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Children's understanding of teaching: A component of self-regulation?

Marion Porath[1], *Constantine Ngara*[2], *Yuan Lai*[2], *Krista Fogel*[2] & *Judy Lupart*[3]

Abstract

Children's understanding of teaching and the conceptual relationships of this understanding to self-regulation and epistemic beliefs were explored by interviewing children identified as gifted, aged 6 to 17, about how they would like to be taught core academic subjects and how they would teach them to their own class. Data were analyzed using a constructivist approach to grounded theory informed by neo-Piagetian cognitive developmental theory. Five levels of understanding were articulated that formed a developmental trajectory in which young children saw teaching as action-based and concrete, focused on helping them do things right. By middle childhood, recognition of basic principles of teaching and learning were evident, then consciousness of the interdependence of teaching and learning. In early adolescence, emergent philosophical views on the nature of knowledge were expressed. Some of the older adolescents demonstrated personal philosophies of learning focused on growth, mutual partnership, and excitement about learning.

Key words: learning, teaching, children, grounded theory, self-regulation

[1] *Correspondence concerning this article should be addressed to:* Marion Porath, PhD, Department of Educational and Counselling Psychology, and Special Education, The University of British Columbia, 2125 Main Mall, Vancouver, BC, Canada V6T 1Z4; email: marion.porath@ubc.ca

[2] Department of Educational and Counselling Psychology, and Special Education, The University of British Columbia

[3] Department of Educational Psychology, University of Alberta

We know very little about how children understand school and the learning and teaching activities that take place there. Knowledge of their understanding of the educational enterprise, including their conceptions of their own learning – what it means and how it takes place – and the teaching process, is still limited despite its very central place in the activities of schooling and emphasis on the importance of inclusion of children's perspectives in educational planning (e.g., Bruner, 1996; Waksler, 1991). While it is important that we understand the perspectives of all learners, it is particularly imperative that we know how children with significantly developmentally advanced ability profiles understand schooling. Familiar norms do not apply to these children, and significant adaptations need to be made to the academic and social aspects of their education (Robinson, Zigler, & Gallagher, 2000). Growth rates and degree of asynchrony in their developmental profiles are significantly different from those of typically developing children (Matthews, 1997; Robinson et al., 2000) and are often either misunderstood or not understood at all by schools (Keating, 1991). This paper focuses on gifted children's understanding of teaching of core academic subjects in an exploration of how their understandings may be relevant to a more general understanding of their engagement with learning and their knowledge of themselves as learners. While the focus is on our brightest learners, we learn a great deal about development in general through studying those at the outermost ends of the intelligence distribution (Robinson et al., 2000).

Children's knowledge about teaching

Research on children's knowledge of teaching is limited; however, important foundational work has been done (e.g., Strauss & Ziv, 2004; Ziv & Frye, 2004). Teaching is conceived of as a "central socio-cognitive experience in children's lives and development" (Strauss & Ziv, 2004, p. 452), important to study from the perspective of children's constructions of the process. Research has examined how preschoolers engage in teaching other children their age, with a focus on awareness of knowledge differences between teacher and learner and beliefs about the knowledge differential (Ziv & Frye, 2004). It has also explored the central role of theory of mind in children's understanding of explanations, particularly in the humanities and social sciences (Wellman & Lagattuta, 2004).

Determination of readiness for school generally entails evaluation of specific academic skills and overall cognitive ability. Ziv and Frye (2004) suggested that a critical supplement to determination of readiness is some understanding of the process of teaching, largely because educators' consideration of *how* to teach should take children's notions of teaching into account. What do they already know about teaching and how do they know it? Based on their current knowledge, how can their understanding be developed and deepened (Ziv & Frye, 2004)? We do not yet know how children's knowledge of the teaching process develops across the school years, nor do we have a generative perspective on children's understanding of teaching. Children's responses to narratives about teaching (e.g., Ziv & Frye, 2004) and degree of agreement with statements about knowl-

edge (see Hofer & Sinatra, 2010) take us in important directions but what do children themselves have to say about teaching and how do their perspectives change over time?

Knowledge about teaching and self-regulated learning

Teaching is seen as conceptually different from learning (Strauss & Ziv, 2004); however, reflection on how one likes to be taught and how one would engage in teaching others may relate to knowledge about how one learns best. Self-regulation, the "ability to orchestrate one's learning" (Bransford, Brown, & Cocking, 2000, p. 97), appears to relate intuitively to how one conceives of teaching and being taught. Learning takes place in a social context in which teaching and learning, even if viewed as conceptually different, are inextricably linked. As Wellman and Lagattuta (2004) state, "Everyday conceptions of ignorance, misconception, knowledge acquisition, and belief change would, thus, surely inform and shape attempts to teach, even if such conceptions may not be absolutely required for teaching efforts" (p. 480). Reflection on how one achieved particular learning objectives (i.e., the degree of match between teaching approach and learning outcome) and the degree of success attained may contribute to individuals' preferred learning repertoires.

This paper does not study a relationship between understanding of teaching and self-regulated learning explicitly but explores possible relationships between the two constructs via a developmental perspective on how children understand teaching as it relates to them ("How I like to be taught") and to others ("How I would teach"). The paper is heuristic in its consideration of how children's understandings of teaching may relate to self-regulated learning.

Epistemic beliefs, understanding of teaching, and self-regulation

Children's understandings of teaching have previously been characterized as epistemological (Porath, 2010). These understandings capture the personal dimensions of epistemological understanding (see Burr & Hofer, 2002) involving how one sees one's self as a knower and learner (Kuhn, 2000). These understandings may parallel, both conceptually and developmentally, children's understanding of what learning means in general and what learning academic subjects means in particular, adding to our knowledge of what children understand about school-related tasks and activities.

Children's conceptualizations of the meaning of learning and the core academic subjects of reading, writing, and mathematics – their personal epistemologies – are conceptually parallel and appear to develop in a similar fashion across childhood and adolescence. Understanding in early childhood is simple and action-based ("learning stuff"; "read books and stuff"), developing in middle childhood first to thinking about meaning ("Learning is to …think about what something means"; "Writing down your thinking – what you have stuck up in your head"), and then to personal meanings of learning ("Learning can mean different things like what…yourself means to you, what is really

inside you…or you can learn knowledge based like… math and reading") and the future implications of learning ("Math helps with doing your taxes"). In adolescence, new understandings gained through an interaction of personal learning with the curriculum are articulated ("Learning … means to find new things, new understanding of things …; "I'm getting more information on the world around me and the author's point of view from reading their books"). Some adolescents demonstrated even more complex responses that demonstrated reflections on the nature of knowledge ("Math is reasoning in a really concrete manner. It's not like imagination; it's just more like really trying to get straight to the point so you're trying to always seek something and there's like an absolute value you are trying to find") (Porath & Lupart, 2009; Porath, Lupart, Katz, Ngara, & Richardson, 2009).

Self-regulated learning is guided by epistemic beliefs (see Hofer & Sinatra, 2010 for a summary of research that supports this premise). If epistemic beliefs and understanding of teaching, both of being taught and teaching others, have conceptual and developmental parallels, instruction can be informed in important ways, particularly in the sense of supporting self-regulated learning.

Theoretical framework

Case's (1992; Case & Okamoto, 1996) theory of the conceptual underpinnings of children's understanding is the framework for articulating the developmental changes in how children understand teaching. Case described children's *central conceptual structures* in a number of domains (Case, 1998; Case & Okamoto, 1996). Central conceptual structures are "blueprints" of children's understanding. They are *central* because a structure forms the basis for understanding a wide range of tasks within a domain (Case & Okamoto, 1996) and *conceptual* because the meanings children assign to concepts are articulated. Case's theory traces the conceptual nature of development, informed by the reasons children give for thinking about concepts as they do. It goes beyond simple descriptions of competence in thinking about concepts related to the mind, a direction recognized as critical in moving knowledge forward (Carpendale & Lewis, 2004). The developmental sequences of conceptual understanding proposed by Case (1992: Case & Okamoto, 1996) provide a "design for development" (McKeough, Okamoto, & Porath, 2002) that informs instruction.

Method

Data in this study were drawn from an extensive data set focused on gifted learners' perspectives on academic and social aspects of schooling (see Porath & Lupart, 2009; Porath et al., 2009).

Participants

Participants were 80 students (43 boys; 37 girls) from Grades 1 through 7 and 10 through 12 who attended a variety of programs for gifted learners, including self-contained classes, pullout programs, and a program that prepared students for early entrance to university. Students were from public and parochial schools in two large western Canadian cities. The students were identified as gifted in different ways, including combinations of teacher nomination, superior academic achievement, and/or superior intelligence or cognitive ability test scores.

Research task

The task designed to elicit understanding of teaching included questions modeled on the first two questions in the task used to tap children's understanding of learning (What does learning mean? What is happening when you are learning?) (Bickerton, 1994) used in the larger study. These questions focused on the core academic subjects of reading, writing, and mathematics, and were analyzed separately (see Porath & Lupart, 2009). Questions about personal preferences for being taught each of these subjects and how children would teach others followed (in italics below), and are the focus of this paper.

Describe what reading/writing/math means to you.

What is happening when you're reading/writing/doing math?

How would you like someone to teach you reading/writing/math?

If you could teach reading/writing/math to your class, what would you do?

Why would you do it that way?

Procedure

Either the first author or a graduate research assistant interviewed the children individually at their schools. Interviews were digitally audiotaped and transcribed verbatim. Notes were taken during the interviews to facilitate transcription.

Coding

Coding guidelines resulted from an iterative process in which data were first read and reread to discover themes in the understanding of teaching; the second author did this initial coding and extraction of themes. Because of the notable parallels between children's responses to the questions about how they would like to be taught and how they themselves would teach and why, responses to these two questions were pooled for analysis. Data were then examined using Case's (1992) neo-Piagetian theory as a framework. Codes were compared and discussed, in several iterations, among the first four

authors using a process described as a "constructivist revision of grounded theory" (Henwood & Pidgeon, 2003, p. 134) where the data guide interpretation within the theoretical framework in three steps: open coding, constant comparison, and theoretical integration (Henwood & Pidgeon, 2003).

Once a coding framework was agreed on, the second and fourth authors then assigned a score representative of level of development, as is common in other neo-Piagetian studies (see, for example, Case 1992; Case & Okamoto, 1996); checked their level of agreement; and brought questions to the larger group for discussion. These discussions resulted in refinement of the coding categories (Table 1). Discussions continued until consensus was reached on scores assigned to the participants.

Table 1:
Coding guidelines: Teaching reading, writing, and mathematics

Score	Level	Reasoning	Examples (a. Reading, b. Writing, c. Math)
0	No coherent response given.	Articulations are either incomprehensible or too vague to be classified anywhere.	
Levels 1 and 2 reflect that knowledge is established. One learns established knowledge and is either right or wrong/successful or not.			
1	Action-based teaching as helping the learner to 'do stuff' or making them good at something. Undifferentiated view of what is learned (subject, knowledge)	Simple description of how to help students learn without concrete examples or Student would teach the same way as the teacher.	a. Help them do stuff. b. Do what the teacher does. c. Make them good.
2	Recognition of basic principle(s) of teaching/learning; rudimentary knowledge of subject/knowledge structure	Concrete ways to help students learn the basic nature of the subject or Simple articulations lacking awareness of the 'how' and 'why' of teaching/learning.	a. Tell me how to pronounce the words, tell me what they mean so I can understand the story. b. Tell me how to write a letter – write the letters, spell a word. c. It would be pretty easy for them and then I'd go for the harder stuff.

Score	Level	Reasoning	Examples (a. Reading, b. Writing, c. Math)
At Levels 3 and above, knowledge is acquired in a co-constructive process. Differences are apparent among learners and teachers need to accommodate these differences. At Level 3, differences are stated with reference to groups of learners (e.g., 'they,' their class or a group within their class, or the slightly more differentiated 'beginners,' 'more advanced'). At Level 4, individual differences are recognized and reflected in statements that indicate that each person has a different approach to learning or varied motivation for learning. Level 5 responses showed evidence of personal epistemology.			
3	Consciousness of interdependence of teaching and learning; awareness that teachers need to address students' learning needs. Simple opinions and reflective thinking about how one learns different subjects	Interdependence in learning amongst subject matter (connections within a discipline, such as reading and writing or oral and written language or between disciplines such as reading and math) or Principles of learning/teaching are qualified or justified with opinions or reflective thinking or with reference to experience, examples, or strategies or Learners' needs are taken into account in a general sense that reflects the how, why, and/or quality of learning (e.g., <u>they</u> would learn better) without reference to individual learning needs.	a. Usually says something that helps us learn so she says something from the literature circles – like connections, offers a message, predictions, imaging, etc. and so on. b. I would show them first. Then I would give them clipboards and paper and then I'd tell each of them to read a book then write a sentence that they like the most. Because I think it makes it fun and you could read *and* write at the same time. c. I think they'll learn better that way. Maybe they'd get some sort of idea in writing too and reading or maybe even make their own book about some idea of math equation stuck into the story.
4	Emergent philosophical views on nature of knowledge and the reciprocal nature of teaching and learning	Recognition of the multiple ways teaching and learning can take place (modes, options, process) or	a. It's important that you know how to read it and you know the immediate meaning of the words, but I'd also teach them how to find

Score	Level	Reasoning	Examples (a. Reading, b. Writing, c. Math)
	Own ideas about how interests/styles of learning can be connected to teaching	Recognition of individual differences in learning needs and styles or Development of imagination and creativity in teaching/learning or Awareness of higher order objectives in teaching and learning	out what the hidden meanings are and like the … metaphors and all that stuff cause … there can be different ways of like conveying the message and you can do it in like a soft way or a hard way depending on how you want the person to see it. b. I would just try to give them what they need and then it is just kind of using your imagination to figure things out. You do need that imagination because you have to be able to see things differently from other people and twist your mind. c. Once they know basic knowledge about the different areas of math then find a way to put those different groups together to solve problems. Like I'd teach them to use the different areas of math to solve one problem.
5	Evidence of personal epistemology Growth-focused teaching and/or learning	Growth focused teaching and/or learning or Personal philosophies of learning and knowledge	a. I would be very passionate about those ideas and maybe they would get engaged with my conversation…. I'm not too sure about the value of… escaping

Score	Level	Reasoning	Examples (a. Reading, b. Writing, c. Math)
		or Learning as exchange of information involving mutual partnership (i.e., relationships around knowledge and learning; excitement about learning that is shared with someone else)	the world or something by reading novels and becoming engrossed in other people's lives, so I think it would be better to let them learn for their own lives, that they can apply to themselves. b. I would like to do …many rough drafts … as humanly possible and then we can discuss the draft and discuss the suggestions and why this would work and why this wouldn't work, and why I think this should work and why they think this should work etc…because that way the person gets the most input and if you talk with them you can see where they are coming from and it may give you new insight into what you are writing, and how you are thinking and how you are processing. c. I would need someone there who can talk about it and who can have a really instinctive connection with how I think and know.

Results

Participants were grouped by grades for analysis; these groupings approximated the age ranges specified by Case (1992) for each of his hypothesized developmental stages (Grades 1 and 2, n=6; Grades 3 and 4, n=12; Grades 5 and 6, n=23; Grade 7, n=12; Early Entrance and Grade 10, n=23; Grade 12, n=4). Means (SDs) for each subject area by age group are presented in Table 2.

Table 2:
Mean (SD) scores for teaching reading, writing, and mathematics by age group

Group	Mean age (SD) in months	Teaching Reading	Teaching Writing	Teaching Mathematics
Grades 1 and 2	93.67 (7.66)	1.83 (.753)	2.17 (.408)	2.67 (.516)
Grades 3 and 4	109.42 (8.10)	2.75 (.965)	2.58 (.515)	2.58 (.515)
Grades 5 and 6	124.75 (6.16)	3.22 (.736)	3.26 (.619)	3.13 (.694)
Grade 7	145.17 (3.07)	3.33 (.492)	3.25 (.622)	3.33 (.778)
Early entrance 1 and 2; Grade 10	176.35 (8.49)	3.78 (.795)	3.65 (.714)	3.70 (.635)
Grade 12	204[a]	3.00 (.816)	3.00 (.000)	2.75 (.500)

[a]Average age is an estimate based on the usual age of students in Grade 12. Age of these students was not noted during data collection.

Repeated measures analysis of variance

A repeated measures analysis of variance was conducted with the within-subject variable ("teaching") consisting of the pooled responses to questions about teaching reading, teaching writing, and teaching math. The between-subjects factor was age group. The condition of sphericity was met, Mauchly's $W = .968$, $p = .304$. There were no significant within-subjects effects. The between-subjects effect was significant, $F\ (1,\ 5) = 14.16$, $p = .000$. Partial eta squared for the effect of age group on each component of the dependent variable was .334 for teaching reading, .365 for teaching writing, and .295 for teaching math, all significant at $p = .000$.

Post-hoc comparisons were not conducted because of unequal group sizes. Figures 1, 2, and 3 summarize the developmental trajectories apparent in the data. In general, development followed a linear trajectory, with the exception of the oldest students whose performance was more like elementary school students. There was also a plateau evident in development of understanding of teaching writing between Grade 5 and Grade 7.

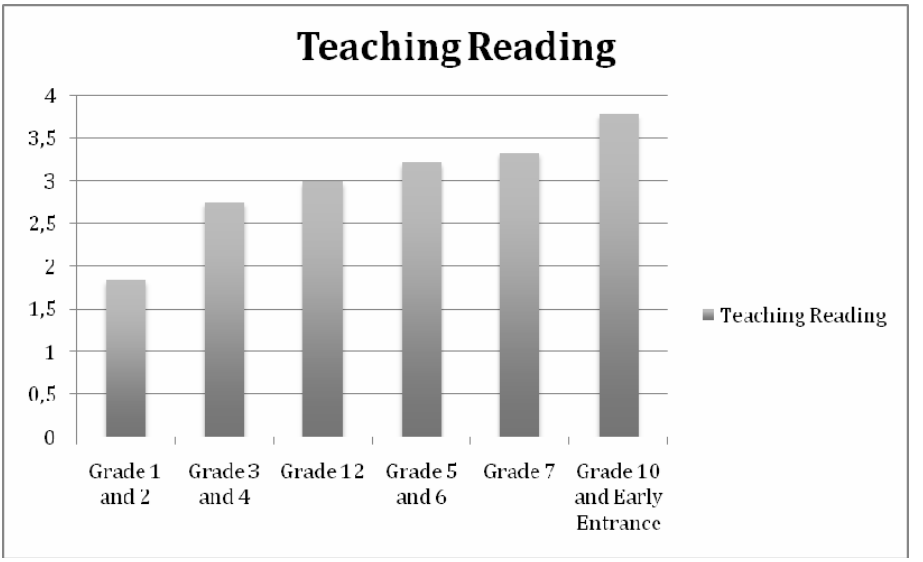

Figure 1:
Developmental trajectory for understanding of teaching reading

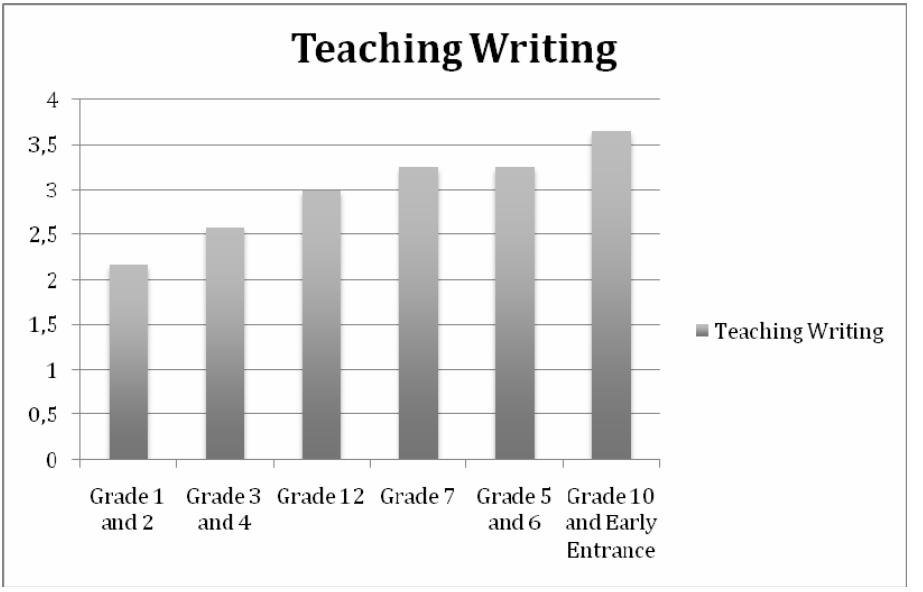

Figure 2:
Developmental trajectory for understanding of teaching writing

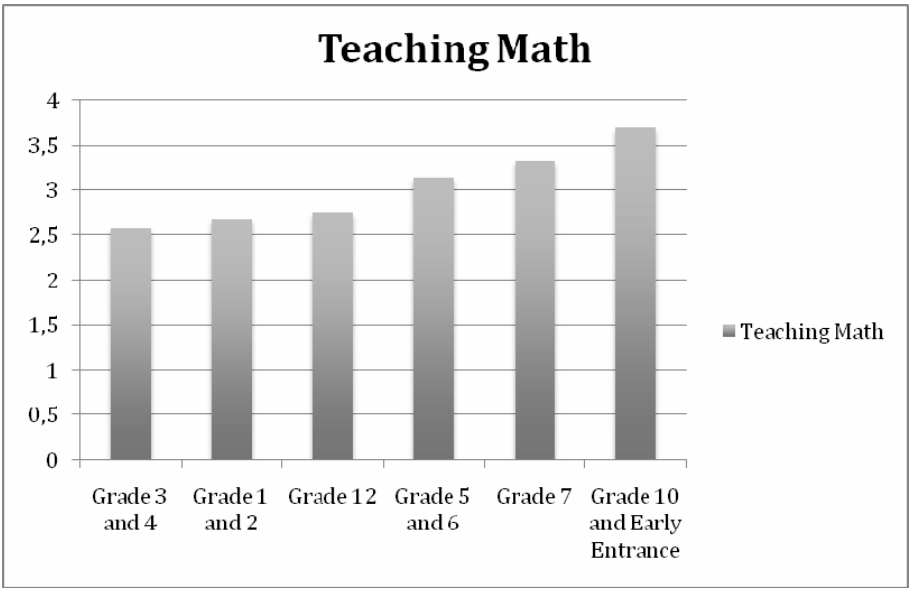

Figure 3:
Developmental trajectory for understanding of teaching mathematics

Conceptual developmental parallels between epistemic beliefs, understanding of teaching, and self-regulated learning

Coding categories were compared to the prototypical levels of understanding identified in analyses of children's responses to what learning means; what reading, writing, and mathematics mean to them; and what is happening when one is learning, reading, writing, and doing math (Porath & Lupart, 2009; Porath et al., 2009). Conceptual and developmental parallels were apparent (Table 3), supporting a relationship between epistemic beliefs and understanding of teaching.

The youngest children generated action-based descriptions of learning, reading, writing, and teaching, with preliminary understandings that some mental activity is involved in learning "how to do" and that teaching helps one to "do better." More discussion of the role of mental activity in learning was evident as children entered middle childhood. They also began to describe component skills of academic subjects and reflected these understandings in their concrete descriptions of ways to learn skills. The notion of meaning as important in teaching and learning emerged at this stage. Understandings became more differentiated in the latter part of middle childhood as multiple ways of learning were described and awareness of self-as-learner, both generally and specifically, became evident. The first inkling that teaching is not a uni-directional activity emerged at this stage as the importance of honouring learner characteristics in teaching was articulated.

Table 3:
Conceptual parallels between understanding of learning, academic subjects, and teaching

Age group[a]	Understanding of self as learner[b]	Understanding of self as reader[b]	Understanding of self as writer[b]	Understanding of self as mathematician[b]	Understanding of teaching
Early childhood (ages 6 to 7)	Action-based	Action-based; awareness of the role of the mind/brain in reading; general awareness of how one learns to read and gets better at reading.	Action-based; awareness of the role of the mind/brain in writing; general awareness of how one learns to write and gets better at writing.	Action-based; awareness of the role of the mind/brain in math; general awareness of how one learns to do math and gets better at math.	Action-based; awareness that teaching helps one to learn and improve one's competence.
Middle childhood 1 (ages 8 to 10)	Action-based connected with mental activity (i.e., learning actions are coordinated with mental activity).	Knowledge of how reading skills are acquired and how knowledge is acquired through reading.	Knowledge of how writing skills are acquired and how knowledge is disseminated through writing.	Knowledge of how math facts and knowledge are acquired.	Basic principles of teaching and learning are apparent that detail concrete ways to learn the subject. Beginning recognition of the importance of meaning in teaching and learning.
Middle childhood 2 (ages 11 to 12)	Mental activity through ultiple ways of engagement; awareness of own ways of learning, future impact of learning.	Multiple ways of processing information while reading; awareness that reading makes them think and offers new perspectives on their ideas; awareness of self as reader and degree of engagement with reading.	Multiple ways of processing information while writing; awareness that writing clarifies and organizes thinking; awareness of self as writer and degree of engagement with writing.	Multiple ways of processing information in math; awareness that math clarifies and organizes thinking; awareness of self as mathematician and degree of engagement with math.	Knowledge is co-constructed. A general understanding that learning takes place in different ways that need to be accommodated.
Early adolescence (ages 13 to 14)	Transformative learning; learning as a link to knowledge traditions; awareness of the many factors that that contribute to learning.	Awareness of point of view and worlds created by authors; awareness of knowledge gained from reading.	Awareness of point of view, audiences, own ways of expression; awareness of knowledge gained from engaging in writing; knowledge of literary structures vis-à-vis their own style.	Awareness of math skills combined with that of the utility of math, their own engagement with math, and/or their attitudes toward math.	Emergent philosophical views of knowledge and the reciprocal nature of teaching and learning; well-developed notions about how their own interests and ways of learning are relevant to teaching.
Mid-adolescence (ages 15 to 16)	Knowledge of self as learner is combined with ideas about the nature of knowledge.	Personal beliefs about reading and knowledge gained through reading inform ideas about their own development.	Writing understood as an interactive process via a combination of process, knowledge dissemination, and communication.	Personal beliefs about the utility of math and their own attitudes toward and engagement with math are informed by understanding of the nature of mathematics.	Evidence of personal epistemology and growth-focused teaching and/or learning.

[a]Age ranges are prototypical. Individuals at different developmental stages may perform at a level incommensurate with their chronological age; [b]Based on Porath and Lupart, 2009, pp. 83-85.

By early adolescence, participants began to place themselves in knowledge traditions, noticing how learning takes place in many different ways in many different places and becoming aware of how knowledge is gained through engagement with academic disciplines. Knowledge gained was seen as transformative. Parallel understandings were evident in their views of teaching; their knowledge of themselves as learners, their engagement with subjects, and what disciplinary knowledge can offer them were central to their notions of the reciprocity of teaching and learning. By mid-adolescence, some participants demonstrated sophisticated notions about the nature of knowledge, their place in knowledge traditions, and how teachers and learners should be mutually engaged in activities focused on scholarly growth.

Conceptual parallels were also apparent between children's understandings of teaching and the characteristics of self-regulated learning. The participants' responses clearly demonstrated their awareness of how their learning could be orchestrated in the most effective ways (Bransford et al., 2000). Aspects of their responses reflect the components of self-regulated learning detailed by Paris and Ayres (1994). The participants' understandings, both of teaching and being taught, reflected the "motivated and strategic efforts … to accomplish specific purposes" (Paris & Ayres, p. 26) associated with self-regulated learning. The participants were clearly active participants in their own learning. All participants except the few youngest ones were focused on constructing meaning in learning and demonstrated a sense of control over their learning. They recognized the value of choice and challenge.

Young children's awareness that teaching helps learning and improves competence reflects their understanding of the consequences of classroom activities, optimistic views of their own development, and awareness of their own learning even though that awareness is limited to 'making them good at stuff,' or "telling me how to pronounce the letters,' for example. By middle childhood, children's knowledge of basic principles of teaching and learning and the concrete ways they described for learning how to read, write, and do mathematics showed their procedural and declarative knowledge (Paris & Ayres, 1994). The understanding that teaching strategies work best in some situations and for some learners revealed their conditional knowledge, and their realization that knowledge is co-constructed demonstrated the collaborative nature of self-regulated learning (Paris & Ayres, 1994). All of the former concepts were present in adolescence as well but were understood more deeply and expressed with more sophistication (see Table 1).

Adolescents showed "awareness and orchestration of learning, … the metacognitive aspects of learning" (Paris & Ayres, 1994, p. 30), increased awareness of their own learning strategies in light of what works best for them, and awareness that teaching and learning are reciprocal in the sense that consciousness of their interests and ways of learning are important to them as well as to their teachers. Adolescents also held "optimistic views of their own development" (Paris & Ayres, 1994) and demonstrated self-determination.

Discussion

This study contributes to our knowledge of how children understand teaching through its generative, developmental exploration of children's perspectives on how they like to be taught and how they themselves would teach. While the participants all were identified as gifted students, parallels between developmental trajectories in other domains have been found between learners identified as gifted and those of average ability (e.g., Porath, 1992; 2006). Gifted students tend to move more quickly through levels of development but, at the same time, development depends on maturation and experience, making age relevant to how all children think. Age group explained 33.4%, 36.5%, and 29.5% of the variance in explanations of teaching reading, writing, and mathematics, respectively.

The participants' perspectives on teaching suggest that understanding of teaching is relevant to regulating one's learning. Even the most undifferentiated responses of early childhood (e.g., "help them do stuff") are informative. Young children's foci on activity, concrete notions of schooling, and beliefs that one can be helped to improve give us signposts for understanding how they understand what education entails. The conceptual parallels between understandings of learning in general, learning academic subjects in particular, and teaching support that teaching and learning are conceptually similar, at least from the point of view of learners.

Understanding of teaching also has an epistemological quality. Personal epistemic beliefs "are concerned with making meaning of school, understanding one's own intentions with regard to learning, and interpreting one's learning in the context of knowledge traditions" (Porath et al., 2009, p. 63). These understandings can inform and shape teaching, as Wellman and Lagattuta (2004) suggested. They provide a 'design for development' (McKeough et al., 2002) for developing and deepening (Ziv & Frye, 2004) learners' understandings of the 'what and how' of teaching. Children's perspectives, particularly in the latter stage of middle childhood when knowledge is perceived as co-constructed, also imply that teachers are learners as well, a position that is supported and valued by educational psychologists (Bransford et al., 2000; Jordan, Porath, & Bickerton, 2003).

Understanding of teaching, with its conceptual parallels to understanding learning, appears to involve a *central 'metaconceptual' structure* such that beliefs about learning and teaching underlie or interconnect (Case, Demetriou, Platsidou, & Kazi, 2001) central conceptual structures in different domains (Porath et al., 2009). This 'metaconceptual' structure may be similar to Case's (1992) executive processes or Demetriou, Efklides, and Platsidou's (1993) hypercognitive system that both entail self-understanding and self-regulation and underpin disciplinary understandings. It also is consonant with Piaget's position that reflective abstraction is a central developmental process (Campbell, 1993).

Children's representations of their understandings also can be "carriers of socialization" (Dweck & London, p. 429) with the potential to offer us insight into the impact of educational approaches. This study did not take educational context into account; however, the nature of the transaction between learner and learning environment is very likely reflected in the perspectives of the participants and in the developmental trajectories of

those perspectives and would be a rich avenue for further research, particularly if done longitudinally. The oldest students demonstrated understanding of teaching that was more like that of elementary school students. While not much should be made of this finding due to the very small sample size, it is a finding consistent with other research on first and second year college students' views of knowledge transmission (e.g., Perry, 1970) and may reflect views of knowledge and teaching consistent with preparation for university entrance examinations (knowledge as certain and testable; teaching as test preparation) that are more consistent with Level 1 and 2 understanding that knowledge is established and, in learning, one is either right or wrong/successful or not.

Education typically disregards learners' perspectives on knowledge and their understanding of their capacity for learning (Bruner, 1996). This study provides a developmental view of what students think about their own learning and how they are taught, generated by the students themselves. Their insights offer us 'ways in' to effective teaching and clues about how to consolidate and deepen their current perspectives and help them achieve more sophistication notions of what education entails.

Author note

Marion Porath, Constantine Ngara, Yuan Lai, and Krista Fogel, Department of Educational and Counselling Psychology, and Special Education, The University of British Columbia; Judy Lupart, Department of Educational Psychology, University of Alberta.

Constantine Ngara is now at University of Bahrain Teachers College.

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