Scaffolding characteristics for elementary school teachers in mathematics learning

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Scaffolding characteristics for elementary school teachers in mathematics learning

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ABSTRACT

Scaffolding for elementary school teachers in mathematics learning has teaching characteristics that indicate the type of stimulation the teacher teaches. With this stimulation, students can learn independently according to their zone of proximal development. However, the existing literature studies allow for the addition of this type of teacher scaffolding characteristics. This study aimed to analyze the possibility of adding scaffolding characteristics of teachers to cover the gaps left by the theory and the results of previous studies. This study used a literature research method with a meta-analysis approach. The findings show that additional scaffolding characteristics are called fading-transfer of responsibility, which refers to the teacher's fading or reduction of support and the transfer of responsibility to students. Thus, it can be concluded that there are four types scaffolding characteristics of teachers in elementary school mathematics learning, namely contingency, fading, and transfer of responsibility, and fading-transfer of responsibility.

INTRODUCTION

Mathematics learning has a general goal to help students understand mathematical reasoning and concepts correctly to solve problems related to mathematics (Amir, 2015). In particular, learning mathematics for the elementary school level is based on recognizing concrete facts in everyday life (Hamzah & Muhlisrarini, 2014). The elementary school mathematics curriculum concepts can be divided into three major groups, namely laying out basic concepts, understanding concepts, and developing skills (Heruman, 2007). To achieve this goal, learning mathematics can use a learning aid process using the constructivist learning theory proposed by Vygotsky, known as scaffolding.

Previous research, which focused on teaching mathematics, stated that the scaffolding idea has been useful in describing the act of teaching. Scaffolding is one of the key actions teachers can take to sustain the cognitive demands of a math task. The term social scaffolding centers on classroom rules, while analytic scaffolding centers on mathematical content to describe the various ways in which teachers can support student work. The research shows that identifying analytic scaffolding movements allows a teacher to balance social and analytic scaffolding that can help teachers implement mathematics learning objectives (González & DeJarnette, 2015). Trif (2015) suggested that in learning mathematics, scaffolding must be clear support, including for the quality of teacher teaching, to help students develop certain skills to reach a certain level of understanding. Teacher practice is important in the support process provided to students in which teachers must develop adaptive practices in scaffolding so that they can direct the professional development of teachers (Visnovska & Cobb, 2015). Teacher accounts in the student learning process are necessary, so they must be synergistic by considering skills and understanding achievement targets (Tropper et al., 2015). The strategy for planning the scaffolding process is included in the modeling of mathematics learning. Several studies found that strategies affect student learning improvement (Schukajlow et al., 2015). Makar et al. (2015) showed that argument-based learning could be used in the mathematics learning scaffolding.

Scaffolding learning is a learning aid given to students with a gradual reduction to make students responsible for their learning. Interaction is an essential feature of scaffolding because support is provided and adapted to facilitate collaboration between less able and more skilled students. Previous research explored two functional aspects of scaffolding interactions, namely the role of the teacher as an aid provider in student learning and the potential value of peer interaction as another way to support the scaffolding process (Rojas-drummond et al., 2013). Scaffolding is a strategy to overcome the change in the classroom by assisting students in overcoming their difficulties during learning. The zone of

proximal development (ZPD) in scaffolding, according to Vygotsky, is the gap between students who can complete tasks on their own and students who can complete assignments with help. ZPD and scaffolding are changes that students need from time to time where knowledge and skills can develop. Through continuous analysis, scaffolding must be adjusted based on the needs of students. The dynamics of the scaffolding proces depend on the adjustment cycle of student performance, task demands, and scaffolding level (Lin et al., 2012). Roll et al. (2012) stated that guidance or support in the learning process affects students' metacognition, where students explore and analyze a problem. Metacognitive scaffolding can help students to be able to solve various issues that will lead to better learning from further instruction.

Previous studies have empirically conceptualized scaffolding, an educational context that includes the interaction of more expert people and peers, small group and whole-class aching and learning environments, and discussions between friends and teachers (Elbers et al., 2013). In general, scaffolding refers to the methods used by teachers in creating a learning environment and taking action to help students learn (to build, deepen, strengthen, and consolidate knowledge). Scaffolding learning includes setting up physical and social structures for engagement, providing responsive challenge and support, and developing conceptual thinking (Bell & Pape, 2012). The idea of scaffolding is a metaphor for a teacher's way of supporting student progress and achievement through relatively difficult tasks (Fernández et al., 2015). Clark & Graves (2004) stated that scaffolding is effective learning because it allows a teacher to keep a task intact while students understand and manage its parts. Scaffolding integrates various aspects of the k, which helps students deal with the task's complexity authentically. Scaffolding needs to be applied in the classroom depending on the students' abilities indeed. Various levels of support are possible, and the more complex a task, the more support students need to complete it. Pfister et al. (2015) showed that scaffolding is likely in inclusive classes (low-achieving students). However, it is essential to have a structured program because the scaffolding metaphor is an understanding-oriented and structured form of support.. Meanwhile, Broza et al. (2015) found that complex learning process and contingent teaching is an appropriate method to apply.

Bikmaz et al. (2010) emphasized that the successful application of scaffolding requires the teacher to determine the difference between what each student can achieve independently and what he can achieve with guidance. To achieve this, the scaffolding principles that must be followed are: first, maintaining a good balance between providing challenges and supporting students; second, using appropriate forms of scaffolding, thirdly modeling favorable personality traits and behaviors; fourth, providing the most appropriate environment; and lastly respond and provide feedback to students regarding their questions and opinions so that they can take responsibility for their learning. Meanwhile, Mercer (2010) said that the scaffolding process requires collaboration between teachers and students, allowing a collaborative interaction to support students in the learning process. This is supported by Warwick et al. (2011), which focused on the necessity of a dialogical approach the class interaction. Kazak et al. (2015) suggested that scaffolding could effectively prepare for conceptual development through dialogue. Previous studies also found that teachers can achieve certain learning objectives in mathematics learning strategies by conducting conversations in both small groups and the whole class to achieve certain learning objectives. (Baxter & Williams, 2010).

A previous study stated that several types of scaffolding could be provided a different levels or times, consisting of macro, meso, and micro levels. The macro-level emphasizes the design of long-term work sequences or projects with repetitive tasks over a protracted period. The meso level requires the design of individual tasks consisting of steps or activities that occur sequentially or in a collaborative construction. Meanwhile, the micro-level focuses on the process of appropriation contingency interactions, stimulation, giving and receiving arguments in interactio, and collaborative interactions (Moschkovich, 2015). This confirms Prediger & Pöhler (2015) that micro and macro-scaffolding are connected to each othe

The research by van de Pol et al. (2010) found that scaffolding consists of three general characteristics. The scaffolding characteristics have an important role in learning. Characterizing scaffolding based on the general scaffolding characteristics in teaching can focus on student development in all different aspects. Thus, teachers can adjust the support that will be given to students according to students' level of development at that time. In addition, the scaffolding characteristics also have a role in t effectiveness of scaffolding through these three general characteristics. Based on theoretical fact, van de Pol et al. (2010) proposed three general sc lding characteristics: contingency, which refers to responsiveness and appropriate forms of support; fading refers to the gradual reduction of support provided; and transfer of responsibility which refers to taking over responsibility when students can learn independently. Smit et al. (2013) also proposed three scaffolding characteristics. The first characteristic is a diagnosis which refers to the teacher's diagnosis of students' conceptual

development. The second characteristic refers to the responsiveness of interaction between students and teachers, which illustrates the fading of support for the transfer of responsibility. Meanwhile, the third characteristic is the transfer of responsibility which refers to the taking over responsibility when students can learn independently.

Thus, hypothetically, it can be assumed that scaffolding characteristics do not include only three characteristics but can be more than that in teaching conducted by the teacher. These three characteristics are just general scaffolding characteristics. The addition of these characteristics may be based on the student's response at that time. Therefore, the focus of this article is to describe the general scaffolding characteristics, which researchers then suspect that there are more than three scaffolding characteristics in elementary school students' mathematics learning.

METHOD

The method used in this study was literature research. Literature research is a series of studies relating to library data collection methods or research whose research objects are explored through various library information (Syaodih, 2009). Meanwhile, according to Baumeister & Leary, a literature research can be broadly described as a systematic way to collect and synthesize previous research (Snyder, 2019).

The data used in this study was secondary data, which is obtained not from direct observation. However, the data was obtained from the research results carried out by previous researchers in the form of scientific articles or journals related to scaffolding. Secondary data obtained from various literature are collected as a unit used to answer the problems that have been formulated. The data was analyzed using a meta-analysis approach, which was carried out by identifying the types of scaffolding characteristics of teachers that were appropriate in learning elementary school mathematics, through two sources of research articles by Van de Pol et al. (2010) and Smit et al. (2013). The two sources were analyzed descriptively and based on their content.

RESULTS AND DISCUSSION

There are two main arguments about scaffolding. Van de Pol et al. (2010) proposed three general scaffolding characteristics: contingency, fading, and transfer of responsibility. These three characteristics refer to small group support, particularly to the support of a single student by a single teacher. Meanwhile, in the whole-class management, Smit et al. (2013) also proposed three scaffolding characteristics as van de Pol et al. (2010), but the terms are different. The three characteristics are diagnosis, responsiveness, and transfer of responsibility. Researchers assume there is an addition of these three characteristics (See Table 1).

Tabel 1. Scaffolding Characteristics Comparison

Van de Pol et al. (2010)	Smit et al. (2013)	This Research
1. Contingency: refers to responsiveness and appropriate forms of support. 2. Fading: Refers to the gradual reduction of the support provided. 3. Transfer of responsibility: refers to taking over responsibility when students can learn independently	1. Diagnosis: refers to the teacher's diagnosis of students' conceptual development. 2. Responsiveness: refers to interactions between students and teachers that illustrate the fading of support for shifting responsibilities. 3. Transfer of responsibility: refers to taking over responsibility when students can learn independently.	1. Contingency: refers to responsiveness and appropriate forms of support. 2. Fading: Refers to the gradual reduction of the support provided. 3. Transfer of responsibility: refers to taking over responsibility when students can learn independently. 4. Fading transfer of responsibility: refers to the fading or reduction of support carried out simultaneously with the transfer of responsibility to students.

The addition of characteristics carried out by researchers is based on three general characteristics according to van de Pol et al. (2010), because Bakker et al. (2015) stated that the proposal by Smit et al. (2013) aimed at evaluating *scaffolding* approach effectivity without separating interventions from the effect. Smit et al. (2013) only characterize their approach as scaffolding. All the main characteristics of the teaching and learning process meet the criteria of scaffolding, i.e., diagnosis, responsiveness, and transfer of responsibility. The effect is already incorporated into the concept. Meanwhile, van de Pol et al. (2010) stated that scaffolding success is included in the definition. Therefore, Bakker et al. (2015) and other researchers preferred the characteristics van de Pol et al. (2010) proposed. The addition of characteristics carried out by researchers is also based on three general characteristics, according to van de Pol et al. (2010). Adding the characteristic refers to the transition from the second general characteristic to the third general characteristic as shown in Figure 1.

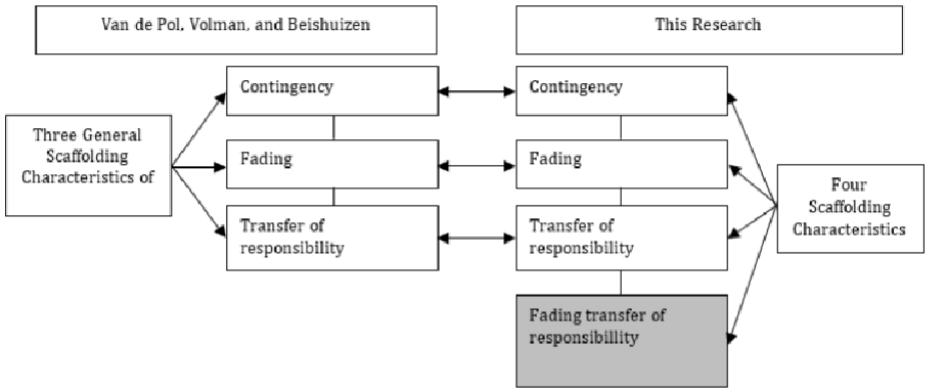

Figure 1. Addition in Scaffolding Characteristics

The three characteristics by van de Pol et al. (2010) are contingency, fading (withdrawal), and transfer of responsibility. In contingency, a teacher adjusts support for a group of students. To provide support in this contingency, the teacher must first determine the level of student competence because this is needed to determine conformity with student learning. The second common characteristic is the gradual fading or withdrawal of support. The degree of withdrawal or fading of support depends on the student's level of development and competence. A teacher makes withdrawals when the level or amount of support decreases over time. This stage has characteristics that distinguish it from the third characteristic, which can be seen from the student's point of view. Students have felt progress in the learning process so that the form of support or assistance provided by the teacher has faded, but they still have assistance, although less than before. The third common characteristic is the transfer of responsibility which refers to the gradual transfer of task performance to students. Responsibility, in this case, can be defined broadly. It can refer to students' cognitive activities or students' metacognitive influences. Responsibility for learning is shifted when a student can increase learning control. There are characteristics in this third characteristic to distinguish it from the second characteristic. Its characteristics are that it can be seen from the student's point of view, they (students) have been able to achieve the goals of the learning process without the help of a more skilled person, both the teacher and their peers. Thus, the responsibility has been completely transferred to the students without any help from others.

The previous description emphasized that the researcher applied van de Pol et al. (2010) to characterize the scaffolding learning process, consisting of contingency, fading, and transfer of responsibility. The researcher can answer the first problem formulation: there are more than three scaffolding characteristics besides contingency, fading, and transfer of responsibility. The addition of these three characteristics is the integration of the second characteristic, namely fading, with the third characteristic, namely the transfer of responsibility which is then termed as the fading transfer of responsibility.

The addition of these three characteristics is based on the results of a literature review that refers to the characteristics of the three scaffolds mentioned by van de Pol et al. (2010). It seems reasonable to link fading with the characteristics of the third scaffolding as a long-term process (Stender & Kaiser, 2015). Dissipation is closely related to the third common characteristic, namely the transfer of responsibility. Through contingent fading, the responsibility for the implementation of the task is gradually transferred to the student. In this review, responsibility is broadly interpreted, referring to students' cognitive or metacognitive activities or student influences.

In summary, the capacity to take over responsibilities only takes place over a long period. As a consequence of this, fading must also be seen as a long-term process. Research by Stender & Kaiser (2015) explained the definition of the scaffolding process as contingent support based on diagnostic activities along with long-term fading to increase student responsibility.

The addition of these characteristics also considers a scaffolding strategy by van de Pol et al. (2010) that distinguishes between six scaffolding facilities, namely: providing information, providing instructions, instructing, explaining, modeling, and questioning, with five scaffolding intentions, namely maintaining direction to support students' metacognitive activities, cognitive structuring, reducing degrees of freedom to support cognitive activities, mobilization and contingency

management/frustration control to support student influence. Van de Pol et al. (2010) determine the scaffolding strategy as a possible combination of facilities with the intention of the scaffolding. Generally, the fulfillment of teaching strategies as scaffolding depends on their application in actual practice and, more specifically, on contingently applied strategies and are also part of the process of fading and shifting responsibilities.

Thus, there are four scaffolding characteristics, of which three are general scaffolding characteristics, and one is an integration or transition from the second and third general characteristics. The four characteristics are contingency, fading, transfer of responsibility, and fading-transfer of responsibility. The fourth characteristic can be described in detail as follows. Fading transfer of responsibility is the integration or transition of the second and third general characteristics. The reduction of support or fading of support by teachers can occur alone or simultaneously with the transfer of responsibility. When students begin to be able to control their learning independently, say in completing assignments, along with the process, the teacher will slowly reduce or eliminate their support. The difference with the three general characteristics is that there is an addition of one characteristic: the integration of the second and third general characteristics.

Since the author refers to the general characteristics formulated by van de Pol et al. (2010), this scaffolding learning intervention refers to the support provided by the teacher to a small group, especially to the support of a single student a single teacher. This is since the possibility of an intervention is based on concrete terms based on the individual situation of students, and this cannot easily be transferred across groups due to heterogeneity allowing teachers to react differently to different students. Therefore, the thing to remember is that the scaffolding process is also based on the student's response at that very time.

Abbreviations and Acronyms

Vygotsky describes zone of proximal development (ZPD) in scaffolding as the gap between students who can complete tasks by themselves and students who can complete tasks with assistance.

CONCLUSION

The analysis carried out on the main source article and several supporting source articles resulted in several conclusions. First, there are more than three scaffolding characteristics which refer to three general characteristics according to Van de Pol, namely the addition of mixed characteristics, fading in the transfer of responsibility. Second, the fourth characteristic of scaffolding is an integration or transition from the second and third general characteristics. This characteristic is the process of reducing or fading support provided by the teacher, which occurs simultaneously with the transfer of responsibility to students.

Based on the results of this study, teachers are advised to develop teaching practices in the classroom using scaffolding learning. Meanwhile, schools can be used as a reference for developing teaching practices to increase the activeness and effectiveness of the learning system. For future researchers, this research provides insight and knowledge in terms of classroom teaching.

As a recommendation, this research by reviewing literature studies is still limited to face-to-face interactions, not online. The literature review also limits the updating of the data used. Learning by considering the scaffolding characteristics cannot be used for online learning in the COVID-19 pandemic. Therefore, the author also suggests that future researchers study this topic in more depth by using this article as a reference.

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KEYWORDS

Scaffolding Characteristics
Zona of Proximal Development
Contingency
Fading
Transfer of responsibility

ABSTRACT

Scaffolding for elementary school teachers in mathematics learning has teaching characteristics that indicate the type of stimulation the teacher teaches. With this stimulation, students can learn independently according to their zone of proximal development. However, the existing literature studies allow for the addition of this type of teacher scaffolding characteristics. This study aimed to analyze the possibility of adding scaffolding characteristics of teachers to cover the gaps left by the theory and the results of previous studies. This study used a literature research method with a meta-analysis approach. The findings show that additional scaffolding characteristics are called fading-transfer of responsibility, which refers to the teacher's fading or reduction of support and the transfer of responsibility to students. Thus, it can be concluded that there are four types scaffolding characteristics of teachers in elementary school mathematics learning, namely contingency, fading, and transfer of responsibility, and fading-transfer of responsibility.

INTRODUCTION

Mathematics learning has a general goal to help students understand mathematical reasoning and concepts correctly to solve problems related to mathematics (Amir, 2015). In particular, learning mathematics for the elementary school level is based on recognizing concrete facts in everyday life (Hamzah & Muhlisrarini, 2014). The elementary school mathematics curriculum concepts can be divided into three major groups, namely laying out basic concepts, understanding concepts, and developing skills (Heruman, 2007). To achieve this goal, learning mathematics can use a learning aid process using the constructivist learning theory proposed by Vygotsky, known as scaffolding.

Previous research, which focused on teaching mathematics, stated that the scaffolding idea has been useful in describing the act of teaching. Scaffolding is one of the key actions teachers can take to sustain the cognitive demands of a math task. The term social scaffolding centers on classroom rules, while analytic scaffolding centers on mathematical content to describe the various ways in which teachers can support student work. The research shows that identifying analytic scaffolding movements allows a teacher to balance social and analytic scaffolding that can help teachers implement mathematics learning objectives (González & DeJarnette, 2015). Trif (2015) suggested that in learning mathematics, scaffolding must be clear support, including for the quality of teacher teaching, to help students develop certain skills to reach a certain level of understanding. Teacher practice is important in the support process provided to students in which teachers must develop adaptive practices in scaffolding so that they can direct the professional development of teachers (Visnovska & Cobb, 2015). Teacher accounts in the student learning process are necessary, so they must be synergistic by considering skills and understanding achievement targets (Tropper et al., 2015). The strategy for planning the scaffolding process is included in the modeling of mathematics learning. Several studies found that strategies affect student learning improvement (Schukajlow et al., 2015). Makar et al. (2015) showed that argument-based learning could be used in the mathematics learning scaffolding.

Scaffolding learning is a learning aid given to students with a gradual reduction to make students responsible for their learning. Interaction is an essential feature of scaffolding because support is provided and adapted to facilitate collaboration between less able and more skilled students. Previous research explored two functional aspects of scaffolding interactions, namely the role of the teacher as an aid provider in student learning and the potential value of peer interaction as another way to support the scaffolding process (Rojas-drummond et al., 2013). Scaffolding is a strategy to overcome the change in the classroom by assisting students in overcoming their difficulties during learning. The zone of

proximal development (ZPD) in scaffolding, according to Vygotsky, is the gap between students who can complete tasks on their own and students who can complete assignments with help. ZPD and scaffolding are changes that students need from time to time where knowledge and skills can develop. Through continuous analysis, scaffolding must be adjusted based on the needs of students. The dynamics of the scaffolding proces depend on the adjustment cycle of student performance, task demands, and scaffolding level (Lin et al., 2012). Roll et al. (2012) stated that guidance or support in the learning process affects students' metacognition, where students explore and analyze a problem. Metacognitive scaffolding can help students to be able to solve various issues that will lead to better learning from further instruction.

Previous studies have empirically conceptualized scaffolding, an educational context that includes the interaction of more expert people and peers, small group and whole-class aching and learning environments, and discussions between friends and teachers (Elbers et al., 2013). In general, scaffolding refers to the methods used by teachers in creating a learning environment and taking action to help students learn (to build, deepen, strengthen, and consolidate knowledge). Scaffolding learning includes setting up physical and social structures for engagement, providing responsive challenge and support, and developing conceptual thinking (Bell & Pape, 2012). The idea of scaffolding is a metaphor for a teacher's way of supporting student progress and achievement through relatively difficult tasks (Fernández et al., 2015). Clark & Graves (2004) stated that scaffolding is effective learning because it allows a teacher to keep a task intact while students understand and manage its parts. Scaffolding integrates various aspects of the k, which helps students deal with the task's complexity authentically. Scaffolding needs to be applied in the classroom depending on the students' abilities indeed. Various levels of support are possible, and the more complex a task, the more support students need to complete it. Pfister et al. (2015) showed that scaffolding is likely in inclusive classes (low-achieving students). However, it is essential to have a structured program because the scaffolding metaphor is an understanding-oriented and structured form of support.. Meanwhile, Broza et al. (2015) found that complex learning process and contingent teaching is an appropriate method to apply.

Bikmaz et al. 2010) emphasized that the successful application of scaffolding requires the teacher to determine the difference between what each student can achieve independently and what he can achieve with guidance. To achieve this, the scaffolding principles that must be followed are: first, maintaining a good balance between providing challenges and supporting students; second, using appropriate forms of scaffolding, thirdly modeling favorable personality traits and behaviors; fourth, providing the most appropriate environment; and lastly respond and provide feedback to students regarding their questions and opinions so that they can take responsibility for their learning. Meanwhile, Mercer (2010) said that the scaffolding process requires collaboration between teachers and students, allowing a collaborative interaction to support students in the learning process. This is supported by Warwick et al. (2011), which focused on the necessity of a dialogical approach the class interaction. Kazak et al. (2015) suggested that scaffolding could effectively prepare for conceptual development through dialogue. Previous studies also found that teachers can achieve certain learning objectives in mathematics learning strategies by conducting conversations in both small groups and the whole class to achieve certain learning objectives. (Baxter & Williams, 2010).

A previous study stated that several types of scaffolding could be provided a different levels or times, consisting of macro, meso, and micro levels. The macro-level emphasizes the design of long-term work sequences or projects with repetitive tasks over a protracted period. The meso level requires the design of individual tasks consisting of steps or activities that occur sequentially or in a collaborative construction. Meanwhile, the micro-level focuses on the process of appropriation contingency interactions, stimulation, giving and receiving arguments in interactio, and collaborative interactions (Moschkovich, 2015). This confirms Prediger & Pöhler (2015) that micro and macro-scaffolding are connected to each othe

The research by van de Pol et al. (2010) found that scaffolding consists of three general characteristics. The scaffolding characteristics have an important role in learning. Characterizing scaffolding based on the general scaffolding characteristics in teaching can focus on student development in all different aspects. Thus, teachers can adjust the support that will be given to students according to students' level of development at that time. In addition, the scaffolding characteristics also have a role in t effectiveness of scaffolding through these three general characteristics. Based on theoretical fact, van de Pol et al. (2010) proposed three general sc lding characteristics: contingency, which refers to responsiveness and appropriate forms of support; fading refers to the gradual reduction of support provided; and transfer of responsibility which refers to taking over responsibility when students can learn independently. Smit et al. (2013) also proposed three scaffolding characteristics. The first characteristic is a diagnosis which refers to the teacher's diagnosis of students' conceptual

development. The second characteristic refers to the responsiveness of interaction between students and teachers, which illustrates the fading of support for the transfer of responsibility. Meanwhile, the third characteristic is the transfer of responsibility which refers to the taking over responsibility when students can learn independently.

Thus, hypothetically, it can be assumed that scaffolding characteristics do not include only three characteristics but can be more than that in teaching conducted by the teacher. These three characteristics are just general scaffolding characteristics. The addition of these characteristics may be based on the student's response at that time. Therefore, the focus of this article is to describe the general scaffolding characteristics, which researchers then suspect that there are more than three scaffolding characteristics in elementary school students' mathematics learning.

METHOD

The method used in this study was literature research. Literature research is a series of studies relating to library data collection methods or research whose research objects are explored through various library information (Syaodih, 2009). Meanwhile, according to Baumeister & Leary, a literature research can be broadly described as a systematic way to collect and synthesize previous research (Snyder, 2019).

The data used in this study was secondary data, which is obtained not from direct observation. However, the data was obtained from the research results carried out by previous researchers in the form of scientific articles or journals related to scaffolding. Secondary data obtained from various literature are collected as a unit used to answer the problems that have been formulated. The data was analyzed using a meta-analysis approach, which was carried out by identifying the types of scaffolding characteristics of teachers that were appropriate in learning elementary school mathematics, through two sources of research articles by Van de Pol et al. (2010) and Smit et al. (2013). The two sources were analyzed descriptively and based on their content.

RESULTS AND DISCUSSION

There are two main arguments about scaffolding. Van de Pol et al. (2010) proposed three general scaffolding characteristics: contingency, fading, and transfer of responsibility. These three characteristics refer to small group support, particularly to the support of a single student by a single teacher. Meanwhile, in the whole-class management, Smit et al. (2013) also proposed three scaffolding characteristics as van de Pol et al. (2010), but the terms are different. The three characteristics are diagnosis, responsiveness, and transfer of responsibility. Researchers assume there is an addition of these three characteristics (See Table 1).

Tabel 1. Scaffolding Characteristics Comparison

Van de Pol et al. (2010)	Smit et al. (2013)	This Research
1. Contingency: refers to responsiveness and appropriate forms of support. 2. Fading: Refers to the gradual reduction of the support provided. 3. Transfer of responsibility: refers to taking over responsibility when students can learn independently	1. Diagnosis: refers to the teacher's diagnosis of students' conceptual development. 2. Responsiveness: refers to interactions between students and teachers that illustrate the fading of support for shifting responsibilities. 3. Transfer of responsibility: refers to taking over responsibility when students can learn independently.	1. Contingency: refers to responsiveness and appropriate forms of support. 2. Fading: Refers to the gradual reduction of the support provided. 3. Transfer of responsibility: refers to taking over responsibility when students can learn independently. 4. Fading transfer of responsibility: refers to the fading or reduction of support carried out simultaneously with the transfer of responsibility to students.

The addition of characteristics carried out by researchers is based on three general characteristics according to van de Pol et al. (2010), because Bakker et al. (2015) stated that the proposal by Smit et al. (2013) aimed at evaluating *scaffolding* approach effectivity without separating interventions from the effect. Smit et al. (2013) only characterize their approach as scaffolding. All the main characteristics of the teaching and learning process meet the criteria of scaffolding, i.e., diagnosis, responsiveness, and transfer of responsibility. The effect is already incorporated into the concept. Meanwhile, van de Pol et al. (2010) stated that scaffolding success is included in the definition. Therefore, Bakker et al. (2015) and other researchers preferred the characteristics van de Pol et al. (2010) proposed. The addition of characteristics carried out by researchers is also based on three general characteristics, according to van de Pol et al. (2010). Adding the characteristic refers to the transition from the second general characteristic to the third general characteristic as shown in Figure 1.

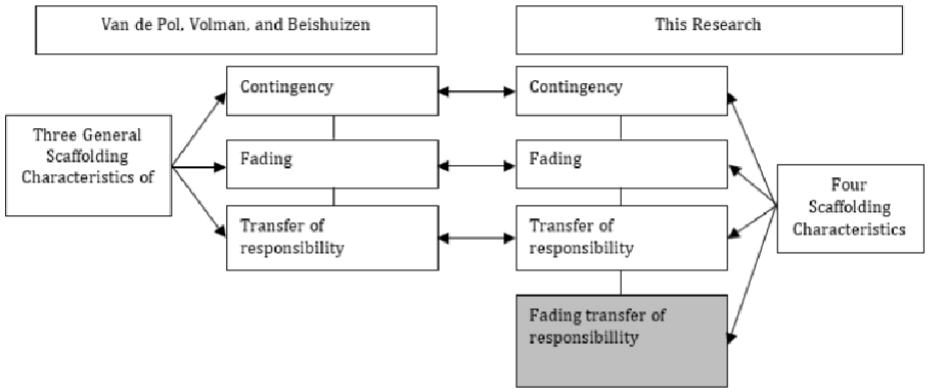

Figure 1. Addition in Scaffolding Characteristics

The three characteristics by van de Pol et al. (2010) are contingency, fading (withdrawal), and transfer of responsibility. In contingency, a teacher adjusts support for a group of students. To provide support in this contingency, the teacher must first determine the level of student competence because this is needed to determine conformity with student learning. The second common characteristic is the gradual fading or withdrawal of support. The degree of withdrawal or fading of support depends on the student's level of development and competence. A teacher makes withdrawals when the level or amount of support decreases over time. This stage has characteristics that distinguish it from the third characteristic, which can be seen from the student's point of view. Students have felt progress in the learning process so that the form of support or assistance provided by the teacher has faded, but they still have assistance, although less than before. The third common characteristic is the transfer of responsibility which refers to the gradual transfer of task performance to students. Responsibility, in this case, can be defined broadly. It can refer to students' cognitive activities or students' metacognitive influences. Responsibility for learning is shifted when a student can increase learning control. There are characteristics in this third characteristic to distinguish it from the second characteristic. Its characteristics are that it can be seen from the student's point of view, they (students) have been able to achieve the goals of the learning process without the help of a more skilled person, both the teacher and their peers. Thus, the responsibility has been completely transferred to the students without any help from others.

The previous description emphasized that the researcher applied van de Pol et al. (2010) to characterize the scaffolding learning process, consisting of contingency, fading, and transfer of responsibility. The researcher can answer the first problem formulation: there are more than three scaffolding characteristics besides contingency, fading, and transfer of responsibility. The addition of these three characteristics is the integration of the second characteristic, namely fading, with the third characteristic, namely the transfer of responsibility which is then termed as the fading transfer of responsibility.

The addition of these three characteristics is based on the results of a literature review that refers to the characteristics of the three scaffolds mentioned by van de Pol et al. (2010). It seems reasonable to link fading with the characteristics of the third scaffolding as a long-term process (Stender & Kaiser, 2015). Dissipation is closely related to the third common characteristic, namely the transfer of responsibility. Through contingent fading, the responsibility for the implementation of the task is gradually transferred to the student. In this review, responsibility is broadly interpreted, referring to students' cognitive or metacognitive activities or student influences.

In summary, the capacity to take over responsibilities only takes place over a long period. As a consequence of this, fading must also be seen as a long-term process. Research by Stender & Kaiser (2015) explained the definition of the scaffolding process as contingent support based on diagnostic activities along with long-term fading to increase student responsibility.

The addition of these characteristics also considers a scaffolding strategy by van de Pol et al. (2010) that distinguishes between six scaffolding facilities, namely: providing information, providing instructions, instructing, explaining, modeling, and questioning, with five scaffolding intentions, namely maintaining direction to support students' metacognitive activities, cognitive structuring, reducing degrees of freedom to support cognitive activities, mobilization and contingency

management/frustration control to support student influence. Van de Pol et al. (2010) determine the scaffolding strategy as a possible combination of facilities with the intention of the scaffolding. Generally, the fulfillment of teaching strategies as scaffolding depends on their application in actual practice and, more specifically, on contingently applied strategies and are also part of the process of fading and shifting responsibilities.

Thus, there are four scaffolding characteristics, of which three are general scaffolding characteristics, and one is an integration or transition from the second and third general characteristics. The four characteristics are contingency, fading, transfer of responsibility, and fading-transfer of responsibility. The fourth characteristic can be described in detail as follows. Fading transfer of responsibility is the integration or transition of the second and third general characteristics. The reduction of support or fading of support by teachers can occur alone or simultaneously with the transfer of responsibility. When students begin to be able to control their learning independently, say in completing assignments, along with the process, the teacher will slowly reduce or eliminate their support. The difference with the three general characteristics is that there is an addition of one characteristic: the integration of the second and third general characteristics.

Since the author refers to the general characteristics formulated by van de Pol et al. (2010), this scaffolding learning intervention refers to the support provided by the teacher to a small group, especially to the support of a single student a single teacher. This is since the possibility of an intervention is based on concrete terms based on the individual situation of students, and this cannot easily be transferred across groups due to heterogeneity allowing teachers to react differently to different students. Therefore, the thing to remember is that the scaffolding process is also based on the student's response at that very time.

Abbreviations and Acronyms

Vygotsky describes zone of proximal development (ZPD) in scaffolding as the gap between students who can complete tasks by themselves and students who can complete tasks with assistance.

CONCLUSION

The analysis carried out on the main source article and several supporting source articles resulted in several conclusions. First, there are more than three scaffolding characteristics which refer to three general characteristics according to Van de Pol, namely the addition of mixed characteristics, fading in the transfer of responsibility. Second, the fourth characteristic of scaffolding is an integration or transition from the second and third general characteristics. This characteristic is the process of reducing or fading support provided by the teacher, which occurs simultaneously with the transfer of responsibility to students.

Based on the results of this study, teachers are advised to develop teaching practices in the classroom using scaffolding learning. Meanwhile, schools can be used as a reference for developing teaching practices to increase the activeness and effectiveness of the learning system. For future researchers, this research provides insight and knowledge in terms of classroom teaching.

As a recommendation, this research by reviewing literature studies is still limited to face-to-face interactions, not online. The literature review also limits the updating of the data used. Learning by considering the scaffolding characteristics cannot be used for online learning in the COVID-19 pandemic. Therefore, the author also suggests that future researchers study this topic in more depth by using this article as a reference.

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