

A systematic review of research on creative thinking in primary education: Focus on empirical methodologies

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This article reviews the methodologies used in 76 empirical studies conducted on creative thinking in primary school education and published between 2011 and 2021. The studies were analysed for their context, foci of investigation and the methodologies used. Each study was coded and analysed quantitatively and qualitatively. The findings are discussed in reference to research on creative thinking and to previous relevant methodological reviews. The results showed that the country which produced the highest number of publications is China followed by the US. Most studies focused on investigating the educational factors that affect the development of creative thinking in primary education. The majority of these studies were based on quantitative approaches, with questionnaires being the most preferred data collection instrument. Based on these results, suggestions are made for future research on creative thinking in primary education.

Introduction

In recent years, creative thinking has been identified as one of the essential skills of the 21st century (Robinson, 2011; World Economic Forum, 2016, 2018). This skill is of paramount importance for the prosperity of both societies and individuals, including children. According to World Economic Forum report, 65% of children studying in primary school today will eventually work in new jobs that have not appeared yet (World Economic Forum, 2016) and which will require individuals to be creative thinkers (World Economic Forum, 2018). This is why, developing creative thinking has become a universal educational goal regardless of social or cultural contexts (Craft, 2003). Today's education is different from yesterday's education. In the past, children were asked to listen to their teachers in order to learn the necessary information that is needed to be successful in the future but today, teachers do not know the information children will need or even the questions they will face in the future (Treffinger, 2007). In addition to that, in today's world, a person who does not have the skill to think creatively is at the risk of failure in any domain (Kaufman & Sternberg, 2019). Therefore, education is urged to nurture students' creative thinking skills in order to enable them to attain success and thrive in the 21st century.

Primary school is a critical period for the development of creative thinking. There is a consensus that creative thinking applies more to primary education than to other educational levels (Smears et al., 2011; Starko, 2010). Neurologically, primary education is the basis for the development of future creative thinkers. According to Eliot (1999), the first 10 years of life is a very important period for the development of creative thinking because the brain is still wiring (Eliot, 1999). Unfortunately, after this period, the child's ability to think creatively declines because of the kind of education and culture she/he is exposed to (Hofstede et al., 2010; Kaufman, 2009; Torrance, 1970; Wilson, 2009).

Therefore, it is unlikely to have future creative thinkers if primary education does not encourage the development of this skill (Kaufman, 2018). Furthermore, future professions such as doctors, engineers, teachers, athletes, inventors, entrepreneurs and farmers are in primary school today. That is why more research should be conducted on this educational level than any other level, considering the necessity to develop creative thinking in children in order to have creative individuals and therefore a creative society. Unfortunately, according to Long, the number of studies conducted on children is still very low compared to studies on older subjects (Long, 2014).

For the purpose of this review, creative thinking is defined as the ability to produce original and useful ideas, taking into consideration the four aspects that contribute to the production of such ideas, including person, press (environment), process and product (Rhodes, 1961; Runco & Jaeger, 2012). It is worth noting that there is still no consensus on what creative thinking is. However, there is a general agreement that creative thinking refers to the ability to produce ideas that are both novel and appropriate (Runco & Jaeger, 2012). This standard definition of creative thinking which emphasises originality and appropriateness is shared by people across cultures (Niu & Kaufman, 2013). Additionally, most studies put emphasis on the usefulness and originality features of creative ideas and solutions (Ren et al., 2021). Regarding terminology, the terms creativity and creative thinking are often used interchangeably (Lucas et al., 2021). However, some scholars made a distinction between the two terms. Creativity refers to four Ps, namely person, process, press (environment) and product (Rhodes, 1961), whereas creative thinking refers foremost to an individual and their thought used to solve a given problem (Martiniano, 2016). In this paper, both terms are used and the four aspects of creativity are taken into account. Creativity as a process is often measured using tests such as *Torrance Tests of Creative Thinking* (TTCT). Creativity of a person is explored by examining the personality traits of the person using self-reports and personality scales. Creativity as a product is investigated by evaluating the product using a certain assessment technique or form. Creativity as press or context is often analysed by exploring the environmental factors that affect the promotion of this skill.

The present article is a methodological paper that reviews and analyses empirical studies on creative thinking in primary education published between 2011 and 2021. Such articles which are addressed to the community of researchers focus on methodological or data analytic approaches (American Psychological Association, 2013). This methodological review that focuses on research methodologies rather than research findings reveals the present status and trends of research, and provides recommendations that can improve research practice in various academic domains. To the best of our knowledge, methodological articles that review creativity research in primary education are almost non-existent. The current article addresses this gap. A thorough search for empirical studies on creative thinking in primary education published between 2011 and 2021 resulted in identifying 76 studies, including published studies in academic journals and gray literature.

The following questions guided this systematic review:

1. What were the general publication trends of the empirical studies on creative thinking in primary education between 2011-2021?
2. What were the foci of investigation in the empirical studies on creative thinking in primary education between 2011-2021?
3. What were the methodologies and the methods used in the empirical studies on creative thinking in primary education between 2011-2021?
4. To what extent were the methodologies used in investigating creative thinking effective?

We have to note that one of the main limitations in the current review is the possibility of missing some relevant studies unintentionally. Also, choosing only studies published in English is another limitation of the review.

In the subsequent sections of this article, we present the findings of previous methodological reviews on creativity research, a detailed description of data collection and analysis procedures for the present review, the results, a discussion of our findings and the suggested recommendations for future research.

Literature review

To the best of our knowledge, there have been four prior methodological reviews on creativity research published to date. Mayer (1999) was the first to present a report on 50 years of creativity research and summarised six methodologies used in creativity research, namely psychometric, experimental, biographical, biological, computational, and contextual. Psychometric methodology regards creative thinking as a measurable mental trait using creativity tests or questionnaires. Experimental researchers consider creativity as a cognitive process and ask participants to find solutions to problems in controlled settings. Biographical researchers investigate creativity using life stories and methods, such as case studies and historiometry. The biological approach compares the brain activities and neurological traits of creative and non-creative individuals during the process of creative problem solving and examines how biological factors influence creativity. Computational approaches emphasise the idea that an individual's creative thinking process can be conceptualized as a computer program using the principles of artificial intelligence. Researchers using contextual methodology investigate creativity in its social, cultural and evolutionary contexts and focus on context instead of individuals (Mayer, 1999). Mayer concluded that the challenge for the next 50 years of creativity researchers is to find a precise and clear definition of creativity and to use a mixture of research methodologies to allow more specification and less hypothesising (Mayer, 1999).

Two other reviewers namely, Wehner et al. (1991) and Kahl et al. (2009), analysed doctoral dissertation abstracts on creative thinking. Wehner et al. explored the limits of the field of creativity and the kind of research conducted in the academic context of the United States. The same context was investigated by Kahl et al. whose selected studies were mostly (94%) submitted by American institutions and the remaining abstracts were from Canada, Finland, the Netherlands, Sweden and the United Kingdom. The disciplines

in the sample by Wehner et al. (1991) included education, business, history and the history of science, sociology, literature and political science. More disciplines emerged from the review by Kahl et al. (2009) such as psychology, economics, social sciences, sciences and engineering, and miscellaneous category (including communications and the arts; language and linguistics; philosophy, religion, and theology). These two reviews revealed different foci of investigation. Wehner et al. (1991) found that most graduates focused on the creative process and creative individuals whereas the findings of Kahl et al. (2009) revealed that the studies place more emphasis on investigating creative products and less emphasis on creative processes. Kahl et al. also found that there was a focus on individual creativity and a decrease in creativity research in relation to culture (2009).

Another article reviewed research methodologies and methods of 612 empirical studies on creativity, published between 2003 and 2012 and compared the findings with those in gifted education (Long, 2014). This review revealed that creativity is being studied in all fields including new domains such as culinary, negotiation, sports, dealing with trauma and therapeutic intervention. It was also found that most studies on creativity were conducted in the United Kingdom, Spain, Brazil, South Korea, China, Israel, and Turkey, but very few were done in African and American countries. The review also indicated that creativity across cultures is an emerging topic and the available cross-cultural studies were limited to comparing the United States and a few Asian countries, mainly China and South Korea. Concerning methodologies, the review revealed that most studies were quantitative that used psychometric and experiment methodologies. In qualitative studies, case study was the most frequently used methodology. Besides, there were less qualitative studies and slightly more mixed-methods studies on creativity.

The reviewer recommends making a comparison between creativity research and other domains in psychology and education in addition to using ethnography to gain an in-depth understanding of the creative process, individual and environment in different cultural contexts (Long, 2014).

Method

Data collection

We searched for creative thinking studies in primary education conducted up to 31 December 2021. The search for data for the present study started with creating a list of keywords to use when searching in the databases and criteria for inclusion. The search string aimed at retrieving a breadth of published articles and doctoral dissertations related to creative thinking in primary education. We tried to include the key words used in such studies. As a result, we used the following search string: (“creativity” OR “creative thinking”) AND (“primary education” OR “primary school” OR “elementary education” OR “elementary school”). This Boolean search combination of keywords was used in six databases namely ERIC (Education Resources Information Center), Scopus, Web of Science, ProQuest, ScienceDirect, Jstore, in addition to the web search engine Google Scholar. We also checked the reference lists of the papers identified for further relevant studies. The titles and the abstracts of the studies found using the search process were

screened to make a judgment on their relevance. To shortlist the studies relevant to the review questions, we decided that the studies to include were:

- a. studies on creative thinking in primary education;
- b. published between 2011 and 2021;
- c. empirical in nature;
- d. published in English;
- e. published in academic journals or as doctoral dissertations.

Finally, the studies were analysed on the basis of full-text screening if they met selection criteria. We identified 112 studies of which 76 studies met all inclusion criteria, including 63 published articles and 13 doctoral dissertations (Table 2). Figure 1 summarises the main steps of collecting data for methodological review.

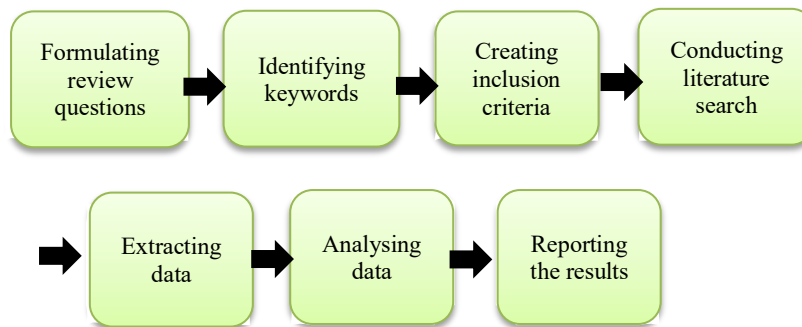


Figure 1: Steps in collecting data for the methodological review

Data analysis

After the collection of all the relevant studies, we tried to develop a descriptive summary of the studies. We created a coding scheme in order to analyse the studies for specific characteristics based on the objectives of the review. The coding process was based on Creswell's design of qualitative analysis (2016). The following information in every empirical study was identified and noted:

- year of publication
- whether it is a journal article or a doctoral dissertation
- context (the country where the study was conducted)
- focus/foci of investigation
- methodology (quantitative, qualitative, or mixed methods)
- data collection instruments

The extracted data was enlisted in a table using a Microsoft *Excel* spreadsheet. Table 1 is an example of how the studies were categorised according to the coding scheme.

Table 1: Example of the coding scheme of the selected studies for analysis

Study	Journal or thesis	Country	Focus/foci of investigation	Method	Data collection instruments
Creativity beliefs, creative personality and creativity fostering practices of gifted education teachers and regular class teachers in Hong Kong (Chan & Yuen, 2014a)	<i>Thinking Skills and Creativity</i>	Hong Kong (China)	This study investigated the relationship between teachers' creativity beliefs, creative personality, and creativity-fostering behaviors in 399 Hong Kong primary school teachers (68 M and 331 F).	Quantitative	Survey
Boys benefit more from teacher support: Effects of perceived teacher support on primary students' creative thinking (Zhang et al., 2020)	<i>Thinking Skills and Creativity</i>	China	This study explored the relationship between perceived teacher support and primary students' creative thinking as well as the mechanism underlying these associations and gender differences	Quantitative	The Perceived Teacher Support Questionnaire, Creative Self-efficacy Scale, Divergent Thinking Test, and Remote Associate Test.
Primary school teachers' conceptions of creativity in teaching English as a foreign language (EFL) in China (Wang & Kokotsaki, 2018)	<i>Thinking skills and creativity</i>	China	This research explored teachers' conceptions of creativity in primary EFL classroom, with a particular focus on the Chinese context	Qualitative	Questionnaires (consisting of 17 open-ended questions) and interviews

Concerning the study's focus or foci of investigation, if a study had many foci, we assigned a code for each focus of investigation separately. Assigned codes included "exploring the relationship between variables affecting teaching for and developing creative thinking"; "Investigating factors that influence teaching for and developing creative thinking"; "Examining the impact of a treatment on creative thinking and/or academic achievement"; "Exploring the discrepancy between two variables affecting the development of creative thinking" and "Measuring students' creative thinking".

After listing the codes, we searched for patterns in the codes and grouped them into themes accordingly. For example, the code "factors influencing teaching for and developing creative thinking" was further included under the themes of "teacher related factors"; "student related factors"; "curriculum related factors"; "school related factors"; "culture related factors"; and "teacher development programs related factors". For other research questions, further analysis was in the form of synthesis and quantitative analysis. For example, we calculated the number of studies that were quantitative or qualitative. We also reported frequencies for each of the codes and themes. The statistical analyses were carried out using *Statistical Package for Social Science* (SPSS 22).

Findings and discussion

This section offers a discussion of the major findings in the current methodological review. The discussion is done in reference to research findings on creative thinking and to the results of previous relevant methodological reviews. Finally, we formulated recommendations based on our review insights that might guide future research in this field.

General publication trends

The review identified 76 studies including 13 doctoral dissertations and 63 journal articles with the majority of the articles (n=22) published in *Thinking Skills and Creativity Journal*. The table below includes all the selected research articles and theses.

Table 2: A list of all the selected research articles and theses (N=76)

Study	Country
Adams (2013), Aish (2014), Alhusaini et al. (2014), Fiddymment (2016), Reedy (2020), Rubenstein et al. (2018), Pelfrey (2011), Skar (2018)	United States
Adiansha et al. (2021), Leasa et al. (2021), Lian et al. (2018), Weran & Kuswandono (2021)	Indonesia
Ahanadou (2017)	Cote D'Ivoire
Al-Dababneh & Al-Zboon (2017)	Jordan
Al-nouh et al. (2014), Al-Yaseen (2015), Alkhars (2013)	Kuwait
Albar & Southcott (2021), Falconer et al. (2018), Murcia et al. (2020)	Australia
Alfonso-Benlliure & Santos (2016), Fernández et al. (2019), Hernández Ortiz et al. (2020), Segundo Marcos et al. (2020), López-Martínez & Lorca Garrido (2021)	Spain
Aziza (2018), Copping (2021), Craft et al. (2013), Newton & Beverton (2012), Turner (2013), Oztop & Gummerum (2020)	United Kingdom
Chien (2019), Liu & Lin (2014), Liao et al. (2018), Yang et al. (2019)	Taiwan
Cho et al. (2013), Han & Kim (2017), Huh & Lee (2020)	Korea
David & Pastor (2017)	Romania
Davis & Kyritsi (2021)	Scotland
Dziedziewicz et al. (2014), Gajda (2016)	Poland
Genek & Küçük (2020), Tekin et al. (2012), Ucus (2018)	Turkey
Hansenne & Legrand (2012)	Belgium
Hartley et al. (2016), Xianhan Huang (2021), Xianhan Huang et al. (2021), Wang & Kokotsaki (2018), Zhang et al. (2020), Chan & Yuen (2014a), Chan & Yuen (2014b), Cheung & Mok (2013), Xian han Huang & Lee (2015), Gong et al. (2020)	China
Jónsdóttir (2017)	Iceland
Kampylis et al. (2011), Zbainos & Tziona (2019)	Greece
Kashani-Vahid et al. (2017)	Iran
Kasirer & Shnitzer-Meirovich (2021), Doron (2017)	Israel

Khan & Kamran (2021), Shaheen (2011)	Pakistan
Onyinyechukwu et al. (2021)	Nigeria
Rak (2021)	Croatia
Schoevers et al. (2021), Schoevers et al. (2019), Stolte et al. (2019), Van Hooijdonk et al. (2020), Willemsen et al. (2020)	Netherlands
Soobik (2021)	Estonia
Tan & Majid (2011)	Singapore
Udomtamanupab (2020)	Thailand
D. H. Cropley et al. (2019)	Unspecified
Wyse & Ferrari (2015)	UK and USA

Figure 2 shows a trend of gradual increase in the number of publications on creative thinking in primary education peaking in 2021 except for the years of 2018 and 2019. The increasing number of studies reflects the increasing interest in creativity research.

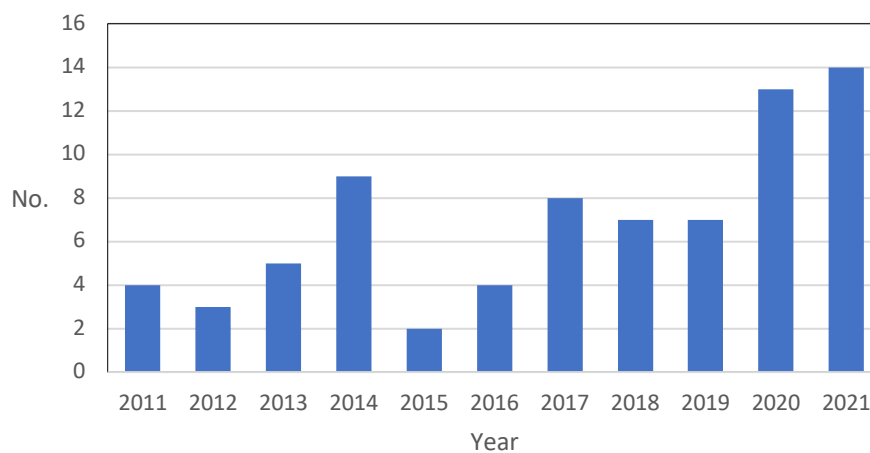


Figure 2: Distribution of studies between 2011 and 2021 (N=76)

Context

Seventy-six selected studies that constituted the data for this review reported on empirical research conducted in 27 countries across all continents. Most frequently, the studies were conducted in China (10), followed by the US (9), the UK (7), Spain (5), and Netherlands (5). Figure 3 illustrates the distribution of studies by each country where the research was conducted. China and the US are ranked at the top in the current review. According to Pllana, these two countries focus on encouraging higher-order thinking skills in their educational system (2019). In China, creative thinking has attracted increasing attention recently. The development of creative thinking in this country is regarded an essential educational objective to be infused into the regular curriculum and across all subjects (Cheng, 2010). Also, the promotion of creative thinking in young children has become a priority in the Chinese agenda of educational policy makers since 2001 (Vong, 2008). In

other systematic reviews with relevant but different foci, the US is also ranked at the top especially in the study of Kahl et al. (2009) with 94% of the studies submitted by American institutions. Current American scholars and educators in the US recognise the fact that creative thinking leads to shaping modern education (Pllana, 2019). However, though creativity is of paramount importance, it is not promoted in the majority of American school districts due to many obstacles linked mainly to standardised testing (Pllana, 2019).

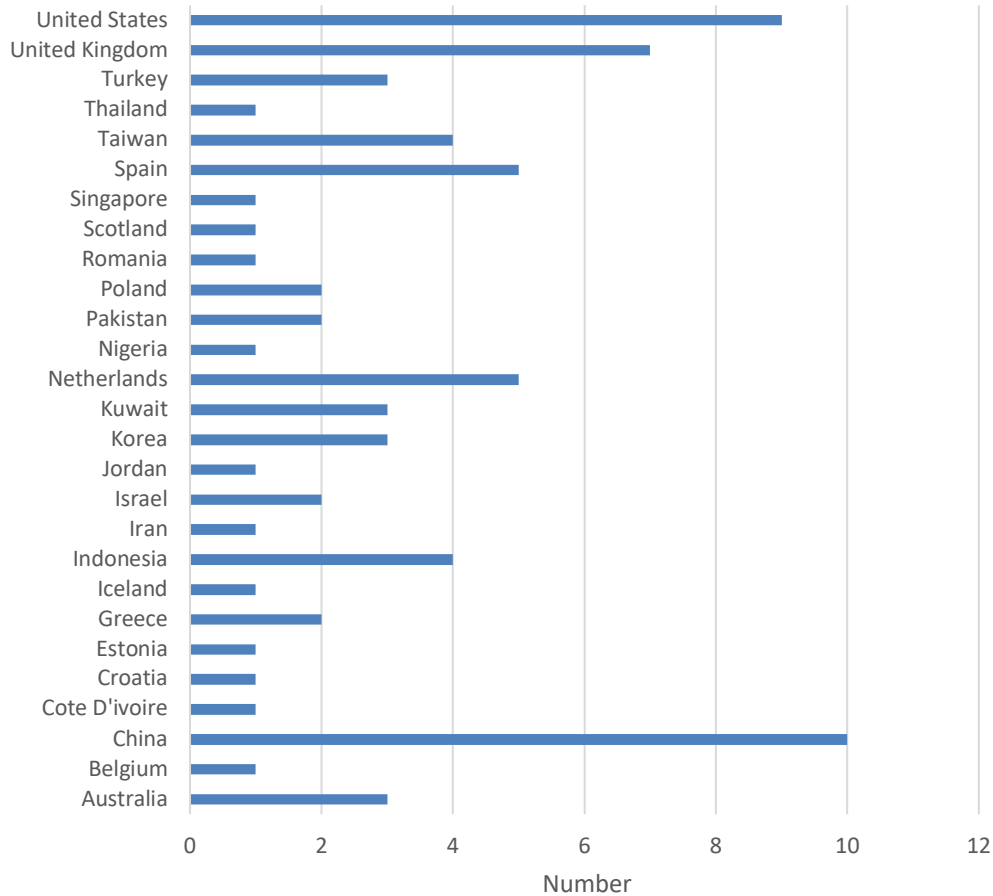


Figure 3: Distribution of the selected studies by country (N=76)

For the other countries, in the current study as in Kahl's study, much research is still being done in the UK. Creativity is emphasised in the British curriculum and included in the Foundation Stage Curriculum and National Curriculum for Schools (Craft, 2003). A report by the National Advisory Committee on Creative and Cultural Education (1999) emphasised the necessity to equip young children with creative thinking skills. The National Primary Strategy for Excellence and Enjoyment also put emphasis on the importance of integrating creative thinking in primary education and providing children

with opportunities to fulfil their creative potentials (Hayes, 2004). Such documents provided the basis for policy discussions in the UK (Craft, 2005). In Europe in general, there is a growing interest in creativity research, unlike Africa. The current review, like Long's review (2014), demonstrates that studies on creative thinking have rarely been conducted in African countries. This could be explained by cultural factors such as the dominance of collectivism and the discouragement of individualism including individual creativity or by educational factors like the encouragement of lower thinking skills such as remembering and understanding in schools.

Foci of investigation

The selected studies on creative thinking focused on a number of issues. These issues are related mainly to the educational factors affecting perceptions and the development of creative thinking. That is to say, there is an emphasis on context or process rather than product or person. This finding does not align with the findings of Kahl et al. (2009) and Wehner et al. (1991) where the focus is placed on the three remaining aspects of creativity. Researchers advocate that research should take into consideration the multidimensionality of creativity construct and explore the interrelationships among the four aspects of creativity and their contribution to the individual's ability to think creatively (Said-Metwaly et al., 2017). Regarding Mayer's categorisation of creativity research, we find that contextual research is mostly emphasised in the selected studies followed by experimental research (1999). As Table 3 shows, seven broad themes of research foci emerged from the data.

Table 3: Foci of investigation in the selected studies

	Frequency	%	Valid %	Cumulative %
Investigating factors that influence teaching for and the development of creativity	42	55.3	55.3	55.3
Exploring the relationship between variables affecting teaching for and the development of creativity	17	22.4	22.4	77.6
Examining the impact of a treatment on the development of creative thinking	10	13.2	13.2	90.8
Examining the impact of a treatment on creative thinking and academic performance	3	3.9	3.9	94.7
Measuring students' creative thinking	2	2.6	2.6	97.4
Examining the relationship between creative thinking and academic achievement	1	1.3	1.3	98.7
Exploring the discrepancy between two variables	1	1.3	1.3	100.0
Total	76	100.0	100.0	

The studies that explored the factors affecting teaching for and developing creative thinking and the relationship between variables affecting teaching for and developing creativity were categorised into six factors (Figure 4).

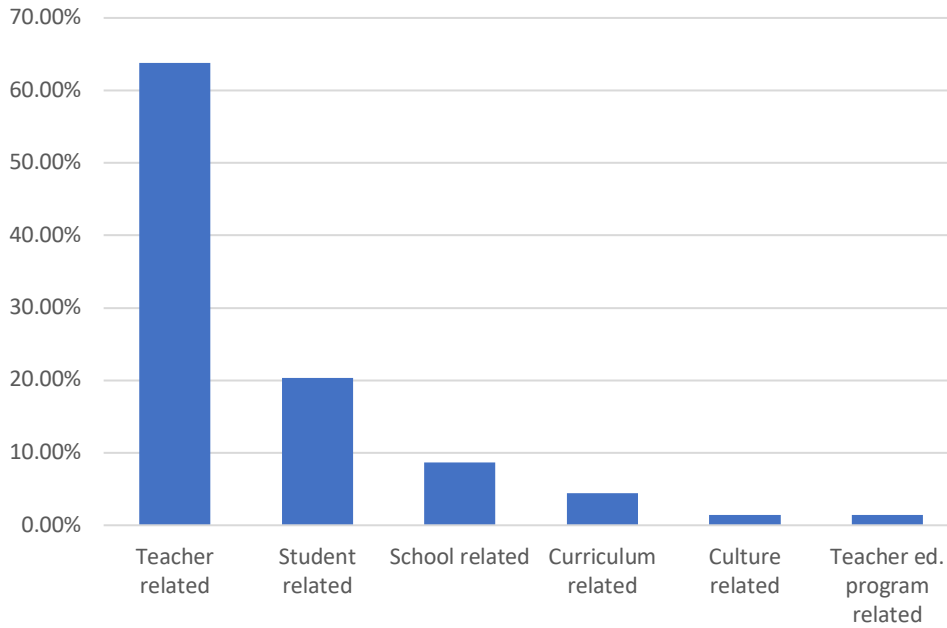


Figure 4: Distribution of studies based on the factors being investigated

The majority of the studies investigated the factors that affect the development of creative thinking in primary education. These factors included: teacher related factors ($n = 44$; 63.8%; e.g. Kasirer & Shnitzer-Meirovich, 2021); student related factors ($n = 14$; 20.3%; e.g. Hansenne & Legrand, 2012); school related factors ($n=6$; 8.7%; e.g. Lian et al., 2018); curriculum related factors ($n = 3$; 4.4%; e.g. Wyse & Ferrari, 2014); culture related factors ($n = 1$; 1.4%; e.g. Davis & Kyritsi, 2020); and teacher education program related factors ($n = 1$; 1.4%; e.g., Al-Yaseen, 2015). There are studies that investigated two kinds of factors, such as Zhang et al. (2020) and studies that explored all the listed factors like Ahanadou (2017) and Shaheen (2011).

A similar study to Shaheen's was conducted in the Moroccan context at the secondary educational level to explore the extent to which English learning classes develop students' creative thinking (Smare & Elfatihi, 2022). Integrating creative thinking in language learning classes is of paramount importance for students (Smare, 2022). That is why the EFL context was chosen. A variety of research instruments were used including document analysis, textbook evaluation, classroom observation, an online questionnaire and interviews with EFL teachers. The aim of the questionnaire was to collect data on teachers' perceptions, attitudes and practices regarding the development of creative thinking in EFL classrooms. Interviews were used to explore the extent to which teachers' views matched their teaching practices. The questionnaire and interview items were selected based on the existing literature on creative thinking. These items aimed at investigating whether teachers have misconceptions of creative thinking such as art bias (Glăveanu, 2014) and the breed myth, the belief that only few genius individuals are

creative (Burkus, 2013). The items also explored whether teachers have a love-hate relationship towards the skill (Kaufman, 2016) that makes them value creative thinking, but do not promote it in their classes due to certain reasons. The findings indicated that the importance of creative thinking has been emphasised in policy documents, yet the textbook and teaching practices encourage lower-order thinking skills, such as remembering and understanding (Smare & Elfatih, 2022).

As was pointed out in the review of literature, there are four aspects of creativity. The aspect that is emphasised in the research influences the instruments that the researcher uses. There was a focus on the process-based view of creativity (e.g., Alfonso-Benlliure & Santos, 2016), the person-based view (e.g., Hern et al., 2020), the product-based view (e.g., Leasa et al., 2021) and the press-based view (e.g., (Huang et al., 2021)). Focusing on each aspect in isolation may imply that these aspects are independent when in fact they are mutually linked (Batey, 2012). Furthermore, researchers utilise research instruments separately when each instrument has its particular limitations (Lemons, 2011). It is important to bear in mind that the use of instruments for a particular focus does not give the comprehensive and holistic understanding of creativity. On the contrary, it reflects a narrow scope of the aspects of the construct (Plucker et al., 2004). In other words, no single instrument explains creativity clearly because of the multidimensional nature of the skill and the interrelationships among its various aspects (Cromptley, 2000; Lemons, 2011). Therefore, as Batey (2012) argued, the use of isolated instruments when investigating creativity may be the reason why there is inconsistency regarding the results in creativity research.

The study of creativity is similar to the apocryphal story of the blind men and the elephant (Lubart & Sternberg, 1998). Each blind man is trying to imagine what the elephant looks like by touching one different part of the animal. This resulted in getting different results and therefore disagreement. Combining all their findings could lead to some truth about the elephant but not the whole truth. This is because of the existence of different types of elephants (e.g., the Asian elephant and the African elephant) and the changing shape of elephants over their life span. Consequently, these blind men could learn from cross-cultural analyses of elephants and from their life span. The same applies to creativity research. Studying one aspect in isolation does not capture the whole truth about creativity. In the current review, very few studies ($n=2$) focused on the four aspects of creativity or culture related factors ($n=1$) that shape perceptions of creativity and its development.

The analysis of the studies regarding the factors that influence creative thinking revealed that researchers focus mainly on teacher related factors, including teachers' beliefs, attitudes and teaching practices. It is true that teachers play a significant role in fostering or suppressing creative thinking as they are the implementers of the curriculum and they act as role models to students because they spend a considerable amount of time with them (Csikszentmihalyi, 1999; Kampilis et al., 2009; Wyse & Spendlove, 2007). Moreover, inaccurate beliefs of creative thinking is the biggest challenge to the development of the skill (Benedek et al., 2021). However, it is important to keep in mind that beliefs are the result of culture, professional development and educational policy documents. Therefore,

researchers have to look at two levels of context when conducting research on creativity: the macro level that focuses on culture, educational policy documents and teacher training programs, and the micro-level which focuses on the teachers and their practices in the classroom. This is why, more research should focus on these macro level factors namely culture, educational policy documents and training in addition to assessment as another important factor that is missing in the selected studies.

Investigating cultural factors affecting the development of creativity is crucial. Each culture influences the individual very strongly by transmitting its own ethics, norms, patterns of behaviour and values to the child through family and contact with people from the same social context (Kumari, 2020). When researchers study a creative person, creative product or creative process, they often decontextualise creative thinking (Lubart, 1999). It is noteworthy that creative thinking does not emerge in a vacuum. As emphasised by Westwood and Low (2003), creative thinking occurs within and is influenced by the social context. As a consequence, creative thinking is likely to be conceptualised and practised in various ways as countries are culturally different. Moreover, though the need for a person to think creatively is of paramount importance today, if the culture does not encourage or inhibits the development of creative thinking, then the individual's ability to think creatively cannot flourish (Kim, 2004). Research on creative thinking also indicates that individuals in certain cultures are more or less creative depending on the extent to which their culture regards creative thinking as the main goal (Morris & Leung, 2010). Therefore, we have to be aware of the meaning of the concept in various cultures if we are interested in promoting creative thinking (Cabra & Guerrero, 2022).

Educational policy documents are the first documents to which teachers are exposed. If these documents do not include goals and objectives that encourage the development of creative thinking, or fail to train teachers to teach for creativity, it is unlikely to have teaching practices that promote the skill. Regarding assessment, there was no single study that investigated whether exams, especially high stakes exams, foster creative thinking. Assessment can have a significant influence on teachers' pedagogical practices as emphasised by Wall and Anderson (1993). Teachers tend to teach to the test, and students study to meet the prescribed objectives of the final examinations (Mitana et al., 2021). These examinations also have an influence on parents and the general community (Mitana, 2018). That is why teaching practices tend to focus more on fulfilling the expectations of examinations, especially high stakes exams. This implies that if exams, especially standardised exams, focus on encouraging lower-thinking skills, the likelihood of having teaching practices that promote higher-order thinking skills such as creative thinking is very low. Therefore, because teachers' practices are influenced by the requirements of assessment, more research should examine the extent to which examinations encourage the development of creative thinking in the classroom.

Methodological approaches

The selected studies were analysed for methodological approaches. They were coded as quantitative, qualitative or mixed methods. It is important to note that the purposes of a quantitative approach are to collect numeric data from a large number of individuals to

comprehend a problem, describe trends or explain the relationship among variables using statistical analysis (Creswell, 2016). Regarding creativity research, this approach can describe the beliefs and attitudes towards creativity and the relationship between variables that influence the development of the skill. Qualitative data are used to investigate a problem by developing a detailed comprehension of the phenomenon (Creswell, 2016). This kind of research is appropriate when we investigate a problem in which we do not know the variables and the participants can provide more information than literature (Creswell, 2016). With regard to creativity, qualitative research is important because they provide data that can explain the variables that shape and form beliefs and practices towards the concept. Concerning mixed method design, it involves the collection of both quantitative and qualitative data. Researchers use mixed method design because it provides a better understanding of a research problem than either a quantitative or qualitative data by itself (Creswell, 2016). Mixing both quantitative and qualitative data when investigating creativity can give a comprehensive understanding of the construct.

As Figure 5 illustrates, of 76 studies, quantitative studies made up the majority, followed by qualitative and mixed methods studies. This finding is similar to Long's (2014) review that found quantitative studies predominant. A difference between Long's review and ours is qualitative studies outnumbering mixed methods studies, whilst in Long's review, there were less qualitative studies and slightly more mixed-methods studies.

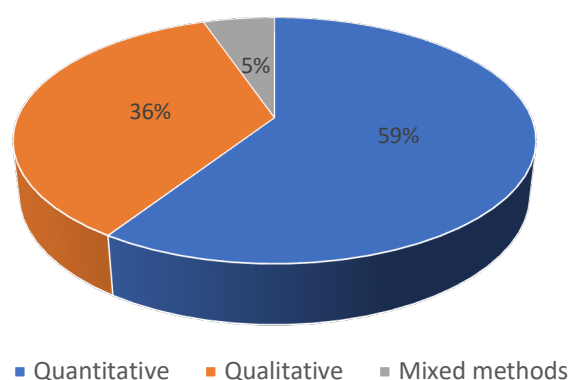


Figure 5: Distribution of studies by the methodological approach (N=76)

Regarding quantitative research, we found three main types of studies. Descriptive research (n=15; e.g., Cropley et al., 2019) involved mainly exploring primary school teachers' beliefs, attitudes and practices regarding the development of creativity in primary education. This kind of research seeks to describe trends in a large population by administering a survey or questionnaire to a group of individuals to explore trends in attitudes, views or behaviours of a large group of individuals (Creswell, 2012). Correctional studies (n=14; e.g., Gajda, 2016) focused on exploring the relationship between the development of creativity and other variables such as intrinsic task motivation, teacher support, intelligence and academic performance. Correlational studies in general focus on investigating the degree of association or relation between two or

more variables (Creswell, 2016). Experimental/ quasi-experimental research (n=16; e.g., Liao et al., 2018) aims at investigating the effectiveness of a program or a teaching practice on the development of creative thinking in children. Such studies seek to test whether an educational practice, activity or material make a difference in results for individuals (Creswell, 2016). Figure 6 demonstrates the proportion of each of the methodology types used in the quantitative studies.

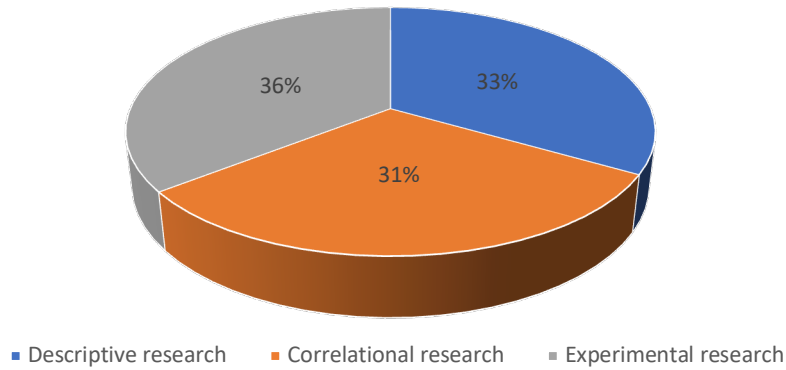


Figure 6: The proportion of the methodology types used in quantitative research(N=76)

As far as experimental research is concerned, the major themes found in the present review are linked to examining the impact of a treatment on creative thinking and academic performance, the impact of a treatment on the development of creative thinking, and the relationship between creative thinking and academic achievement. Figure 7 illustrates the percentage of each theme in the review.

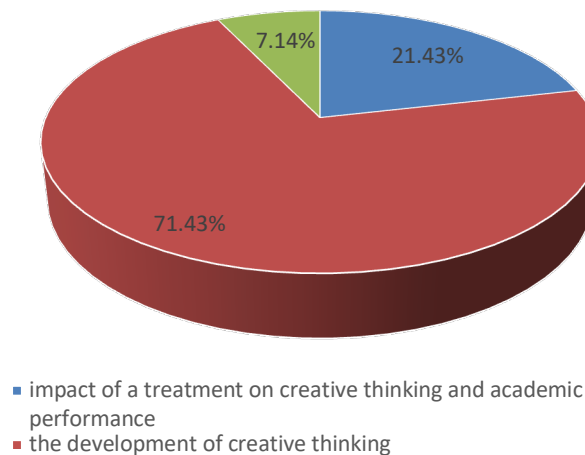


Figure 7: Examining the ... (N=76)

One of the issues related to experimental research is the debate on whether creativity is domain general or domain specific. To clarify this point, Sternberg gave the example of Einstein and Van Gogh. If Einstein had training as an artist, would he show the same creativity in painting as Van Gogh? And if Van Gogh had training as a physicist, would he be as creative as Einstein? If the answer to these questions is no, why are there people who show talent in different domains such as Leonardo da Vinci who is talented in both painting and invention? (Sternberg, 2009). In other words, is creative thinking domain-general (i.e., an individual who shows creativity in one domain is likely to show creativity in other domains) or domain specific (i.e., creativity in a particular domain is not linked to creativity in other domains). Noteworthy, the domain-general view was prevalent in creativity research for several decades (Baer, 2015). However, because the work of creative individuals throughout history is almost exclusively limited to a specific domain, creativity researchers start to focus more on domain specificity view (Barbot et al., 2016). Therefore, one of the pieces of criticism linked to the use of experiments when investigating creativity is ignoring the specific characteristics of the domain or task being investigated and treating creativity as a general construct (Barbot et al., 2011).

Zeng and others have argued that the research instruments that do not take into consideration the specific characteristics of the domain are more suitable for measuring children's creativity because children have not yet developed expertise in their domain (Zeng et al., 2011). In the current review, we found that there were studies that used tests related to the domain of study such as the *Mathematical Creativity Test* (Stolte et al., 2019), *Scientific Creativity Test* (Yang et al., 2019) and studies that used Torrance tests of creative thinking which include exercises that aim at enhancing divergent thinking or giving multiple responses or solutions to a problem, regardless of the specialty of the domain, like the studies by Huh & Lee (2020) and Liao et al. (2018).

As far as qualitative research is concerned, many types including case study, phenomenology, grounded theory and action research were used. The overwhelming majority of the studies, like in Long's review (2014), were case studies. Case study is a standard qualitative research method that is used to investigate a phenomenon in a particular context (Thelwall & Nevill, 2021). This method mirrors the extent to which investigating a general phenomenon in narrow context is deemed important to knowledge creation (Thelwall & Nevill, 2021). This is relevant to creativity research as analysing local contexts is considered important so as to create a comprehensive understanding and knowledge about the development of the skill in a certain context. However, as was noted before, most studies ignore the cultural context and focus mainly on the educational one with regard to perceptions of creativity and its development. It is important to pinpoint that we were not able to determine what qualitative type of research was utilised in some qualitative studies. One reason for this was the poor methodological quality in those studies. Figure 8 illustrates the proportion of each methodology type used in the selected qualitative studies.

Concerning methods in qualitative research, the majority of examined studies used interviews. This finding is consistent with the views of Thelwall and Nevill's (2021) who claimed that interviews are the most prevalent method for obtaining qualitative data.

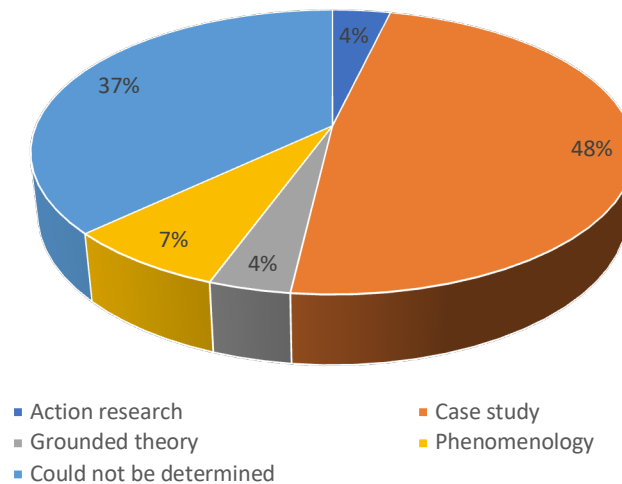


Figure 8: Percentages of the methodology types used in qualitative research (N=76)

Interviews are important because they give a voice to non-researchers to state their perspective without the influence of the researcher's views (Thelwall & Nevill, 2021). Observation is also used in qualitative research on creativity in primary education. Generally, observation is under-utilised in creativity research because the task of collecting data can be intensive with regard to time and resources and because of the absence of protocols and recommended research practices that cover data collection, analysis and reporting processes when observing creative thinking in an educational environment (Katz-Buonincontro & Anderson, 2018). Other studies used content analysis of visual and textual materials, open ended questionnaires and focus groups. Figure 9 illustrates the percentage of each method, the largest being interviews and the smallest, focus groups.

As was argued before, using multiple instruments could be useful to investigate creativity. A mixed methods approach that combines both quantitative and qualitative could provide a more complete understanding of creativity than either approach. In our review, mixed methods approach is the least used (5%, Figure 5). Adding a qualitative approach to the quantitative one when investigating creativity would for example allow to comprehend the construct more and get new insights from the data. Investigating creativity from a single vision of quantitative or qualitative can restrict other prospects that are open to research. As a case in point, researchers may use both quantitative and qualitative approaches when exploring beliefs of creative thinking. A qualitative approach using ethnographies or unstructured interviews can provide an in-depth view of the meaning of the construct as well as valuable insights into the factors that facilitate or impede the development of the skill.

In the four mixed methods studies, we observed that two studies failed to report any evidence of the integration of qualitative and quantitative data. They did not clarify the design they used, and they did not show how the findings were integrated and what

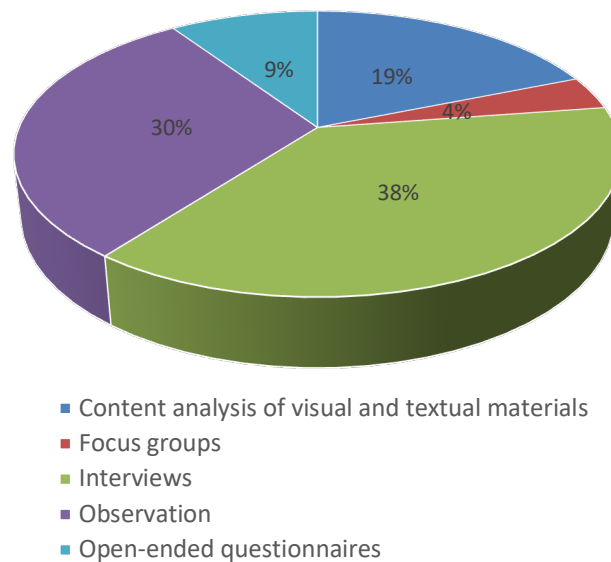


Figure 9: The proportion of each research method used in qualitative studies (N=76)

insights are gained from mixing the two methods. Without a clear description of the adopted design, readers cannot evaluate the quality of the methodology. The other two studies used a convergent design and integrated the findings of the two methods in the results and the discussion sections. A convergent design entails the independent collection of quantitative and qualitative data and the merging of these data in the discussion section to find out whether the results converged, diverged or enhanced each other. For example, Shaheen (2011) used both quantitative data (a questionnaire) and qualitative data (classroom observations and interviews) to find out the extent to which teachers' views match their practices (Shaheen, 2011). However, two of the four mixed-methods studies used only narrative to report the integration and neglected the use of joint displays. Joint displays are visual displays that aim at integrating quantitative and qualitative data during data collection, analysis, and discussion (McCrudden et al., 2021). These visual displays could be tables, diagrams, or matrices that clarify the additional insights gained from using a mixed methods design.

Conclusion

In this methodological review, we systematically reviewed empirical studies on creative thinking in primary education published between 2011 and 2021, focusing on different aspects of their methodology. Seventy-six studies were analysed in terms of their distribution over time, context, foci of investigation and the methodologies used. Our review revealed a number of issues linked to creativity research in primary education. First, there is a scarcity of research conducted on creativity in primary education compared to other educational levels. Second, the findings of the review indicate an overall increasing interest in creativity research recently, most frequently conducted in

China and the US, unlike Africa and some Asian and American countries that are still lagging behind with regard to creativity research. Third, in terms of foci of investigation, creativity fostering factors related to teachers attract more attention compared with culture or assessment related factors. Fourth, concerning methodological design, quantitative approach is still prevalent in creativity research followed by qualitative and mixed methods approaches. Fifth, general and domain specific, though they are still open to question, are both used in creativity research in primary education. Finally, there is scarcity of mixed methods design research which is very important in order to get a holistic understanding of creativity.

Recommendations

This systematic review highlights some methodological issues on creativity research in primary education. Based on these findings, we offer the following suggestions that might help future researchers in addressing these issues. First, due to the importance of creativity for children, more research on creativity should be conducted on primary education. Second, more use should be made of mixed methods design approaches, to get a more comprehensive and holistic understanding of creativity. Third, creativity research should focus on the four aspects of creativity, namely person, press, product and process, and the interrelationships among them. Fourth, studies that investigate cultural factors affecting perceptions and practices of teachers should be conducted. Fifth, qualitative research should specify the type of qualitative research they are using. Sixth, mixed methods research should describe explicitly the design they are using in order to understand how qualitative and quantitative data are integrated and the insights the researcher gained from this integration. Seventh, the low frequency of using mixed methods studies in the present review could be explained by the existence of a number of obstacles to carrying out this type of research. Researchers need to investigate those obstacles and suggest possible ways to overcome those problems in order to increase the number of mixed methods methodologies in creativity research. Finally, more creativity research should be conducted, especially in Africa, to cope with the changing world and prepare its citizens for the unknown future.

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Please cite as: Smare, Z. & Elfatih. M. (2023). A systematic review of research on creative thinking in primary education: Focus on empirical methodologies. *Issues in Educational Research*, 33(2), 752-780. <http://www.iier.org.au/iier31/smare.pdf>