозначной модели и общих процедур, способных описать и проанализировать влияние, которое оказывает обучение (EU-Strategic Partnership, 2020): краткосрочных результатов – результаты, достигнутые немедленно; долгосрочный результат – более существенные преимущества для вовлеченных учителей (совершенствование методов преподавания учителей, участвующих в обучении); характер охвата и информационного продвижения – влияние на институциональный и социальный контекст школы, в которой учителя проходят обучение.

Ключевые слова: качество, профессиональное развитие, оценка, обратная связь.

Introduction

The quality of teaching has been recognized as one of the most important factors determining student achievement within the schools (Kunter et al. 2013; Hattie, 2012). The professional development of teachers has a certain impact on the improvement of the entire educational system (OECD, 2013; Darling-Hammond & Lieberman, 2012). Also, for this reason, the issue of the effectiveness of teaching - of the practice of teachers and teachers themselves (OECD, 2018) - has risen to the top of the educational policy agenda (Darling-Hammond, 2017). Many nations have recognized that teacher preparation and development are needed for effective education.

Beyond the specific organizational forms, local or national, state or provincial, the different teacher development systems (Darling-Hammond, 2017) bring together multiple components in equilibrium, ‘including the recruitment of qualified individuals into the profession; their preparation; their induction; their professional development; their evaluation and career development; and their conservation over time’ (*ibid*, p. 294). The main international organizations, OECD (2013), and the European Commission (2012, p. 42), ask countries to establish feedback and accountability procedures. Effective support for teachers’ lifelong learning is based on a perspective of career-long competence development, using tools such as the active involvement of teaching staff in lifelong learning as well as the progressive assessment of long-term competence development. We must not forget that ‘a more effective and efficient use of public funds must involve coherent and complete systems, not only for recruitment, selection and job placement, but also for professional development throughout the entire career of the teaching professions’ (European Commission, 2012). Thus, it becomes important for countries to have systems for evaluating the effectiveness of in-service training (ITT), the ‘process by which teachers engage in further education or training to refresh or upgrade their professional knowledge, skills and practices in the course of their employment’ (UNESCO, 2019), with a view to continuous professional development. This process must be able to ensure, over time, the characteristics of more effective teachers as shown in table 1.

Table 1. Characteristics of more effective teachers. European Commission, 2012

<i>Cluster</i>	<i>Characteristic</i>	<i>Description</i>
Professionalism	Commitment	Commitment to do everything possible for each student and enable all students to be successful
	Confidence	Belief in one’s ability to be effective and to take on challenges
	Trustworthiness	Being consistent and fair; keeping one’s word.
	Respect	Belief that all persons matter and deserve respect
Thinking/ reasoning	Analytical thinking	Ability to think logically, break things down, and recognize cause and effect
	Conceptual thinking	Ability to see patterns and connections, even when a great deal of detail is present
Expectations	Drive for improvement	Relentless energy for setting and meeting challenging targets, for students and the school
	Information-seeking	Drive to find out more and get to the heart of things; intellectual curiosity
	Initiative	Drive to act now to anticipate and pre-empt events
Leadership	Flexibility	Ability and willingness to adapt to the needs of a situation and change tactics
	Accountability	Drive and ability to set clear expectations and parameters and hold others accountable for performance
	Passion for learning	Drive and ability to support students in their learning and to help them become confident and independent learners.

The formative and summative uses of in-service teachers training (ITT) ‘should be clearly linked to tools and techniques, roles and responsibilities of different stakeholders, as well as to their prevailing focus on individual, school or system level - on input (e.g., professional development attendance) or outcome (change in teacher competences or

learner attainment)' (European Commission, 2012, p. 42). As noted by Timperley et al. (2007), after understanding the 'black box' between teaching activities and student achievement, it is necessary to discover the 'second black box', located between teachers' professional learning opportunities and their impact on teaching practice.

In-service training effectiveness: explicative models and levels

Studies have shown that in-service teachers need regular training to maintain and strengthen their professionalism mainly because knowledge of pedagogical content does not automatically deepen as professional experience increases (Brunner et al., 2006). Several meta-analyses and reviews have shown that professional development programs can help promote teachers' knowledge, attitudes and pedagogical skills and indirectly student learning (Lipowsky & Rzejak, 2015, p. 28; Hattie, 2009; Timperley, et al, 2007; Yoon, et al, 2007). There is a large mix of characteristics that would make professional development programs for teachers effective: 'a combination of the input, application and output variables of the professional development process, a focus on training content, reference to the results of research on educational effectiveness and participant feedback, as well as the creation of situations in which participants experience self-efficacy and participate in professional communities focusing on student learning' (Lipowsky & Rzejak, 2015, p. 27) - type and quality of training, school climate, students 'skills, knowledge domain, etc. In order to measure the effects of in-service teachers training (ITT) it is possible to use the updated of the Kirkpatrick's Evaluation Training model, (Wade, 1984) which is divided into 4 levels:

1. *Reaction* - assess the teachers' response, in particular, how they felt about the training (using surveys and interviews on customer satisfaction, engagement, relevance, also in the Learning Management System - LMS). However, the link between participant satisfaction and changes in their knowledge and actions is generally weak (Lipowsky & Rzejak, 2015, p. 28; Goldschmidt & Phelps, 2007);

2. *Learnings* – defines the effectiveness with which the information has been learned by the teachers but also changes in their attitudes, beliefs and levels of motivation. These are considered to be important predictors for teaching quality and student learning (Lipowsky & Rzejak, 2015, p. 28) using a pre-and post-testing process of *knowledge, skill, attitude, confidence, commitment*. Specifically, the skills assessment can be carried out through the analysis of artefacts after sharing a scale on the quality levels with the schools; the assessment of confidence, on the other hand, can be achieved through narrative and phenomenological techniques;

3. *Behaviours* – describes the degree to which the training has influenced the in-class behaviour of teachers and students and how they are applying their new knowledge to their teaching practice (using observation scales and records of behaviours; content analysis of reward systems; the school's follow-up with stakeholders on the degree to which teachers apply what they have learned during the training when they are in the workplace);

4. *Results* - measures the impact that the training has had at the school level (achievement: if students achieve better learning outcomes; if their motivation increases, etc.) how it contributes to the success of the organization as a whole but also offers evidence for monitoring the training program itself (e.g., sample and control group - teachers involved or not involved in training). This refers to the school results themselves (e.g., multi-level metrics - customer satisfaction rating, turnover rate, development projects, with an impact on the return on investment - ROI) (leading indicators are: short-term observations and measurements suggesting that critical and focused behaviours could have an impact on desired results).

Many training analyses do not extend the 4-level assessment and schools do not take time and budget to measure the impact and make decisions on the design and delivery of training. From another perspective, the result chain, inspired by the Logic Model Approach (Margoluis & Salafsky, 1998) in the context of governance and development, allows us to extend the effect-study to at least five levels and target groups (teachers involved in the training, multidisciplinary team, school organization, final user citizen and local area level) and obtain effect measurement scales on the basis of 5 levels:

- *input* – i.e., money, staff time, materials and equipment, transport costs, infrastructure, etc.;

- *activities* – related the governance and development and, specifically, the training to be carried out;

- *outputs* – results achieved immediately and largely controlled; specifically, improvement of the skills for which the training was made (see levels 2-3 of Kirkpatrick Model);

- *outcomes* – expected benefits and derived over time, as achievement of an influenced result; it is always linked to something different (behavioural change) and better (change in performance): i.e., approval of a new law, change in user behaviour, adoption of new routines, etc. (see levels 3-4 of Kirkpatrick Model);

- *impact* – broader impact as a long-term effect (months, years, etc.) of programs, policies or services on the institutional and social context; the detectable improvement in the life of the people who deal with the schools involved in the training; the positive economic, social, cultural, institutional, environmental and technological changes in the life of a targeted population, for this reason necessarily related to broad national and international goals.

Lipowsky and Rzejak (2015) offered an integrative model of the factors influencing the effectiveness of professional development programs: quality and quantity of learning opportunities during the program; characteristics and skills of the facilitator; previous training received by the participants; general conditions in the schools where participants teach; interactions between these variables (Figure 1).

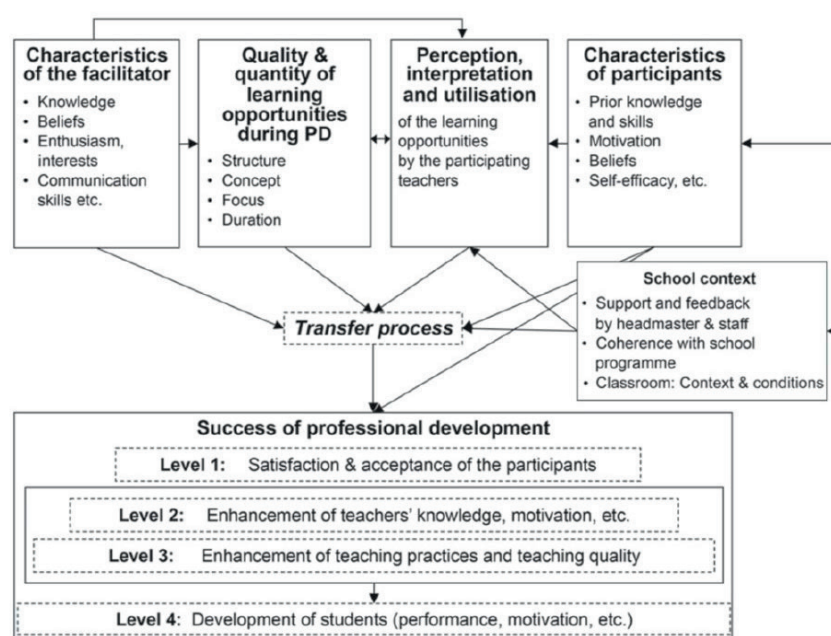


Figure 1. Analysis model for teacher professional development research. Source: Lipowsky and Rzejak, 2015

Lipowsky & Rzejak (2015) selected and analysed existing meta-analyses (Timperley et al., 2007; Tinoca, 2004; Yoon et al., 2007) and derived some recurring features in effective in-service teacher training. The selection criteria were studies referring to the levels of the reference model (see figure 1), in German or English, published in peer-reviewed journals or as monographs or, in in which the characteristics of effective training of teachers are explicit

Characteristic of participant. It is not clear whether previous teacher training is effective on student learning or not. Rank et al. (2011) demonstrate the positive effect, however, Landry et al. (2009) demonstrate a negative effect. Surveys on the influence of motivational variables have been more numerous and have highlighted the importance of participants' personal needs, interests, experiences and goals (Gorozidis & Papaioannou, 2014) and, more generally, the influence of intrinsic motivation (Rzejak et al., 2014) as opposed to extrinsic motivation. However, Lipowsky & Rzejak (2015) note that these studies often reveal conceptual overlaps regarding constructs.

Teaching quality of learning opportunities. Lipowsky & Rzejak (2015) also analysed many studies of the effect of the structural and didactic characteristics. These include trainer characteristics (McDowall et al., 2007) as well as less standardized training programs. The relationship between the duration of teacher training and its effectiveness is not direct and straightforward (Timperley et al., 2007). A one-shot training program is generally considered to be of poor quality (Smith & Gillespie, 2007). However, Timperley et al. (2007) conclude that duration in itself is a necessary but not sufficient condition for effective learning; much depends on the educational objectives (e.g., declarative knowledge of teachers, classroom practices, student learning), the type of activity, and the depth of personal processing (Garet et al., 2001). In particular, some studies show that teacher training programs are articulated according to the circle of input, practice and reflection (Browder et al., 2012; Piwovar et al., 2013; Van den Bergh, Ros & Beijaard, 2014), aimed at complex skills, such as classroom management, and using microteaching or lesson analysis were effective (Lewis and Perry, 2014). This was especially so when teachers had the opportunity to analyse and grasp the link between their beliefs, their teaching practices and students' learning, i.e., recognize and evaluate the effects of their teaching and pedagogical actions on students (Lipowsky, Rzejak & Dorst, 2011; Timperley et al., 2007)

Focus on student domain-specific learning. 'Domain-specific' teacher training programs (Seidel & Shavelson, 2007), which aim to improve knowledge of pedagogical content, help teachers understand learning processes related to subjects such as science and mathematics, and help to overcome their misconceptions. Timperley et al (2007) point out that such programs also improve knowledge of disciplinary assessment.

Study of systematic reviews and meta-analyses

A comparative analysis (Esser & Hanitzsch, 2012) of six meta-analyses concerning the effect of vocational training was carried out. Four references have been chosen, already selected and analysed by the synthetic study by Lipowsky & Rzejak (2015) - Tinoca (2004), Timperley et al. (2007), Blank & De las Alas (2009), and Hattie (2012) - together with two more recent ones by Egert et al. (2018) and Filges et al., 2019. The aim of the study was to identify evidence regarding the focal construct (in-service teacher/ continuing professional training; impact/effect; programs/instructions) and the analysis model adopted (e.g. standard deviation, effect-size).

Comparative analysis

Some of the most recent systematic reviews on the effects of in-service training in education are presented below (Egert et al., 2018, Filges et al., 2019 and Kalinowski et al., 2019). Egert et al. (2018) pointed out the correlation between in-service training for early childhood professionals, especially in caring skills, and external assessments of service quality as well as development outcomes in young children. The review summarizes the results of 36 experimental and quasi-experimental studies (2,891 teachers). The study revealed a mean effect of in-service training on process quality (effect size [ES] = 0.68, SE = 0.07, $p < 0.001$). The study, conducted on nine studies (including 486 teachers and 4,504 children), in particular, also highlighted a mild effect on the child's development (SE = 0.14; SE = 0.02, $p < 0.001$) and on the corresponding class (ES=0.45, SE=0.11, $p < 0.001$).

Filges et al., (2019) conducted a systematic review of the social effects of vocational and in-service training of the care professions (educational, social, criminal and judicial outcomes for children and young people). The complete review was conducted on studies with experimental and quasi-experimental designs with a control group and validated with standardized tests. 5,146 potentially relevant studies were collected and 51 studies were reviewed, all belonging to the education sector (preschool educators and teachers). Specifically, it studied the effects of personal development on language development and literacy (38 studies), on social and emotional development (12 studies), and on stress reduction (1 study). Thirty-four of the 51 studies were conducted in the United States, two in the United Kingdom, and the rest in countries such as Australia, Chile, Denmark, Germany, Ireland, the Netherlands, New Zealand and Portugal. The standardized mean difference (SMD) through the Hedges g and the application of the small N correction was used as a model and analysis notation. 95% confidence intervals (CI) were used.

Kalinowski et al. (2019) focused their review on 38 studies related to the effect of professional and in-service teacher training on students' academic language competence when teaching subject areas. The study found not only a certain extent of effectiveness. but also allowed them to individualize some characteristics that the professional development of teachers must possess in order to be effective. The authors trust that 'professional development helps to change the thinking and practice of teachers and benefits students, if certain specific characteristics are taken into account, such as design and implementation, cooperation and collaboration, input, application, and reflection, active learning and materials for language support.

The studies presented, referring to the period 2018-2019, were compared with those already analysed by Lipowsky and Rzejak (2015) and referring to the period 2004-2009. Table 2 illustrates some meta-analyses focused on the effect of teacher training on student's outcomes. The effect varies with respect to the subject area and school grade.

Table 2. Meta-analyses focused on the effect of teacher training on student's outcomes

Reference	Construct	n. studies and period	Educational area	Model and notation
Tinoca (2004)	PD - professional learning	35, experimental or quasi-experimental design, after 1969	Science, secondary school	$d^* = 0.45$ $r = 0.22, p < 0.001$
Timperley et al. (2007)	PD	72, experimental or quasi-experimental design, after 1989	School, cross disciplinary	$d^* = 0.66$ $d = 0.94$ (science) $d = 0.50$ (math) $d = 0.4$ (literacy) $d = 0.61$ (1-6 th grade) $d = 0.36$ (7-8 th grade) $d = 0.60$ (9 th -up grade)
Blank & de Las Alas (2009)	PD	16, experimental or quasi-experimental design, between 1986-2007	Science and math, secondary school	$ES^{**} = 0.212$
Hattie (2012)	ISP in-service programs & PD	5 meta-analyses, between 1980-2007	School, cross disciplinary	$d^* = 0.62; SE = 0.034$
Egert et al. (2018)	IPD – In-service Professional Development	36	Pre-school and school	$ES^{**} = 0.68;$ $SE = 0.07; p < 0.001$ $ES = 0.45, SE = 0.11,$ $p < 0.001$ (class develop.) $ES = 0.14;$ $SE = 0.02, p < 0.001$ (single-child develop.)
Filges et al. (2019)	CPD – Continuing professional development	51, experimental or quasi-experimental design, after 1997	Pre-school and school	$d = 1.26; SD^* .59$ (language-literacy develop.) $d = 0.91; SD = 0.48$ (socio-emotional develop.)

* medium-size effect (Cohen's d)

** difference between experimental and control group/control group's Cohen's d (ES)

*** standardized mean difference (SMD), Hedges

Comments and reflections

The comparative analysis (Esser & Hanitzsch, 2012) of six meta-analyses on the effect of professional development - Lipowsky & Rzejak (2015), Tinoca (2004), Timperley et al. (2007), Blank and De las Alas (2009), Hattie (2012), Egert et al. (2018), Filges et al. (2019) - highlighted differences in the construct-focus of professional development (PD) and the procedures for describing the effect.

The comparative analysis found the common problem of the lack of definition of concepts and an inconsistent use of terms, typical when the reviews are based on international research and in the field of education (Kalinowski et al. 2019). The suggestion to reduce the risk of misleading meanings is to carefully sift through the variety of synonyms used for each term / construct and first check the different combinations of words for syntax. The construct of 'professional development' (PD) turned out to be problematic on both a linguistic and procedural level. Table 2 illustrates a difference

between the meta-analyses conducted before 2012 and those conducted after. While the meta-analyses by Tinoca (2004), Timperley et al. (2007) and Blank and De las Alas (2009) use the unique construct of professional development (PD), those of Hattie (2012), Egert et al. (2018) and Filges et al., (2019) in contrast, differ by construct. In the first, 'in-service programs' (ISP) and 'professional development' (PD) are used interchangeably; in the second, 'in-service professional development' (IPD) is used; the third uses 'continuous professional development' (CPD). As Kalinowski et al (2019, p. 3) point out well, 'professional development' (PD) is a very broad and inconsistently used term in the literature'. In general, it is understood as 'any targeted, to some extent face-to-face, formalized and organized learning and / or training opportunity for in-service teachers' (*ibid*, p. 3). The comparative analysis also found it difficult to uniquely define professional development, as well as the creation of the 'appropriate research syntax' (*ibid*, p. 11).

The effectiveness of teacher professional development is usually described on the basis of dated models, such as Kirkpatrick (1979) and Wade (1984), referring to 4 levels of outcome (teacher reaction; teacher learning; teacher practice; students learning). Although Yoon et al. (2007) note a direct sequential relationship between professional development, teacher learning/practice, and student achievement, in general, four-level studies 'are neither unidirectional nor linear' (Kalinowski et al. 2019, p. 8; Reinold, 2016). The well-known meta-analysis by Hattie (2012) reported an overall effect size of 'professional development' of $d=0.62$, however 'it is not clear exactly how Hattie calculated this data' (Lipowsky & Rzejak, 2015, p. 29). Only in the area of language and literacy, do the studies agree on the direct effect between the extended professional development of teachers and the development of students' skills (Cheung & Slavin, 2012; Filges et al., 2019).

Table 2 also allows us to detect a difference between models and metric used to size the effect. The fifth column of the table shows that the data obtained (d) differs greatly according to the field of extraction - reference discipline and school grade (Timperley, 2007), reference sample (Egert et al., 2018), skills to be learned (Filges et al., 2019). Above all, the statistical procedure often differs: medium-size effect (Cohen's d) (Tinoca, 2004; Timperley et al., 2007; Hattie, 2012), the difference between experimental and control group divided by the control group's Cohen's d (ES) (Blank & de las Alas, 2009; Egert et al., 2018); standardized mean difference (SMD) through Hedges' g (Filges et al., 2019). As noted by Kalinowski et al, (2019, p. 11) 'drawing further conclusions with confidence is hampered by heterogeneous study designs, sometimes vague reports and missing information, and the extremely varied measures upon which the research examined is based, which could indicate a lack of standardization and appropriate tools in the field.' It then becomes necessary to carry out studies that systematically test the levels of efficacy to obtain information on the relationships between the levels, as well as follow-up studies that determine the sustainability of the effects (*ibid*).

Although the training of in-service teachers in many countries has been made compulsory and structural and conceived as opportunity for growth and professional development regards the entire school community, in a strategic and functional logic for improving the quality of the school system (Perla, 2019), ministries of education do not yet have a univocal model and shared procedures capable of describing and analysing the impact that the training provided has, using the terms of the (European Commission, 2020): *output* - results achieved immediately, i.e. increase in skills - focus subject to training; *outcome* - wider benefits for involved teachers - improvement of teaching practices of teachers involved in training; *outreach* - effects on the institutional and social context of the school where and of the territory within which the teachers involved in the training.

In conclusion, the study carried out supports the claim that most of the studies analysed on the effectiveness of teacher training programs are complex and consist of different components. So, it is often not possible to identify the individual characteristics responsible for the effectiveness of a positively evaluated training programme' (Lipowsky & Rzejak, 2015, p. 48). Lipowsky & Rzejak (*ibid*, p. 50) also underlined that 'despite the growing research efforts in recent years, many questions still need to be addressed in order to offer teachers a wide selection of high-quality professional development programs that will suit their individual interests, needs and goals'. The suggestion that the authors offer for future reviews and meta-analyses is to invest in the specificity of the teaching domains which should be analysed separately, but above all to differentiate the survey structure based on the dependent variables in relation to the 'levels' of educational success (level 2: teacher learning: teachers' attitudes, beliefs, knowledge and motivation; level 3: teaching actions; level 4: student learning). For this reason, the propose that the suggestions of Filges and colleague (Filges et al., 2019) that studies, in general, do not currently allow to offer interested parties robust evidence on the expected gains from professional development in the educational area, except language and literacy skills. This is why they advise countries outside the United States to carry out rigorous, randomized controlled trials in the thematic area of educational development. The data and information returned offer a comparative analysis (Esser & Hanitzsch, 2012), based on systematic reviews (Polanin et al., 2019) and meta-analysis, useful for setting up further meta-analytical investigations on the topic especially in terms of the disambiguation of terms and the narrowing of the field.

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