

Design principles of effective professional development for school teachers: A systematic literature review

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This paper presents the findings of a systematic literature review that answers the research question: how does current literature define effective professional development? In answering this question, a set of design principles for effective professional development have been produced for utilisation by researchers and practitioners within and beyond the teaching profession. The literature review sourced articles published between 1 January 2004 and 31 December 2021 from four prominent education databases. The search produced 10420 records. A series of inclusion and exclusion criteria were then applied, leaving 18 suitable articles to be included in the findings. A methodological quality assessment was undertaken, and data was extracted and synthesised to produce a set of ten design principles for effective professional development. This review has been reported on in line with the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement. The review is also registered on Open Science Framework Registries.

Introduction

Rationale

The pursuit of improved student outcomes is a complex one. Literature suggests that high-quality teaching has a sizable impact on these outcomes, as demonstrated in the USA (Darling-Hammond, 2000) and in Australia (Hattie, 2003). We also know that professional development is a valid tool to improve teacher quality (Drago-Severson & Blum-DeStefano, 2018; Naylor & Sayed, 2014). It makes sense, then, for policy makers and researchers alike to ask the question: how can we improve the quality of teacher professional development?

This question becomes even more complex when one considers that the definition of professional development, itself, is an oft-challenged one. Professional development, in our article, refers to any experience of workplace learning that is deliberate or can be measured. It is also referred to in literature as ‘professional learning’ or ‘continuing professional development’ (Netolicky, 2016). Whilst the terms are often used interchangeably, this review sees the terms ‘professional development’ and ‘professional learning’ as different concepts. Murray (2016) defined professional learning as any act that “results in improvements in teachers’ knowledge and instruction” (p. 9). The notion that professional learning can occur anywhere, makes professional development a more deliberate process. The focus of this paper is, therefore, professional development.

Professional development can include activities run by external providers and activities that already occur within schools. Netolicky (2019) includes “talks, courses and conferences... and other times where educators learn, and that influence their lives and work” (p. 5) as common examples of professional development.

This review synthesises global research on professional development since 2004, to provide professionals, academics and policy makers with a clearer understanding of how to design, implement and evaluate effective professional development. This systematic literature review is reported on in line with the *Preferred Reporting Items for Systematic reviews and Meta-Analyses* (PRISMA) statement (Page et al., 2021). Appendix A maps the items reported on in this review to the PRISMA Checklist (Page et al., 2021). Our review has also been registered on *Open Science Framework (OSF) Registries* (OSF Registries, 2023).

Context

Professional development for teachers is a widely researched and heavily debated topic. A large number of empirical studies and research syntheses already exist. However, these syntheses are rarely systematic. This study differentiates itself from other literature in the field by utilising a systematic literature review to produce a set of design principles that can be used to guide the creation of effective professional development programs.

Systematic literature reviews often have higher levels of rigour, transparency and replicability than traditional literature reviews. The systematic process can also reduce the implicit researcher bias associated with reviewing literature that is either already known to the researcher or limited to the researcher's preferred subject areas and networks (Mallett et al., 2012).

Although the risk of bias is comparatively reduced, it is important to consider that the protocols of a systematic literature review are still often informed by the context in which it is conducted. This review was conducted as part of a wider study around professional development and higher accreditation for teachers in Australia (Graham et al., 2023). As such, protocol selection decisions were made in line with the history of, and discourse surrounding professional development in this context.

Other systematic literature reviews have been conducted in the field of professional development and whilst they do not answer the question posed in this study, they do contribute important knowledge to wider literature. Two notable studies are discussed in our paper. Sims et al. (2021) identified forms and characteristics associated with effective professional development. Their findings could support the reader in selecting an appropriate methodology for professional development delivery. However, their review did not discuss design principles and may not be appropriate to inform the creation of new professional development programs.

The purpose of professional development is also an important consideration when planning for an effective professional development program. Kirsten (2020) conducted a systematic literature review that tested four hypotheses around the efficacy of professional development that are prominent in current discourse. Kirsten's review assumes professional development to be a tool to achieve policy goals. Our paper challenges that assumption. Whilst professional development can be an important mechanism in achieving policy goals, the review conducted in our paper will also encompass professional development that supports the development of praxis.

Praxis can be defined as “acting in the world in a way that contributes positively and meaningfully to society, or acting in the interests of humankind” (Mahon et al., 2019, p. 464). This idea gives professional development purpose beyond the policy goals of the context in which it is conducted. As such, the findings of our systematic literature review advance current knowledge of professional development, by contributing a set of design principles that guide future researchers and practitioners in the creation of effective professional development that can be used to achieve policy goals and promote meaningful change in wider society.

Objectives

The aim of this study is to answer the research question: how does current literature define effective professional development? This is achieved by synthesising current literature to create a set of design principles that can be utilised by researchers and practitioners within and beyond the teaching profession.

This review was conducted as part of a wider study around professional development and higher accreditation for teachers that poses the question: “what are the design principles for an effective professional development program targeting professional accreditation?” (Graham et al., 2023, p. 1385). The design principles developed in this review will be refined and tested in line with the protocols outlined in Graham et al. (2023) to produce a set of final design principles that specifically target professional development for teachers undertaking higher professional accreditation.

Methods

Eligibility criteria

This review synthesises the findings of research conducted between 2004 and 2021. The specific date range was selected to capture all literature published since the inception of professional teaching standards in New South Wales, Australia. Whilst this date is significant within that context, it does not intend to impact the findings of the study beyond setting a standard of currency in the literature reviewed. As the review was conducted throughout 2022 and 2023, it was determined that all research published between 1 January 2004 and 31 December 2021 would be eligible for inclusion.

The study focuses purely on peer-reviewed articles, to promote a level of methodological rigour in the literature included. Time and budget requirements also necessitated the review be limited to articles available in English and articles where the full text was available online by open access or through library subscription. Additionally, articles were included in the synthesis if they met the following criteria, as agreed by the research team:

- The research evaluates the effectiveness of a professional development program,
- The professional development program targets teachers,
- The research was conducted in either a primary or secondary school setting,

- The research draws conclusions about what constitutes effective professional development,
- The findings/discussion of the research are not limited to the effectiveness of a single professional development program,
- The research measures the term ‘effective’ by gains in teacher knowledge/skills/performance (ie. not improved student outcomes),
- The research is not conducted on a ‘niche’ or ‘experimental’ form of professional development (robotics, virtual reality, Massive Open Online Courses etc.),
- The research is not, itself, a review.

Information sources

The researchers consulted with University of Sydney Library staff to identify and select an appropriate range of electronic databases and source relevant literature. Selection was made on the basis of each database’s reach and reputation within the field of educational research. The four databases selected were: Scopus, Education Resources Information Center (ERIC), Web of Science and British Education Index. Data extraction was finalised on 25 February 2022.

Search strategy

Background

The Population, Exposure, Outcome (PEO) framework (Khan, 2003) was selected to guide the formulation of the keywords to be used in the search. The outcome from this process is summarised as:

- Population: school teachers
- Exposure: professional development
- Outcome: effective

Search terms

The keywords were then used in conjunction with the eligibility criteria to generate the following search terms:

- Population (1):
teacher OR educator AND
- Population (2):
school* OR college* AND
- Exposure:
“professional development” OR “professional learning” OR training AND
- Outcome:
quality OR effective* OR success* OR impact*
- Date range: 1 January 2004 – 31 December 2021
- Databases: Scopus, ERIC, Web of Science, British Education Index.
- Language: English
- Refined by: peer-reviewed journals, full text available online by open access or by library subscriptions.

The differing interfaces between databases necessitated slight variations of the search terms to be used in each instance. The exact search protocols used are shown in Appendix B. All records were exported to and stored in *Endnote* version 20 (The EndNote Team, 2013).

Selection process

Once all records had been sourced, the selection process was undertaken in two phases. In the first phase, a title and abstract screening was undertaken by the primary researcher. The researcher scanned each record's title (and abstract, if required) to determine whether the record was related to the research question, and then whether the article met the eligibility criteria. This phase was undertaken over a period of approximately 30 days.

The second phase of the selection process was a full-text screening. In this phase, two of the review's named researchers read each article and made a final decision as to whether the article met the eligibility criteria. Where consensus was not reached, the third researcher would make the final decision. This phase was undertaken over a period of approximately 14 days.

Endnote's 'Rating' functionality was utilised to provide a simple framework to guide each phase of the study. This is outlined in Table 1.

Table 1: Endnote coding system

Rating	Code
0 stars	Record yet to be screened
1 star	Record excluded in initial screening
2 stars	Full text to be sourced
3 stars	Article ready for full-text screening
4 stars	Article excluded in full-text screening
5 stars	Study included in synthesis

Data collection process

Once a final determination of the studies to be included was made, each included article was read by one researcher and relevant data was extracted. To ensure a level of rigour and uniformity in this process, the data was then checked by a second researcher. Where there was any disagreement between the two researchers about whether findings were to be included, it was agreed that a final decision would be made by the third researcher.

A data extraction summary tool was developed based on comparable systematic literature reviews and can be seen in Appendix C (El Soufi & See, 2019; Kristoffersson & Linden, 2020). This tool provided all researchers with a clear framework around what data was relevant for extraction which, in turn, assisted in determining whether the article was appropriate for inclusion. In addition to this tool, extraction was guided by whether the findings were relevant in answering the research question: how does current literature define effective professional development?

Quality of study assessment

Table 2 shows a methodological quality assessment tool that has been adapted from Dixon-Woods et al. (2004) and was used to assess the methodology of each included article and the likelihood of various forms of bias. Dixon-Woods et al. (2004) describes the items in the tool as prompts and argues that in order to be applicable to extensive array of qualitative methodologies, they must be, by nature, subjective. This tool was deemed to be appropriate in this context due to wide array of methodologies used to determine 'effectiveness' regarding professional development.

Table 2: Methodological quality assessment items
(adapted from Dixon-Woods et al. (2004))

Item	Description
A	Research question is clear and appropriate
B	Sample size is stated and appropriate
C	Sampling methodology/participant selection is clear and appropriate (response/ attrition rate acknowledged)
D	Data collection tool/methodology is clear and appropriate
E	Data analysis methodology is clear and appropriate
F	Claims made in discussion/results are supported by sufficient evidence
G	Data, interpretations and conclusions are clearly integrated

To account for the inherent subjectivity in both this tool and in qualitative research, each full-text screening was conducted by two members of the research team. Where there was a difference of opinion, a final determination was made by the third member of the team.

It is also important to note that where a methodological item was not stated in a study, it was assumed to be absent. This assumption reduced the likelihood of assessment bias on the part of the research team.

Synthesis methods

The extracted data (summarised in Appendix C) was then analysed by all three researchers. Ten broad themes were identified through an iterative process of inductive and deductive theming. Each piece of data or point, if presented in a list, was then allocated a score of 1-7 based on the study's methodological quality (shown in Table 3 and Appendix C) and the scores we added up to give an indicative prevalence of each theme based on the qualitative analysis of the literature. The themes were then presented as statements that answer the primary research question (i.e. Effective professional development should...).

Results

Study selection

Initial search

A preliminary search was conducted using the previously stated eligibility criteria. The process returned 10420 records (3970 from Scopus, 2933 from ERIC, 2446 from Web of Science, and 1071 from British Education Index). The 'Find and Remove Duplicates' function on *Endnote* was used to remove any duplicate records captured by multiple databases. This process removed 2668 records, leaving 7752 eligible records. A manual process of removing duplicate records was then undertaken. This removed an additional 541 records, leaving 7211 to be screened (Figure 1).

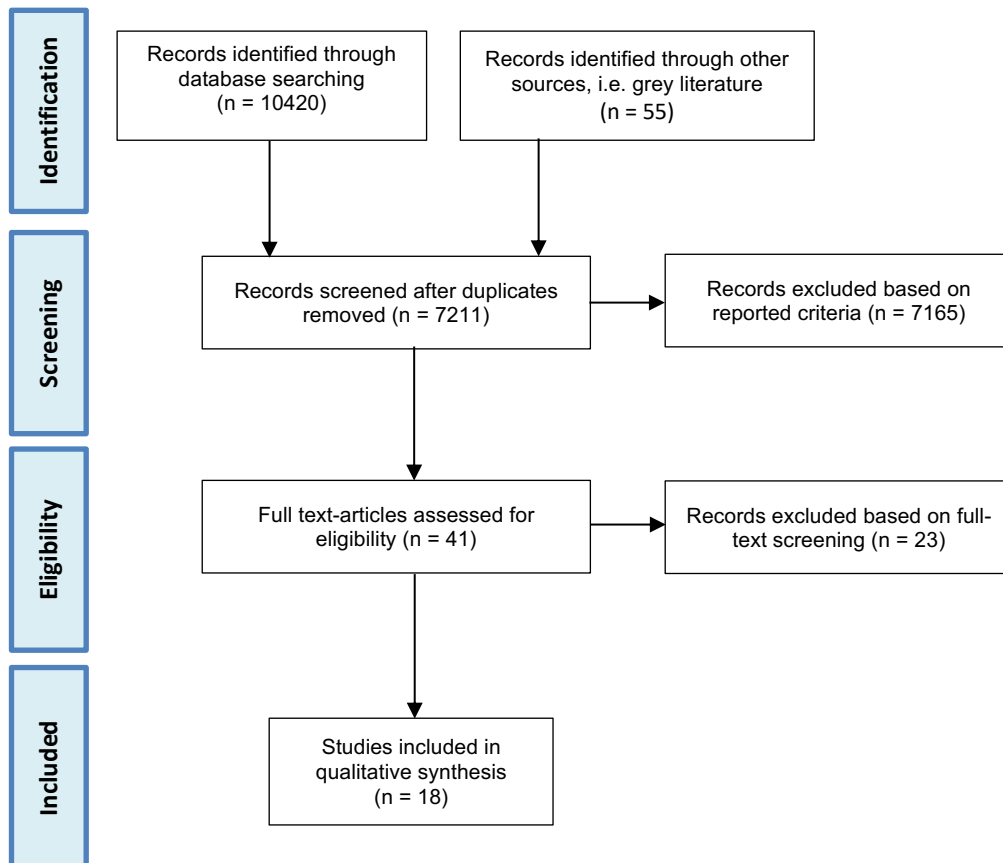


Figure 1: PRISMA flowchart

Preliminary screening

A title and abstract screening, outlined in the initial search phase, was then conducted by the primary researcher on the remaining 7211 records, based on the aforementioned inclusion criteria. This process excluded a further 7165 records, with 41 deemed eligible.

Figure 1 shows a diagrammatic overview of this process, in line with PRISMA guidelines. The figure also shows how many articles were excluded in each phase of the study.

The 'Find Full Text' function on *Endnote 20* was then used to draw any additional information that was not captured during the export from each database. The remaining articles were downloaded through a manual search using the University of Sydney Library and Google Scholar. This process sourced the full text for all 41 articles.

Full-text screening

A full-text screening of each article, as outlined previously, was then undertaken to determine final inclusion in the study. The same inclusion criteria as previously stated were applied to the full article. A further 23 articles were excluded because, upon examination of the article in its entirety, the findings of the article could not be used to answer the research question (n=12), the findings were not based on primary data (n=10), or the full text could not be sourced in English (n=1).

Methodological quality of evidence

Table 3 summarises the results of the methodological quality assessment made for each article included in the full-text screening.

Table 3: Methodological quality assessment data

Article Author (year)	Assessment item (adapted from Dixon-Woods et al., 2004)							Overall rating
	A	B	C	D	E	F	G	
Abu-Tineh and Sadiq (2018)	X	X	X	X	X	X	X	7
Cameron et al. (2013)				X		X		2
Collins and Liang (2015)	X	X			X	X		4
Colombo (2007)		X				X		2
Dasoo (2020)			X	X		X	X	4
Daugherty (2009)	X	X	X	X				4
Ekinici and Acar (2019)	X	X		X	X			4
El-Deghaidy et al. (2015)	X	X		X	X		X	5
Hickey and Harris (2005)				X	X	X	X	4
Hilton et al. (2015)	X	X		X	X	X	X	6
Howell et al. (2021)	X			X	X	X	X	5
Karlberg and Bezzina (2020)		X	X	X	X	X	X	6
Koellner et al. (2011)				X	X		X	3
Labone and Long (2016)						X	X	2
Lee (2004)							X	1
McCray (2018)	X							1
Vansteelandt et al. (2019)				X	X	X	X	4
Yates (2007)		X		X	X		X	4
Mean (%)	44%	50%	22%	72%	61%	61%	67%	3.56 (51%)

Risk of bias

The results of the methodological quality assessment (summarised in Table 3) give an indication of the relative strength of each study against the criteria outlined in Table 2. As with any tool used to quantify something as complex as research quality, the results should be interpreted with care (Jarwal et al., 2009). The *Data Extraction Summary* (shown in Appendix C) provides an elaboration of the context, research questions, methodology and sampling techniques used in each study to both substantiate the scores allocated to each study and allow the reader to draw their own conclusion as to the risk of bias associated with each study.

Study characteristics and findings

A summary of the data extracted from each of the 18 studies is shown in Appendix C.

Results of syntheses

The data in Appendix C was then synthesised into themes to create a set of design principles. Table 4 provides an overview of these principles and they are unpacked below. The number in brackets next to each heading indicates the relative prevalence of the theme within the literature analysed. The score was calculated by the number of coded data points that supported the theme multiplied by the methodological quality assessment score of the study for each point. The themes are presented in descending order based on their prevalence score and are worded to coherently complete the design principle stem. Themes that had a prevalence score of less than ten were not included as design principles.

Table 4: Design principles for effective professional development

No.	Design principle: Effective professional development should...	Prevalence score
DP 1	be collaborative and involve participation from school/system leaders	81
DP 2	be tailored to the needs of participants	63
DP 3	be authentic and align with current school/system priorities	36
DP 4	be sustained and provide teachers with adequate time/resources for change	35
DP 5	focus on enhancing teacher skills/knowledge	31
DP 6	challenge participants and encourage self-reflection	28
DP 7	include rigorous evaluation 'of' and 'by' participants	19
DP 8	be evidence-based and of high quality	19
DP 9	clearly articulate the goals/learning intentions of the professional development	13
DP 10	encourage active participation of participants	10

Effective professional development should be collaborative and involve participation from school/system leaders (score 81)

Collaboration had the highest prevalence score with 13 of the 18 studies discussing the need for professional development to be a collaborative process (Abu-Tineh & Sadiq, 2018; Collins & Liang, 2015; Dasoo, 2020; Ekinici & Acar, 2019; El-Deghaidy et al., 2015;

Hickey & Harris, 2005; Hilton et al., 2015; Karlberg & Bezzina, 2020; Koellner et al., 2011; Labone & Long, 2016; McCray, 2018; Vansteelandt et al., 2019; Yates, 2007). Collins and Liang (2015) found that teachers “benefitted from being able to discuss questions, concerns, or ideas that came up during the PD experience”. (p 12). Peer-driven professional development and various forms of coaching were also found to be effective. Hickey and Harris (2005) reported that “teachers have positive feelings from professional development led by peers” (p 15). Collaboration was also found to be most effective when school and system leaders were involved in and supportive of the process (Hilton et al., 2015; Labone & Long, 2016).

Effective professional development should be tailored to the needs of participants (score 63)

Effective professional development cannot take a ‘one size fits all’ approach according to 12 of the 18 studies reported on (Abu-Tineh & Sadiq, 2018; Cameron et al., 2013; Collins & Liang, 2015; Dasoo, 2020; Daugherty, 2009; Ekinci & Acar, 2019; Hickey & Harris, 2005; Koellner et al., 2011; Labone & Long, 2016; Lee, 2004; Vansteelandt et al., 2019; Yates, 2007). Professional development, where possible, should be designed in collaboration with participants (Daugherty, 2009; Ekinci & Acar, 2019; Lee, 2004), acknowledge that participants’ needs may change over time (Koellner et al., 2011) and be participant-driven (Labone & Long, 2016; Yates, 2007).

Effective professional development should be authentic and align with current school/system priorities (score 36)

Authenticity and alignment with school and system priorities was found to increase the effectiveness of professional development in seven studies (Abu-Tineh & Sadiq, 2018; Colombo, 2007; Ekinci & Acar, 2019; Labone & Long, 2016; Lee, 2004; Vansteelandt et al., 2019; Yates, 2007). Professional development is more effective when the content demonstrates an authentic connection to the work of participants (Colombo, 2007; Yates, 2007) and aligns with school and system priorities (Abu-Tineh & Sadiq, 2018; Labone & Long, 2016). It is also important for professional development to remain current and change with school/system priorities (Ekinci & Acar, 2019; Vansteelandt et al., 2019).

Effective professional development should be sustained and provide teachers with adequate time/resources for change (score 35)

The need for adequate time and resources was identified in nine studies (Collins & Liang, 2015; Ekinci & Acar, 2019; Hickey & Harris, 2005; Koellner et al., 2011; Labone & Long, 2016; Lee, 2004; McCray, 2018; Vansteelandt et al., 2019; Yates, 2007). Effective professional development provides adequate time for participants to prepare for (Hickey & Harris, 2005), implement (McCray, 2018) and reflect upon (Koellner et al., 2011) the content and program. Suggestions on how long this could take included 20 hours (Vansteelandt et al., 2019), 30 hours (Collins & Liang, 2015) and one semester (Labone & Long, 2016).

Effective professional development should focus on enhancing teacher skills/knowledge (score 31)

Professional development was found to be more effective when it focused on building the skills and knowledge that participants used in the workplace and was reported on in seven studies (Abu-Tineh & Sadiq, 2018; Cameron et al., 2013; Dasoo, 2020; Daugherty, 2009;

Labone & Long, 2016; Vansteelandt et al., 2019; Yates, 2007). In the context of teaching, this included curriculum (Daugherty, 2009), instruction (Labone & Long, 2016) and pedagogy (Abu-Tineh & Sadiq, 2018).

Effective professional development should challenge participants and encourage self-reflection (score 28)

Reflection was discussed in five of the 18 studies examined (Colombo, 2007; Ekinici & Acar, 2019; Koellner et al., 2011; Vansteelandt et al., 2019; Yates, 2007). It was noted that effective professional development should be rigorous enough to engage participants (Colombo, 2007; Ekinici & Acar, 2019). It should also ask participants to reflect on their current practices and on the content of the professional development program in order to improve their own practice (Koellner et al., 2011; Yates, 2007).

Effective professional development should include rigorous evaluation 'of' and 'by' participants (score 19)

Evaluation was found to be fundamental to designing and delivering effective professional development in four studies (Daugherty, 2009; Ekinici & Acar, 2019; Labone & Long, 2016; Lee, 2004). By eliciting feedback from participants, professional developers were able to measure participant perceptions which could be used to improve the learning program (Daugherty, 2009; Labone & Long, 2016). Additionally, evaluation of participants allowed professional developers to assess the impact of their program on participant skills and knowledge which provided additional data points for effective evaluation of the program (Ekinici & Acar, 2019; Lee, 2004).

Effective professional development should be evidence-based and of high quality (score 19)

Quality, evidence-based professional development programs were identified to be more effective in four studies (Abu-Tineh & Sadiq, 2018; Daugherty, 2009; Howell et al., 2021; Koellner et al., 2011). It encompasses the need for high-quality instruction (Abu-Tineh & Sadiq, 2018), comprehensive design (Daugherty, 2009) and evidence-based instructional models (Howell et al., 2021).

Effective professional development should clearly articulate the goals/ learning intentions of the professional development (score 13)

Goals and learning intentions were noted as increasing the effectiveness of professional development in three studies (Collins & Liang, 2015; Ekinici & Acar, 2019; McCray, 2018). Professional developers should make participants aware of the learning goals of a program (Ekinici & Acar, 2019). The design of the program should also be backward mapped from these goals (Collins & Liang, 2015). Alignment between these goals and the program is likely to increase learning (McCray, 2018).

Effective professional development should encourage active participation of participants (score 10)

The impact of active participation on participant learning was found in three studies (Ekinici & Acar, 2019; Labone & Long, 2016; Vansteelandt et al., 2019). Active participation included a range of participant-led activities (Ekinici & Acar, 2019), participant modelling (Labone & Long, 2016), and the co-creation of new knowledge (Vansteelandt et al., 2019). It is worth noting that El-Deghaidy et al. (2015) found the opposite to be true, stating that “teachers did not seem to be involved in CPD programs that require them to take active leadership roles. They seemed to be acquainted with

always being passive receptors and being directed by others” (p 1592). However, this principle was generally supported in the literature reviewed and ultimately met the criteria for inclusion.

Discussion

The findings of this paper build upon current knowledge of effective professional development by presenting a systematically generated set of design principles that can be used by researchers and practitioners in future work. These design principles provide the user with a tool to create and substantiate evidence-based professional development programs in a more deliberate manner. The design principles generally align with current discourse around effective professional development, and given the nature of the review, this is to be expected. However, the systematic and transparent nature of this review allows the reader to draw more informed conclusions as to why we do what we do. As such, this section will discuss the findings of this paper in relation to other systematic literature reviews in the field.

Whilst the research question in Kirsten (2020) differs from the one posed in this paper, some alignment can be seen in the results. Kirsten (2020) tested four hypotheses, two of which are relevant to the findings of this review. Hypothesis 1 was that “PD policy should target both teachers and administrators, since teachers’ learning partly relies on administrators’ understanding of teaching and learning.” (Kirsten, 2020, p. 9). This was supported in our study’s results. This theme was also prevalent in the findings of our review, represented as Design Principle 1 and appearing in 13 of the 18 included studies.

Hypothesis 3 was that “Policies should build on information from practice and invite teachers to participate in the monitoring of the quality of teaching, learning and professional development.” (Kirsten, 2020, p. 9). This hypothesis was also supported in our study’s results. Whilst the hypothesis is framed from the perspective of the policy maker, agreement can be found in the design principles produced in our review. Design Principle 5 speaks to alignment between practice and professional development design, and Design Principle 7 encompasses involving teachers in the evaluation, and by extension, the design process.

Similarly, Sims et al. (2021) discussed 14 mechanisms that contribute to effective professional development. Broadly, the study found that if more of these mechanisms are present, professional development can be thought to be more effective. The mechanisms were: “manage cognitive load, revisit material, ... goal setting, credible source, praise/reinforce, ... instruction, practical [social] support, feedback on practice, modelling, rehearsal, ... prompts/cue, action planning, self-monitoring practice, context-specific repetition.” (Sims et al., 2021, p. 87). These mechanisms are not presented in any order, nor do they claim to act as design principles but significant alignment is evident between the mechanisms and the results of our study.

Some notable topics prominent in current discourse around professional development did not feature in any of our design principles. These omissions were not made with any

intent and are simply the result of the systematic nature of the study. Some examples include ‘communities of practice’, the notion of ‘follow-up’ in relation to the delivery of professional development and ‘subject-specific content’ that is common in teacher professional development. The absence of these and other expected themes could, perhaps, be explained by a lack of empirical, peer-reviewed research in the case of newer concepts. This could also be a topic for future research.

Limitations

This study attempted to follow a rigorous, systematic and transparent process to identify, analyse and synthesise literature in the development of ten themes and subsequent design principles. However, like any other research, the methodologies undertaken should be considered by future researchers and practitioners when using these findings.

This review has been undertaken and reported on in line with the *Preferred Reporting Items for Systematic reviews and Meta-Analyses* (PRISMA) statement (Page et al., 2021). Due to the qualitative nature of the included studies, a metaanalysis was not determined to be the most appropriate method for data synthesis. As such, some preferred reporting items are not present in this review. Appendix A maps the items reported on in this review to the PRISMA checklist (Page et al., 2021).

It is important to consider that when codifying data that is largely of a qualitative nature, some level of subjectivity is unavoidable. Results should therefore be interpreted with care (Jarwal et al., 2009). This review accounts for this inherent subjectivity by making the process transparent and available for scrutiny, both in publication and in registration.

The researchers acknowledge the under-representation of lower socioeconomic schools and developing countries in the research reviewed in this study. This comes as a result of the systematic nature of the process and speaks to a broader imperative for greater representation and research in these schools and countries. This should be considered by future researchers and practitioners in these contexts.

Conclusion

This systematic literature review has produced a set of ten design principles that can be used to create and strengthen system-level professional development policies within and beyond the teaching profession. They can also be used by practitioners in the development, implementation and evaluation of future professional development programs.

The findings of this systematic literature review suggest that by incorporating more of these design principles into future professional development programs, professional developers can increase the likelihood of participants gaining and retaining their program’s desired skills and knowledge.

The design principles generated in this systematic literature review were created to be universally applicable. As such, future researchers may wish to test these design principles in their own contexts in order to further refine them in line with their context's specific needs.

Other information

Registration and protocol

This systematic literature review has been registered on Open Science Framework (OSF) Registries (OSF Registries, 2023). Additionally, the wider study's rationale and protocols have been published in Graham et al. (2023).

Support

No funding has been sought by the authors in the preparation of this review.

Competing interests

The authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Appendix A: Preferred reporting items for systematic reviews and meta-analyses (PRISMA) Checklist (Page et al., 2021)

(use 'zoom in' function in web or PDF reader to read)

Section and topic	Item No.	Checklist item	Where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	p. 1260
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	p. 1260
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	pp. 1260-62
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	pp. 1262
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	pp. 1262-1263
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	p. 1263
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	pp. 1263-1264
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	p. 1264
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	pp. 1264-1265
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	N/A
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	N/A
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	p. 1265
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	N/A
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	p. 1265
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	N/A
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	N/A
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	N/A

	13c	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	N/A
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	N/A
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	N/A
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	N/A
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	pp. 1266-1267
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	N/A
Study characteristics	17	Cite each included study and present its characteristics.	App. C
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	pp.1267-1268
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/ credible interval), ideally using structured tables or plots.	App. C
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	pp.1268-1270
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g.confidence/ credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	pp. 1268-1270
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesised results.	N/A
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	N/A
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	pp. 1268-1270
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	pp. 1271-72
	23b	Discuss any limitations of the evidence included in the review.	p. 1272
	23c	Discuss any limitations of the review processes used.	p. 1272
	23d	Discuss implications of the results for practice, policy, and future research.	p. 1272
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	p. 1273
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	p. 1273
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	N/A
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	p. 1273
Competing interests	26	Declare any competing interests of review authors.	p. 1273
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	p. 1273

Appendix B: Search protocols by database

(use 'zoom in' function in web or PDF reader to read)

British Education Index protocols

Search ID#	Search Terms	Search Options	Actions
<input type="checkbox"/> S1	AB ('teacher' or educator*) AND AB ('school' or college*) AND AB ('professional development' or 'professional learning' or training) AND AB ('quality or effective' or success* or impact*)	Limiters - Full Text; Publication Date: 20040101-20211231; Publication Type: Academic Journal; Language: English Expanders - Apply equivalent subjects Search modes - Boolean/Phrase	View Results (1,071) View Details Edit

Web of Science protocols

2,446 results from Web of Science Core Collection for:

Q teacher* or educator* (Abstract) and school* or college* (Abstract) and "professional development" or "professional learning" or t...

Refined By: Document Types: Articles X Languages: English X Open Access X Clear all

Abstract teacher* or educator* X

And Abstract school* or college* X

And Abstract "professional development" or "professional learning" or training X

And Abstract quality or effective* or success* or impact* X

And Author Example: O'Brian C* OR OBrian C* AZ

Publication Date 2004-01-01 to 2021-12-31

ERIC (OVID) protocols

#	Searches	Results	Type	Actions	Annotations
1	((teacher* or educator*) and (school* or college*) and ("professional development" or "professional learning" or training) and (quality or effective* or success* or impact*).ab.	21743	Advanced	Display Results More	
2	limit 1 to (full text and english language and journal articles and peer reviewed and yr="2004 - 2021")	2933	Advanced	Display Results More	

Scopus protocols

3,970 document results

(TITLE-ABS-KEY (teacher* OR educator*) AND TITLE-ABS-KEY (school* OR college*) AND TITLE-ABS-KEY ("professional development" OR "professional learning" OR training) AND TITLE-ABS-KEY (quality OR effective* OR success* OR impact*)) AND PUBYEAR > 2003 AND PUBYEAR < 2022 AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (OA, "all")) AND (LIMIT-TO (DOCTYPE, "ar")) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE, "j"))

Appendix C: Data extraction and summary

Abbreviations: QAR= quality assessment rating (0-7); PD=professional development; CPD=continuing professional development (use 'zoom in' function in web or PDF reader to read)

Study- Author (Year)	Research context	Research question/ objectives	Method- ology	Participants	Method- ological QAR	Key findings
Abu-Tineh & Sadiq (2018)	Country: Qatar Context: independent schools	What are the characteristics of effective PD as perceived by independent school teachers in Qatar? (p 314) What are the most and the least effective models of PD as perceived by independent school teachers in Qatar? (p 314)	Survey	Teachers 631 responses (63.1% response rate) 1000 participants selected through random stratified sampling (14000 population)	7	Top 5 characteristics of effective PD 1. Enhances teachers' content and pedagogic knowledge 2. Promotes collegiality and collaboration 3. Focuses on individual and school improvement 4. Models high-quality instruction 5. Aligns with other reform initiatives (p 316) Top 5 effective PD models: 1. Providing professional support from experienced teacher to newly hired teacher 2. Workshops at schools 3. Teacher study groups 4. Peer observation 5. Extended training courses (series of workshops) (p 316)

Cameron et al. (2013)	Country: Australia Context: a regional school cluster	'The study 'sheds light on factors that can influence teachers' willingness to access professional learning opportunities' (p. 380).	Mixed method (open-ended survey and interviews)	Teachers 56 participants (six school leaders, 50 teachers) Self-selected from five schools	2	Beneficial teacher learning can occur not only through the deliberate enhancement of professional skills, knowledge, and attitudes but also through meaningful attention to personal learning needs. (p391) '... educational systems need to broaden the ways in which teacher learning is supported...at particular junctures in their career journeys.' (p391) '... teachers, when planning their professional growth, should be free to choose at least some learning opportunities focussed on their personal needs' (p391)
Collins & Liang (2015)	County: USA PD Type: online PD Funding Source: Race to the Top	'Which features of high quality online PD were noted by participating educators in a state-wide online teacher PD program?' (p 4)	Survey (21 Likert scale and 8 open-ended questions)	Teachers 895 responses Population / sampling unknown	4	<i>Duration:</i> '30 hours or more in programs having positive effects' (p 12) <i>Participation:</i> 'a number (of participants) commented they would have benefitted from being able to discuss questions, concerns, or ideas that came up during the PD experience, similar to discussions and interactions in face-to-face PD sessions' (p 12) <i>Design:</i> 'online activities should provide flexible scaffolding and authenticity of purpose for teachers' (p 14) Clear communication of program goals and careful backward planning are key elements in successful PD and working with adult learners. (p 14)
Colombo (2007)	USA Context: Riverdale Schools cluster PD Type: cultural competence Funding: Office of English Language Acquisition	'This article discusses the elements of PD that are essential to increasing cultural competence in mainstream teachers' (p 10)	Mixed method (observation, participant evaluation and interviews)	Teachers 27 responses from 105 selected participants	2	'... effective PD provides workshops that create a sense of being lost, includes authentic field experiences, and eloquently links workshops and field experience activities' (p 16)
Dasoo (2020)	Country: South Africa Context: network of independent schools	'This article focuses on the key role of teachers in the decision-making process concerning the design and implementation of Continuous Professional Teacher Development (CPTD) at a network of independent schools in Johannesburg.' (p 45)	Mixed method (semi-structured interviews, questionnaires, and document analysis)	Teachers 15 participants from five schools Stratified sampling (beginning, mid-career, late-career teachers)	4	Teachers in this study wanted to learn and develop in a collaborative manner and environment. (p 53) Participants understood that theoretical knowledge of schooling and education is crucial but ... requested hands-on information and skills that they could apply in the everyday learning context of the classroom. (p 53) Teachers reflected that they want to work and learn in dedicated teams or groups of teachers who share similar subjects or grades. (p 55) Consulting with teachers regarding CPTD is a positive step in creating CPTD that will not only inspire teachers about their learning and development, but also promote their interest in schooling and educational issues. (p 55)
Daugherty (2009)	Country: USA Context: STEM teachers	'What are the primary design elements used to deliver engineering-oriented PD (logistics, format,	Case studies	Teachers 63 responses from participants of five PD programs	4	Projects should incorporate rigorous evaluation into the design of their PD so that they can provide a better understanding of how teachers learn engineering, change, and impact student learning. (p 21) Secondary level engineering-oriented PD should also move toward more comprehensive

	PD Type: engineering pedagogy	activities, instructors, and instructional strategies) and why were these elements selected?' (p 11)				<p>designs to account for the minimal teacher preparation in engineering at the pre-service level. (p 21)</p> <p>A clear vision of teaching and learning engineering needs to drive the design of the PD. Teachers' needs, whether mathematics, science, technology, or a combination, should inform the design and should be continuously monitored. (p 22)</p> <p>The design should be a collaborative venture between PD providers and the teachers so as to account for the particular contexts within which the teachers operate. (p 22)</p>
Ekinci and Acar (2019)	Country: Turkey Context: primary school teachers	<p>'What are the opinions of the teachers about the concept of PDt?' (p 112)</p> <p>'What are the opinions of the teachers about the process of PD?' (p 112)</p> <p>'What are the opinions of primary school teachers about the characteristics of effective PD?' (p 112)</p> <p>'What are the features of an competent PD model?' (p 112)</p>	Interviews	Teachers 20 responses from one school district	4	<p>A PD activity can respond to the needs, reflect life, be able to be used in class, solve class problems, and meet parents' expectations. (p 115)</p> <p>They should be given the right of choose their PD activities which are suitable for individual differences, and they should plan their development. (p 115)</p> <p>The content of the PD activities prepared for them was given; theoretically, they did not reach the application level, they were given as a shallow, repetition of the known things and they did not arouse any curiosity. (p 115)</p> <p>Self-control, reflective thinking, idealism, self-criticism, reasoning, being open to communication and empathy are the features of effective PD. (p 115)</p> <p>... they demand a PD process with active participation, hands-on, micro-teaching demonstrations, case studies, one-to-one, face-to-face communication with small groups, sharing experiences, and school-based activities. (p 116)</p> <p>Another suggestion regarding the PD of teachers is collaboration. (p116)</p> <p>Teachers need to define the need before starting an effective PD process. (p 120)</p> <p>In the process of PD, it should be clearly defined how PD will be done, which tasks will be carried out and when they will be carried out and who will complete which tasks and in which position he/she will complete them. (p 120)</p> <p>The teacher's working environment and its facilities should be evaluated while planning PD. (p 120)</p> <p>A suitable content should be prepared, and the information should be up-to-date, interesting, useful and ideal for new developments. (p 120)</p> <p>Teachers' requests should be taken into consideration while determining the place and time of PD activities. (p 120)</p> <p>The active use of reflective thinking in the PD process can accelerate the teacher's development. (p 120)</p> <p>The central element that increases the quality of the education process is an evaluation. (p 120)</p> <p>Social, economic, and expert supports should be provided to teachers for healthy and regular progress in the effective PD process. (p 120)</p> <p>Teachers should be monitored at every moment of PD. (p 120)</p>

El-Deghaidy et al. (2015)	Country: Saudi Arabia Context: science teachers PD Type: science pedagogy	'What are science teachers' views of an effective CPD provision?' (p 1582)	Questionnaire	Teachers 609 responses (304 to optional open-ended questions) from 1052 selected. Pop. 3150 (three educational administrations) Stratified by district	5	Teachers did not seem to be involved in CPD programmes that require them to take active leadership roles. They seemed to be acquainted with always being passive receptors and being directed by others ... teachers are trapped in the mindset of the providers. (p 1592) There needs to be more emphasis on collaborative activities where teachers can share and exchange experiences together in a safe community that supports each other and increases collegiality, in addition to activities that require teachers to take leadership roles. (p 1595)
Hickey & Harris (2005)	Country: USA Context: one rural school PD Type: school leadership PD	Presents: • 'a discussion of the foundation of practitioner research' (p 12) • 'a discussion of teachers as experts who can offer unique perspectives to their peers.' (p 12) • 'need for collaborative efforts in school organizations will be addressed.' (p 12) • 'utilization of teachers as leaders and the unique contributions they can create will be addressed.' (p 12)	Surveys (1x Likert scale and 1x open ended)	Teachers Nine participants from one school 62 teachers total at the school	4	Our results suggested that teachers have positive feelings from professional development led by peers. (p 15) It is suggested that districts incorporate the following six recommendations to encourage the growth of teachers as leaders: 1. Identify teacher strengths; 2. Match teacher strengths to professional development needs; 3. Develop professional development programs with these strengths and needs in mind; 4. Provide teachers with time to prepare for their presentation; 5. Provide opportunities for informal presentations to reduce anxiety and stress of presenting; and 6. Provide time throughout the year to take advantage of collaborative opportunities. (p 15)
Hilton et al. (2015)	Country: Australia Context: two school clusters (in Queensland and South Australia) Low SES areas	'The study determines 'whether the engagement of school leaders as <i>active co-participants</i> in teacher PD has the potential to positively influence teachers' and indeed the leaders' professional growth and if so, how and why this might be the case.' (p 105)	Mixed methods (interviews, surveys, school visits, informal discussions, and workshop sharing and reflection sessions)	Teachers and school leaders 70 teacher participants from 18 schools 20 school leader participants from 11 schools	6	'... co-participation by leaders in teacher professional development can have a profound influence on teachers' professional growth.' (p 118) '... leaders and teachers contribute to one another's professional learning.' (p 118)
Howell et al. (2021)	Country: USA Context: mid western school district PD type: using technology to teach literacy	'How does a PD model, which includes gradual release of teacher inquiry, the social practice of writing, and digital tools, influence elementary teachers' abilities to make writing a more digital, participatory process?' (p 100)	Mixed method (observations, field notes, teacher reflections, semi-structured interviews and surveys)	Teachers 15 participants from five schools (self-selected)	5	Elements of a PD model for technology integration 1. In-Service (I do) 2. Coaching, Planning Sessions, Peer Observations (We do) 3. Online Modules, Coaching, Collaborative Inquiry and Student Aid (You do together) 4. Individual Practice with Online Support (You do alone) (p 114)

Karlberg and Bezzina (2020)	Country: Sweden Context: preschool, primary school and high school Four municipalities within Sweden	'The study is identifying the perceptions of teachers across four municipalities in Sweden on continuing professional development' (p 1)	Survey	Teachers 1884 responses (37% response rate)	6	Perceived positive impact of previous forms of PD on teachers' development (highest to lowest): 1. University run courses 2. Sessions provided by NBE 3. Web-based learning 4. Study visits 5. Collaborative Learning 6. Mentoring 7. Planning meetings 8. School-based sessions 9. Network meetings 10. Sessions provided by municipality (p 7) '... those with more than 5 years experience identify a significant impact on forms of PD that reinforce and promote collaborative practices, namely 'school-based sessions', 'collaborative learning' and 'network meetings' (p 7)
Koellner et al. (2011)	Country: USA PD type: mathematics pedagogy	<i>Not stated</i>	Mixed method (interviews, observations and knowledge assessments)	Teachers and school leaders 62 participants (10 school leaders and 52 teachers) from eight schools	3	'Modelled how to promote community... foster discussions focused on the current (and often changing) needs of the Tls ... encouraged thinking metacognitively, or reflecting on one's own thought processes, ... encouraged them to "wear one hat at a time" ... encouraged the Tls to self reflect on both their learning from the ISMs and their facilitation during their workshops ... video taped all of the Tls' workshops and provided opportunities for them to watch and reflect on their video, ... provided coaching or one-on-one learning opportunities for individual Tls. We conjecture that implementing these various processes, in combination, was essential to supporting Tls' ongoing efforts to develop community, foster KT, and adapt their workshops both to meet the needs of the participating teachers and to fit within their local context.' (p 133)
Labone & Long (2016)	Country: Australia Context: Sydney Catholic school cluster	'The study aims to describe, in depth, how the system-based professional learning model was implemented at the individual school level' (p 61)	Case studies (interviews and surveys)	Schools Three schools (number of teachers participants unclear)	2	<ul style="list-style-type: none"> • Focus on content and instructional practices informed by awareness of student thinking; • learning components that are participant driven and feature experiential and active learning as well as modelling by teachers; • feedback, including group review and self-reflection; • collaborative practices that support the development of professional learning communities, trust and discourse; • temporal characteristics that require the professional learning to be sustained for a minimum of one semester and include follow-up with classroom-based support; and • coherence in teachers' knowledge and beliefs as well as broader school and system-based policies (p 57-58) <p>'... the findings suggest that system based professional learning is most likely to be successful and sustained when all elements are present and are supported by leaders who are committed to the initiative.' (p 76)</p>
Lee (2004)	Country: USA PD type: teacher-needs based PD	'How to develop the various phases of an effective PD program: Beginning, during, and after?' (p 41)	Mixed method (survey studies, interviews, concepts maps, participants'	<i>Not declared</i>	1	'... planning a PDP should start with the ends (outcomes) in mind and that teachers should be encouraged to be involved in the planning process.' (p 46) Recruiting teachers from the same context ... The advantage of this recruiting process was that teachers from the same building came to the program with an existing support group and the

			assignments, site visits and participant reflections)			team would have a strong potential influence on the mathematics curriculum in their school system. (p 46) Connecting professional learning and professional practice ... schools should provide participants with more time to grow, begin to measure what happens as a result of their participation, and provide teachers with follow-up to PD, such as opportunities for practice in the classroom. (p 46) Building a partnership between university, public schools, and local education agents. (p 47)
McCray (2018)	Country: USA	'In what ways do middle and high school teachers view professional development?' (p 583); 'Do middle and high school teachers feel that there is an impact on their professional practices during the post PD period?' (p 583)	Mixed method (participant journals, interviews and exit debriefings)	Teachers 10 participants (from a faculty of 45)	1	'... by incorporating teacher leadership and input, teachers are able to engage in personalized dialog to improve their professional practices and student achievement.' (p 584) '... focused and aligned professional development increases learning.' (p 584) Teachers need time and support to implement the practices learned in PD. (p 584)
Vansteelandt et al. (2019)	Country: Belgium PD Type: reading PD	<i>Not stated</i>	Questionnaire	Teachers Eight participants (self-selected)	4	Design principle 1 <i>Content focus</i> . The first design principle refers specifically to the content of the CPD. (p 12) Design principle 2 <i>Active learning</i> . The second design principle focuses on participants' continuing inquiry of practice, co-creation of and reflection on professional and academic knowledge and skills to increase students reading motivation. (p 15) Design principle 3 <i>Coherence</i> . The third design principle focuses on the alignment of the CPD program with participants' goals, beliefs and with current educational reforms and policies to increase students' reading motivation. (p 15) Design principle 4 <i>Duration</i> . The fourth design principle ensures that participants took part in an extended and intensive CPD program, of sufficient duration with activities that are spread out in time and include at least 20 hours of contact time. (p 15) Design principle 5 <i>Collective participation</i> . The fifth design principle focuses on the participants collaborating on each other's teaching practices to increase students' reading motivation. (p 16) Design principle 6 <i>Autonomy support</i> . The sixth design principle focuses on the participants' need for autonomy. (p 16) Design principle 7 <i>Competence support</i> . The seventh design principle focused on the participants' need for competence. (p 16) Design principle 8 <i>Relatedness support</i> . The eighth design principle focused on the participants' need for relatedness. (p 16)
Yates (2007)	Country: Australia	The study 'investigated primary and secondary teachers' perceptions of professional learning activities	Survey	Teachers 395 responses	4	Principles of effective teacher professional development: 1. Experiential, engaging teachers in concrete tasks that elucidate learning & development 2. Participant driven. Grounded in inquiry, reflection & experimentation 3. Collaborative, interactional, involving sharing knowledge

		they had undertaken' (p 215)				<p>4. Connected to and derived from teachers' work with students</p> <p>5. Supported by modelling, coaching & collective problem solving around specific problems of practice</p> <p>6. Connected to & integrated with comprehensive school change</p> <p>7. Sustained, ongoing and intensive (p214)</p> <p>'... teachers rated their experiences as providing professional renewal more highly if they undertook an ICT professional learning activity ... or ... an experience of longer duration' (p 218)</p>
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Please cite as: Graham, M., Grice, C. & Cotton, W. (2024). Design principles of effective professional development for school teachers: A systematic literature review. *Issues in Educational Research*, 34(4), 1260-1284. <http://www.iier.org.au/iier34/graham.pdf>