

USING VALSINER'S ZONE THEORY TO INTERPRET A PRE-SERVICE MATHEMATICS TEACHER'S ZONE OF PROXIMAL DEVELOPMENT

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Abstract

The purpose of this study was to use Valsiner's (1987) constructs of the zone of free movement (ZFM) and zone of promoted action (ZPA) to understand the zone of proximal development (ZPD) of a pre-service secondary mathematics teacher during her student teaching semester. Using classroom discourse, we characterized the zones established by the teacher and identified an additional 'phantom' zone of promoted action (PZ) whereby the teacher appeared to promote certain events but in reality did not permit them to occur. We found the PZ to be a precursor to the reconfiguration of the ZFM established by the teacher and thus, potentially, a developmental necessity for the teacher. The existence of a PZ seemed to be an external manifestation of the ZPD and thus a predictor of one's readiness for professional development. We also found the teacher's capacity to construct a communal ZPD (Wells, 1999) in the classroom significant in her ability to reorganize the PZ into a true ZPA.

Theoretical Perspective and Purpose

In a Vygotskian perspective on learning, the zone of proximal development (ZPD) is postulated as the space characterizing one's potential capacity for development with the assistance of a more knowing other (Vygotsky, 1962). Moreover, the ZPD is predicated upon how that more knowing other organizes, or "scaffolds", the task at hand. As such, it is important to understand one's ZPD in order to design appropriate instruction. However, in spite of the significance of the ZPD in characterizing one's growth (Oerter, 1992), it is largely inaccessible as a diagnostic for instruction. As such, we need a more accessible route into the ZPD so that we can more effectively scaffold an individual's development.

The purpose of this study was to explore Valsiner's (1987) zone theory as a way to understand the novice teacher's ZPD. Within the context of child development, Valsiner (1987) extended the notion of a ZPD to include two additional zones of interaction: the zone of free movement (ZFM) and the zone of promoted action (ZPA). The ZFM is an "inhibitory psychological mechanism" (p. 99) set up by the adult to constrain the freedom of the child's choices of thinking and acting. The ZFM limits access to different areas of the environment, determines availability of objects in the environment, and constrains ways of acting with objects in the accessible area. It ultimately canalizes the direction of development for the child, providing a framework for cognitive activity and emotions. In essence, the ZFM addresses the question of what is allowed by the adult (or teacher). On the other hand, the ZPA describes a "set of activities, objects, or areas in the environment" (Valsiner, 1987, pp. 99-100) with

which the adult attempts to persuade the child to act in certain ways. It is defined by what is being promoted by the adult without obligating the child to comply. The ZPA is contained within the ZFM, since theoretically the adult cannot promote what he or she does not allow. The ZFM and ZPA are seen as equivalent when the child's only choice becomes what the adult requires.

The ZPD is connected to the ZFM and ZPA in that learning is optimized only when the child's ZPD lies completely within the options the adult makes possible. However, a portion of the ZPD always lies outside the ZFM because only part of a person's potential can be realized in a given environment at a given time (Oerter, 1992). Since the ZFM and ZPA are socioculturally determined, the child can only develop those aspects of the ZPD that are advertised by the adult (ZPA) and not prohibited (ZFM) by the culture in which he or she is acting. This anomaly exists because in every social interaction where development is promoted, a "canalization" occurs that excludes other options of the ZPD" (Oerter, 1992, p. 193). In other words, when a particular experience is promoted (and hence allowed), some other event is necessarily excluded. We include here our rendering of Oerter's (1992) depiction of the relationship between these three zones (See Figure 1).

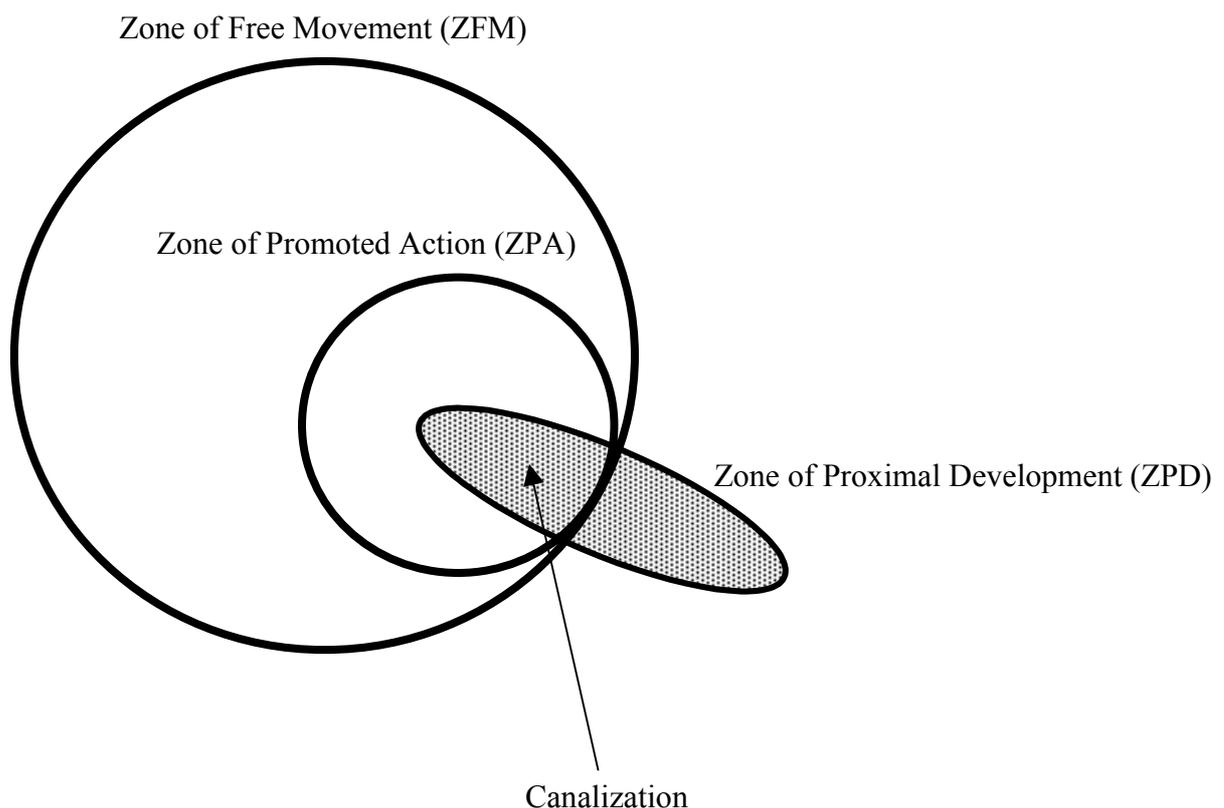


Figure 1. Relationship between the ZFM, ZPA, and ZPD.

The classroom provides a further illustration of how these zones interact. For example, if a teacher chooses to promote only individual seatwork comprised of repetitive mathematical exercises, then he or she is necessarily excluding the possibility of an open, inquiry-based classroom from the ZFM/ZPA complex. As a

result, the student's full potential of development within the ZPD cannot be realized because he is not exposed to collective mathematical inquiry. In this case, the learning environment (ZFM) necessary for establishing a ZPD in which students realize their potential for mathematical thinking based on activities of public conjecturing and argumentation fails to be established. The implication is that the individual's ZPD would not be fully contained within the ZFM, thereby creating a canalization in his or her development.

If we consider that the ZPD is ontogenetic (i.e., within the learner) and the ZFM/ZPA complex is microgenetic (i.e., between the learner and the environment), (see Lightfoot, 1988), then it seems reasonable to explore an individual's ZPD by identifying the ZFM and ZPA in which development occurs. We have previously used this approach to describe the complex interactions occurring in the professional development of science teacher interns (e.g., Carter, Westbrook, & Wheatley, 1998). The data from those studies led us to conclude that professional development was most likely to occur in situations where the cooperating teacher structures a large ZFM, thus increasing the likelihood of overlap between the intern's ZPD and ZFM. Applying the zone concepts in that context provided a glimpse into the conflicts that arise when the beliefs and practices of a novice teacher are not congruent with those of a more experienced teacher acting as the more knowing other.

Elsewhere, we have used Valsiner's (1987) zone theory to examine patterns of discourse established by pre-service mathematics teachers (Blanton & Westbrook, 1998). Our inquiry showed that these teachers funneled students' thinking through leading questions that restricted the ZFM and established a ZPA organized around the teacher's conceptions. Such patterns of discourse appeared to promote verbalizations in the classroom that provided the illusion of sense making, yet instead established cognitive boundaries in the classroom. In the study reported here, we again use an analysis of discourse in a novice teacher's classroom to extend this previous inquiry into the practical and developmental applications of Valsiner's zone theory. Our premise here was that the way the novice practitioner organized the ZFM/ZPA complex *in the classroom* would additionally inform us about his or her development within the ZPD. That is, by identifying what a teacher allowed (ZFM) or promoted (ZPA) in an instructional context, we could better understand that teacher's trajectory of development and thereby more effectively scaffold his or her development. In this sense, we claim that the ZFM and ZPA provide a more accessible route into the teacher's ZPD.

Methodology

At the time of this study, the student teacher participant, Mary Ann (pseudonym), was in her final academic year of teacher preparation and was student teaching in an urban school. She was assigned to a 7th-grade classroom in which she taught general mathematics and pre-algebra. She had a supportive cooperating teacher whose intent seemed more collaborative than authoritative. We observed Mary Ann approximately once per week during the one-semester student teaching practicum. Each visit was

documented by field notes and audio and video recordings and consisted of two classroom observations and a 45-minute interview.

We used (verbal) classroom discourse to identify the ZFM/ZPA complex that Mary Ann established in her classroom. In particular, the analysis focused on identifying what Mary Ann allowed or promoted during the course of instruction and how this might have shifted throughout the practicum. Our focus on discourse draws on a genre of research in teacher education in which classroom discourse analyses have been successfully used to understand teachers' developing practices and to identify the social and cognitive aspects of the learning environment (see, e.g., Blanton, Berenson, & Norwood, in press; Peressini & Knuth, 1998; Wood, 1995). The tapes, transcripts, and the researchers' notes served as the primary data sources for this study. The research team independently and collectively analyzed the transcripts, viewed the videotapes, and developed assertions from classroom discourse about the zones established by Mary Ann.

Analyses and Interpretation

In the process of identifying the ZFM and ZPA established in the classroom, we found that part of the ZPA could be illusionary. That is, Mary Ann at times established what we describe as a '*phantom*' *zone of promoted action* (PZ), or, a zone in which she seemed to promote actions that in actuality were not permitted. We characterize this zone as a phantom zone because it reflects an apparent contradiction in how the ZPA and ZFM interrelate. That is, in theory the ZPA should be contained within the ZFM; one can only promote what is at least allowed. However, the PZ represents precisely that which appears to be promoted (hence allowed) but in fact is not. In this sense, we maintain that part of the ZPA can be illusionary and thus exist outside the ZFM/ZPA complex.

For example, we found discourse patterns in Mary Ann's early practice that appeared to promote the illusion of sense making, yet established cognitive boundaries in the classroom. We include the following protocol as representative of the discourse characterizing Mary Ann's early classroom practice during her first month of student teaching (see also Blanton, Berenson, & Norwood, in press). In it, Mary Ann led a whole-class discussion with her students about the following problem:

Alex had \$5 left in his wallet after he spent \$12 on snacks and souvenirs at the Jubilee. How much money did he take to the Jubilee?

- 1 Teacher: How much money did he spend?
- 2 Jim: Twelve dollars.
- 3 Teacher: Twelve dollars. OK, if he spent \$12, would he be minus or plus?
- 4 Students: Minus.

- 5 Teacher: Minus. He's going to be minus. So how much money he took to the Jubilee is an unknown. It's something that we don't know....
So, how do we represent unknowns?
- 6 Students: Variable.
- 7 Teacher: A variable. OK, what variable do [you] want to use?
- 8 Mark: M.
- 9 Teacher: OK, so m is the amount of money he has, and how much did he spend?
- 10 Carol: Twelve.
- 11 Teacher: Twelve dollars. And how much did he have left over?
- 12 Students: Five.
- 13 Teacher: (Mary Ann writes the equation ' $m - 12 = 5$ ' on the OP to be solved.) OK, what was the very first step [in solving this equation]? What was the very first step that I gave you yesterday Chad?
- 14 Chad: Isolate the variable.
- 15 Teacher: Isolate the variable. OK, how did we isolate the variable?

We infer from this episode that, while Mary Ann promoted the illusion of sense making, her forms of questioning necessarily restricted students' ZFM. That is, by asking short-answer, leading questions (e.g., 1¹, 3, 7, 13) Mary Ann seemed to be restricting students from essential problem-solving activities such as purposeful conjecture and argumentation. In essence, she promoted students' (verbal) participation, yet her questions placed cognitive limits on their thinking. In this sense, we would argue that Mary Ann established a PZ in that students were invited to participate in class discussions, but only in a manner that funneled their responses toward Mary Ann's approach for solving the problem. Thus, while it was clear to us that Mary Ann valued having students participate in her class, we maintain that she promoted a type of interaction with students in her early practice that necessarily canalized the development of their mathematical thinking in a direction which treated mathematics as a procedural body of knowledge.

In Figure 2, we identify the ZFM, ZPA and PZ established by Mary Ann in her classroom during her early practice. We note that the nature of the relationship between the ZPD and the ZFM/ZPA complex suggests that those areas contained within the PZ established by Mary Ann represent areas not developed within the student's ZPD.

¹ Numbers refer to lines in the protocol.

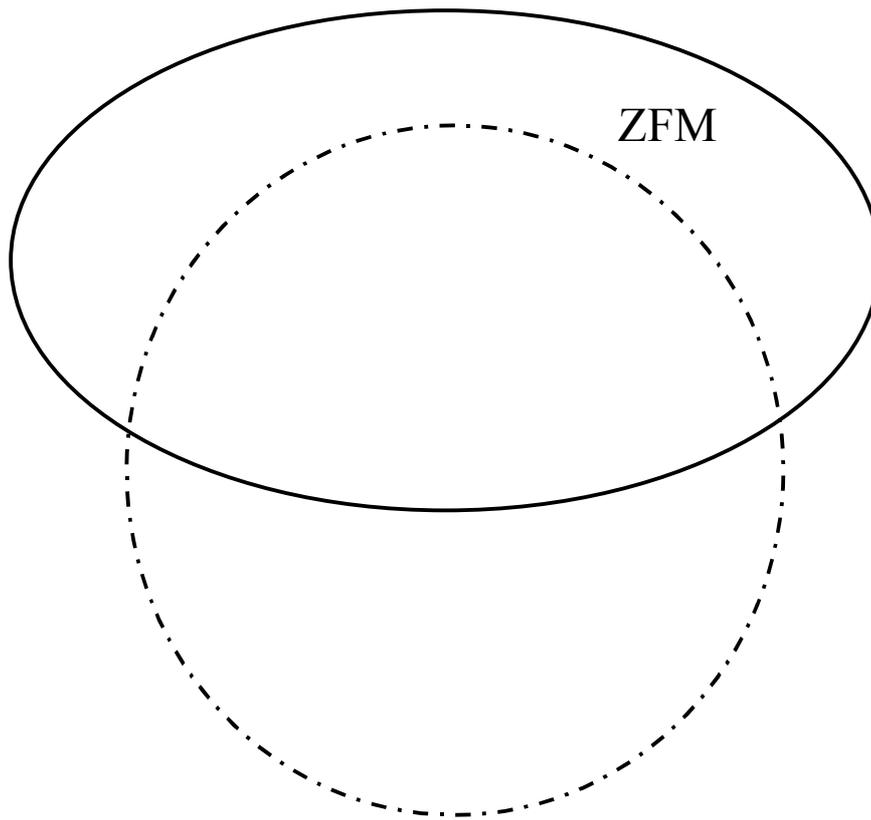


Figure 2. The ZFM, ZPA, and PZ established in Mary Ann’s early classroom practice.

The PZ became significant in our understanding of the ZFM/ZPA complex and thus Mary Ann’s ZPD. In particular, we found the PZ to be a precursor to the reconfiguration of the ZFM established by Mary Ann and as such, we posit that it constituted a developmental necessity for her. For example, Mary Ann ultimately expanded her ZFM by promoting (and permitting) students’ activities of conjecture and argumentation. Thus, what had been a PZ for Mary Ann transitioned into a set of events (e.g., argumentation and conjecture) that ultimately she promoted and allowed. Thus, we argue that the PZ potentially signals a necessary, although not sufficient, condition for development. As such, we suggest that the existence of a PZ may be an external manifestation of the ZPD and thus a predictor of one’s readiness for professional development.

We find further support for this claim in Vygotsky’s theory on concept formation. In particular, we suggest that the construct of the PZ parallels Vygotsky’s (1962/1934) notion of *pseudo-concept*, which he used in describing the development of higher mental functioning in children. Vygotsky argued that the pseudo-concept is an essential bridge in children’s thinking to the final stage of concept formation. While the pseudo-concept a child possesses is phenotypically equivalent to that of an adult, it is psychologically different. As a result, the child is able to “operate with [the concept], to practice conceptual thinking, before he is clearly aware of the nature of these operations” (p. 69). Applying this to our study, we concluded that the PZ signals

that desirable teaching practices might be within the teacher's ZPD although the teacher might not yet have a fully articulated understanding of those practices. As such, the PZ is therefore a zone of possibility, or a ZPD where with mediation there is potential for growth. Thus, identifying the existence of a PZ in a teacher's practice helps us to understand his or her potential for growth. As such, we maintain that when a teacher is operating within a PZ, she is in a place of transition, or a pseudo-conceptual stage, and has the potential for professional development.

Finally, we conjecture that Mary Ann was able to reorganize her ZFM because she allowed herself to make sense of *students'* ideas, and as she did so, she became engaged by students *as a learner*. Through this process of co-participation with students, she seemed to shift towards more student-centered inquiry. We thus argue that a teacher can potentially effect the transition of the PZ into a true ZPA if she is able to construct a communal ZPD (Wells, 1999) as Mary Ann did. Wells' notion of a communal ZPD entails a community of inquiry whereby "jointly undertaken activity creates a context in which *all* participants – teachers ... as well as students – can assist each other in their zones of proximal development" (p. 312). He further argues that "for learning to occur in the ZPD, it is not so much a more capable other that is required as a willingness on the part of all participants to learn from and with each other" (p. 324). From this perspective, we found that Mary Ann's participation in a classroom communal ZPD facilitated her reorganization of the ZFM in a way that diminished the PZ.

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