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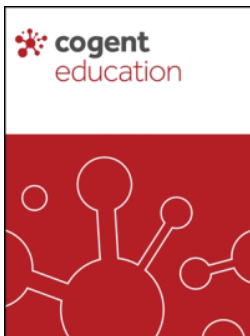
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TEACHER EDUCATION & DEVELOPMENT | REVIEW ARTICLE

Revisiting and re-representing scaffolding: The two gradient model

Shoaib Ahmed Malik^{1*}

Abstract: In this paper I intend to illustrate Vygotsky's Zone of Proximal Development (ZPD) and then extend the discussion to scaffolding and its relationship with the ZPD. This is then followed by some concerns raised in literature regarding scaffolding as a concept and as a metaphor which involves analysing the arguments for regarding the role of cultural tools and peers as scaffolds akin to instructors. In consideration of some of the criticisms directed at scaffolding, I introduce the concept of the Two Gradient Model (TGM) which is a descriptive model that attempts to clarify the interaction between the instructor and learner. Furthermore, the TGM also demonstrates the need to differentiate between instructors and cultural tools as scaffolds where the latter should be kept relegated as secondary components in the scaffolding process. Additionally, the TGM also differentiates between instructors and peers whereby the latter do not occupy the same interpersonal dynamics as the former in a pedagogical environment.

Subjects: Educational Research; Education Studies; Philosophy of Education

Keywords: ZPD; Vygotsky; scaffolding; model; metaphor; development; constructivism

1. The zone of proximal development

A major break from classical psychology was the deviation from the understanding that the recipient activity of children was the determining factor in their mental development (Vygotsky, 1984). This approach presumed that context and the external actors (e.g. teachers or parents) had little or no bearing in the learning process and students were to be treated as "receptacles" through which education became "an act of depositing (Paulo, 1970)." By contrast, constructivism shifted this focus from the passive child to the engaged child whose development relied on the dynamic interactions with either external elements and or internal dialogue. Constructivism, then, principally has two

ABOUT THE AUTHOR

Shoaib Ahmed Malik, PhD, is an interdisciplinary researcher. Though he is formally an assistant professor of science, primarily teaching chemistry, physics and mathematics, his research interests cover education, theology and philosophy of religion and science. His central interest is the role of models and metaphors in these various fields and how they contribute in shaping worldviews. His research aims at contributing towards building nuanced perspectives on metaphors and models and helping the wider audience understand their pivotal importance in heuristics.

PUBLIC INTEREST STATEMENT

This article provides a critical analysis of a metaphorical concept that is entrenched in the field of education: scaffolding. The metaphor has since then evolved into various moulds and has been criticised on its many fronts. The main thesis of the article is to not to lose sight of the *intended* metaphor in its historical and contextual settings. In sustaining this argument, I also bring forth a new perspective by which scaffolding can be viewed as a system of gradients between instructor and learner which I call the Two Gradient Model. The implications of this model are also discussed with regard to the role of pedagogical tools and peers in the learning process.

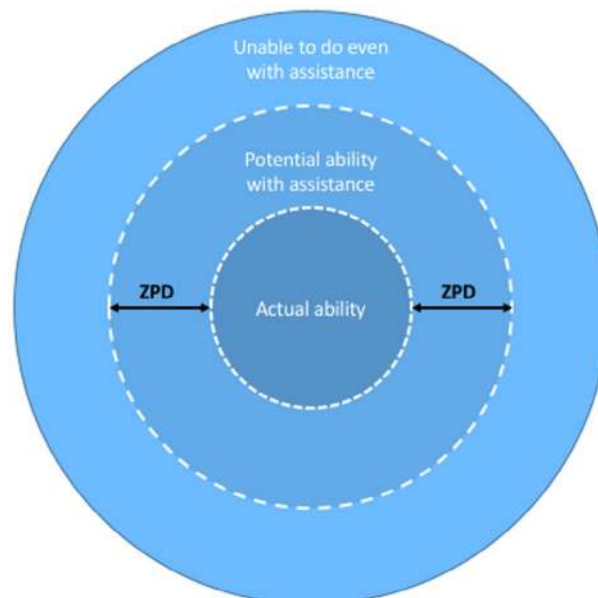
main foundations. First, learning is an active process and not simply a passive reception of knowledge. Second, learning is built on previously acquired knowledge (Duit, 1991). However, in the constructivist view learning is not simply a linear progression of conceptual growth, rather it is the transformation of the pre-existing knowledge that evolves with new binding knowledge (van de Pol, Volman, & Beishuizen, 2010).

Jean Piaget and Lev Vygotsky are two well-known household names of the constructivist camp. Piaget focused more on the child's internal manifestation of curiosity and motivation to learn. The Piagetian child, also known as the "natural epistemologist" (Wood, 1986), is the independent driving force in the learning process while the interaction of the teacher is there secondarily to establish consistency of symbols and links between the child's mental schemas (DeVries, 2000; Marie & Pettersen, 2014). By contrast, Vygotsky highlighted the importance of the interaction as the primary factor in the learning process as he wrote, "human learning presupposes specific social nature and a process by which children grows *into* the intellectual life of those around them" (Vygotsky, 1984) (*italics my own*). The "into" in the previous quote emphasises how from the Vygotskian perspective the intellectual stratosphere is an external reality to the child that is gradually acquired and internalised through engagement via social protocol (Wood, 1988). In this view, a gradient of intellect is established where there is the actual intellect which lies within the child and there is the potential intellect ready to be acquired from the environment (borrowing from Aristotelian terminology). If the potential intellect is actualised, this manifests itself as the new actual intellect and a new reference for the potential intellect is generated. This constant gap between the child's actual intellect and the potential intellect is known as the zone of proximal development (ZPD). Vygotsky (1984) famously summarised it as:

the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers.

However, the ZPD should not be confused for an infinite continuum of a never-ending destination of potential intellect. The ZPD is specifically the region between the intellect which a child already has and intellect a child can acquire with guided assistance. Beyond that boundary is intellect that is outside the reach of the child even with assistance (see Figure 1). If the instruction of teaching is over-pitched, then the child might face difficulty in comprehending the subject, whereas pitching below the difficulty of the student's ability might make the process too easy; the ZPD lies between

Figure 1. A visual summary of the ZPD.



these extremes (Lui, 2012). Additionally, this does not involve a dogmatic production of tailoring students' answers to teacher's predetermined answers, rather it encourages validating student's responses and attempts to see how relevant, consistent and progressive they are with reference to the goal(s) of the topic being discussed (Morge, 2005). Furthermore, the ZPD should not be seen as a description of a process but rather as mental markers that approximate the references states of a learner which are determined by an instructor depending on the capacity of the learner, the goals of the lesson and the content of the material to be covered (Mercer & Littleton, 2007). Lastly, Vygotsky never actually specified how to perform a developmental interaction in the ZPD and was left to later successors in determining its active manifestations (Boblett, 2012; Verenikina, 2008). It is here where the dynamicity of the developing process in the ZPD was fully appreciated by the notion of scaffolding.

2. Scaffolding

Scaffolding was initially introduced by Wood, Bruner, and Ross (1976) but was not explicitly linked with ZPD till much later (Puntambekar & Hubscher, 2005; Stone, 1998a). The term was used to explain the tentative role of tutors, teachers and parents in the learning process of children akin to how scaffolds are temporary structures that are used to construct buildings. The involvement of such actors in the ZPD:

enables a child or novice to solve a problem, carry out a task or achieve a goal which be beyond the unassisted efforts ... This scaffolding consists essentially of the adult "controlling" those elements of the task that are initially beyond the learner's capacity, thus permitting him to concentrate upon and complete only those elements that are within his range of competence. (Wood et al., 1976)

In a simpler sense, scaffolding is seen as temporary, assisted learning which tries to create independency in the student. In this process a dynamic system is established between the tutor and the student which involves a gradual development of the student as he acquires more confidence and capability in the task or concept at hand (Lajoie, 2005). Three notions are of importance in explaining this dynamic: contingency, fading and responsibility (see Figure 2).

First is the role of contingency which involves tailoring and customising the teaching strategy according to the student's capacity. On applying such strategies, the teacher should get some form of feedback, be it visual, through tests or verbal signals that the student is understanding and developing in what is being taught or instructed. Of course, a balance needs to be maintained between the rigidity of planning and the flexibility of improvisation. Boblett (2012) suggested a relevant and useful three-tier hierarchy of scaffolding which illustrates the varying ratios of rigidity and flexibility.

Figure 2. The dynamic interaction between an instructor and learner which illustrates the notions of contingency, fading and responsibility.

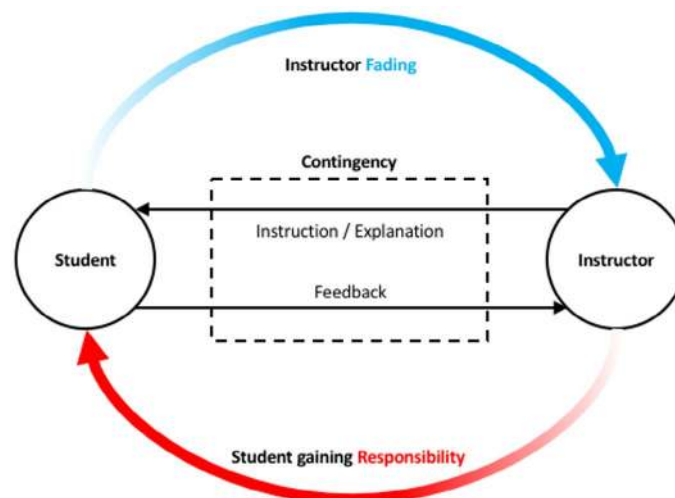
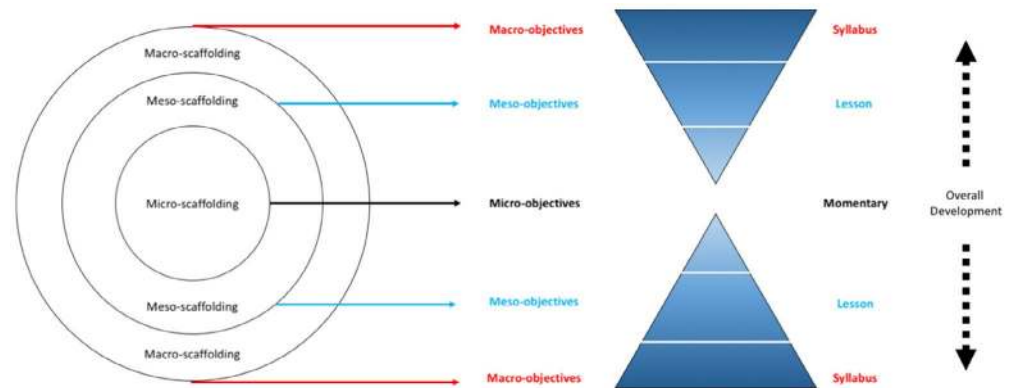


Figure 3. A networked illustration that attempts to show interrelationships between macro, meso and micro-scaffolding, their corresponding objectives and their analogous hierarchal development.



Macro-scaffolding refers to the general progression of the course syllabus whether decided by the instructor, internal authority or an external authority. Meso-scaffolding corresponds to the goals and activities required of a specific class. Finally, micro-scaffolding refers to the momentary interaction between the instructor and student. Micro-scaffolding allows the greatest flexibility but is constrained by the boundaries set by the macro and meso-scaffoldings once they have been fixed. However, a word of caution on these distinctions is needed. Scaffolding as traditionally used only refers to micro-scaffolding whereas the other two are much looser and newer associations of the term. Macro and meso-scaffolding should be understood as long-term developments with respect to the time and objective(s) of the overall syllabus and or the lesson in contrast to the momentary aspect of micro-scaffolding. Furthermore, as shown in Figure 3, micro-scaffolding has an asymmetrical relationship with the other two types in that it is independent from macro and meso-scaffolding but the opposite is not true. Micro-scaffolding, then, is the core feature of the entire system. Nonetheless, the simultaneous balance of these three scaffolds should be best determined by the instructor on a case-by-case basis depending on the wider context and constraints.

The second notion is that of fading which refers to the temporal nature of the support. As the student develops confidence, the instructor should know when and how to gradually withdraw support to let the student develop independently. The final notion is of responsibility which is interlocked with fading in an opposing binary relationship. The more the instructor fades, the lesser the responsibility he has with the concept or task to be achieved, i.e. the student becomes more in charge of the learning process, and *vice versa* (van de Pol et al., 2010). However, the instructor must be vigilant against blind repetitive production of a desired outcome and thus not be mistaken in conflating production for comprehension (Bliss, Askew, & Macrae, 1996; Maggioli, 2013; Stone, 1998a), rather he should ensure that the gap between them is as minimal as possible. For example, scientific concepts primarily rely on utilising mental models. However, differentiating between the outputs of models (production) is very different to understanding the nature of the models themselves (comprehension). A relevant example would be of the subshells in the atom. Students of chemistry are usually taught about electron configurations which vary according to the subshell type, e.g. *s*, *p*, *d* and *f*, and the number or level of each shell, e.g. *1p*, *2p* or *3p* etc. Using these symbols and their conventions students can write electron configurations of any element in the periodic table. However, a smart student should also know that these subshells are mathematical fictions and are not real phenomena of the atom (Sillberberg & Amateis, 2014; Wallace, 1996). The distinction between them is an important marker in determining genuine understanding of atoms from “output processing” understanding of atoms. In summary, the combination of contingency, fading and responsibility define the dynamic nature of scaffolding. Though others have elaborated on various aspects of scaffolding (Maggioli, 2013) or different kinds of scaffolding (Tabak, 2004a), I believe these cover the core aspects of how scaffolding should operate ideally if not in practice. However, scaffolding is not free from controversy as will be seen in the following section.

2.1. Problems with scaffolding

The notion of scaffolding has become popular not only in cognitive psychology but also teaching in general because of its easy-to-grasp descriptions of the instructor-learner dynamics. It is of no surprise then in seeing scaffolding being applied to teaching practices various platforms and fields of education (Chaiklin, 2003; Mercer & Littleton, 2007; Verenikina, 2008). Problematically, however, the original understanding of scaffolding was not in the context of classrooms, rather it was initially proposed by Wood et al. (1976) in a study of child development (Maybin, Mercer, & Stierer, 1992) which involved observing parents who were helping their children in a specific task of completing a puzzle (Wood, 1986; Wood et al., 1976), and thus it was not necessarily construed as a theory of learning (Maggioli, 2013). Scaffolding, then, was referred to the guided assistance of the parent which was revised to either guide the child when necessary or withdraw support when the child was capable to complete the task on his own. The obvious problem with applying scaffolding to the modern teaching environment is its lack of similarity with the one-to-one guidance of a parent (Stone, 1998a). A classroom contains more than one student and thus it becomes questionable as to what extent can the instructor determine the ZPD. Alternatively, does it even make sense to even discuss the ZPD in a classroom setting (Puntambekar & Hubscher, 2005; Wood, 1988)? Moreover, even if determining the ZPD issue was surmountable, how can scaffolding be provided to a classroom with students from different backgrounds, strengths and weakness by one instructor? The answers to these questions are not so easy to determine as the notion of scaffolding has evolved and transmuted into various moulds and definitions that has resulted in the inevitable broadening of its meaning (Boblett, 2012; Maggioli, 2013). The root causes for these misunderstandings can be traced to two central issues: confusions surrounding the metaphor itself and the application of scaffolding to non-instructors.

2.1.1. The metaphorical problem

The first concern is to do with connotations surrounding the metaphor itself, particularly the issue regarding the literalisation of the metaphor. Examples of such concerns include “imposition of a structure on students” (as quoted in Stone, 1998a), “knowledge being shaped by adults according to a fixed ‘blueprint,’” (as quoted in Stone, 1998b) and how scaffolding is “a planned event in construction, while in an educational setting, ‘the support sometimes falls apart rather suddenly and at inopportune times’” (as quoted in Maggioli, 2013). Consequently, new teachers might misconstrue the metaphor’s true objective as being rigid and instructive rather than contingent and adaptive. More specifically, it can suggest a one-way dialogue “wherein the scaffolder constructs the scaffold alone and presents it for the use of the novice” (as quoted in Verenikina, 2004); it suggests that the instructor should speak *at* the student and not *with* the student which would imply a return to the traditional directed instruction where the student is considered as a passive entity in the teaching process, a notion completely antithetical to the co-constructive relationship between the instructor and learner in the Vygotskian paradigm (Verenikina, 2008). Consequently, there have been two negative reactions with regard to moving forward with the metaphor. The first trajectory involves changing the metaphor itself. For example, Lepper et al. (as cited in Puntambekar & Hubscher, 2005) pointed out that the connotation of scaffolding as a metaphor is that the student will go back to “ground zero” once the scaffold is removed as with a painter or a worker, and thus they suggested a more appropriate metaphor would be an arch supported by a temporary structure which once removed would render the arch independent. Rogoff suggested “apprenticeship” as another substitute which focuses on the organisationally experienced superior guiding the younger apprentice (as cited in Stone, 1998a). The second trajectory involves negating or avoiding the metaphor altogether, either intentionally or not, as it can be captured by other terms such as “assisted performance,” “reciprocal teaching,” and “guided participation,” where each new term was an attempt to develop specific aspects of the scaffolding mechanism (Boblett, 2012). For example, “assisted performance” was used intentionally as a replacement of scaffolding to avoid the monotonous assistance of the *same kind* of support as suggested by the metaphor (Stone, 1998a). A third and tolerant trajectory has been to advance with the metaphor such as Applebee and Langer who introduced the notion of “Instructional

scaffolding” that suggested how to tailor the concept of scaffolding to fit the needs of an entire class through reading and writing (as cited in Boblett, 2012), a significant evolution of scaffolding from its original research context; or Warwick, Mercer, and Kershner (2013) who utilised “direct” and “indirect” scaffolding as different forms of contingency involved in the dynamic interaction between instructor and learners. Subsequently, scaffolding has occupied different names at various times and academic spaces which has only contributed towards broadening its semantic boundaries. Having acknowledged each trajectory, then, how should we proceed hereon with the metaphor?

Criticisms directed at scaffolding *due* to the metaphor itself reflect misdirected attempts to understand the metaphor in an ahistoricised and decontextualised sense. By insensitively focusing on the “construction” domain of the metaphor, some authors have misconstrued the intended meaning of scaffolding by viewing it outside of its theoretical breeding ground (Verenikina, 2008). Stone (1998b) acutely highlighted how the metaphor in its original context “... provided a powerful counterpoint to both Piagetian individual constructivism and the emerging model of isolated information-processing systems.” However, historical origination is no reason to hold on to the metaphor but then neither is neglecting or ignoring the metaphor a productive strategy as the metaphor has become widely popular and familiar in all circles of research (Verenikina, 2004). A moderate approach would be to use the metaphor cautiously while understanding its limitations and utilising its remaining generative power, if any. Unlike logical propositions which can be judged to be entirely false or true, metaphorical statements are partially true and false; they are simultaneously “is and is not” (Pellauer & Dauenhauer, 2016). For example, an atom is like the solar system with regards to the neutrons and protons (the nucleus) being in the centre of the atom as the sun and electrons around the nucleus like the planets, but is unlike the solar system in that electrons are not coloured planets. The key is to determine the intended relationship embedded in the metaphor by the user. Scaffoldings are tentative structures in *relation to the building* they are attached to, they are there till the building’s completion and removed when it is completed. Similarly, scaffolding between instructor and learner is a real-time, titrated and tentative process. Those who have criticised scaffolding on other entailments (Lakoff & Johnson, 1980) of the metaphor such as “blueprints” or “workers on the scaffolds” have entertained unnecessary tangents, and it is this activity of stretching the metaphor beyond its territorial mark or misdirecting its intention that needs to be curbed. Otherwise what ends up happening is a goose chase of criticising metaphors rather than a critical analysis of the substantial concept. Hopefully, this suggestion will lead to more cautious use of the metaphor and its intended idea.

2.1.2. *The conceptual problem*

The second concern is with defining the nature of a scaffold. The literature on scaffolding has extended to more than simply teaching agents where the discussion has spread to the role of computerised equipment, written artefacts, peer interactions and even the environment on whether they can be considered as potential scaffolds (Kim & Hannafin, 2011; McNeill, Lizotte, Krajcik, & Marx, 2006; Sherin, Reiser, & Edelson, 2004; Tabak, 2004b). There are two problems with going down this route. First, by extending the definition of scaffolds to such an extent makes it difficult to see the difference between scaffolding and simply support. If these are used synonymously, it can lead to an “atheoretical use of scaffolding” (Palinscar, 1998) and thus unclear in its significance (van de Pol et al., 2010). Even if this option is entertained, it becomes hard to establish a criterion by which something can be considered a scaffold in comparison to when it cannot. More fundamentally, how can we nonarbitrarily consider a calculator to be a scaffold in contrast to a pencil? Second, cultural tools have the possibility in either extending a student’s actual skill set or clarifying a student’s knowledge base, but they don’t have any intrinsic impetus in developing towards the learner’s potential level. For example, if a student is being taught the various parts of the human body a diagram only helps summarise the interconnectedness of the human anatomy which have been studied in isolation. Similarly, a calculator on its own only helps speed up the processing for a required mathematical function which would take much longer by hand, but that itself does not necessarily develop the student towards any self-regulation or independence. Additionally, cultural tools do not have the guiding feature which an animated teacher does. A calculator on its own cannot direct a student towards a certain goal, nor can a calculator transfer responsibility or fade from the student

like a teacher can. Hence, cultural tools are only as good as the user which in this case must be under the guidance of an instructor and thus cannot themselves be scaffolds. At best, algorithmic computers that adapt their difficulty with respect to the feedback obtained from the student's responses can be admitted as being similar to an instructor (Kim & Hannafin, 2011). However, even these can be questioned due to lacking non-cognitive elements such as emotions, motivations and cultural contexts which can be argued are necessary components of scaffolding (Pea, 2004; Polman, 2006; Rosiek & Beghetto, 2009). If technology is to be understood as a teaching aid, it should be understood as "technologically-enhanced scaffolding" (Kim & Hannafin, 2011; Shen, 2010) rather than as scaffolding in its own right. In summarising all these contentions, Stone (1998b) aptly pointed out the core problem in that scaffolding can be considered as a noun and as a verb, and so, one should not be confused for the other as he wrote,

There are entities that serve as scaffolds, such as diagrams, and these entities serve an important role in instruction. However, what is most crucial is the process by which these entities are **used** to foster new understandings. In essence, one could argue that the core of the scaffolding metaphor rests squarely on viewing it as a *process*. (bold my own)

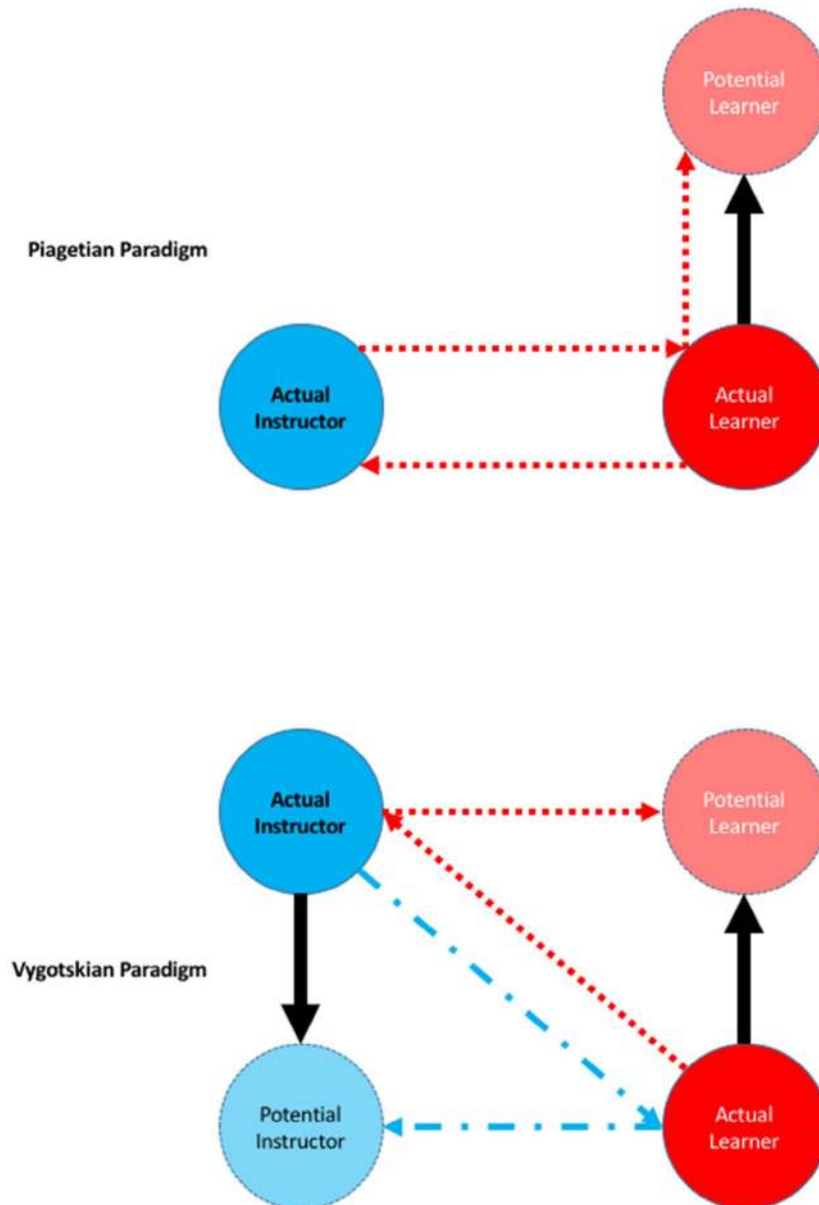
However, I would take the argument further than Stone (1998b) and suggest that the role of the dynamic interaction between instructor and learner is pivotal to the entire scaffolding process and no position defending cultural tools as scaffolds can withstand the aforementioned criticisms. At best, there can be co-regulation of cultural tools (Warwick et al., 2013) by instructors but there can never be an equivocation of the two. Peers are much more different than cultural tools in that a case can be made that they *can* be assisting in the development of learning, but I would argue that they don't necessarily have the same objectives that an instructor may have in a learning environment. The social dynamics of a peer group differs to the expert-like authority of the instructor. The ethos of learning *with* peers and *by* peers may encourage a collective process which encourages the learners to reconsider their viewpoints. However, the real-time titration and tentative support that can be supplied by an expert who can funnel the necessary knowledge and communicate according to the learner's development is a difficult process to establish amongst peers. Also, rather than looking for cues of struggle in the learner, peers may offer more explicit forms of help because they might see it as aiding as one of their own rather than seeing it as a form of development towards independence, and thus why the aided learners might not perform as well because the independency was never created in the first place (Howe, 2013). Competent peers may also have the necessary "concept at hand" but may fail to confidently communicate it with the learners (Puntambekar & Hubscher, 2005). Additionally, even if the competent peer were able to communicate an idea across to the targeted learner, it may seem quite difficult to determine what sort of development actually took place as progression and regression are equally possible (Hogan & Tudge, 1999) as will be seen later in Figure 5. The necessity of a strong knowledge base and experience should be an important factor in the interaction (Wood, 1988), but this isn't something peers have in comparison to an instructor. Ideally, instructors should have sufficient familiarity and experience with the subject or skill being taught which is what gives them the teaching-autonomy in the relationship in the first place. Furthermore, and as will be shown in the next section, the gradient of knowledge and experience established between an expert instructor and a learner is much more developed than one between a peer and a learner, and it is this gradient that drives the scaffolding process.

3. Two gradient model

In light of the aforementioned points, I propose to introduce the concept of the two gradient model (TGM). The TGM is a descriptive model that is premised on the idea that in order for scaffolding to occur, both instructor and learner need to be viewed as establishing gradients between each other. A gradient represents a differential system between two points of contrast, and in the case of scaffolding both the instructor and the learner each have a gradient between their actual states and their potential states. These gradients may be similar in that they both represent a quantitative

Figure 4. A comparison of the Piagetian paradigm (top) and Vygotskian paradigm (bottom).

Note: The TGM is represented in the Vygotskian paradigm.



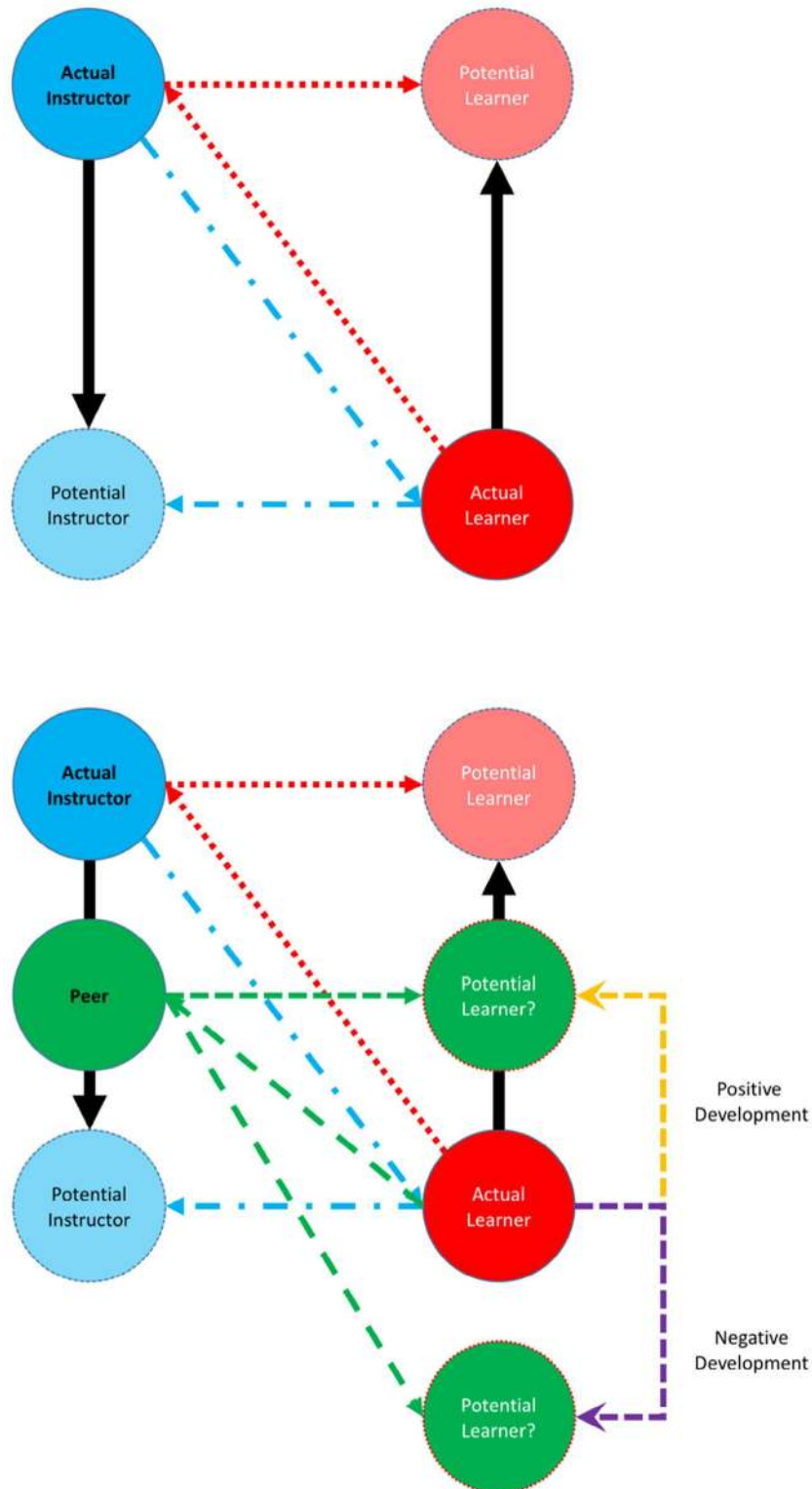
character but they are qualitatively different from one another. From the perspective of the learner, the instructor represents an authority who is in the position to be a reliable guide, has the background expertise which he himself does not have and so can aid him when necessary, and thus a positive gradient of intellect, guidance or skill is established. Simultaneously, the instructor must selectively funnel his extensive knowledge and array of experiences and then manufacture his guidance in the manner to which the learner can relate to and understand. By doing so he “comes down” to the level of the learner which establishes a negative gradient. This, however, does not entail nor suggest a licence of direct instruction for instructors to dominate over their learners, a concern that was discussed earlier. Rather, it suggests the requirement of flexibility and real-time assessment which the instructor is supposed to have with regards to adapting to the challenges confronted in scaffolding. Tabak (2004b) also suggested that a partner-like instructor rather than a teacher-like instructor can create a symmetrical relationship between the instructor and the learner in which the learner is more receptive. In this scenario, the learner views the partner-like instructor as “one of us” rather than as “one of them.” This can be pinned down to the interpersonal dynamics where the

teacher-like instructor carries with him the negative connotations of a school where the authority of a teacher is a constant reminder, and thus an “outsider.” Though I agree with the symmetry suggested by Tabak (2004b), I would not go so far to suggest in saying that seeing a teacher make mistakes and struggle with concepts and questions can help the learner feel better as the teacher seems to be on the same level and thus “one of them.” This is because Tabak (2004b) did not consider how making mistakes alongside the learner can also be interpreted as being incompetent and may even lead to the learner losing confidence in the instructor. The interpersonal relationship between the instructor and learner should be as symmetrical as possible in that the learner feels that both he and the instructor have equal ownership in the task to be achieved (Hogan & Tudge, 1999; Hsin & Wu, 2011). However, this should not be conflated for the necessary asymmetrical intellectual and experiential relationship required for scaffolding to occur; social symmetry can be established without reducing the instructor to a near peer-like individual in the expertise domain. This raises the important point on how an instructor must have an adaptive capacity to change his delivery according to the various learners, and thus various ZPDs, he might encounter in his teaching career. For example, explaining atoms to a primary school student requires a very different language and style of teaching than a secondary school student. Even students in the same class or age group might require different styles of teaching and or formatting of the content being taught. In both situations the instructor has the higher level understanding of the topic and according to the situation he must adapt to the context of the student’s needs and the broader restrictions that might be in place. Therefore, just as the student requires development from his actual state towards potential state, so too the instructor must simultaneously progress towards his potential state by learning how to effectively relay the necessary guidance and information to the learner based on his performance. This, I believe, represents the heart of scaffolding in which instructor and learner simultaneously develop each other. In such a relationship both parties have ownership in the task and thus both are irreducibly driving each other’s development (Puntambekar & Hubscher, 2005; Rojas-Drummond, Torreblanca, Pedraza, Vélez, & Guzmán, 2013): there is no such thing as a one-handed clap. Just as a building needs scaffolding in place to develop, the scaffolding needs to change according to the various extensions (in either shape or size) of the building to be constructed.

These points are reflected in Figure 4. Figure 4 top represents the Piagetian paradigm where the solo scientist instigates his own learning and uses the instructor to confirm his mental schemas, and thus there are no gradients to establish *between* the instructor and learner. However, there is an internal gradient within the learner which is how he keeps developing once confirming with external interactions. Figure 4 bottom represents the TGM in the Vygotskian paradigm where the concurrent operation of the instructor coming down to the learner’s level and the student developing towards his potential state (in either skill or concept) in which he does not need assistance. In the absence of any differential state between learner and instructor, the gradients collapse and thus scaffolding no longer exists. An implicitly similar point could be picked up in the work of van de Pol and Elbers (2013) where in their differentiation between contingent and non-contingent support an instructor in the latter category fails to estimate and adapt according to the learner’s level and thus scaffolding collapses. Additionally, a cultural tool cannot establish a gradient because it is only as useful as the intended purpose. Within the context of teaching, purpose presupposes a will of an agency that cultural tools do not possess. Consequently, cultural tools should be strictly understood as *effective processors* not as *effective developers*. Though the former can partake in the latter and enhance development (Kim & Hannafin, 2011), they cannot *in toto* replace development. Cultural tools and instructors, then, are categorically different from one another and therefore all “synergistic” scaffolds (Tabak, 2004a) should be taken as nothing but mythic notions. Calculators speed up mathematical procedures, the internet speeds searching for information and diagrams visually help systematise isolated concepts in an organised fashion. However, it is instructors who can help learners in developing the relationship between trigonometric identities (sin, cos and tan), with identifying how to critically assess reliable sources online, and help sharpen the learners’ ability to determine whether a diagram is arranged symbolically, mathematically, ontologically, physically or aesthetically and thus what difference each one makes in interpretation.

The TGM could also be used to represent the difference between peers and instructors as seen in Figure 5. The gradient established between a competent peer and a learner may not be as well differentiated as that between an expert instructor and a learner. The key difference between an expert and a peer is that the former has much more experience and knowledge with the concept or skill

Figure 5. Comparison of gradients established between the gradients of the instructor and learner (top) and the gradients established between a competent peer and learner (bottom).



that is being dealt with. Accordingly, the combination of being familiar with the nuances involved and the ability to read the learner's cues for the intended objective of developing him makes the expert learner better suited for scaffolding than a peer. Additionally, Vygotsky's ZPD by definition necessitates that the instructor has identified the actual and potential state of the learner. Peers carry no such obligation in their role as a friend or as a classmate but even if they did, it would be difficult to navigate as to how much the student would be developed as would be seen by a competent instructor. Similarly, expert instructors modify their approach or stance so that the necessary developments are achieved but the same cannot be said of a peer who may simply want to help the learner with completing the task. Hence, there may not be a potential state for the peer as he may not see any need to identify nor work towards one. Lastly, as noted by Hogan and Tudge (1999), development through peer guidance is not a homogenous observation. It may be countered that I am arguing as an idealist in that instructors don't share the same criticism; I have no problem in conceding to this point. It may be very well possible that some instructors may lead to regressive development, but a normative account, which is what I am arguing for, is necessary to have any comparison in the first place. Accordingly, I believe that it is necessary to differentiate between peers and instructors due to the prerequisites (knowledge and experience) assumed in the competent educator and the varied differences that play out in the interpersonal fields between peers and instructors with the learner.

It is hoped that the TGM contributes towards clarifying scaffolding between the instructor and the learner. Though the underlying principles in TGM are nothing new, it was sought to bring a new representation of the scaffolding process with the intention to clarify and make more explicit the differential aspect between instructor and learner and hence bring more focus on the implicit gradients established in scaffolding. A second motivation to introduce the TGM was to carry forward the argument of sustaining a two-tiered classification between the primary role of the instructor in comparison to the secondary role of cultural tools in scaffolding. By similar extension, the TGM can also be used to differentiate between peers and instructors in that, potential states for peers may not exist due to not having any necessity to identify and or work towards one. Additionally, the TGM can be used to help visualise the ambiguity in the developmental process of the learner guided by peers in comparison to an instructor.

4. Conclusion

The intention of this article was to revise the notion of scaffolding. Undoubtedly, the metaphor and the concept has been morphed into a variety of different conceptions and applied to a variety of different pedagogical spaces. I have tried to show how these were caused either by misunderstanding the metaphor or misapplication of the concept. However, as I have argued in this article, the suggestions and temptations to broaden scaffolding as to allow cultural tools in its definition and application are unwarranted and should be resisted as they are categorically different. A tool is only as useful as the one who wields it and so must always be seen as a secondary kind of aid in comparison to an instructor. To diminish the qualitative boundary between an instructor and a cultural tool only contributes towards further digression and misunderstanding of the concept. Only by realising the implicit field of gradients established between instructor and learner can scaffolding regain its undiluted status as an animated process that cannot be instigated nor sustained by cultural tools. Though peers may act as instructors but due to the reasons mentioned earlier, they cannot be considered as scaffolds as their relationship with the learner occupies a different interpersonal continuum than that of an instructor. It is hoped that the TGM has contributed in making this case while also adding clarity to the scaffolding process in its broader context.

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