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Title **Design Principles in Focus: A Scoping Review of their Use in Design-Based Research**

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Abstract In the context of Design-Based Research (DBR), where design principles (DP) are often described as a key link between theory and practice, little is known about how present this concept is within the research literature and in what ways it is addressed. This scoping review (n = 425) explores the extent to which and the contexts in which the term 'design principles' appears in the titles and abstracts of peer-reviewed English-language publications within the field of design research. In order to achieve this, the following research questions will be addressed: To what extent and in which contexts is the term 'design principles' used in titles and abstracts of peer-reviewed English-language publications within the context of design research? To complement the review, a qualitative content analysis of verbs pertaining to design principles was conducted, aimed at the second research

question: In what ways is the term ‘design principles’ used and described in titles and abstracts of peer-reviewed publications within the context of design research? This analysis seeks to identify recurrent verb usage patterns. The findings show that design principles are widely used in a variety of publications, particularly in the field of educational sciences and subject didactics. They are used largely empirically, primarily for the development of teaching concepts. Verbal analysis and thematic clustering revealed that design principles function as both research outcomes and practical tools throughout the DBR process. Despite their growing importance, the study highlights inconsistencies in the implementation and reporting of design principles, indicating a lack of shared standards across the field. Further research is required to examine methodological patterns, discipline-specific applications and the specific roles of design principles in different DBR phases.

Keywords Design-Based Research, design principles, scoping review, educational research, methodological standards, design guidelines

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Design Principles in Focus: A Scoping Review of their Use in Design-Based Research

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1.0 Introduction

This paper provides a basic framework for theoretical and practice-based engagement with design principles (DP). It sets the stage for a more systematic engagement with DP in Design-Based Research (DBR), providing a basis for both reflection and further development in geography education and beyond.

The three authors of this article each completed their doctoral theses (Ph.D.) using the DBR approach. Since then, they have continued to engage with DBR both theoretically and conceptually, with a particular focus on its application and further development within the field of geography education. For this paper, however, the perspective is broadened to include contributions from all disciplines and to consider all English-language publications by conducting a scoping review. This broader conceptual approach aims to provide a more comprehensive and cross-disciplinary view of the use of DP within DBR as a whole.

2.0 Theoretical Background

The methodological approach of Design-Based Research addresses the 'theory-practice problem' (e.g., Fischer et al., 2003; Wilhelm & Hopf, 2014), which has often been defined in educational research, by bridging 'theoretical research and educational practice' (The Design-Based Research Collective, 2003, p. 8). Emerging in the early 2000s as a response to the limitations of traditional experimental educational research, DBR represents a group of approaches that integrate design and empirical inquiry in iterative cycles. However, DBR is not wholly defined by a uniform methodology, but rather by the objective of producing sustainable educational innovations, with the aim of solving problems from educational practice (Reinmann, 2005). In order to achieve this objective, DBR combines empirical educational research with the theory-based development of teaching-learning environments (The Design-Based Research Collective, 2003). Therefore, DBR needs conceptual tools that systematically guide both the development and the research processes. Among the conceptual tools proposed to support this dual aim of DBR, the development of design principles has been discussed in the literature as a key approach[2].

[1] *Shared first authorship/Joint first authorship

[2] Hypothetical learning trajectories (HLTs) are a further example of a tool to develop theories in DBR. In a manner analogous to that of DP, HLTs are utilised as a research instrument with a view to narrowing the discrepancy between teaching and learning. This means that an HLT changes during the research process and fulfills different functions after it has been created, which vary depending on the phase (Bakker & van Eerde, 2015, with references to Simon, 1995, and Gravemeijer, 1994).

In the scholarly discourse on DP within DBR, different authors emphasise varying roles, functions and modes of application, offering diverse insights into how DP can be understood and utilised. Generally, DP can be understood as a collective term for instructional design criteria and guidelines for educational practice (e.g., Van den Akker, 1999; Plomp, 2010; Euler, 2014). They may be formulated at different levels of abstraction, depending on their conceptual basis (Euler, 2014). This basis can include theoretically or empirically derived assumptions, overarching educational aims, theoretical learning frameworks, or context-specific interpretations and adaptations thereof. These principles serve as points of crystallisation for practical design and the acquisition of scientific knowledge, playing a pivotal role in the design phase (Euler, 2014; Feulner et al., 2021). Within DBR, the design phase typically refers to the planning and development of interventions, whereas design cycles describe the iterative process of designing, implementing, evaluating, and refining these interventions based on empirical findings. Through these processes, DP undergo continuous refinement within the context of evaluation and interpretation during the design cycles, eventually emerging as a central outcome of the DBR project (Feulner et al., 2021). The use of such DP in DBR primarily aims to enhance transparency and traceability (Hiller et al., 2026) in design decision-making. In English-language publications, the concept of 'design principles' is widely used (e.g., Van den Akker, 1999; Plomp, 2010; Anderson & Shattuck, 2012; McKenney & Reeves, 2012; Knogler, 2014; Euler & Collenberg, 2018). In addition to this formulation, other expressions with similar meanings and intentions can be found, such as principles of design or design guidelines, and other spellings, such as designprinciples, do also exist.

The use of DP in DBR is frequently accompanied by justifications regarding their relevance and function (Hanghøj et al., 2022; Shattuck & Anderson, 2013). However, despite these justifications, several questions remain concerning whether DP represent an established concept within DBR across different disciplines, whether they are sufficiently widespread to serve as a reliable foundation, and for what specific purposes they are employed in the research process.

3.0 Objectives

A clearer understanding of how design principles are represented within the Design-Based Research discourse provides valuable insights into the development and conceptualisation of the field. To explore how DP are addressed in the scholarly literature, this study conducts a scoping review of English-language publications. The aim is to provide a structured overview of the visibility and embedding of the term 'design principles´ within DBR. Titles and abstracts are analysed to identify recurring patterns in how DP are introduced and framed, allowing for insights into their role and function across different disciplinary contexts. As the focus lies on the visibility of the term rather than on its detailed application in individual studies, the analysis is limited to titles and abstracts. While this restriction narrows access to methodological and theoretical detail, it enables a broader examination of the research field — also in light of economic considerations.

4.0 Design of the Scoping Review

A scoping review is a specific form of evidence synthesis that aims to systematically map the extent, nature and key characteristics of existing research on a particular topic (Munn et al., 2022; Pham et al., 2014). Unlike systematic reviews, which typically address narrowly defined questions — often related to the effectiveness of interventions — scoping reviews follow an exploratory approach that allows for a broader investigation of a research area (Munn et al., 2022). A distinguishing feature of scoping reviews is their focus on describing and organising evidence, rather than evaluating the methodological quality of the included studies (Munn et al., 2018). Their key purposes include mapping research landscapes, clarifying conceptual boundaries, identifying gaps, synthesising diverse forms of evidence, and laying the groundwork for future systematic reviews (Munn et al., 2022; Peters et al., 2015; Pham et al., 2014; Verdejo et al., 2021). Scoping reviews have become increasingly popular across a wide range of disciplines (Munn et al., 2022; Tinoca et al., 2022).

The scoping review approach was chosen for the present study due to the broad and exploratory nature of the research objectives, which seek to examine how the term 'design principles' is used within the context of Design-Based Research in international academic literature. Given the diversity of possible applications and conceptualisations of the term, the review aims to identify patterns of usage, thematic contexts and disciplinary trends (e.g., year of publication, scientific field, educational reference, research design terminology in the context of DBR, design concepts and products, type of contribution). To ensure feasibility and to focus on the visibility of the term 'design principles' within the field of DBR, the review was limited to the titles and abstracts of publications. This restriction was deliberately applied, as it aligns with the exploratory nature of the review and provides sufficient information for thematic mapping, while the analysis of full-text content — particularly the actual use or derivation of DP — was not focus of this review.

The specific objectives of this review are: (1) to systematically identify peer-reviewed publications that refer to DP in the context of design research, (2) to map the characteristics of these publications (e.g., topics, methods and research areas),(3) to analyse how DP are addressed or referenced in the titles and abstracts, serving as an indicator of their potential use in the studies and (4) to identify conceptual and empirical gaps, thereby generating new research questions. In addition, this article critically examines the methodological scope and limitations of the scoping review approach applied. In line with established methodological frameworks (Peters et al., 2017), the following steps were conducted:

(1) identifying the research question (see 4.1)

(2) identifying relevant studies (see 4.2)

(3) selecting studies (see 4.3)

(4) extracting data (see 4.4)

(5) synthesising and discussing results (see 5 and 6).

The analysis primarily follows a descriptive approach, identifying recurring patterns and trends across the selected literature. In addition, sentences containing the term ‘design principles’ were subjected to a qualitative analysis of the verbs used to capture how DP are referenced and engaged within the literature.

The reporting of this review is guided by the PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) to ensure transparency, consistency, and methodological rigour (Tricco et al., 2018).

4.1 Research Question

The review is guided by two overarching research questions:

→ To what extent and in which contexts is the term ‘design principles’ used in titles and abstracts of peer-reviewed English-language publications within the context of design research?

→ In what ways is the term ‘design principles’ used and described in titles and abstracts of peer-reviewed publications within the context of design research?

To address the first research question, several subquestions are considered:

a) In which years and to what extent were publications released that meet the specified search criteria?

b) In which scientific fields are these publications situated?

c) What does the design refer to in the respective studies?

d) Is the article’s engagement with design principles primarily empirical, theoretical, or conceptual?

The four subquestions were developed to ensure a systematic and differentiated response to the first research question. Since the aim of the scoping review is to map the breadth and characteristics of how the term ‘design principles’ is used in design research, it is necessary to examine not only when and in which disciplines the term appears, but also how it is conceptually and methodologically embedded. The first two subquestions capture temporal and disciplinary trends, allowing us to identify developments and concentrations within the field. The third subquestion clarifies the contextual reference of ‘design´, acknowledging the heterogeneity of design research. The fourth subquestion provides insight into how the term functions within different kinds of research contributions. Together, these subquestions provide the analytical depth required to comprehensively describe the distribution and nature of the term’s use across the literature.

To address the second research question, the study examines which verbs are used in direct connection with DP in abstracts. The aim is to

gain indications of the different roles and functions that DP may assume across various research designs and contexts. Two subquestions guide this investigation:

e) Which verbs are most frequently used in abstracts of DBR studies in connection with design principles?

f) What semantic clusters can be formed from these verbs, and what do they reveal about the functions attributed to design principles in DBR?

By addressing these research questions, this review seeks to provide a nuanced overview of the presence, evolution and scholarly treatment of DP within the field of DBR, thereby contributing to a clearer conceptual understanding of their role in DBR.

4.2 Information Sources and Search Strategy

A systematic literature search was conducted on 8 April 2024 using four electronic databases: Scopus, Web of Science, ProQuest and ERIC. These databases were selected because of their broad coverage of relevant disciplines and their inclusion of high-quality academic publications. Only English-language, peer-reviewed publications were included to ensure the inclusion of scientifically sound and high-quality sources. Citation tracking (snowballing) was not used because the initial systematic search already yielded a substantial number of relevant records, making additional manual searching unnecessary. No restrictions were applied in terms of publication date or specific thematic focus in order to capture the full range of literature available.

To address the research questions, specific search terms were selected to reflect both the methodological framework and the conceptual focus of the review. The following keywords and combinations were used:

‘design research’, ‘Design-Based Research’, ‘DBR’ and ‘design principle’, ‘designprinciple’, ‘principles of design’, ‘design guideline’.

These terms were intentionally combined to capture literature that discusses DP explicitly within the context of design research[3] or DBR. The inclusion of both full terms and the acronym ‘DBR’ aimed to ensure that relevant studies using different terminologies were retrieved. Similarly, variations in phrasing (e.g., plural forms or compound spelling) were included to account for differences in indexing and author usage across databases. In addition, it was checked to what extent the databases automatically capture plural forms of the search terms, even when these were not explicitly included in the search strings.

The search was limited to titles and abstracts, as these fields were deemed sufficient for identifying relevant records. A full-text search

[3] This included hits in the search such as ‘educational design research’ or ‘action design research’.

was intentionally avoided due to the potential for generating an unmanageable number of hits, which would have overwhelmed the screening process. For Scopus and ERIC, the limitation to English-language publications was applied directly in the search strings. For Web of Science and ProQuest, language was restricted using the databases' respective filters after running the searches. Where available, an additional filter for peer-reviewed publications was also applied.

Table 1 shows the bespoke search strings used in each database, reflecting the specific indexing and syntax requirements.

Table 1: *Overview of database-specific search strings for literature search*

Database	**Search String** *(Filters applied: Peer-reviewed, English)*
Scopus	TITLE-ABS (("design research" OR "Design-Based Research" OR "DBR") AND ("design principle" OR "designprinciple" OR "principles of design" OR "design guideline")) AND (LIMIT-TO(LANGUAGE, "English"))
ERIC	((abstract:("design research" OR "Design-Based Research" OR "DBR") OR title:("design research" OR "Design-Based Research" OR "DBR")) AND (abstract:("design principle" OR "designprinciple" OR "principles of design" OR "design guideline") OR title:("design principle" OR "designprinciple" OR "principles of design" OR "design guideline"))) AND language:("English")
Web of Science	(TI=("design research" OR "Design-Based Research" OR "DBR") OR AB=("design research" OR "Design-Based Research" OR "DBR")) AND (TI=("design principle" OR "designprinciple" OR "principles of design" OR "design guideline") OR AB=("design principle" OR "designprinciple" OR "principles of design" OR "design guideline"))
ProQuest	(TI("design research" OR "Design-Based Research" OR "DBR") OR AB("design research" OR "Design-Based Research" OR "DBR")) AND (TI("design principle" OR "designprinciple" OR "principles of design" OR "design guideline") OR AB("design principle" OR "designprinciple" OR "principles of design" OR "design guideline"))

4.3 Eligibility Criteria (Inclusion/Exclusion)

To ensure consistency, transparency and relevance throughout the review process, predefined inclusion and exclusion criteria were applied (see Table 2). These criteria, derived from the research aim and questions, serve to establish the boundaries of the scoping review and guide both reviewers and readers in understanding the scope and focus of the study. Based on the research questions, studies had to meet the following formal criteria to be included, otherwise they were excluded from the scoping review:

Table 2: *Inclusion and exclusion criteria used for study selection in the scoping review*

Inclusion criteria		**Exclusion criteria**	
I1	The article is written in English.	E1	The article is not written in English.
I2	The article has been published in a peer-reviewed journal.	E2	The article is not published in a peer-reviewed journal.
I3	The article is not a duplicate; in case of duplicates, only the first occurrence is included.	E3	The article is a duplicate; only one version is included.
I4	The article is about design principles of a(n) design/environment/intervention.	E4	The article is about principles of DBR, not about design principles of a(n) design/environment/intervention.
I5	The title or abstract indicates that design principles are applied, developed or theoretically examined in depth within the article. This includes references to the definition of design principles, their derivation or the explicit formulation of design principles derived from a study or theoretical framework.	E5	The title or abstract merely mentions design principles, suggesting that they could potentially be derived in future work. However, no actual derivation, application or in-depth theoretical engagement with design principles is undertaken within the article.
I6	The search query '(design research/Design-Based Research/DBR) AND (design principle/designprinciple/principles of design/design guideline)' is fulfilled.	E6	The search query '(design research/Design-Based Research/DBR) AND (design principle/designprinciple/principles of design/design guideline)' is not fulfilled as the terms do not appear together (title and abstract included).

The applied criteria were designed to ensure that the selected studies are not only methodologically sound but also substantively relevant to the aim of this scoping review. Formal aspects such as language (I1/E1)

and peer-review status (I2/E2) ensured accessibility and academic quality. Duplicate records (I3/E3) were excluded to avoid distortions in the data set. Substantive criteria (I4–I6) were formulated to focus the review on studies that interact deeply with DP in the context of DBR. For example, I4 and E4 distinguish between general principles of the DBR methodology and concrete DP of specific interventions. Criterion I5 requires a deeper conceptual or empirical engagement with DP. Articles were excluded (E5) in the case that DP were merely mentioned or only briefly referenced. I6 ensures that only studies explicitly addressing both DBR and DP are included, as indicated by their co-occurrence in the title or abstract, otherwise they were excluded (E6). This step was necessary because some databases automatically include keywords in the search, not just titles and abstracts, which could affect the retrieval of relevant records.

4.4 Reference Management, Screening and Data Extraction

To manage the search results and systematically apply the inclusion and exclusion criteria, a combination of digital tools was employed. Initially, the records retrieved from the databases were imported into Citavi to identify and to remove duplicates. During this step, the completeness of bibliographic data was also verified. Missing information — particularly abstracts, author names, or publication years — was manually completed wherever possible.

The cleaned dataset was subsequently imported into Rayyan, an AI-assisted tool for systematic screening, to conduct a structured title and abstract review. Additional duplicates were detected and removed using Rayyan's automated functionality. The inclusion and exclusion criteria were then applied through a double-coding process by at least four reviewers, ensuring that all abstracts were independently assessed. Cases of uncertainty were flagged and subsequently resolved through consensus coding, resulting in a high level of intercoder agreement. While formal metrics of intercoder reliability (e.g., Cohen's κ) were not calculated, the independent double-screening combined with consensus resolution suggests a high degree of reliability in the screening process. The final dataset was prepared for subsequent analysis.

4.5 Data Analysis

The analysis was conducted in MAXQDA, drawing on a structured dataset in which each abstract was imported as an individual document containing bibliographic metadata such as title, authors, publication type, year and keywords. Based on the research questions, a deductive category system was developed in advance. This system comprised seven main categories:

- Year of publication

- Scientific field
- Educational reference
- Research design terminology for DBR
- Concepts and products of design
- Type of contribution (e.g., empirical or theoretical contribution)
- Sentences with the term ‘design principles’ (e.g., use of verb).

During the coding process, these main categories were further differentiated inductively through the creation of subcodes. Each main category included a subcode labelled ‘not apparent/not specified’ to transparently indicate when information on that category could not be derived from the abstract[4]. Three researchers were involved in the coding process, with a 50 % overlap of abstracts aimed at enhancing coding reliability. Cases in which uncertainties arose were flagged and subsequently coded through consensus, ensuring uniformity in coding decisions. Entire documents were coded per category in order to treat each article as a distinct case within the analysis, allowing for frequency-based evaluations.

Statistical procedures and calculations focused primarily on the analysis of document variables and code frequencies. This involved the creation and interpretation of frequency tables, which helped to systematically capture and compare the occurrence of specific codes across the dataset. The results provided a structured overview of key patterns within the material and served as a basis for further interpretation.

To explore how DP are addressed in the context of DBR in academic publications, a qualitative content analysis was carried out (Kuckartz & Rädiker, 2022). The focus was placed on identifying verbs directly linked to the term ‘design principles’ within the abstracts.

The analysis is based on the assumption that verbs in scientific texts provide indications of the epistemic role and functional use of a concept (Halliday & Martin, 1993, as cited in Thompson, 1996). It is assumed that by examining the verbs associated with the term ‘design principles’, it becomes apparent which actions, processes, or meanings are attributed to the concept in the respective study. For instance, it can be expected that specific verbs indicate whether DP are understood and used as outcomes, methodological tools, or theoretical foundations. The verb analysis thus serves as an entry point to examine the functions that DP fulfil in different research designs and contexts.

In the first step of the analysis, all sentences from the abstracts that included the term ‘design principles’ were coded, resulting in 585 segments. In the second step, these coded segments were examined in

[4] A distinction is made here as to whether no allocation could be made during coding because it was not apparent for the coders, or because it was not explicitly mentioned in the abstract and therefore could not be specified.

more detail to identify the verbs used in relation to DP – specifically focusing on their function within the respective studies (e.g., whether they were developed, derived, applied, or adapted). The verbs were not pre-selected but were extracted inductively from the corpus to ensure that the full variety of action-related expressions associated with DP could be captured empirically.

In the next step, the identified verbs were clustered according to the types of practices or actions they represent within the research process. The aim of this clustering was to consolidate semantically related actions involving DP and to reveal the functions and meanings attributed to them across the studies. The clusters were developed on the basis of semantic similarities between the verbs, following a combined inductive/deductive approach. This approach drew on both the empirically observed verb usages in the abstracts and theoretical considerations of central processes and functions of DBR (Feulner et al., 2021; Euler, 2014).

In cases of semantic ambiguity, where a verb could potentially be assigned to more than one cluster, the surrounding sentence context was examined. Each verb was then classified according to its most frequently observed functional role across the corpus to ensure a consistent and transparent categorisation.

5.0 Results

5.1 Overview of Included Studies

A total of 1,050 records were identified through database searches conducted on 8 April 2024, across the following platforms: Scopus (n = 726), ERIC (n = 273), Web of Science (n = 28) and ProQuest (n = 23). After removing 218 duplicates, 832 individual articles remained for screening based on titles and abstracts. In Rayyan, 385 articles were excluded based on the predefined eligibility criteria, resulting in 447 records being included for further analysis. These 447 abstracts were imported into MAXQDA. During the coding process, 22 were found not to meet the inclusion criteria and were excluded. The final dataset thus comprised 425 abstracts. Figure 1 illustrates the study selection process.

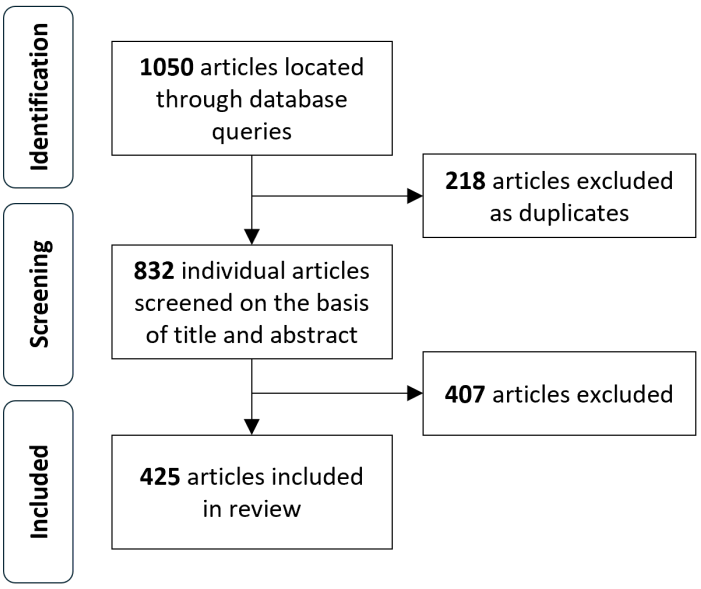

Figure 1: *Flowchart of the study selection process*

The following section provides the results of the scoping review, with the research questions reported in sequence.

5.2 Extent and Context of the use of the Term 'Design Principles' in the Context of Design Research

This section addresses the primary research question concerning the extent and context to which the term 'design principles' is used in the context of design research.

a) Analysis of Publication Trends

The first of the guiding subquestions focuses on when and to what extent relevant publications appeared, prompting an analysis of publication trends. Based on the specified search criteria, the scoping review reveals a steady increase in relevant publications over time (see Fig. 2). While only isolated publications appeared before 2010, the number of relevant studies began to rise significantly from 2012 onwards. From 2015 onwards, annual counts exceed 20 publications and continue to climb steadily. The peak occurred in 2022, with a total of 66 publications, followed closely by 56 in 2023. As of 2024, 16 publications have been recorded so far. Given that the search was conducted on 8 April 2024, this number has most likely increased.

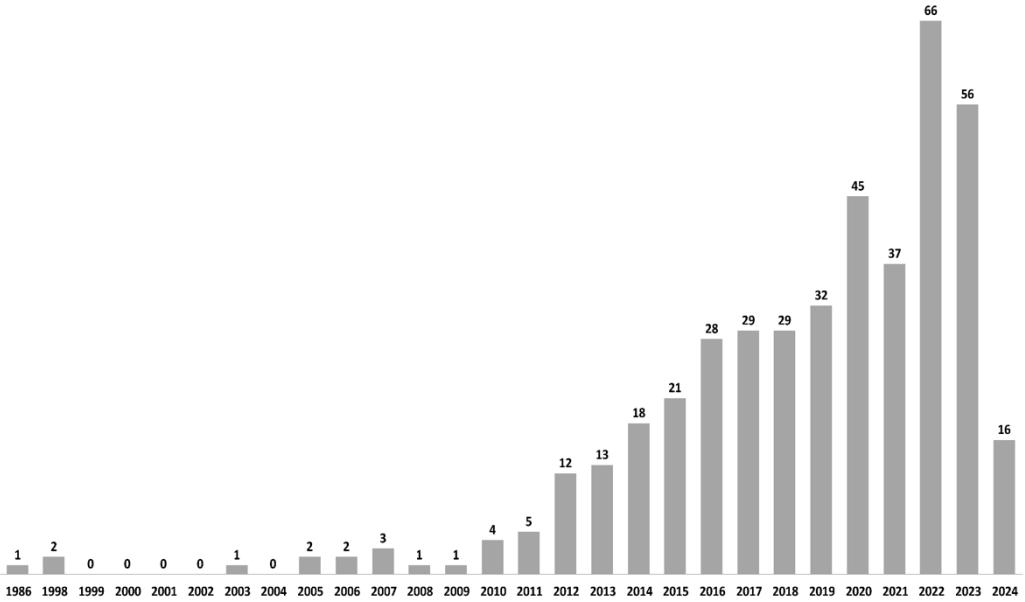

Figure 2: *Number of publications per year*[5]

b) Analysis of the Scientific Fields

This section presents the analysis of the second subquestion regarding the scientific fields in which the identified publications are situated. The publications meeting the specified search criteria are primarily concentrated in the field of *educational sciences/educational* research, followed by *subject didactics* and *information and management research*. Additional fields include *engineering and computer science*, *medicine* and *health*. Smaller clusters appear in *linguistics*, *product design (including digital products)*, *vocational training/workplace learning* and *economy*. Fields like *applied sciences*, *financial education/business administration* and *psychology* each contributed five publications, while *architecture*, *biology*, and *risk and crisis management* each accounted for four publications. Two publications could not be clearly assigned to a specific field (*not apparent*) or fell into less common areas such as *urban planning* (see Table 3).

The distribution shows that DP-related Design-Based Research is concentrated within educationally oriented disciplines, while also indicating that the methodological approach is being applied across a diverse range of scientific fields. It was found that there were many applications associated with digital education. The category designated as *educational sciences/educational research* emerged as the most frequent one.

[5] For reasons of readability, the years between 1986 and 1998 have been omitted from the chart. This might give the impression of an uninterrupted timeline. Readers should be aware that this omission reflects a formatting decision rather than a continuous flow of data, and there is, in fact, a significant publication gap during those years.

Table 3: *Scientific fields*[6]

Scientific fields	Number
Educational sciences/educational research	164
Subject didactics	98
Information and management research	60
Engineering and computer science	23
Medicine	16
Health	10
Linguistics	9
Product design (including digital products)	8
Vocational training/workplace learning	7
Economy	7
Applied sciences	5
Financial education/business administration	5
Psychology	5
Architecture	4
Risk and crisis management	4
Not apparent	2
Urban planning	1

In order to gain deeper insights into the subject-specific orientation of didactics research, the 98 publications assigned to the category of *subject didactics* were further differentiated by didactic disciplines (see Fig. 3). This provides a more detailed understanding of the specific subject areas covered within didactics research.

[6] It was possible to assign more than one code from the scientific fields-category to a single abstract during the coding process (for instance one abstract was assigned with the codes *educational sciences/educational research* and *subject didactics*) resulting in a slightly higher number of total codes (432) than the number of coded abstracts (425).

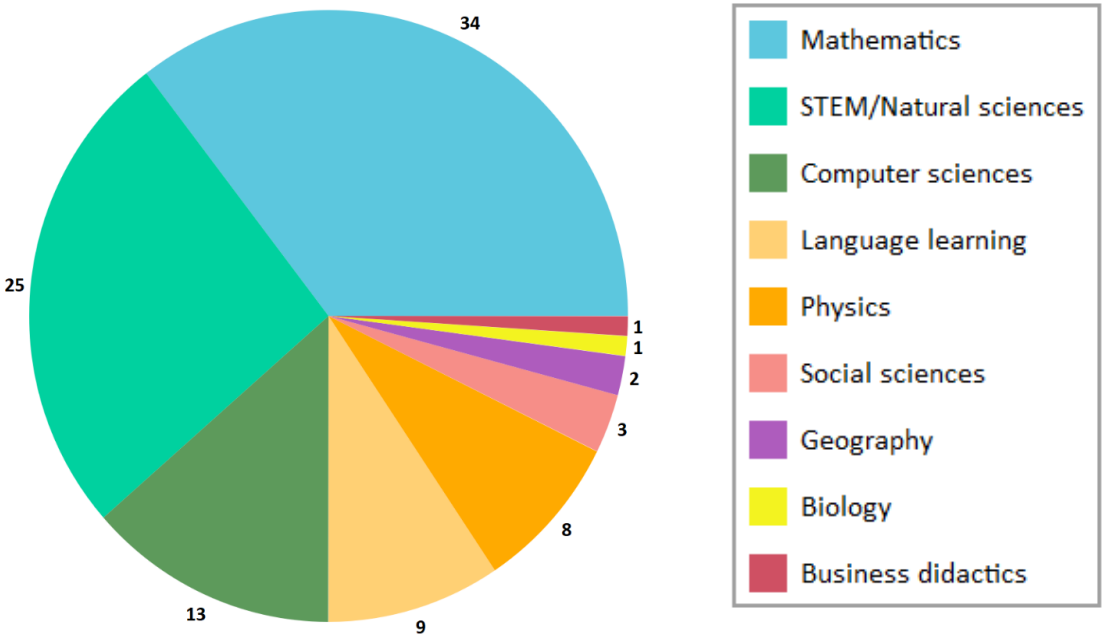

Figure 3: Field of subject didactics

The analysis demonstrates a pronounced concentration in the field of *mathematics* education, which accounts for the largest proportion of publications. Subsequently, contributions are made from a more extensive field of *STEM/Natural sciences*, and from the discipline of *computer science* education. *Language learning* and *physics* education are also represented in the dataset. Other disciplines such as the *social sciences*, *geography*, *biology*, and *business didactics* are represented only marginally.

To gain a more detailed understanding of the articles related to education, their foci were further coded to examine the specific institutions and contexts in which they were applied or studied (see Fig. 4). This categorisation allows us to identify the areas of education where research activity is most concentrated when dealing with educational issues.

The distribution of publications across educational contexts shows a strong emphasis on formal educational settings (see Fig. 4). *School* contexts are the most prominent with 135 publications, closely followed by *university/college* contexts with 130 publications. Together, these two categories account for the vast majority of education-focused articles.

In contrast, *adult education/vocational training* appears in 24 articles. A number of publications (20) do not specify a particular educational setting (in the title or abstract of the publication), while *general educational contexts* – including interdisciplinary or unspecified institutional settings such as extracurricular places of learning, museums, or citizen science – were identified in 17 articles. Finally, *preschool education* is the least addressed.

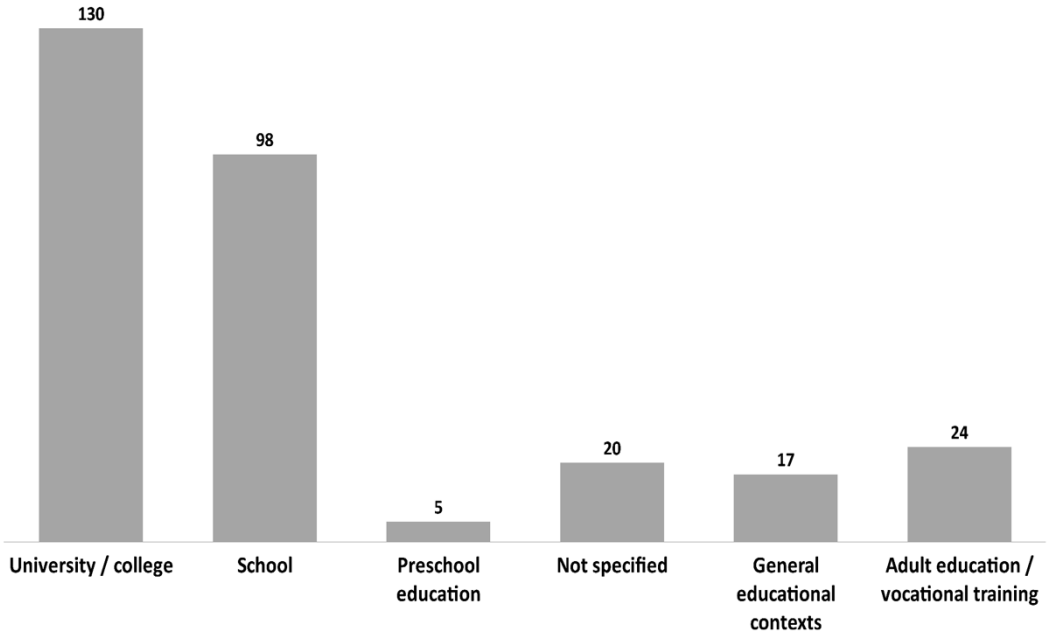

Figure 4: *Education sector*

c) Identifying Different Concepts and Products of Design

The concepts and products that 'design' refers to in studies working with DP are examined in order to address the next subquestion. For the purpose of analysis, the various subcodes were categorised in order to ensure that each category comprised a range of design foci. Table 4 provides a detailed overview of the different design foci in the publications examined.

Table 4: *Nature of the designs*[7]

Concepts and products of design	**Number**
Teaching concepts and curricular design	203
Digital technologies and media	104
Non-educational process models	55
Digital and blended learning concepts/products	49
Products and instructions for product design	17
Other	1

[7] It was possible to assign more than one code in this category to a single abstract during the coding process resulting in a higher number of total codes (429) than the number of coded abstracts (425).

The analysis shows that *teaching concepts and curricular design* constitute the most frequently referenced categories, followed by *digital technologies and media*, *non-educational process models* and *digital and blended learning concepts/products*. Finally, *products and instructions for product design* were mentioned in 17 instances.

d) Types of Engagement with Design Principles: Empirical, Theoretical, Conceptual

Addressing the subquestion 'Is the article's engagement with design principles primarily empirical, theoretical, or conceptual?', the abstracts were coded accordingly.

During the coding process, a number of subcodes were created, which are categorised as follows (including the number of contributions allocated to the categories):

- conceptual: preliminary stage of an empirical study (3)

- empirical (383)

- theoretical contribution (25)

- not apparent (9)

The majority of the studies (383) are in the field of empirical work, justifying a closer look at these contributions. In the empirical studies, a subdivision was made according to the research method employed (see Fig. 5). The majority of studies use qualitative research methods, followed by those using mixed methods and studies using quantitative methods. However, in 201 documents, the research methodology was not specified in the title or abstract, which limited the analysis.

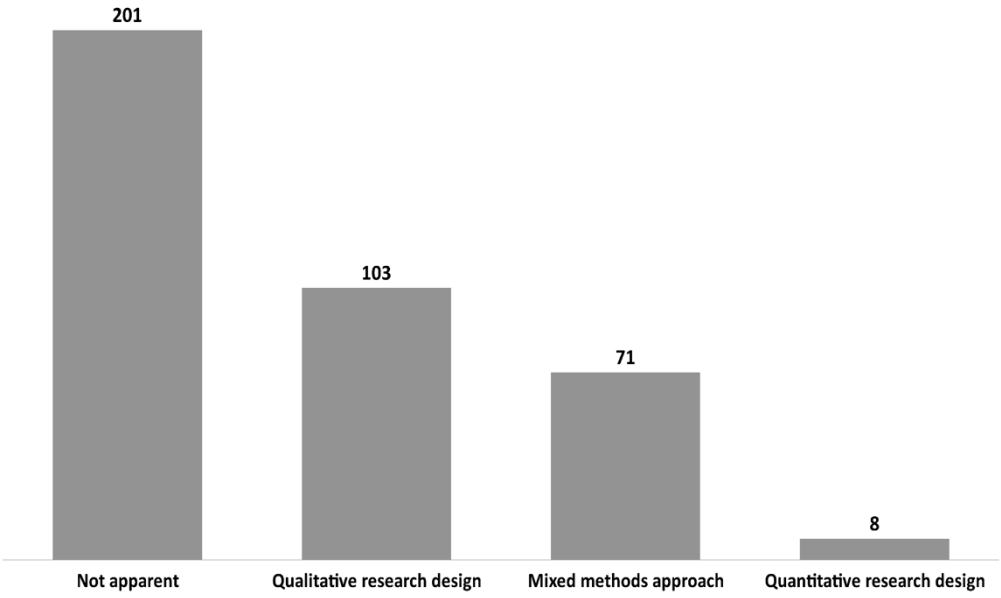

Figure 5: *Research methods*

5.3 Ways in which the Term 'Design Principles' is used and described in the Context of Design Research

This section addresses the second research question concerning the ways in which the term 'design principles' is used and described in the context of design research.

e) Frequency of Verb Usage

The frequency of verbs is considered meaningful, as recurring expressions across multiple abstracts suggest shared conceptual understandings and typical research practices related to DP. It is evident that there are discernible frequencies in the utilisation of specific verbs, as illustrated in Figure 6. The following figure illustrates the 15 most frequently used verbs in relation to DP:

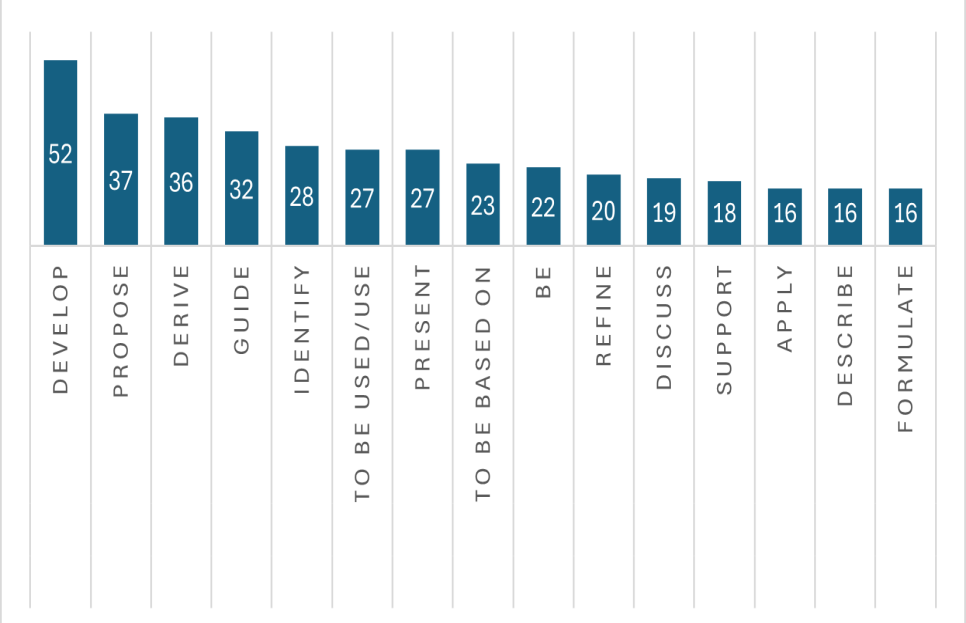

Figure 6: *Frequency of verb usage in relation to design principles*

The frequency distribution of the verbs shows that the central form of action in dealing with DP in DBR is their development. Many studies focus on the conception and further development of DP, as indicated by the frequent use of verbs such as *develop, identify* and *formulate*. With 52 coded segments, the verb *develop* is by far the most frequently used. This is illustrated by the following anchor example:

'... we developed a set of design principles that reflect key elements of effective GIS-driven content instruction, which guided the adaptation of the design framework.' (James et al., 2020, abstract[8])

[8] All citations refer to the author, year, and abstract. Page numbers are not available due to the exclusive use of abstracts in the analysis.

The repeated utilisation of the verb *propose*, as evidenced by phrases such as 'propose design principles' or 'propose a design framework', signifies that in numerous studies, DP are presented as a consequence of the research process. The verbs *apply, be used/use* and *guide* are frequently found in the context of DP indicating their role in the design of learning environments, didactic concepts or digital tools. The verbs *discuss* and *describe* appear less frequently in studies on DP suggesting that reflexive or critical-analytical perspectives are less commonly addressed.

f) Semantic Clusters of Verb Usage in Relation to Design Principles

A total of eight thematic clusters and one additional cluster, labelled 'Other/Not Assigned', were identified (see Table 5). The latter includes solely the verbs *to be* and *to result*, which could not be clearly assigned to a specific semantic category. The following table presents a detailed overview of the clusters, including their conceptual rationale:

Table 5: *Thematic clusters of the verb analysis*

Cluster	**Rationale**
1. Development & Conception	This cluster encompasses verbs that denote the active development or elaboration of design principles (e.g., *to develop* or *to formulate*).
2. Derivation & Elicitation	This cluster comprises verbs denoting the theoretical, empirical, or practice-based derivation of design principles (e.g., *to derive*, *to identify* or *to extract*).
3. Application & Implementation	This cluster encompasses verbs that describe the role of design principles as guiding elements in the design process. For example, verbs such as *to address*, *to apply* and *to inform* fall into this category.
4. Evaluation & Validation	This cluster comprises verbs denoting empirical testing, validation or assessment of design principles (e.g., *to evaluate* or *to explore*).
5. Research outcome & Communication	This cluster comprises verbs that present design principles as outcomes of the research process, including such verbs as *to propose*, *to present* and *to describe*.
6. Adaptation & Modification	The cluster underscores the role of design principles as dynamic tools, subject to iteration, adaptation, or refinement (e.g., *to adopt* or *to explicate*).

7. Role of Design Principles in the DBR process	This cluster is concerned with verbs that describe the role of design principles within the research process itself. Examples of such verbs include *to guide* and *to inform*.
8. Other/Not assigned	This cluster contains verbs that could not be clearly categorized or whose contextual meaning remains ambiguous (e.g., *to be* or *to result*).

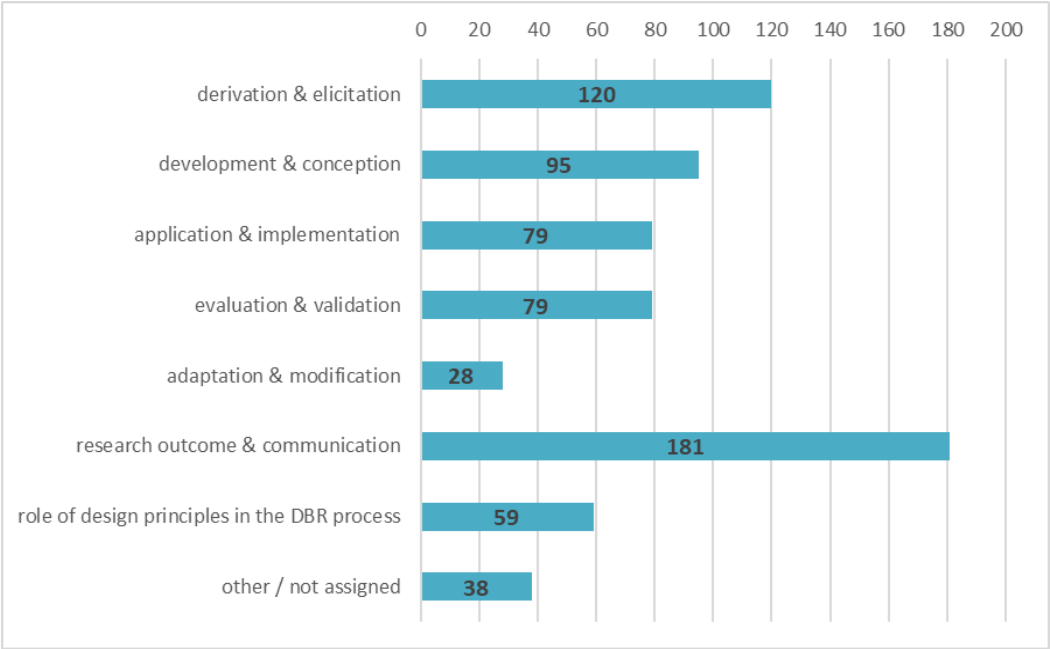

Figure 7: *Coded segments per cluster*

With 181 coded segments, the *Research outcome & Communication cluster* contains the largest number (see Fig. 8). DP appear as research outcomes in several DBR studies. This function of DP is particularly evident in the frequency of specific verbs within the *Research outcome & Communication cluster*. The most frequently used verbs such as *propose, present, provide, contribute* and *discuss* (see Fig. 8) – reflect different ways of making 'new' knowledge visible. This indicates that DP are actively brought into scientific discourse, rather than merely mentioned in abstracts: They are offered for discussion (*discuss*), made available (*provide*), or framed as a contribution to research (*contribute*).

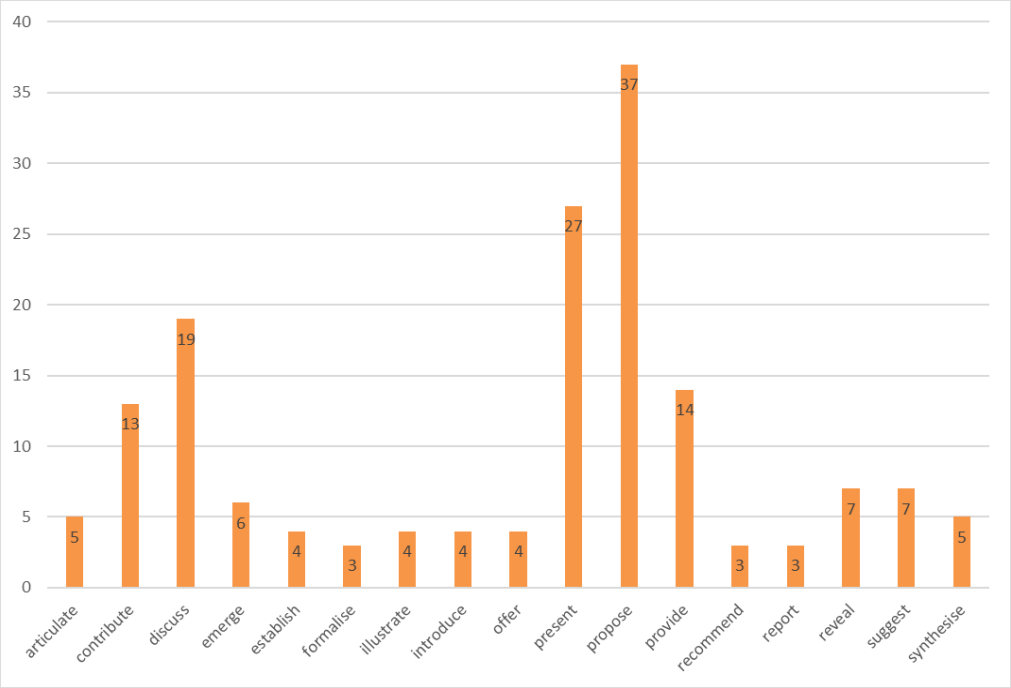

Figure 8: *Verb frequency within the cluster Research outcome & Communication*

Analysing the most frequently used verbs in the cluster *Derivation & Elicitation – derive, identify* and *be based on* – suggest that DP are described as being derived from theory, empirical data or experience (see Fig. 9). The verb *derive* is primarily used in this way. This is illustrated by the following anchor examples:

'...derive a set of initial design principles, based on insights from literature and own exploratory case studies.' (Bitzer et al., 2016, abstract)

'...drawing on design principles derived from both academic literature and practical experience.' (Beer et al., 2014, abstract).

The phrase *to be based on* explicitly indicates that DP are grounded in existing theories and concepts, as demonstrated by: 'We identify the following new design principles based on CBR theory' (Tawfik et al., 2020, abstract).

In contrast, the verb *identify* is often used in literature reviews or theoretical groundwork to denote the extraction of DP. For example: 'We conducted a literature review to identify preliminary design principles.' (Cai et al., 2023, abstract) and 'This study attempted to identify a set of principles that can underpin the design.' (Cremers et al., 2016, abstract).

The linguistic patterns show that DP are often described as being grounded in existing theories, concepts, and studies.

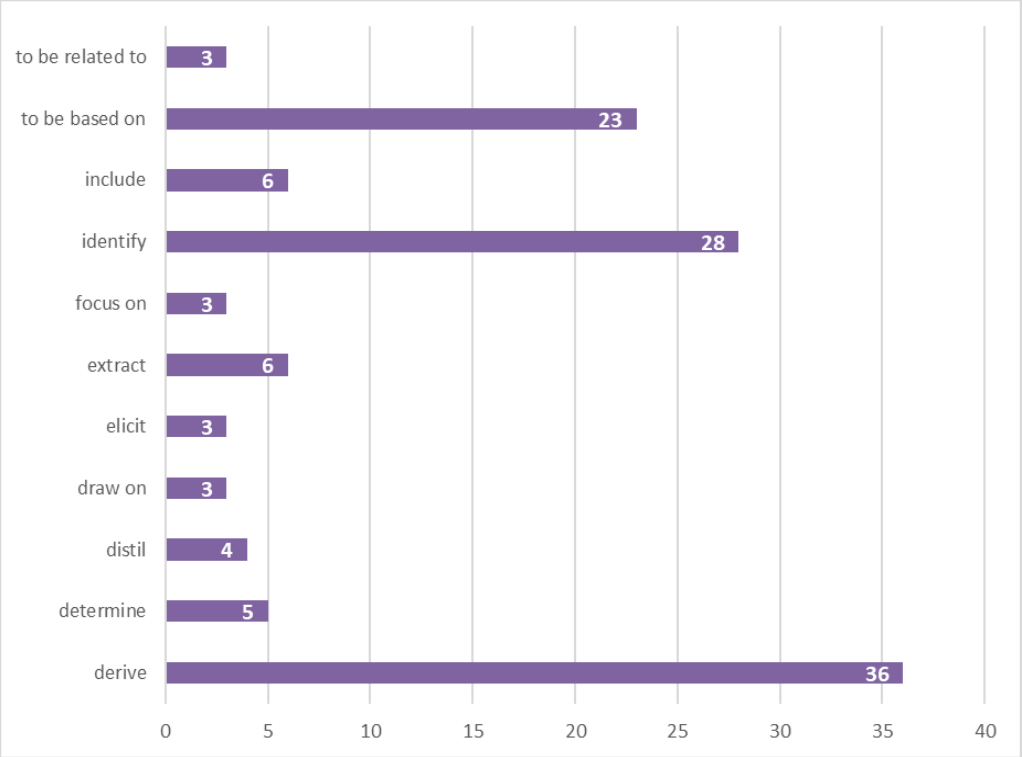

Figure 9: *Verb frequency within the cluster Derivation & Elicitation*

The *Development & Conception cluster* is evidently dominated by the verb *to develop* (52 occurrences) (see Fig. 10). This high frequency underscores the central role of the development process of DP within DBR. Verbs such as *formulate, create* and *conceptualise* are frequently used in connection with DP and indicate their constructive orientation. The verb *produce* (eight instances) is employed particularly in contexts that emphasise technical innovations, digital tools, or application-oriented formats.

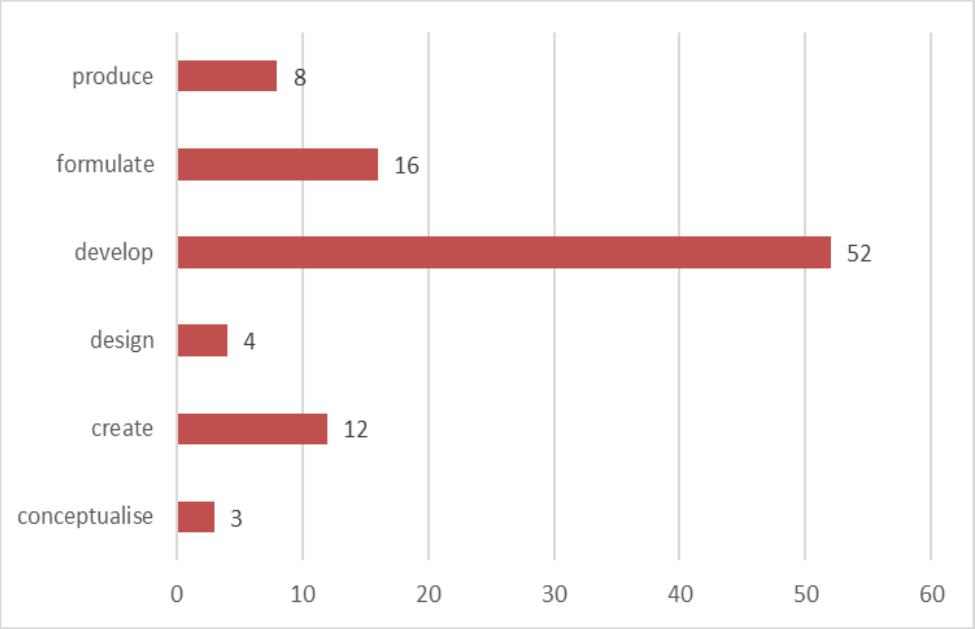

Figure 10: *Verb frequency within the cluster Development & Conception*

In the *Application & Implementation cluster*, the most frequently occurring verb is *guide*, appearing 32 times (see Fig. 11). In several cases, the verb *guide* appears in relation to DP and is used in the context of shaping and developing the product. The following anchor examples illustrate this point:

'...we argue that design principles can be used to guide the design and development of learning environments.' (Herrington & Reeves, 2011, abstract)

'...suitable pedagogical design principles to guide the construction of hybrid learning spaces for today's university students.' (Kauppi et al., 2020, abstract)

The verb *guide* also appears in contexts where DP are linked to the transfer of the developed product to other contexts. The following two examples present this use:

'...we present design principles that can potentially guide the development of methods suitable for other contexts.' (Philipp et al., 2023, abstract)

'Our primary research contribution is a set of design principles that guide software providers.' (Giessmann & Legner, 2016, abstract)

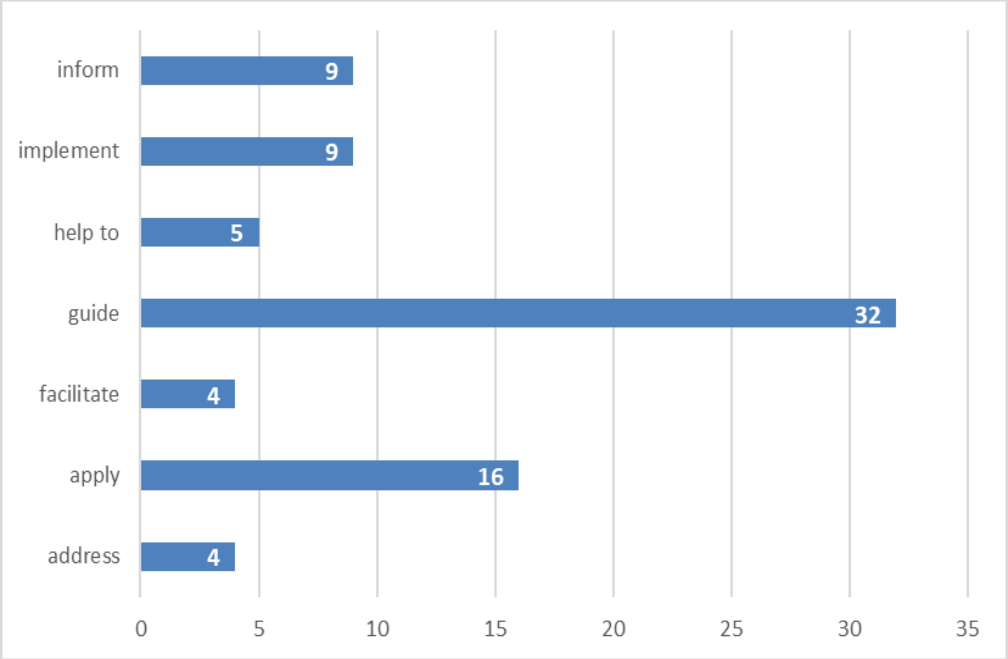

Figure 11: *Verb frequency within the cluster Application & Implementation*

The *Evaluation & Validation cluster* refers to the process in which established DP are empirically tested within the DBR study. The verbs allocated to this cluster demonstrate varying emphases in the associated research practices. One verb that merits particular attention is *to refine* (see Fig. 12). Its usage indicates the progressive specification and further development of DP throughout the research process. The subsequent anchor example will illustrate this usage:

'...we first used existing literature to construct an initial version of task design principles which we then empirically tested and refined…' (Komatsu et al., 2024, abstract)

The verbs *investigate, test, evaluate, validate,* and *analyse* indicate a research-oriented, evaluative engagement with DP. In essence, these verbs reflect a research logic in which DP are empirically examined – a process that constitutes a core component of the iterative development within the DBR framework.

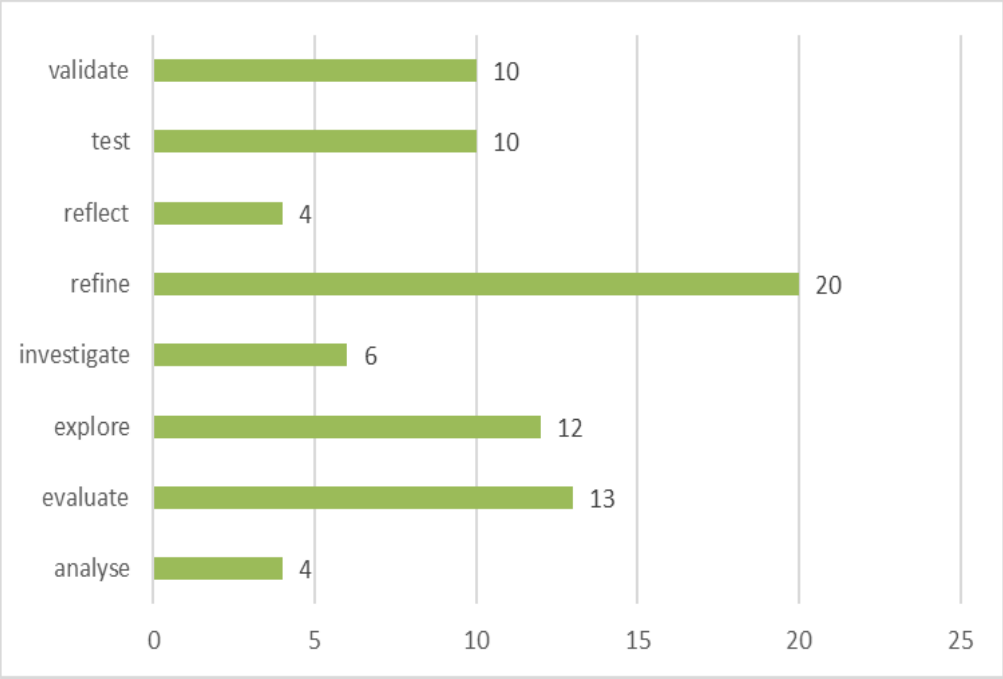

Figure 12: *Verb frequency within the cluster Evaluation & Validation*

The *Adaptation & Modification cluster* highlights a core feature of DBR: the iterative refinement of both the designed artefact and the underlying DP, aiming to adapt them to the needs of specific target groups. With regard to segment count, this is the smallest cluster, with the verb *improve* being the most prevalent (see Fig. 13). This verb reflects the aspiration for continuous enhancement, which is inherent to the cyclical nature of DBR. The objective is to adjust, to refine, and eventually to articulate the DP through an iterative process:

'They then improve the design principles iteratively in expert workshops […]' (Bitzer et al., 2016, abstract)

The verb generate also appears in this cluster, indicating that DP may emerge from the testing and evaluation of the developed artefact:

'Findings generated contextual design principles to optimize the Maker Days.' (Naghshbandi, 2020, abstract)

The verb *explicate* is used in contexts where DP are made perceptible and intelligible through iterative insights. The verb *adapt*, in turn, primarily refers to the contextual adjustment of both DP and artefacts to meet specific requirements or audience needs:

'…the initial design principles and key elements of a professional learning programme adopted to support teachers.' (McLoughlin et al., 2024, abstract)

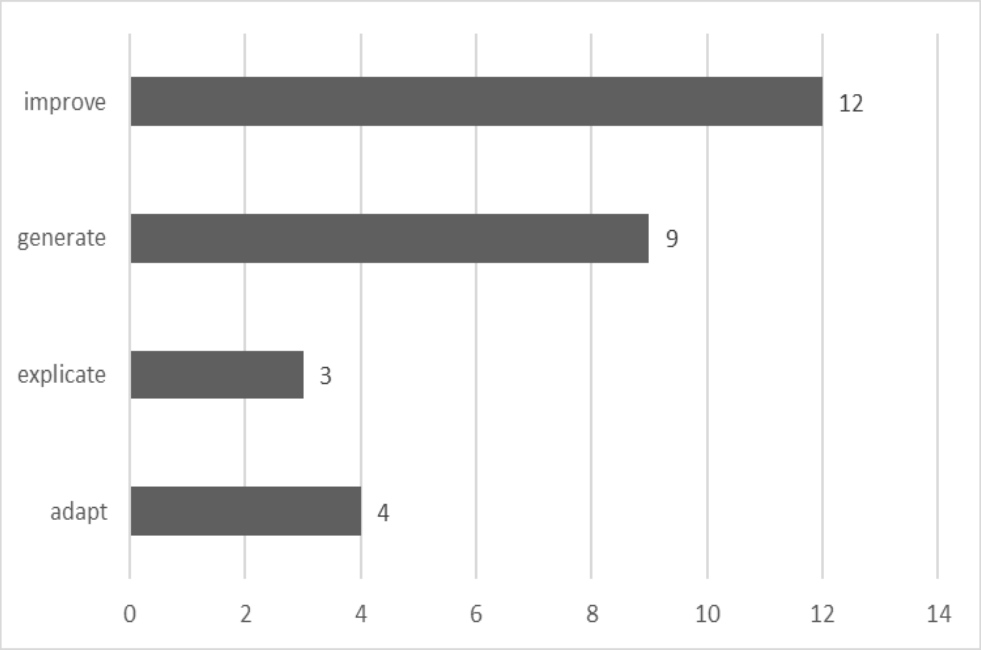

Figure 13: *Verb frequency within the cluster Adaptation & Modification*

The *Role of Design Principles in the DBR process cluster* differs from the other clusters in that it cannot be clearly assigned to a specific phase within the DBR process. Conversely, the verbs grouped in this cluster emphasise the supportive function of DP within the research and development process (see Fig. 14). This supportive role is evident, for instance, in the verb *support*, as illustrated in the following example:

'The design principles will also support researchers and practitioners in the development.' (Graham et al., 2023, abstract)

In a similar manner, the verb *serve* highlights the guiding function of DP in design-related decision-making:

'…design principles that serve as commitments for designing for teacher change and student learning.' (Miller et al., 2021, abstract)

The verb *aim* similarly underscores the application of DP with a particular goal or intention in mind:

'…design principles for technology-supported physical education courses that aim to increase university students' PA knowledge, motivation and levels.' (Sultoni et al., 2022, abstract)

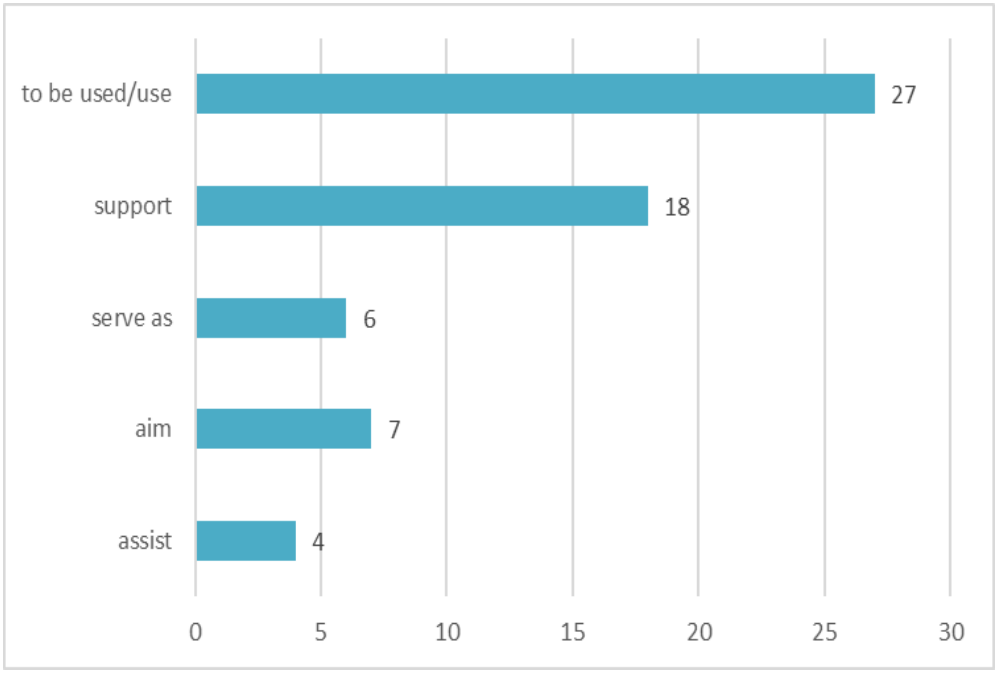

Figure 14: *Verb frequency within the cluster Role of Design Principles in the DBR process*

6.0 Discussion

This section provides an analysis of our findings and initiates a discussion of these related to the use of the term 'design principles' within the context of Design-Based Research. In response to the initial research question (*To what extent and in which contexts is the term 'design principles' used in titles and abstracts of peer-reviewed English-language publications within the context of design research?*), the analysis indicates that the term 'design principles' is extensively utilised across a diverse array of publications in DBR, exhibiting an increasing trend in frequency. The growing frequency of publications may reflect not only the increasing establishment of DBR as a recognised research methodology, but also a broader trend towards practice-oriented, intervention-based research across educational and related fields.

The analysis reveals a pronounced concentration of research activity within the domains of *educational sciences/educational research* and *subject didactics*. This pattern suggests that there may be a particular emphasis on the formulation and use of DP in these disciplines, serving as conceptual tools to support both the development of practical products and the systematic documentation and theorisation of design decisions (Euler, 2014). Particularly in the often complex teaching and learning situations with unique settings, DP could help enhance the transparency, standardisation, and transferability of design decisions. This finding is consistent with the observation that the majority of products developed address the concepts of teaching and curricular design (Tinoca et al., 2022; Zheng, 2015). Technological advancements

and the digitalisation of education may have further contributed to the greater prominence of design-oriented research questions, particularly in *subject didactics* and *educational sciences/educational research*. The findings contrast with the relatively low representation of fields such as *medicine*, *economy* or *financial education/business administration*. This disparity might be due to differences in methodological traditions and preferences. While DBR's iterative, context-sensitive approach aligns well with educational research, other disciplines may favour alternative design or evaluation methodologies.

A more detailed look at the field of subject didactics reveals that DBR studies employing DP are particularly concentrated in *STEM* subjects, especially *mathematics*, the *natural sciences*, and *computer science* education. Tinoca et al. (2022) arrived at a similar conclusion in their systematic review of DBR in the field of education. This concentration may reflect the strong tradition of design-oriented, intervention-based research within these disciplines. In physics education research in particular, this long-standing tradition has been discussed in detail by Haagen-Schützenhöfer et al. (2024).

The findings also show a clear concentration of DBR studies using DP in formal education contexts, particularly *schools* and higher education institutions (*university/college*). This may reflect the structural proximity of these sectors to academic research as well as the suitability of their relatively controlled learning environments for the iterative, intervention-based approach characteristic of DBR. By contrast, the limited representation of *preschool education*, *adult education/vocation training* and informal learning contexts might be due to more complex access conditions, greater heterogeneity of settings, or weaker integration of DBR as a methodological framework within these sectors. This suggests potential for future research to explore the applicability and value of DBR and DP in these underrepresented educational areas.

Regarding the different concepts and products of design, the results suggest that a significant proportion of research employing DP in DBR centres on the development or enhancement of *instructional teaching concepts and curricular designs*. The other focus on *digital technologies and media* and *digital and blended learning concepts/products* highlights the importance of digital tools and platforms as key design objects. The identification of *non-educational process models* suggests that some research applies DBR with DP to, for example, economic contexts (often organisational or procedural) outside of formal education. This illustrates the variety of ways in which design is implemented within DBR, ranging from practical applications to theoretical investigations, spanning educational and non-educational contexts.

A clear trend emerges regarding study typologies: Empirical studies strongly dominate, while purely theoretical contributions remain comparatively rare. This distribution reflects the practice-oriented, iterative character of DBR, where the development, testing, and refinement of designs are central (Hanghøj et al., 2022). However, the low

number of theoretical works might indicate a gap in the systematic conceptualisation and theorisation of DP.

The limited ability to determine the research design in many cases means that no firm conclusions can be drawn regarding methodological preferences within DBR studies using DP. While the identifiable designs hint at a tendency towards qualitative and mixed methods approaches – which aligns with the iterative and context-sensitive character of DBR – these findings must be interpreted with caution. It is worth noting that Tinoca et al. (2022), in their systematic review on DBR in education, arrived at very similar findings, with qualitative research methods and mixed methods approaches being represented in nearly equal proportions in the data, and only a small number of publications using a purely quantitative methodological approach.

In addressing the second research question – namely, *in what ways is the term 'design principles' used and described in titles and abstracts of peer-reviewed publications within the context of design research?* – a number of key findings can be derived from the verb analysis and the seven thematically constructed clusters.

The verb analysis reveals that DP play a dominant and multifaceted role throughout the research process in DBR studies. These principles are frequently presented as part of the research outcomes and are thus included in academic publications. However, the findings also suggest that these principles have not yet been conclusively established or implemented; rather, they have been formulated as theoretical or practical propositions. In this form, they can initiate further discussion and stimulate subsequent research.

The frequency analysis of the selected verbs also shows that the primary action associated with DP in DBR is their development (Hanghøj et al., 2022). DP are often understood as something 'new' that emerges and is refined during the research process, as highlighted by the comparatively frequent use of the verbs *develop* and *refine*, which emphasise this dynamic of ongoing development. However, the analysis reveals that critical and reflective uses of verbs relating to DP are underrepresented in the abstracts, as they are rarely mentioned.

The objective of the verb clustering was to group semantically related actions involving DP and to highlight the various functions and meanings attributed to these principles across DBR studies. The largest cluster, labelled *Research outcome & Communication*, includes 181 verb occurrences, indicating that DP are frequently presented as key outcomes. While it is to be expected that academic abstracts would primarily emphasise results, it is noteworthy that DP are explicitly communicated as contributions to scientific knowledge rather than merely as tools for structuring the design process. These patterns of verb usage emphasise the communicable, transferable and theory-generating nature of DP as research outcomes.

The second-largest cluster, *Derivation & Elicitation*, reflects the theory-driven development of DP. It illustrates that DP are not only part

of the scientific outcomes but are also typically rooted in existing scientific theories and conceptual frameworks (Serwene et al., 2024).

The clusters *Development & Conception, Application & Implementation, Evaluation & Validation* and *Adaptation & Modification* all point to the role of DP in the development and refinement of a product. These clusters provide a robust foundation for the assertion that DP play a constructive role in DBR studies, in which they guide the iterative development and research process. This process commences with the initial design and testing phase, progresses through evaluation and adaptation stages, and culminates in a final product and its potential transfer to other contexts. Within this process, DP may be applied in practice to achieve concrete results or to improve a design. They can serve to test effectiveness or relevance in specific situations and also provide a framework for guiding design decisions throughout a project.

The functions mentioned above are further emphasised in the somewhat distinct cluster entitled *Role of Design Principles in the DBR process*, which highlights the supportive function of DP throughout the development and evaluation cycles. The findings demonstrate that DP serve as a versatile instrument, with their wide range of applications reflecting their agility and flexibility within DBR processes.

In conclusion, the findings presented across the analysis and discussion provide answers to both research questions, showing that DP play an increasingly prominent role in DBR studies which use them for knowledge acquisition (see inclusion criteria I5 'DP are applied, developed or theoretically explored in depth'), serving as both a conceptual anchor and a practical tool across diverse research contexts (see verb analysis and cluster building). Their extensive use signifies a notable progression in the field, indicating that, within DBR, DP have been progressively established as an instrument for the acquisition and articulation of design knowledge.

The findings also indicate that, while DBR using DP is increasingly recognised and applied across disciplines, there remains considerable variability in implementation (e.g., the range shown in this study's thematic clustering of verbs). In particular, the results suggest that current standards for applying DBR with the use of DP are not yet fully established – and perhaps should not be. Given the diversity of scientific fields, designs and contributions represented in the reviewed studies, a uniform or highly systematic approach may not only be impractical but could also limit the methodological flexibility that is central to the DBR paradigm as the wide range of implementations reflects the iterative, practice-oriented nature and context-sensitive nature of DBR itself. Therefore, it is difficult to systematically document or reflect on how DP are conceptualised, developed and tested. Nevertheless, this finding suggests a discrepancy between the theoretical principles of DBR as a rigorous methodology and its practical implementation (Hanghøj et al., 2022). We recommend further discussion to assess the need for more robust methodological guidelines and shared standards

to ensure transparency, comparability and quality across DBR studies using DP as a tool for scientific knowledge acquisition.

7.0 Limitations and Outlook

The objective of this scoping review was to achieve a more profound understanding of the visibility and potential use of design principles as reflected in titles and abstracts within the context of Design-Based Research. When conducting the scoping review, some limitations have to be acknowledged. As is typically the case with scoping reviews, the analysis described in this article does not include an in-depth examination of the quality of the studies (Sucharew & Macaluso, 2019). Despite the absence of quality assessments and syntheses, the substantial number of studies involved (n = 425) necessitated the management of a considerable volume of work. Due to this, the screening process was time-consuming and additional people were part of the process (during the screening in Rayyan and the coding in MAXQDA). As with other studies, scoping reviews are susceptible to bias, such as selection bias (Sucharew & Macaluso, 2019), even when criteria are specified (e.g., through inclusion and exclusion criteria or descriptions of the code system) (see 4.3). Although frequent close collaboration between the researchers, including joint discussions and consensus-based resolution of ambiguous cases, was intended to minimise the risk of bias during screening and coding, the potential for selection and interpretation bias remains a limitation inherent to the study design. Moreover, the search strategy and choice of databases may have influenced the disciplinary distribution of the identified studies. The inclusion of ERIC, a database that is particularly specialised in educational research publications, likely contributed to the identification of a higher number of DBR studies working with DP in the field of education.

Additionally, as the review was limited to titles and abstracts, detailed classifications of study characteristics were often not possible, and there is a risk that some interpretations or assignments may have been incomplete or inaccurate due to restrictions on the information available. This limitation became particularly evident in the attempt to analyse the methodological approaches of the studies. In addition, we are aware of several authors who work with DBR and DP, and have published in English, but whose studies did not appear in the dataset – most likely because the term ‘design principles’ was not mentioned in the title or abstract. Future research could address this limitation by incorporating full-text searches or text-mining approaches to capture relevant studies where DP play a role, but are not explicitly mentioned in titles or abstracts. Combining systematic database searches with expert-based selection or citation tracking could also help to reduce the risk of missing relevant work.

Regarding the analysis and clustering of verbs, a limitation is evident in the non-distinct allocation of verbs to the clusters. In certain instances, individual verbs have been allocated to multiple clusters, contingent on their particular usage within the abstract. Nevertheless, it can be concluded that the chosen clustering approach proved functional in generating insights related to the second research question. To gain a clearer understanding of how DP are conceptualised and applied, however, a full-text analysis would be essential.

A further limitation which should be mentioned is that scoping reviews offer a broad, descriptive overview rather than a synthesised answer to a specific question (Sucharew & Macaluso, 2019). Consequently, it is recommended that the analysis is further refined through the implementation of subsequent studies addressing specific aspects in more detail. Therefore, the subsequent section outlines areas where further research appears particularly warranted. The research gaps that have been identified encompass three interconnected yet distinct domains, each of which offers potential for advancing the understanding and use of DP in DBR.

1) Systematic literature reviews

The present scoping review has provided a valuable overview of the discourse on DP in DBR. Building on this, systematic literature reviews could offer deeper insights by including full-text analyses. Such an approach would make it possible to investigate the methodological approaches and research designs of the identified studies – an area where the present review was limited due to the focus on titles and abstracts. In addition, systematic reviews could assess the quality of the included studies, which was beyond the aims of this scoping review. This would help to better evaluate the evidence base for the application of DP within DBR.

2) Further analysis of the existing dataset

The data generated within the scoping review offer valuable potential for more detailed internal analysis. For example, differentiated time-based analyses could explore when certain topics, concepts, or design objects (e.g., digital technologies and media) have become more prominent, and how these patterns intersect with specific disciplines. Studies could also examine which terminology for DBR – such as educational design research or action design research – is predominantly used within particular academic fields, in order to identify potential disciplinary differences in the understanding and methodological orientation of DBR. Furthermore, analysing how verb usage in relation to DP has evolved over time might reveal shifts in how DP are conceptualised or applied across different phases of DBR research. Additional insights could be gained by exploring the study participants involved – for instance, which groups (teachers, students, educational experts)

are most often represented in empirical DBR studies, and whose perspectives are most frequently integrated into iterative design processes.

3) Extending DBR and DP to underrepresented contexts

Future research could explore the applicability and value of DBR and DP in underrepresented educational areas, such as informal learning contexts, early childhood education, or informal educational settings. This would help to test and to refine the approach in more diverse environments, extending its impact beyond formal schooling.

4) Towards a Deeper Linguistic Understanding of Design Principles

While the verb analysis focused on identifying and clustering verbs in relation to DP within DBR abstracts, a further linguistic analysis using Halliday's transitivity system could offer valuable additional insights (Halliday, 1973, 1985 as cited in Eggins, 1994). Such an approach would allow for a deeper examination of the underlying process types (e.g., material, mental, relational), agents, and participants involved in the actions related to DP. This could help to clarify not only what is done with DP, but also how agency and intentionality are constructed in academic discourse. Although not pursued in the present study due to scope limitations, this form of analysis would be a meaningful extension for future research.

5) Conceptual and methodological refinement of DBR with DP

A fourth area of future research concerns the understanding and function of DP within DBR studies. It would be particularly relevant to investigate which phases of the DBR process are actually addressed and made explicit in publications. For instance, it would be necessary to ascertain whether the emphasis lies on the initial formulation of DP, their final articulation or their iterative refinement throughout the research process. This line of research could assist in identifying which functions and associated practices related to DP remain underrepresented or insufficiently discussed in the published literature. The provision of such insights would facilitate a more comprehensive understanding of how DP are operationalised at different stages of DBR projects. Additionally, it would be valuable to investigate which sectors or stakeholder groups actually adopt or use the published DP, in order to determine whether they are applied, reused, or adapted in different contexts.

Furthermore, the limited number of purely theoretical works identified in this review points to a gap in the systematic conceptualisation and theorisation of DP. Given that DP are intended to bridge theory and practice, future research could usefully explore how their theoretical foundations can be developed and communicated more explicitly.

In conclusion, a nuanced understanding of DP in DBR is essential for advancing methodological rigour and theoretical clarity within this research paradigm. The present scoping review has sought to systematically examine the discourse on DP and offers valuable insights that can support researchers and practitioners to strengthen the methodological and theoretical foundations of DBR.

Acknowledgements

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