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Examining the Effects of Text Genre and Structure on Fourth- and Fifth-Grade Students' High-Level Comprehension as Evidenced in Small-Group Discussions

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Abstract

Although there is a rich literature on the role of text genre and structure on students' literal comprehension, more research is needed regarding the role of these text features on students' high-level comprehension as evidenced in their small-group discussions. As such, the present study examined the effects of text genre (i.e., narrative and informational) and structure (i.e., story, comparison, causation, problem/solution, and sequence) on fourth- and fifth-grade students' small-group discussions, and the text-based discussions were coded for high-level comprehension discourse indicators (i.e., authentic questions, elaborated explanations, and exploratory talk). The results indicated that students evidenced more indices of high-level comprehension when discussing narrative texts than when discussing informational texts. Meanwhile, teachers tended to initiate more questions in discussions on informational texts. The deeper structure of the texts was also shown to influence the discussions. Specifically, students generated significantly more authentic questions during discussions on texts with comparison structures than for any of the other four text structures, while causation structure texts triggered more authentic questions from teachers. Overall, this study contributes to the understanding of the effects of text factors on students' high-level comprehension.

Keywords: reading comprehension, text-based discussion, text genre, text structure, Quality Talk

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Análisis de los Efectos del Género y la Estructura Textual en la Comprensión de Alto Nivel de Alumnado de Cuarto y Quinto Curso en Discusiones en Pequeño Grupo

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Resumen

Aunque existe amplia literatura sobre el papel del género y la estructura textual en la comprensión literal del alumnado se precisa más investigación acerca del papel de esas características textuales sobre un alto nivel de comprensión evidenciado en discusiones en pequeño grupo. Este estudio analizó los efectos del género (narrativo e informacional) y la estructura textual (historia, comparación, causación, problema/solución y secuencia) en las discusiones en pequeño grupo de alumnado de cuarto y quinto curso. Las discusiones basadas en los textos se codificaron según indicadores del discurso relativos a comprensión de alto nivel (preguntas auténticas, explicaciones elaboradas y habla exploratoria). Los resultados indicaron que el alumnado mostraba mayores índices de alto nivel de comprensión cuando discutía textos narrativos más que informativos. El profesorado tendía a iniciar más preguntas en las discusiones sobre textos informativos. La estructura profunda de los textos también se mostró que influía las discusiones. Había mayor número de preguntas auténticas durante las discusiones sobre textos con estructura comparativa que para las otras cuatro estructuras, mientras que los textos con estructura de causación producían más preguntas auténticas en el profesorado. Esta investigación contribuye a la comprensión de los efectos de factores textuales en los altos niveles de comprensión del alumnado.

Palabras clave: comprensión lectora, discusión basada en el texto, género textual, estructura textual, calidad del habla

Despite advances in every sphere of our modern existence, the ability to read and process oral and written text remains of paramount importance to daily, human functioning in and out of school. The challenge, of course, is that deep, meaningful comprehension of text remains elusive for many, especially given that text genre and structure can vary dramatically. At its essence, reading comprehension is a multidimensional process involving the reader, the text, the activity, and the context during which the reader engages in meaning making that leads to understanding and insight (RAND Reading Study Group, 2002). A number of text features have been investigated in the extant literature and shown to play substantive roles in students' comprehension (Graesser, Singer, & Trabasso, 1994; McNamara, Ozuru, & Floyd, 2011; Meyer & Freedle, 1984; O'Reilly & McNamara, 2007). For example, comprehension is differentially affected by the genre and structure of the text, the length, and cohesion within and across sentences. Moreover, the content of the text has the potential to amplify challenges for readers.

Although the nature of the text is important in the comprehension process, the skills and abilities that the reader brings to bear during their interaction with the text are also fundamentally important. Strong comprehenders possess a wide range of capacities and abilities including: (a) the cognitive capacity to direct and focus their attention, to make reasoned inferences, or to read for a particular purpose; (b) motivation to engage the text and persist when difficulties are encountered while reading; and, (c) a thorough knowledge of relevant vocabulary and discourse patterns, as well as an understanding of the domain or topic of the text and strategies to invoke when difficulties arise during reading (RAND Reading Study Group, 2002). Students with deficits in one or more of these capacities will likely struggle with everything from basic reading processing to deep, meaningful comprehension, particularly when called upon to comprehend complex text.

Further, the process of the reader interacting with the text is an activity that takes place within a given context. Contexts can vary widely from a remote, rural school in South Africa where 10th graders are reading an emotion-laden, narrative text for an assignment to an 11 year-old American girl who is reading a fascinating, expository account of the social structure of ants for pleasure reading. Arguably, these types of contextual dynamics

affect every aspect of the reading and comprehending processes, and the contextual dynamics are particularly difficult for struggling readers to negotiate (Alexander & Jetton, 2000). For example, when the purpose for reading is not evident, struggling readers may falter when attempting to marshal reading strategies to make meaning of the text. Thus, it is fundamental that the activity and context for reading and comprehending are as explicit as possible for the learner.

When the aforementioned factors interact in productive ways, as they would in an ideal reading model, then deep, meaningful comprehension (i.e., high-level comprehension) can be achieved. The reality, of course, is that such deep, meaningful comprehension as idealized in most reading models is rarely achieved. Rather, what is needed are ways to better gauge and understand the factors that appear most influential in the processes of reading and comprehending, given variations in the aforementioned elements. Such is the focus of the present investigation. Specifically, the purpose was to examine the effects of text genre (i.e., narrative versus expository) and structure (e.g., story versus causation) on 4th- and 5th-grade students' high-level comprehension as evidenced during small-group discussions.

Introduction

High-level Reading Comprehension

Literal comprehension requires an adequate, yet basic, understanding of the written text. This is a lower form of comprehension because it only results in a verbatim recollection or recognition of text or text-based content. On the other hand, Resnick (1987) suggested a higher form of thinking that involves "elaborating, adding complexity, and going beyond the given" (p. 42). When readers develop and interpret implicit meanings, check assumptions, and build connections between the text and their prior knowledge or personal experiences, they have gone beyond literal understanding, comprehending the text at a higher level (Reninger & Wilkinson, 2010). In the present work, the term *high-level comprehension* refers to critical, reflective thinking about and around the text (Murphy, Wilkinson, Soter, Hennessey, & Alexander, 2009). Such comprehension would be illustrated by a student who, having read an expository text on

major inventions in American history, provides a detailed, multi-part argument as to why the cotton gin played a fundamental role in the industrialization of America. In essence, although the expository text did not refer to the American industrial revolution the student linked the authors' perspectives on important American inventions to her own knowledge of the industrial revolution. In doing so, she showed evidence of high-level thinking through her discourse.

Our conceptualization of high-level comprehension aligns with the National Assessment of Educational Progress (NAEP) reading framework for 2013 (NAEP, 2012). Specifically, the framework comprises three *cognitive targets* underlying meaningful comprehension (i.e., locate and recall, integrate and interpret, and critique and evaluate). The first cognitive target, "locate and recall," requires readers to be able to identify textually explicit information and make simple inferences within and across texts. The second cognitive target is "integrate and interpret." Readers engaged in this process think about the text in ways that include comparing or connecting ideas, making assumptions, asking questions, or considering alternatives. The third cognitive target comprising the framework is "critique and evaluate," within which readers consider the text critically to judge and evaluate the text and synthesize different perspectives in relation to their experiences or even other texts. In sum, our understanding of high-level comprehension parallels the types of comprehension identified in the framework as the second (i.e., integrate and interpret) and third (i.e., critique and evaluate) cognitive target; that is, comprehension that goes beyond locating or recalling explicit details from the text to thinking about, around, and with the text (Murphy et al., 2009).

Text Genre and Structure

Text genre. Comprehension of text is influenced by both the overarching purpose of the text (i.e., genre), as well as, the underlying structures embedded within the text. Although there are many nuanced forms of text genre, three forms (i.e., narrative, informational, and persuasive) are identified within the reading framework (NAEP, 2012) and are particularly common in formal school settings. Within the present study, we are particularly interested in narrative and informational texts as they are

prevalent in the reading curricula for upper elementary-school students (i.e., 9-11 years). Narrative text is written to tell a fictional story, while informational text is intended to inform the reader of an event or provide general information about a given topic or domain. In most American schools, 4th grade marks the transition from *learning to read* to *reading to learn* about topics from various content areas (e.g., science or social studies). During the first three years of schooling, students develop the capacity to decode, interpret, and produce written symbols for oral language and continue to build their repertoire of sight words (Snow, Burns, & Griffin, 1998). By grade four, schooling takes on a different purpose; that is, reading to learn. This shift places greater demands on students' higher-order thinking skills, critical-analytic skills, and their motivation to engage or persist when text complexity increases.

Consequently, young learners encounter more comprehension difficulties with informational texts than they do with narrative materials (Hidi & Hildyard, 1983). The conversational nature of narrative text and the common structure the majority of stories share makes narrative texts easier to comprehend for young learners. In contrast, informational texts place less emphasis on dialogue, contain more abstract, novel concepts than narrative texts, and use various text structures to deliver these ideas (Gersten, Fuchs, Williams, & Baker, 2001).

In comparison to narrative texts, early elementary school readers may not receive the same level of exposure to expository texts (Duke, 2000). This lack of exposure could contribute to later difficulties. Therefore, as students experience the transition from narrative stories to informational texts during the 4th and 5th grades, text genre may be a critical factor that influences their high-level comprehension.

Literature on the relationship between text genre and text-based talk shows that different genres may influence the quantity and quality of talk about and around the text (Price, Bradley, & Smith, 2012). Price et al. (2012) found that teachers generated a significantly greater number of extra-textual utterances during an information book read-aloud, when compared to a storybook read-aloud. Meanwhile, other studies showed that informational texts prompted discussions that were different from those sparked by narrative stories, and they required different types of comprehension activities (e.g., Mason, Peterman, Powell, & Kerr, 1989).

Text structure. Both narrative and informational texts possess an organizational structure unique to their genre, and knowledge of these structures plays a crucial role in comprehension. Text structure knowledge facilitates strategic reading and helps build coherent mental representations of the text that are more sustainable and retrievable (Meyer, 1985).

Narrative text structure. Story structure, also referred to as narrative structure or story schema, was defined by Stein and Glenn (1979) as consisting of two major components: the setting and the episode. The setting mainly consists of the character and the context of the story. The episode is divided into six subcategories: initiating events, internal responses, plans, actions, consequences, and reactions. The awareness of story grammar helps students predict the flow of the text, which consequently facilitates comprehension (Duchan, 2004).

Research has shown that young learners developed mental models for story grammar after repeated exposure to narrative stories (Applebee, 1978; Fitzgerald, 1984). Mandler and Johnson (1977) found that children of all ages used their knowledge of how stories were structured to help them learn important details. These indications of the naturalistic development of story grammar knowledge suggest that 4th- and 5th-grade students might have an advantage in generating high-level comprehension with narrative texts structure over informative or persuasive texts.

Informational text structure. Informational text is organized differently from narrative text with which students are more familiar. A well-written informational text is generally organized logically to facilitate readers' comprehension (Meyer, 2003). This organization follows a leveled structure in which the main idea or most salient message situates on the top-level and subsequent details are presented in a hierarchical way based on their relevancy to the main idea. Informational texts can be classified according to one or more top-level structures. Meyer (1975) identified five common patterns in informational text structure: comparison, problem/solution, causation, sequence, and description. Top-level structures can be seen as existing on a continuum from more structured to less structured texts (Meyer & Freedle, 1984). For instance, causation and problem/solution texts contain more structural components than less structural texts like descriptive texts. Previous research found that more organized text structures, like causation, comparison, and problem/solution, generally provide greater mnemonic

advantages for learning and memory than the structures of description and sequence texts (Meyer & Freedle, 1984; Sanders & Noordman, 2000).

Like narrative texts, knowledge of informational text structure allows readers to better organize their ideas and build coherent mental representations of the informational text (Meyer et al., 1980). However, the lack of exposure to non-fiction books during early childhood may lead to the lack of such knowledge and result in difficulties when students are newly exposed to informational texts during their later elementary school years.

Text-Based Discussion

A central finding within the empirical literature on learning is that the quality of classroom talk is strongly associated with the depth of student learning, understanding, and problem solving (e.g., Mercer, 2002; Nystrand, Wu, Gamoran, Zeiser, & Long, 2003; Wegerif, Mercer, & Dawes, 1999). Such empirical findings are deeply rooted in social constructivist and social cognitive theory. In essence, "…talk is a central feature of social-constructivist pedagogy," and talk is an effective tool for promoting thinking (Wilkinson, Murphy, & Soter, 2010, p. 144). Moreover, such effective talk can be modeled by knowledgeable others or comparable peers, cultivated through conversational moves, and sustained through cognitive and environmental prompts or cues. Discussions provide an opportunity for students to ask and answer questions, share ideas, put forth alternatives, and challenge ideas so as to reach higher levels of thinking and comprehension through thoughtful elaboration and co-construction of meaning about and around the text. Further, as a pedagogical tool, discourse also provides a window through which educators can glean understanding regarding students' comprehension.

Former discussion approaches. A considerable number of approaches to conducting classroom discussions exist in the literature. Prior research has identified nine discussion approaches characterized by a peer-reviewed record of research (Wilkinson, Murphy, & Soter, 2003; Soter, Wilkinson, Murphy, Rudge, Reninger, & Edwards, 2008; Murphy et al., 2009): *Collaborative Reasoning* (Anderson, Chinn, Waggoner, & Nguyen, 1998), *Paideia Seminar* (Billings & Fitzgerald, 2002), *Philosophy for Children* (Sharp, 1995), *Instructional Conversations* (Goldenberg, 1993), *Junior Great Books Shared Inquiry* (Great Books Foundation, 1987), *Questioning*

the Author (Beck & McKeown, 2006; McKeown & Beck, 1990), *Book Club* (Raphael & McMahon, 1994), *Grand Conversations* (Eeds & Wells, 1989), and *Literature Circles* (Short & Pierce, 1990). Each approach has unique goals for discussion (e.g., students gaining literal comprehension), stance toward text (e.g., efferent or expressive), roles for the teacher and students (e.g., teacher controls turns and topic), and, at a minimum, a loosely articulated conceptualization of how the discussion should unfold (e.g., teacher begins with a question of central importance in the text).

To better understand the ways that classroom discussions play a role in basic and high-level comprehension, Murphy and colleagues (Murphy et al., 2009) conducted a meta-analysis of empirical research conducted on the aforementioned approaches to text-based discussion. The meta-analysis revealed that not all approaches were equally effective at promoting comprehension, and increases in student talk did not necessarily equate to concomitant increases in students' comprehension outcomes. Rather, gains in students' comprehension were strongly associated with the stance toward the text—the approaches with a critical-analytic stance toward the text related to the relatively largest effects. Also important was the structure of the discussion. It appeared that the strongest effects were seen for discussion approaches where there was enough structure for those involved to understand their role, but not so much structure that the approach appeared prescriptive. Finally, strong comprehension effects were seen with approaches where the teacher gradually released control to the students and the students' increasing interpretive authority was recognized and reinforced.

Having identified the approaches with the most substantive effects on students' high-level comprehension, Soter and colleagues (Soter et al., 2008) closely examined the nature of the talk taking place during discussions espousing one of the identified, productive approaches. Soter et al. found that during productive discussions, students hold the floor for longer periods of time compared to the teacher, there is shared control between teachers and students, and teachers facilitate discussion more than they play an active role in the discussion. Also important was the nature of the discourse itself. Teachers and students asked more open-ended questions for which there was not necessarily one correct answer (i.e., authentic questions), rather than declarative or factual knowledge questions (i.e., test questions); students

often provided longer, extended utterances in which they used a series of reasoning words (e.g., because or since) to explain their position; and, students often worked together to build their understanding of the text (i.e., co-construction of meaning). Having conducted the meta-analysis and the discourse analysis of these approaches to text-based discussion, Wilkinson et al. (2010) combined the features of the discussion approaches that were shown to be effective at promoting high-level comprehension into a model of discussion called *Quality Talk*. Subsequent to this initial research, the model has been revised and enhanced based on further research. The contemporary Quality Talk model is described below.

Quality Talk. The Quality Talk model of discussion can best be understood as two interleaving strands that inform one another as the teachers' and students' knowledge of the approach grows. The first strand pertains to the conceptual model of Quality Talk, which is characterized by four components including the instructional frame, pedagogical principles, teacher moves, and discourse tools and signs (i.e., discourse elements). The second strand pertains to the operationalization of Quality Talk by teachers and students, and it includes teacher professional development, discourse coaching, and explicit lessons for students on the discussion and their role in Quality Talk discussions.

The first strand. One of the central features of productive Quality Talk discussions, as evidenced through the instructional frame, is the shared control between the teacher and students. Teachers have control over the choice of text and the topic of the conversation, whereas students hold interpretive authority and control of turns. In addition, Quality Talk discussions place emphasis on both expressive and efferent stances toward the text, as research suggests that "a moderate degree of knowledge-driven and affective engagement is necessary, though not sufficient," for students to foster a high critical-analytic orientation to text (Wilkinson et al., 2010, p. 149). Further, one of the critical pedagogical principals central to Quality Talk pertains to the role of the teacher in Quality Talk discussions, when teachers gradually release responsibility of the discussion to their students (cf. Pearson & Gallagher, 1983), students are afforded the opportunity to take on greater responsibility. Once students begin to gain interpretive authority over the text, they can begin to think, reason, and respond to the text more deeply. Yet it is important to note that, despite their *decreased* role

in Quality Talk discussions, teachers still continue to facilitate and guide the discussion through their careful use of *teacher moves* (e.g., marking, summarizing, modeling). Through their selective use of teacher moves, teachers are able to provide the necessary support and guidance for students without suppressing student talk. Finally, based on an analysis of discourse from 42 quantitative studies, Soter et al. (2008) identified a set of discourse features known to serve as proximal indicators of high-level comprehension. Thus, these indices are the focus of Quality Talk: authentic questions, uptake, and questions that elicit high-level thinking (i.e., generalization, analysis, speculation; Nystrand et al., 2003); questions that elicit extra-textual connections (i.e., affective, intertextual, and shared knowledge connections); students' elaborated explanations (Webb, 1980); and students' exploratory talk (Mercer, 2000).

   The second strand. As part of Quality Talk, teachers are provided initial and ongoing professional development training.   During this training, teachers are explicitly taught all aspects of the conceptual model, including the four components encompassing *the first strand*. This means that in the professional development, teachers are taught how to implement Quality Talk using the instructional frame and pedagogical principals, when and how to use teacher moves, and perhaps most importantly, how to identify and support students' use of the discourse indicators indicative of high-level comprehension in their discussions. Then throughout their implementation of Quality Talk, teachers participate in discourse coaching. Prior to coaching, teachers prepare by reviewing a video of a recent past discussion, identifying instances of each discourse indicator. Then, they meet with a discourse coach to receive feedback and support to ensure successful implementation of Quality Talk. For the final aspect of the second strand, teachers deliver explicit lessons to their students. Teachers present lessons geared toward teaching students various aspects of the Quality Talk Model (e.g., how to generate authentic questions) using researcher-provided, age-appropriate slides.

Purpose of the Present Study

Quality Talk is effective in enhancing students' ability to think and reason about text and is particularly effective for narrative texts (Reninger & Wilkinson, 2010). However, there is lack of empirical research that

addresses how Quality Talk is influenced by the features of the text being discussed. Given the inherent complexity of text structures, it is possible that young readers encounter more difficulty in comprehending informational texts, compared to the more simply structured narrative texts. Such difficulty may hinder students' critical-analytic thinking about the text. Further, among the five structures of informational text, some structures (e.g., comparison) are more organized than others (e.g., sequence), hence it is possible that within informational text, some structures facilitate reading and foster high-level thinking while others do not. Rooted in social constructivist theory and pedagogy, we would expect the influence of the various text features on students' comprehension to manifest in their small-group Quality Talk discussions. Similarly, it may be that the genre and structure of the text also influence the discourse and pedagogy of the teachers. As such, we also explored teachers' talk as it varied by genre and structure. Specifically, two research questions guided the present study including:

RQ1: To what extent does text genre influence students' high-level comprehension, as indicated by the presence of discourse elements, and teachers' questioning patterns during small-group discussions about text?

RQ2: To what extent does text structure influence students' high-level comprehension, as indicated by the presence of discourse elements, and teachers' questioning patterns during small-group discussions about text?

Method

Participants

The sample of participants consisted of 32 elementary students enrolled in 4th- ($n = 14$) and 5th-grade ($n = 18$) classrooms in the northeastern United States. The teachers from each classroom ($n = 2$) also participated in the study. General academic achievement and reading ability, indexed by students' grade point average for the previous year and standardized assessment outcomes (i.e., Iowa Test of Basic Skills), was approximately evenly distributed across the classrooms by grade. Gender was approximately evenly distributed across the classrooms, most of the students were Caucasian, and the school received funding to provide free or reduced

lunches to approximately 30% of the school population. The teachers involved in the study have taught between 10 and 18 years at a range of grades from 3rd through 8th grade.

Design and Procedure

The research team spent 12 weeks of the 2012-2013 school year examining the effectiveness of Quality Talk in the school setting. As previously described, participating teachers received professional development training at the beginning of the study and coaching over the course of the 12 weeks. Then teachers implemented the explicit Quality Talk lessons for students over a two-week period and conducted weekly group discussions on the main selections from their reading series. Teachers chose the texts based on their sequence in the reading series curriculum. Teachers received discourse coaching periodically during the study and were debriefed with the research team at the conclusion of the study

Baseline videos of teachers leading discussions were collected prior to professional development. Teachers' feedback on the instructional approach and materials were collected throughout the study during professional development activities. Repeated measures of comprehension and fluency were also collected to assess changes in comprehension and critical-analytic thinking.

Materials

Fifteen texts were included in the study, as shown in Table 1. All discussions were conducted on reading selections selected from the grade-level Scott Foresman *Reading Street*$^{©}$. Coh-Metrix, Version 3.0 (McNamara, Louwerse, Cai, & Graesser, 2013), was used to calculate Flesch-Kincaid grade level and the word count.

Table 1.
Features of the Discussion Texts

Text Title	Genre	Top-level Structure	Flesch-Kincaid Grade Level	Word Count
Grade 4				
Encantado: Pink Dolphin of the Amazon	Informational	Causation	4.6	1882
Navajo Code Talkers	Informational	Problem/solution	8.1	1891
Seeker of Knowledge	Informational	Sequence	5.5	1047
Encyclopedia Brown and the Case of the Slippery Salamander	Narrative	Story	5.2	1101
My Brother Martin	Informational	Sequence	6.4	1555
Jim Thorpe's Bright Path	Informational	Sequence	4.7	2413
How Tia Lola Came to (Visit) Stay	Narrative	Story	4.9	2461
A Gift from the Heart	Narrative	Story	3.7	1368
The Man Who Went to the Far Side of the Moon	Informational	Comparison	5.1	1343
Grade 5				
The Stormi Giovanni Club	Narrative	Story	3.3	2220
The Gymnast	Narrative	Story	5.4	969
The Truth About Austin's Amazing Bats	Informational	Problem/solution	6.2	1706
King Midas and the Golden Touch	Narrative	Story	4.4	1545
Sweet Music in Harlem	Narrative	Story	3.9	1600
The Hindenburg	Informational	Causation	8.3	1351

Data

Small-group discussions were recorded for each text (i.e., either three or four groups per class, per text), resulting in a total of 62 discussions. Baseline videos were not included in the analysis because they were not all small-

group discussions. The remaining 47 small-group discussion videos ranged in length from 10 to 20 minutes. To ensure consistency, the middle 10-minute segment of each video was selected for coding. Specifically, 10 units (i.e., one minute = one unit) from each discussion were coded and analyzed in this study, see Table 2.

Table 2.
Summary of Data Sources

Characteristics of the study	Grade 4	Grade 5
Number of students	14	18
Number of recorded discussions	33	29
Number of coded discussions	27	20
Number of units in coded discussions	270	200

Coding
The discussions were coded according to a modified version of the coding scheme developed by Soter et al. (2008) using *StudioCode* software. During training, coders were taught the discourse features and practiced coding using samples from a comparable set of data. Once training was completed, two trained individuals coded approximately 10% of the discussions ($n = 6$). They reached acceptable agreement above 85%. All disagreements were resolved by discussion between coders. Periodic agreement checks were conducted during coding to protect against drift. Coder agreement exceeded 85% on all checks.

   Discourse indicators. As described previously, discussions that facilitate high-level comprehension can be characterized by specific discourse indicators. The discourse indicators of interest in this study were: authentic questions (AQ), test questions (TQ), elaborated explanations (EE), and exploratory talk (ET). With respect to both authentic and test questions, these indicators were also coded with respect to the agent (i.e., teacher or student) that initiated the question. Elaborated explanations and exploratory talk are attributed exclusively to student talk, and thus, students initiated all of these instances.

According to Soter et al. (2008), the fundamental rule when coding a question is to code what the question actually elicits rather than the question itself. A question, and the response it elicits, is called the *question event*. This notion nicely aligns with Nystrand's (2003) articulation that questions should be thought of as "sites of interaction," and that participants' responses to questions reflect their "understandings of the interactions as manifest in their discourse moves" (p. 144). Therefore, question events generally include a question, one or more student responses to the question, and a follow up to the response by either a teacher or student (Nystrand, 2003).

Authentic question. An authentic question is one in which the person asking the question is genuinely interested in knowing the answer because the answer is not pre-specified. In addition, the person who responds to the question generally thinks more fully about the possible answer, since the answers to authentic questions are open to argument, debate, and discussion. Answers to authentic questions should be supported by reasons and evidence from the text, other sources, and/or reasoning.

Transcript excerpt #1. Students were discussing the informational text *The Hindenburg*, which is about the crash of the giant airship in 1937.

> *S1: How far away do you think they could hear the explosion? Like how far did it travel do you think? (AQ)*
> *S2: Well it probably went a long way, if they were in the middle of the ocean it would have been different, but it looks like they were near a city. Cause on 418/419 you can see the buildings and stuff. (EE)*
> *T: They were just a little south of NYC, huh?*
> *S3: There was a bunch of smoke, so I bet you could see the smoke from pretty far away, too.*

Test question. A test question is an inauthentic question, in that it presupposes a particular answer. The answer can usually be found in the text, and there *is* a correct answer. Test questions often occur when the teacher has a particular answer in mind and wants the students to respond stating this answer. A test question could also be asked by a student. In this case, the question would typically have one factual or text-based answer. This generally occurs when the student asking the question does not know a specific fact.

Transcript excerpt #2. Students were discussing the informational text *The Man Who Went to the Far Side of the Moon*, which is about the story of the three Apollo 11 astronauts.

S1: So who was the first person who landed on the moon? (TQ)

S2 & S3: Neil Armstrong

S1: Really?

S2: Yeah.

Elaborated explanation. Elaborated explanations were coded when students explained their thinking in a fairly coherent form to others in the group. A common example in the discussions involved a student explaining how things work or why things work in a particular way. Elaborated explanations foster greater engagement and "cognitive restructuring and cognitive rehearsal on the part of the student doing the explaining'' (Webb, Farivar, & Mastergeroge, 2001, p. 13).

Transcript excerpt #3. Students were discussing a narrative text called *The Stormi Giovanni Club*, in the story a girl got a precious pen from her grandpa and lost it.

T: So was the pen a good gift? (AQ)

S1: I think it was…I think it was a good gift because it started her passion for pens.

S2: Well I thought her passion for pens only started because she lost the pen.

S3: Because she wanted to see if she could find something as cool as…

S4: I don't think it was the best gift. It's kind of in the middle. It was pretty cool, cause like, maybe it was passed down from her great-grandpa to her grandpa to her. But she was not really allowed to do anything with it. So it was one of those gifts that when you were little you don't really pay attention to, cause I have all these little Precious Moments® things that just sit in the cabinet that I got for gifts. I really don't pay attention to them. (EE)

S2: If it was passed down from her great-grandpa and if she was young, I think it is a kind of bad gift, because then if she did lose it, and it's special then you don't want to… (EE)

An additional example of an elaborated explanation can be evidenced in transcript excerpt #1 by Student #2.

Exploratory talk. Exploratory talk was coded when students shared and co-constructed knowledge together. Mercer (2002) defined exploratory talk as talk in which partners engage critically but constructively with each other's ideas. When exploratory talk occurs, students' answers to authentic question are challenged by others with reasons and alternatives. Hence, this kind of co-reasoning helps students "share knowledge, evaluate evidence, and consider options in a reasonable and equitable way" (Mercer, 2000, p. 153). An example of exploratory talk can be seen above in transcript excerpt #3.

Results

Impact of Text Genre on Students' High-Level Comprehension and Teachers' Questioning Patterns

The first research question pertained to the role that text genre played in students' high-level comprehension and teacher questioning as indexed by the occurrence of Quality Talk discourse elements. We first discuss the outcomes for students and follow with a discussion of the outcomes for teachers. As indicated in Table 3, the proportion of the two question types varied only minimally by genre. For example, when students read narrative texts they asked approximately 0.40 authentic questions per minute in their discussions, whereas when students read informational texts they asked approximately 0.48 authentic questions per minute. On average students asked slightly less than one question every other minute. This trend was also present for test questions, albeit on average, students asked far less test questions than authentic questions. However, as was expected, students generated relatively more elaborated explanations for discussions on narrative texts than for discussions on informative texts. Yet, the instances of exploratory talk were very few when compared to the instances of elaborated explanation.

Table 3.

Student- and Teacher-initiated Discourse Indicators by Genre

Discourse Indicators	Genre	# of DIs	# of Units	DIs per Unit (*SD*)
Student-initiated				
Authentic questions	Narrative	84	210	0.40 (0.61)
	Informational	125	260	0.48 (0.69)
	Total	209	470	0.44 (0.66)
Test questions	Narrative	6	210	0.03 (0.17)
	Informational	14	260	0.05 (0.27)
	Total	20	470	0.04 (0.23)
Elaborated explanations	Narrative	155	210	0.74 (0.83)
	Informational	136	260	0.52 (0.67)
	Total	291	470	0.62 (0.75)
Exploratory talk	Narrative	19	210	0.09 (0.29)
	Informational	22	260	0.08 (0.28)
	Total	41	470	0.09 (0.28)
Teacher-initiated				
Authentic questions	Narrative	143	210	0.68 (0.82)
	Informational	237	260	0.91 (0.96)
	Total	380	470	0.81 (0.91)
Test questions	Narrative	46	210	0.22 (0.48)
	Informational	77	260	0.30 (0.68)
	Total	123	470	0.26 (0.60)

Note. Due to the unequal occurrence of narrative and informational texts present in the reading series, the number of discussions conducted on the two genres was not the same. Thus, interpretation of the raw number of discourse indicators per genre is biased. The column pertaining to the proportion of discourse indicators per unit (i.e., one unit = one minute) provides an adjusted value that can be compared across genres. # of DI's = number of discourse indicators; # of Units = number of units; DIs per Unit = number of discourse indicators/number of units; SD = standard deviation.

To further explore the role of genre on students' high-level comprehension, a one-way multivariate analysis of variance (MANOVA) assessed the impact of genre (i.e., narrative vs. informational) on the four discourse indicators (i.e., authentic questions, test questions, elaborated explanations, and exploratory talk). There was a significant difference between narrative and informational texts on student-initiated discourse indicators, F (4, 465) = 2.864, p = .023; Pillai's Trace = .024; partial η^2 = .024. Follow-up univariate ANOVAs resulted in a significant difference in genre only on elaborated explanations (F (1, 468) = 9.614, p = .002; partial η^2 = .02), where the narrative texts triggered significantly more elaborated explanations than informative texts.

We were also interested in the ways in which teachers' questions varied by genre. As indicated in Table 3, the descriptive statistics demonstrated that when discussing narrative texts with their students, teachers asked fewer authentic questions per minute in their discussions, than when discussing informational texts, (i.e., 0.68 compared to 0.91 authentic questions per minute). This trend was consistent with test questions, albeit on average, teachers asked far fewer test questions than authentic questions.

To further explore these descriptive trends, a one-way multivariate analysis of variance (MANOVA) assessed the impact of genre (i.e., narrative vs. informational) on the two teacher-initiated discourse indicators (i.e., authentic questions and test questions). In examining the data to check the assumptions of the planned analysis, the checking revealed that the data were not normally distributed, as assessed by Shaprio-Wilk test (p < .05). However, one-way MANOVA is fairly robust to deviations from normality, and as a result, we interpreted Pillai's Trace. There was a statistically significant difference between narrative text and informational texts on teacher-initiated discourse indicators, F (2, 467) = 4.526, p = .011; Pillai's Trace = .019; partial η^2 = .019.

Follow-up univariate ANOVAs resulted in a significant difference on authentic questions (F (1, 468) = 7.636, p = .006; partial η^2 = .016), but not for test questions (F (1, 468) = 1.923, p = .166; partial η^2 = .004). Teachers initiated significantly more authentic questions for informational texts than for narrative texts, Bonferroni correction was applied to account for multiple ANOVAs and potential family-wise error (i.e., statistical significance at p < .025).

Impact of Text Structure on Students' High-Level Comprehension and Teachers' Questioning Patterns
Our second research question pertained to the role of text structure on students' high-level comprehension and teachers' questioning patterns. Again, we first discuss the outcomes for students and follow with a discussion of the outcomes for teachers. As detailed in Table 4 displaying the descriptive data, students asked more authentic questions when discussing comparison texts than when discussing other text structures. Additionally, when discussing comparison structure texts, students generated greater instances of exploratory talk, compared with other text structures. Although as previously indicated, the overall the instances of exploratory talk were few.

Table 4.
Student- and Teacher-initiated Discourse Indicators by Text Structure

Discourse Indicators	Story			Causation			Comparison			Problem/Solution			Sequence		
	# of DIs	# of Units	DIs per Unit (SD)	# of DIs	# of Units	DIs per Unit (SD)	# of DIs	# of Units	DIs per Unit (SD)	# of DIs	# of Units	DIs per Unit (SD)	# of DIs	# of Units	DIs per Unit (SD)
Student-initiated															
AQs	84	210	0.40 (0.61)	28	70	0.40 (0.67)	30	30	1.00 (0.83)	26	70	0.37 (0.57)	41	90	0.46 (0.69)
TQs	6	210	0.03 (0.17)	0	70	0 (0)	6	30	0.20 (0.48)	0	70	0 (0)	8	90	0.09 (0.36)
EEs	155	210	0.74 (0.83)	43	70	0.61 (0.79)	12	30	0.40 (0.56)	44	70	0.63 (0.64)	37	90	0.41 (0.62)
ET	19	210	0.09 (0.29)	3	70	0.04 (0.20)	5	30	0.17 (0.38)	6	70	0.09 (0.28)	8	90	0.09 (0.29)
Teacher-initiated															
AQs	143	210	0.68 (0.82)	80	70	1.14 (1.18)	22	30	0.73 (0.79)	47	70	0.67 (0.72)	88	90	0.98 (0.94)
TQs	46	210	0.22 (0.48)	20	70	0.29 (0.75)	0	30	0 (0)	26	70	0.37 (0.69)	31	90	0.34 (0.72)

Note. Due to the unequal occurrence of text structure present in the reading series, the number of discussions conducted on the various structures was not the same. Thus, interpretation of the raw number of discourse indicators per genre is biased. The column pertaining to the proportion of discourse indicators per unit (i.e., one unit = one minute) provides an adjusted value that can be compared across genres. AQs = authentic questions; TQs = test questions; EEs = elaborated explanations; ET = exploratory talk; # of DIs = number of discourse indicators; # of Units = number of units; DIs per Unit = number of discourse indicators/number of units; SD = standard deviation.

To further explore the role of text structure on students' high-level comprehension, a one-way multivariate analysis of variance (MANOVA) assessed the impact of text structure (i.e., story, causation, comparison, problem/solution, and sequence) on the four discourse indicators (i.e., authentic questions, test questions, elaborated explanations, and exploratory talk). There was a significant difference between the five text structures on the student-initiated discourse indicators, F (16, 1860) = 3.956, p < .001; Pillai's Trace = .132; partial η^2 = .033.

Follow-up univariate ANOVAs showed that text structure had statistically significant effects on student-initiated authentic questions (F (4, 465) = 6.178, p < .001; partial η^2 = .05), test questions (F (4, 465) = 5.986, p < .001; partial η^2 = .049), and elaborated explanations (F (4, 465) = 3.739, p = .005; partial η^2 = .031), using a Bonferroni adjusted α level of .0125. No significant difference for text structure was found on exploratory talk (F (4, 465) = 1.033, p = .389; partial η^2 = .009). Bonferroni post-hoc tests showed that when discussing comparison structure texts, students generated significantly more authentic questions than for each of the other four text structures: story (p < .001), causation (p < .001), problem/solution (p < .001), sequence (p = .001). A similar trend was present when comparing the number of test questions generated when discussing comparison structure texts to the other structure types: story (p = .001), causation (p = .001), problem/solution (p = .001); but, there was not a significant difference between comparison structure and sequence structure (p = .206). Further, consistent with the results on text genre, students discussing story structure texts generated significantly more elaborated explanations than students discussing sequence texts (p = .005).

In addition to the role of text structure on students' high-level comprehension, we were also interested in the influence of text structure on teachers' questioning patterns. From the descriptive data shared in Table 4, it is evident that teachers asked more authentic questions when discussing causation texts compared to when discussing texts with other structures. Also worthy of note is that teachers did not ask *any* test questions when discussing a text with a comparison structure.

To further explore the role of text structure on students' high-level comprehension, a one-way multivariate analysis of variance (MANOVA) assessed the impact of structure (i.e., story, causation, comparison,

problem/solution, and sequence) on the two teacher-initiated discourse indicators (i.e., authentic questions and test questions). There was a significant difference between the five text structures on the teacher-initiated discourse indicators, F (8, 930) = 3.716, $p < .001$; Pillai's Trace = .062; partial η^2 = .031. Follow-up univariate ANOVAs showed that text structure resulted in a significant effect on teacher-initiated authentic questions (F (4, 465) = 4.816, $p < .001$; partial η^2 = .04); but not on test questions (F (4, 465) = 2.775, $p = .027$; partial η^2 = .023), using a Bonferroni adjusted α level of .025.

Bonferroni post-hoc tests showed that when discussing causation structure texts, teachers initiated significantly more authentic questions than story structure texts ($p = .002$), but no significant difference was found when comparing causation structure texts with other text structures.

Discussion

The purpose of this study was to examine students' high-level comprehension during small-group discussions as a function of the characteristics of the text that they discussed. Our findings suggested that students evidenced more indices of high-level comprehension when discussing narrative texts than when discussing informational texts. Yet when inspecting the discourse indicators of high-level comprehension independently, only the proportion of elaborated explanations was significantly different between discussions based on narrative texts compared to informational texts. This result may be due to the fact that narrative texts contained more familiar information, and thus, students had more knowledge available to facilitate comprehension. Further, it is possible that the conversational nature of the narrative texts made it easier for students to connect to their personal life experiences during the discussions and put forward coherent and reasoned explanations.

For instance, in transcript excerpt #3, one student was able to relate a gift she had once received to the gift in the story. She used her personal experience as evidence to support her argument. In responding to authentic questions about informational text, however, students often need to develop their explanations based on certain facts. Without the requisite prior knowledge, students may encounter difficulties in generating elaborated

explanations to support a well-developed argument, and students may need to seek help from the textbook. For example, in transcript excerpt #1 students were discussing the explosion of the Hindenburg. One of the students (i.e., Student #2) cited the illustration in the textbook as the evidence to support her reasoning. Thus, it is reasonable that students in this study articulated more elaborated explanations when discussing narrative texts.

Alternatively, teachers asked more authentic questions during discussions about informational texts. Because students who participated in the study were experiencing a critical transition from *learning to read* to *reading to learn*, the informational texts may have been more demanding than narrative texts to comprehend. Thus, the higher frequency of teacher-generated authentic questions could be due to the extra guidance teachers needed to provide to their students when discussing the informational texts.

Yet perhaps a clearer picture becomes apparent when considering the deeper structure of the texts. While all of the narrative genre texts were characterized as having a story structure, the informational genre texts were characterized as having one of four structures, with the different structures varying widely. As expected, texts with a story structure (i.e., narrative texts) elicited the greatest number of students' elaborated explanations. Importantly though, of the five text structures analyzed in the study, texts with a comparison structure elicited significantly more questions (i.e., both authentic and test) from students in discussions, despite being classified as informational genre text. This finding is supported by prior research that showed mnemonic advantages of comparison structure (e.g., Richgels et al., 1987). Additionally, teachers asked more authentic questions during discussions about texts organized with the causation structure (i.e., one type of informational text).

In short, this study found that text features, in particular text genre and structure, influenced classroom discussions about text, as evidenced by indices of students' high-level comprehension and teachers' questioning pattern. These findings also suggest that perhaps certain individual difference variables (i.e., topic knowledge and topic interest) may play essential roles in text-based discussions. Topic knowledge has long been associated with individual's understanding and memory of text (Alexander & Murphy, 1998) and interest often predicts students' response to a

particular topic (Alexander, Kulikowich, & Schultz, 1994). Therefore, it is imperative that these characteristics be examined in subsequent studies.

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Middle School Students' Conceptual Understanding of Equations: Evidence from Writing Story Problems

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Middle School Students' Conceptual Understanding of Equations: Evidence from Writing Story Problems

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Abstract

This study investigated middle school students' conceptual understanding of algebraic equations. 257 sixth- and seventh-grade students solved algebraic equations and generated story problems to correspond with given equations. Aspects of the equations' structures, including number of operations and position of the unknown, influenced students' performance on both tasks. On the story-writing task, students' performance on two-operator equations was poorer than would be expected on the basis of their performance on one-operator equations. Students made a wide variety of errors on the story-writing task, including (1) generating story contexts that reflect operations different from the operations in the given equations, (2) failing to provide a story context for some element of the given equations, (3) failing to include mathematical content from the given equations in their stories, and (4) including mathematical content in their stories that was not present in the given equations. The nature of students' story-writing errors suggests two main gaps in students' conceptual understanding. First, students lacked a robust understanding of the connection between the operation of multiplication and its symbolic representation. Second, students demonstrated difficulty combining multiple mathematical operations into coherent stories. The findings highlight the importance of fostering connections between symbols and their referents.

Keywords: conceptual understanding, algebra, equations, story problems, middle school.

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Comprensión Conceptual de Ecuaciones en Estudiantes de Secundaria: Evidencia en la Escritura de Problemas Historiados

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Resumen

Se investigó la comprensión conceptual de ecuaciones algebraicas en estudiantes de secundaria. 257 estudiantes de 6º y 7º grado resolvieron ecuaciones algebraicas y escribieron problemas que se correspondieran con ciertas ecuaciones. Aspectos sobre las estructuras de las ecuaciones, incluyendo el número de operaciones y la posición de la variable desconocida, influyeron en el rendimiento en ambas tareas. En la tarea de escritura de historias, el rendimiento en ecuaciones de dos funciones fue más pobre de lo esperado en base a su rendimiento en ecuaciones de una función. El alumnado cometió variedad de errores en esta tarea, incluyendo: (1) relatos que reflejan operaciones diferentes de las dadas en las ecuaciones, (2) fallos en ofrecer un contexto para algunos elementos de la ecuación dada, (3) fallos para incluir en sus historias contenido matemático de las ecuaciones dadas, e (4) inclusión de contenido matemático en las historias que no estaba en las ecuaciones dadas. La naturaleza de los errores de la escritura de historias sugiere dos lagunas centrales en la comprensión conceptual del alumnado: carecer de una comprensión robusta de la conexión entre la operación de multiplicación y su representación simbólica y dificultad combinando múltiples operaciones en historias coherentes. Los resultados subrayan la importancia de fomentar conexiones entre símbolos y sus referentes.

Palabras clave: comprensión conceptual, álgebra, ecuaciones, problemas historiados, escuela secundaria.

The teaching and learning of algebra has been a focus of reform recommendations over the past several decades (e.g., Kaput, 1998, 1999; Kilpatrick, Swafford, & Findell, 2001; RAND Mathematics Study Panel, 2003), prompting scholars to define algebra and identify aspects of algebraic reasoning that are accessible to students across the grades. Kaput (2008) identified two core aspects of algebra: (a) generalization and the expression of generalizations in increasingly systematic, conventional symbol systems and (b) syntactically guided action on symbols within organized systems of symbols.

Current reform recommendations are prompted in large part by high failure rates associated with the traditional treatment of algebra as an isolated high school course in which students manipulate symbols that hold no meaning for them. Indeed, Kaput's (2008) characterization of algebra highlights the importance of helping students become facile with the symbol system of algebra. Facility with the symbol system of algebra involves both *looking at* and *looking through* symbols (Kaput, Blanton & Moreno, 2008).

Looking through symbols involves maintaining a connection between symbols and their referents. *Looking at* symbols and acting on those symbols involves working with symbols as objects in their own right, without concern for their referents. In the context of instruction, students might be presented with a diagram, a table, a verbal description, or a physical enactment and be prompted to build oral, written, or drawn descriptions of the situation that are closely tied to the original situation. These descriptions can be further and further abstracted until a conventional symbolic representation (e.g., an algebraic equation) is reached. In each step of the symbolization process, one can *look through* the symbols and make a connection to the original context or a previous symbolization, or one can *look at* the symbols to take advantage of their compact form and be free of concern for their referents.

When students learn the procedures associated with *looking at* symbols without highlighting the referential connection to an associated situation or experience—a common occurrence in traditional algebra courses—difficulties can arise (Kaput et al., 2008). Indeed, the literature is replete with reports of middle and high school students' difficulties solving algebraic equations (e.g., Koedinger & Nathan, 2004), interpreting algebraic

equations (e.g., Stephens, 2003), and symbolizing mathematical situations (e.g., Clement, 1982; Heffernan & Koedinger, 1997; Kenney & Silver, 1997; McNeil et al., 2010). These difficulties might be construed as indicating gaps in students' conceptual understanding of algebraic symbols.

Understanding the meaning of algebraic symbols can be viewed as a form of conceptual understanding, in the sense that it reflects understanding of general principles or regularities within the domain (Crooks & Alibali, in press). Put another way, symbols have meanings that reflect general properties that apply across specific instances of the symbols. When students *look through* symbols, connecting them to their referents, these meanings are activated and they can inform students' behavior. However, when students *look at* symbols, for example, when operating on symbols without connecting them to their referents, these general meanings are not activated and therefore cannot guide students' behavior. Students' lack of conceptual understanding of algebraic symbols (or their failure to activate this understanding at a given moment) might lead them to misapply procedures learned by rote or to generate symbolic expressions that are syntactically incorrect or that do not appropriately capture the mathematical relations they wish to express.

How can students' conceptual understanding of symbolic algebraic equations be assessed? Measuring students' conceptual understanding presents researchers with many challenges (Crooks & Alibali, in press). In past work, researchers have asked students to solve algebraic equations (e.g., Herscovics & Linchevski, 1994) or to translate word problems into algebraic equations (e.g., Swafford & Langrall, 2000). However, for students who have had some exposure to instruction in the symbol system of algebra—even for those lacking the understanding to *look through* symbols—such tasks might be routine. Students can succeed on routine tasks without conceptual understanding if they have learned procedures by rote; therefore, students' performance on such tasks may not provide full information about their conceptual understanding of algebraic equations. Instead, novel tasks are needed to provide a more accurate view. Students given a novel task do not have readily available procedures for completing the task, and they must therefore rely on conceptual understanding to guide their approach to the task (Rittle-Johnson, Siegler & Alibali, 2001; Rittle-Johnson & Schneider, 2014).

In the present study, we asked middle school students to generate a story to correspond with a given equation, as a means to investigate their conceptual understanding of algebraic equations. Because the story writing task is novel to most learners, it has been used in previous studies to assess conceptual understanding in a range of mathematical domains and participant groups, including fraction division in late-elementary students (Sidney & Alibali, 2013) and teachers (Ma, 1999), and one- and two-operator algebraic equations in high school students (Stephens, 2003). We also asked students to solve a set of symbolic equations so we could assess the relationship between their conceptual understanding and their equation solving.

Method

Participants
Participants in the study were 257 students (213 6th-grade students and 44 7th-grade students) from a middle school in Boulder, Colorado. Students in both grade levels utilized the *Connected Mathematics* curriculum (Lappan, Fey, Fitzgerald, Friel, & Phillips, 1998). All students had experience solving equations, but they had not been exposed in school to the novel task of writing a story that could be represented by a given equation. Due to absences, thirteen students did not complete the equation-solving assessment, and three students did not complete the story-writing assessment.

Materials
For the equation-solving task, students were asked to solve for *n* in each of 12 equations. The equations varied systematically along three parameters: position of the unknown (start vs. result), number of operations (one vs. two), and operation type (addition, subtraction, or multiplication for one-operator equations and addition-subtraction, multiplication-addition, or multiplication-subtraction for two-operator equations). The equations used are presented in the Appendix. Order was counterbalanced across two different test forms.

For the story-writing task, students were given a set of single-unknown algebraic equations and were asked to write corresponding stories. The

given equations were generated using the same three parameters as in the equation-solving task, resulting in a total of twelve types of equations. These equation types were divided into two sets, which we refer to as "versions," each of which contained three result-unknown equations and three start-unknown equations. Version A included result-unknown addition, result-unknown multiplication, result-unknown multiplication-subtraction, start-unknown subtraction, start-unknown addition-subtraction, and start-unknown multiplication-addition equations; Version B included result-unknown subtraction, result-unknown addition-subtraction, result-unknown multiplication-addition, start-unknown addition, start-unknown multiplication, and start-unknown multiplication-subtraction equations. In addition, for each equation type, two different number sets were used. Finally, each set was presented in forward and reverse order. The equations used in the story-writing task are presented in the Appendix.

To minimize demands on their creativity, students were provided with eight story scenarios that they could use when writing their stories. The scenarios were provided at the top of each page of the story writing booklet and were as follows: (1) Kevin lives on a farm, (2) Nicole is going shopping, (3) Ian collects CDs, (4) Emily is playing basketball, (5) Tara is saving to buy a bicycle, (6) Mike is baking cookies, (7) Alayna has some M&Ms, and (8) Beth is having a birthday party. Students were told that they did not have to use all eight of the scenarios when writing their stories and that they could use the same scenario more than once. To clarify the task, students were given an example equation, $22 - 8 = n$, accompanied by the example solution "Kevin lives on a farm. He had 22 pigs, but he sold 8 of them. How many pigs does he have left?"

Procedure
Students' classroom teachers administered the paper-and-pencil assessments. Each student was randomly assigned to one of the two equation-solving forms and one of the eight story-writing forms. One of the two participating teachers administered both assessments on the same day; the other administered them on two consecutive days. All students completed the story-writing assessment before the equation-solving assessment.

Students were instructed to show all of their work, to draw a circle around their final answers (on the equation-solving form), to not use a calculator, and to not erase any work. The teachers collected the forms at the end of each testing session.

Coding

Equation solving. Students' solutions to the equation-solving tasks were given a score of 1 if they were correct or if they showed evidence of a correct procedure with a computational error. Solutions that were otherwise incorrect were given a score of 0.

Story writing. Students' solutions to the story-writing tasks were given a score of 1 if they were well-formed story problems that corresponded with the numbers and operations in the given equation, and a score of 0 if they were incorrect attempts or if no attempt was made. Cases in which students solved a given equation for n and then integrated that solution into the story rather than pose a question were also treated as correct, as long as they did not also include other errors. For example, for the equation $19 + 33 = n$, one student wrote, "Ian has 19 CDs one month. The next month, he collected 33 more. Now he has 52 CDs"; this story was considered correct because it correctly corresponds with the given numbers and operations.

Each incorrect solution was assigned one or more codes describing the nature of the students' errors. Error categories and accompanying examples are presented in Table 1.

Table 1
Errors types and examples

Type of Error	Equation	Student Example	Percent of Problems
No response		(Student leaves problem blank)	3.1
Incomplete story	$6 \times n + 23 = 89$	Ian collects CDs. He was trying to figure out how many he has.	1.4
Wrong operation	$63 + n - 13 = 91$	Alayna has 63 M&Ms and she gives some to a friend. Then another friend gives her 13 M&Ms. Now she has 91 M&Ms. How many did she give her friend?	5.2
Missing mathematical content	$45 - n = 21$	Kevin has some pigs. He gave away a certain amount. Now Kevin has 21 pigs. How many pigs did Kevin give away?	5.5
Adds mathematical content	$6 \times 13 = n$	Alayna has some M&Ms. She has 6 of them, but she buys 13 more bags that hold 6 each. How many does she have now?	5.6
No story action	$6 \times 13 = n$	Ian has 6×13 CDs. How many CDs is that?	8.5
Wrong question	$63 + 41 - 13 = n$	Ian had 63 CDs and got 41 new ones. 13 of the new CDs didn't work. How many new CDs did work?	3.0

Table 1 (continued)
Errors types and examples

Type of Error	Equation	Student Example	Percent of Problems
No end statement	$6 \times 13 = n$	Tara is saving for a bicycle. She is making 13 dollars an hour for watching her younger brother. She watches him for 6 hours.	3.5
Convert two-operator to one-operator equation	$21 \times 4 - 17 = n$	Mike is baking cookies. He has 84 cookies made. Then the dog eats 17. How many cookies does Mike have left?	1.7
Convert start-unknown to result-unknown	$45 - n = 21$	Sara has 45 pencils. She broke 21 pencils. How many are left?	3.4

To assess reliability of the coding procedures, a second trained coder recoded 10% of the story-writing data. Agreement was 84% for identifying errors and 83% for classifying errors into categories.

Results

We focus first on how structural characteristics of the equations (position of unknown, number of operations, and operation type) influenced students' performance on the two tasks. We then examine the most common types of student errors on the story-writing task, with an eye towards investigating what such errors imply about students' conceptual understanding of algebraic equations.

Equation Solving Performance

To evaluate students' performance on equation solving, we used mixed effects logistic regression in the *lme4* package in the R statistics software (Bates, Maechler, Bolker, & Walker, 2014). We fit a model that included the manipulated factors (unknown position and number of operations), their interaction, and grade level (sixth or seventh) as fixed effects, and that used a maximal random effects structure (Barr, Levy, Scheepers, & Tily, 2013). We evaluated all fixed effects using likelihood-ratio tests in which we compared the full model containing the fixed effect of interest to an identical model in which only that effect was removed (i.e., Type 3-like tests; Barr et al., 2013).

On average, students succeeded on 9.8 out of the 12 equation-solving items. The percent of participants who succeeded for each equation type is presented in Figure 1.
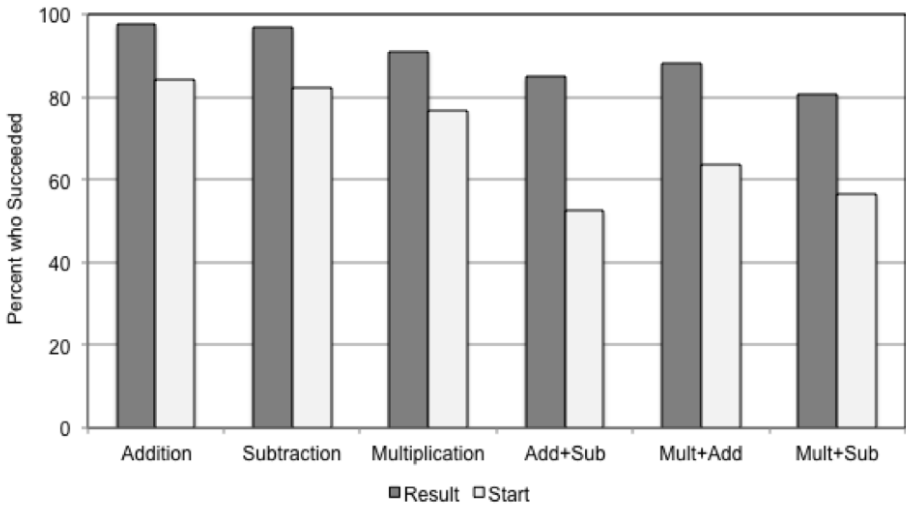
Figure 1. Percent of participants who succeeded on the equation-solving task for each operation or operation combination and each position of the unknown.

The data pattern suggests that both number of operations and unknown position influenced students' performance on equation solving. Indeed, a model with number of operations yielded a substantially better fit to the data than a model without number of operations, χ^2 (1) = 23.21, $p < .001$, and a model with unknown position yielded a substantially better fit to the data than a model without unknown position, χ^2 (1) = 24.50, $p < .001$. Not surprisingly, participants were more successful on one-operator equations than on two-operator equations, and they were more successful on result-unknown equations than on start-unknown equations. The odds of correctly solving a one-operator equation were estimated to be 5.42 times the odds of correctly solving a two-operator equation, 95% CI [3.63, 8.08], and the odds of correctly solving a result-unknown equation were estimated to be 6.08 times the odds of correctly solving a result-unknown equation, 95% CI [4.02, 9.21]. The interaction of unknown position and number of operations did not improve model fit. A model that included grade level yielded a somewhat better fit to the data than a model without grade level, χ^2 (1) = 2.96, $p = .085$. Surprisingly, sixth-grade students performed slightly better

than seventh-grade students, ($M = 9.64$, $SE = 0.16$ vs. $M = 9.02$, $SE = 0.37$, out of 12). The odds of sixth-grade students successfully solving an equation were estimated to be 1.65 times those of seventh-grade students, 95% CI [0.96, 2.84]. This may be due to the fact that the sixth-grade sample included some students in accelerated classes, whereas the seventh-grade sample did not.

We also wished to examine whether there were variations in equation-solving performance across the specific pairs of operations and across the specific individual operations that we tested. To do so, we examined one-operator and two-operator equations separately. For two-operator equations, a model that included equation type (addition-subtraction, addition-multiplication, or subtraction-multiplication) fit the data better than a model without equation type, $\chi^2 (2) = 10.16$, $p = .006$. Participants performed best on multiplication-addition equations ($M = 1.52$ correct, $SE = 0.04$, out of 2), and similarly, but slightly less well on addition-subtraction equations ($M = 1.37$ correct, $SE = 0.04$, out of 2) and multiplication-subtraction items ($M = 1.37$ correct, $SE = 0.05$, out of 2). The odds of succeeding on multiplication-addition stories were estimated to be 1.97 times the odds of succeeding on addition-subtraction stories, 95% CI [1.39, 2.78]. The odds of succeeding on multiplication-subtraction stories and addition-subtraction stories did not differ significantly.

For one-operator equations, the main effect of equation type was not significant. Performance was similar and high for all three types of one-operator equations (addition: $M = 1.82$ correct, $SE = 0.03$, subtraction: $M = 1.79$ correct, $SE = 0.03$ correct, multiplication: $M = 1.68$, $SE = .04$ correct, all out of 2).

Story Writing Performance
We also used mixed effects logistic regression to evaluate students' performance on story writing. Recall that there were two versions of the story writing assessment, each of which included six of the twelve equation types (see Appendix). Participants' total scores were comparable across versions (version A, $M = 3.73$ correct, $SE = 0.15$, version B, $M = 3.61$ correct, $SE = 0.15$, $t(252) = 0.58$, *ns*). The percent of participants who succeeded in writing stories for each equation type is presented in Figure 2.
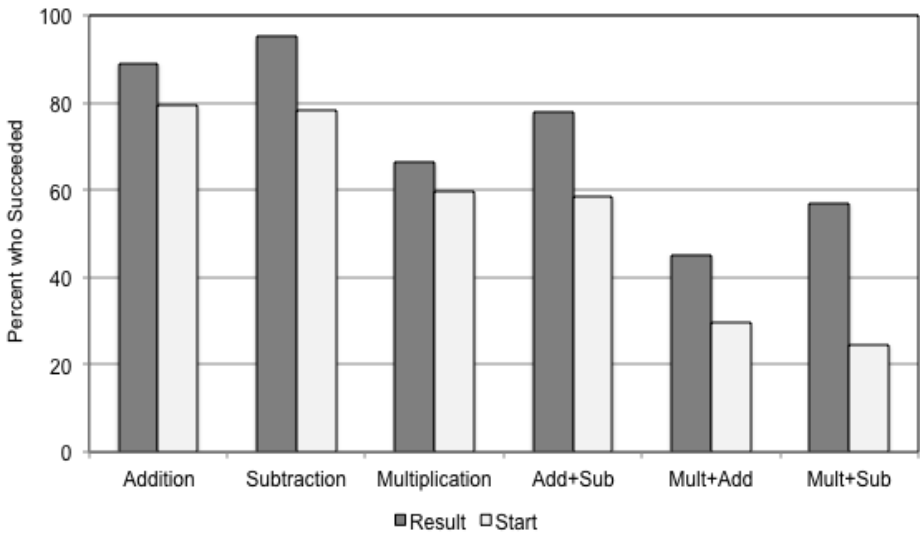
Figure 2. Percent of participants who succeeded on the story-writing task for each operation or operation combination and each position of the unknown.

The main findings for story writing were similar to those for equation solving. A model with number of operations yielded a substantially better fit to the data than a model without number of operations, χ^2 (1) = 17.42, $p <$ .001, and a model with unknown position yielded a substantially better fit to the data than a model without unknown position, χ^2 (1) = 7.54, $p <$ .006. Participants were more successful generating correct stories for one-operator equations than for two-operator equations, and they were more successful generating correct stories for result-unknown equations than for start-unknown equations (see Figure 2). The odds of correctly writing a one-operator story were estimated to be 7.85 times the odds of correctly writing a two-operator story, 95% CI [3.53, 17.42], and the odds of correctly writing a result-unknown story were estimated to be 3.40 times the odds of correctly writing a start-unknown story, 95% CI [1.53, 7.56]. The interaction of unknown position and number of operations did not improve model fit. A model that included grade level yielded a significantly better fit to the data than a model without grade level, χ^2 (1) = 6.02, p = .01. As for

equation solving, sixth-grade students outperformed seventh-grade students, though the margin was small (sixth $M = 3.90$ correct, $SE = 0.11$, vs. seventh $M = 3.29$ correct, $SE = 0.23$, out of six). The odds of sixth-grade students successfully writing stories were estimated to be 2.12 times those of seventh-grade students, 95% CI [1.19, 3.79].

We also wished to examine whether there were variations in story writing performance across the specific pairs of operations and across the specific individual operations that we tested. For two-operator equations, a model with equation type fit the data better than a model without equation type, $\chi^2 (2) = 28.28$, $p < .001$. A majority of participants were successful at writing addition-subtraction stories (68% of participants); fewer participants succeeded at writing multiplication-addition stories (37% of participants) and multiplication-subtraction stories (41% of participants). The odds of succeeding on addition-subtraction stories were 6.72 times the odds of succeeding on multiplication-addition stories, 95% CI [4.34, 10.40], and 5.43 times the odds of succeeding on multiplication-subtraction stories, 95% CI [3.50, 8.41].

For one-operator equations, there was also a main effect of equation type, $\chi^2 (2) = 19.74$, $p < .001$. A comparable percentage of participants succeeded on writing addition stories (84% of participants) and subtraction stories (87% of participants), whereas fewer participants succeeded on writing multiplication stories (63% of participants). The odds of successfully writing addition stories were estimated to be 4.24 times the odds of successfully writing multiplication stories, 95% CI [2.66, 6.76]. The odds of successfully writing addition stories and subtraction stories did not differ significantly.

To investigate the possible existence of a "composition effect" (Heffernan & Koedinger, 1997) in story generation, we next examined whether writing stories for each type of two-operator equation was more difficult than would be expected on the basis of performance writing stories for the corresponding one-operator equations. We estimated the probability of success at writing stories for each of the six types of two-operator equations (i.e., addition-subtraction, addition-multiplication, and subtraction-multiplication for start- and result-unknown equations) by multiplying the rates of success in writing stories for the relevant one-operator equations. We then compared these estimated probabilities of

success with the actual probabilities of success observed in the data. This analysis revealed that writing stories for two-operator equations was indeed more difficult than would be expected on the basis of performance writing stories for the corresponding one-operator equations, $t(5) = 4.03$, $p < .01$. Thus, combining operations in stories presented a substantial challenge for students.

Performance on the equation-solving task and the story-writing task was significantly correlated, $r(240) = .44$, $t(239) = 7.53$, $p < .001$. This finding is consistent with reports in the literature from other domains indicating that students' conceptual understanding and procedural skill are positively associated (e.g., Baroody & Gannon, 1984; Dixon & Moore, 1996; Hiebert & Wearne, 1996; Knuth, Stephens, McNeil & Alibali, 2006; Rittle-Johnson & Alibali, 1999).

Analysis of Story-Writing Errors

We turn next to an analysis of the errors students produced in story writing. Here we present a detailed analysis of those error categories that were assigned on more than 5% of all items (with the exception of the Other category, which was a heterogeneous category): (1) Wrong operation, (2) No story action, (3) Missing mathematical content, and (4) Added mathematical content.

Wrong-operation errors are errors in which some aspect of the student's story reflected an operation different from the one in the given equation. For example, given the equation $6 \times 13 = n$, one student wrote, "Kevin lives on a farm. He has 6 cows and he buys 13. How many does he have?" In this story, the student used a story action that reflects addition rather than multiplication. Table 2 presents the distribution of different types of *Wrong-operation* errors in stories generated for one-operator ($N = 31$) and two-operator ($N = 48$) items. As seen in the table, in the large majority of cases, wrong-operation errors involved converting multiplication to addition.

Table 2

Proportion of Wrong-operation errors of each type

Operation	1-operator items	2-operator items
Addition		
To multiplication	0.06	0.00
To subtraction	0.10	0.06
Addition total	*0.16*	*0.06*
Subtraction		
To addition	0.03	0.10
Subtraction total	*0.03*	*0.10*
Multiplication		
To addition	0.68	0.63
To subtraction	0.03	0.00
To division	0.06	0.00
Multiplication total	*0.77*	*0.63*
N	31	48

Note: Totals do not sum to 1.0 because in some cases the specific change of operation (either which operation was changed, or what it was changed to) could not be precisely identified. This often occurred when other errors were also present.

No-story-action errors are errors in which the student did not provide a story context for some element of the given equation. For example, given the equation $4 \times 13 + 25 = n$, one student wrote, "Kevin lives on a farm. He has 4×13 pigs. The next day he gets 25 more. How many does he have now?" In this story, the student did not provide a story context for the multiplication operation. Table 3 presents the distribution of equation elements that were not described in story form for one-operator ($N = 29$) and two-operator ($N = 101$) items. As seen in the table, when students omitted an element from their stories, it was most often the element that corresponded with multiplication in the given equation.

Table 3
Proportion of No-story-action errors of each type

Content element	1-operator items	2-operator items
Addition operation	0.00	0.36
Subtraction operation	0.00	0.27
Multiplication operation	1.00	0.80
Result quantity	0.00	0.02
N	29	101

Note: Total for 2-operator items does not sum to 1.0 because some stories included multiple No-story-action errors.

Missing-mathematical-content errors are errors in which students failed to include some of the mathematical content from the given equation in their stories. For example, given the equation $6 \times n = 78$, one student wrote, "Alayna has some M&Ms. A bag has 6 M&Ms in a bag. How many more bags does she need?" In this story, the student described a multiplicative relationship involving 6, but did not include the result quantity, 78. Table 4 presents the distribution of elements that were missing for one-operator ($N = 23$) and two-operator ($N = 61$) items. As seen in the table, when an element was missing, it was most often either the start or result quantity. However, in cases where a mathematical operation was missing, it was most often multiplication.

Table 4
Proportion of Missing-mathematical-content errors of each type

Content element	1-operator items	2-operator items
Addition operation	0.09	0.12
Subtraction operation	0.00	0.13
Multiplication operation	0.04	0.26
Start quantity	0.48	0.39
Result quantity	0.44	0.38
N	23	61

Note: Totals do not sum to 1.0 because some stories included multiple Missing-mathematical-content errors.

Added-mathematical-content errors are errors in which students included mathematical content in their stories that was not present in the given equation. Such errors were coded only when the added content was integral to the solution of the story problem, and not when it was simply "distractor" information that was not needed for solving the problem. In coding the data, it became apparent that students often made *Added-mathematical-content* errors of a particular type when the given operation was multiplication. Specifically, given the expression $n \times m$, students often expressed the initial quantity on its own before describing the multiplication operation. Combining these statements, the mathematical relationship described was $n + n \times m$ rather than $n \times m$. For example, given the equation $4 \times 21 = n$, one student wrote, "Mike is making cookies for a school bake sale. He has made 21, but now needs to make 4 times that amount. How many cookies will he have made altogether?" Inspection of the *Added-mathematical-content* errors indicated that fully 79% were of this type (including 74% of the *Added-mathematical-content* errors made on one-operator items, and 81% of such errors made on two-operator items).

The analyses of these most-frequent errors—*Wrong operation*, *No story action*, *Missing mathematical content*, and *Added mathematical content*—converge to suggest that students lack a full-fledged conceptual understanding of the operation of multiplication and its symbolic representation.

Distribution of Story-Writing Errors on One- and Two-operator Equations

We next examined whether particular story-writing errors were especially likely to occur for two-operator items. To address this issue, we examined whether particular error codes were assigned more frequently on stories generated for two-operator equations than would be expected on the basis of their frequency in stories generated for the corresponding one-operator equations. We performed this analysis on each of the error categories that occurred on more than 5% of all items: (1) *Wrong operation*, (2) *No story action*, (3) *Missing mathematical content*, (4) *Added mathematical content*, and (5) *Other*. We also performed a comparable analysis on the *Convert start-unknown to result-unknown* error category, which was only applicable

to stories generated for start-unknown equations, and which occurred on 6.7% of start-unknown items.

We estimated the probability of each type of error on stories generated for each of the two-operator equations (e.g., start- and result-unknown versions for addition-subtraction, addition-multiplication and subtraction-multiplication) by adding the probabilities of that type of error on stories generated for the relevant one-operator equations and then subtracting their joint probability. For example, to estimate the probability of a *Wrong-operation* error on a story generated for a result-unknown addition-multiplication equation, we added the probabilities of *Wrong-operation* errors on stories generated for result-unknown addition equations (3.1%) and result-unknown multiplication equations (8.6%) and then subtracted their joint probability (0.27%). We then compared these estimated probabilities with the actual probabilities for that error category.

The frequency of *Wrong-operation*, *Missing-mathematical-content*, and *Added-mathematical-content* errors on stories generated for two-operator equations did not differ from what would be expected on the basis of their frequency on stories generated for the corresponding one-operator equations. However, No-story-action errors occurred more frequently on stories generated for two-operator equations than would be expected on the basis of their frequency on stories generated for the corresponding one-operator equations, $t(5) = 4.86$, $p = .002$, one-tailed. This finding suggests that, for two-operator equations, students often avoided generating a story action, rather than face the challenge of generating a coherent two-operator story.

Convert-start-unknown-to-result-unknown errors also occurred more frequently on stories generated for two-operator equations than would be expected on the basis of their frequency on stories generated for the corresponding one-operator equations, $t(2) = 3.99$, $p = .03$. Thus, for start-unknown two-operator items, students sometimes "simplified" their task by writing stories that reflected result-unknown scenarios.

Errors in the *Other* category also occurred more frequently on stories generated for two-operator equations than would be expected on the basis of their frequency on stories generated for the corresponding one-operator equations, $t(5) = 2.25$, $p = .04$, one-tailed. Because the *Other* category is a heterogeneous category, it is not clear how this finding should be

interpreted. Nevertheless, some of the errors observed in the *Other* category are of interest because they belie difficulties integrating multiple operations into a coherent story. In some cases, students generated stories that were incoherent because different units applied to each operation. For example, given the equation $14 \times 7 - 23 = n$, one student wrote, "Nicole wants to buy some necklaces for her[self] and her friends. They come in packs of 14 for $7. She wants to have a few leftovers for her[self], so if she has 23 friends, how many will she keep for herself?" In this example, the multiplication element of the story focuses on the *cost* of the necklaces, but the subtraction element of the story focuses on the *number* of necklaces. In other cases, students appeared to have difficulties assigning meaning to the quantities involved in operations. For example, given the equation $63 + 41 - 13 = n$, one student wrote, "Kevin lives on a farm. He has 63 cows, 41 ducks, and 13 pigs. The pigs are on a sale, though. How [many] animals will he have after the pigs are sold?" In this example, the student incorporated story actions that reflect addition (finding the total number of animals) and subtraction (selling the pigs) but treated the value $63 + 41$ as indicating the number of animals *including* the pigs, rather than only the number of cows and ducks. In both of these examples, students displayed some understanding of the operations involved in the equations but had difficulty integrating multiple operations into coherent stories.

Discussion

Our primary aim in this study was to investigate middle school students' understanding of algebraic equations. In past work, such understanding has often been assessed by asking students to solve equations. We too asked students to complete an equation-solving task; however, we also employed a novel story-writing task in an attempt to gain further insight into students' conceptual understanding of the meanings of the algebraic equations, by making it impossible for them to rely on rote or memorized procedures. Our findings suggest that the story-writing task did indeed reveal much about students' thinking.

Although students in our study were fairly successful at solving algebraic equations, they experienced difficulties with equations that

involved two operations and equations with unknown starting quantities. Students' performance on the story-writing task showed a similar pattern, with two-operator items being more difficult than one-operator items, and start-unknown items being more difficult than result-unknown items. These results are consistent with reports of middle and high school students' difficulties in interpreting word problems (Kenney & Silver, 1997; Koedinger & Nathan, 2004; Sowder, 1988) and symbolic equations (Stephens, 2003).

The nature of these errors revealed two broad areas of concern in students' conceptual understanding. First, students' errors indicated that their conceptual understanding of some arithmetic operations—in particular, multiplication—was weak or incomplete. This finding is compatible with past research identifying middle school students' difficulties in identifying which operations need to be performed to *solve* story problems (Sowder, 1988) and reports that 8th-grade students' intuitive understanding of multiplication is weaker than their understanding of addition (Dixon, Deets, & Bangert, 2001). Second, students' errors indicated that they had difficulties combining multiple operations into coherent stories. This finding is reminiscent of findings that students have difficulties solving and symbolizing story problems that involve multiple operations (Heffernan & Koedinger, 1997; 1998; Koedinger, Alibali, & Nathan, 2008). We consider each of these issues in turn.

A closer analysis of student work falling into four common error categories indicated that, for many students, their conceptual understanding of multiplication was weak or incomplete. When students made *Wrong-operation* errors, in the overwhelming majority of cases, the operation that they represented incorrectly was multiplication. In most of these cases, students wrote stories reflecting the operation of addition instead. When students made *Missing-mathematical-content* errors, they often neglected the equation's starting or resulting quantity; however, in cases where the omitted portion of the equation was an operation, that omitted operation was usually multiplication. Students who made *No-story-action* errors were most likely to have had difficulty generating a story situation that could be represented by a given multiplication operation. Finally, students' *Added-mathematical-content* errors again indicated difficulty generating a story that appropriately corresponded to a given multiplication operation. The

vast majority of *Added-mathematical-content* errors occurred when students composed a story reflective of the expression $n + n \times m$ rather than the given $n \times m$.

Carpenter and colleagues (Carpenter, Fennema, Franke, Levi, & Empson, 1999) have noted that even very young children can solve multiplication word problems such as the following one: "Megan has 5 bags of cookies. There are 3 cookies in each bag. How many cookies does Megan have all together?" (p. 34). Students' success on such problems indicates that they do have some grasp of the operation of multiplication. We suggest, however, that the link between such a story situation and its symbolic representation (i.e., 5×3) may be tenuous for many students. Whereas students often successfully model and subsequently solve multiplication word problems using repeated addition of groups (Carpenter et al., 1999), students who are provided a multiplication operation in symbolic form do not necessarily connect these symbols to a repeated addition scenario (Koehler, 2004). This interpretation points to the importance of spending ample instructional time on the symbolization process, so that students can make stronger connections between symbolic representations and their referents and develop facility both *looking through* and *looking at* symbols (Kaput et al., 2008).

A second area of concern raised by students' performance on the story-writing task has to do with their abilities to combine multiple operations into coherent stories. Our data point to the existence of a "composition effect" in story writing, as has been shown in past work on symbolization. Students often simply avoided generating story actions for two-operator equations –and did so much more frequently than would have been expected given the frequency of such errors on stories generated for one-operator equations. In addition, on the challenging two-operator start-unknown items, students frequently simplified their task by generating stories that reflected simpler, result-unknown situations—again, more frequently than would have been expected given the frequency of such errors on one-operator items. Taken together, these findings suggest that students found it difficult to integrate multiple mathematical operations. Consistent with this view, students sometimes generated stories that included all the relevant numbers, but not in ways that fit together conceptually. For example, students sometimes generated stories in which different units applied to

each operation, rendering the stories as a whole incoherent. The present findings are reminiscent of past research indicating that students have difficulties symbolizing story problems that involve multiple operations (Heffernan & Koedinger, 1997) as well as solving equations that involve multiple operations (Koedinger et al., 2008).

The story-writing task was designed to assess students' conceptual understanding of symbolic expressions. We believe that it did in fact provide insight into such understanding—particularly concerning multiplication and operation composition issues—that the equation-solving task on its own did not reveal. Although performing multiplication operations was not necessarily difficult for students (as was evident in their good performance on the equation-solving task), the story-writing task revealed difficulty with the underlying meaning of multiplication. Likewise, students' abilities to generate stories to correspond with two-operator equations were poorer than their abilities to solve comparable equations. The nature of students' errors suggests that integrating operations poses a special challenge.

Finally, our findings are consistent with past research that has documented associations between knowledge of concepts and knowledge of procedures. Although we do not wish to argue that the equation-solving task is a purely procedural one, we believe that students who have extensive practice with equation solving can be successful without possessing or activating deep conceptual understanding of algebraic equations. We believe that the novelty of the story-writing task, on the other hand, encourages students to rely more heavily on their conceptual understanding, and thus story writing can provide greater insight into their conceptual understandings of algebraic equations.

Our findings have implications for the mathematics instruction of students in the elementary and middle grades. First, our findings support Russell, Schifter, and Bastable's (2011; Schifter, 1999) call for an increased focus on generalized arithmetic in the elementary grades, especially regarding articulating generalizations about the behavior of the operations. The *Common Core State Standards for Mathematics* also call for opportunities to develop such understanding (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Both the Standards for Mathematical Practice and the

middle school content standards emphasize the need to describe real-world relationships mathematically Students at all grade levels are expected to "make sense of problems and persevere in solving them," which includes "explain[ing] correspondences between equations, verbal descriptions, tables, and graphs...." (p. 9). Asking students to write story problem scenarios to represent different mathematical expressions and equations (including ones that involve multiplicative relationships) is one way to address this standard.

Our findings further suggest that students could benefit from instructional activities that focus on multiplicative relationships and on combining multiple mathematical relationships. One such activity might involve interpreting various components of equations in relation to their referents, including not only isolated numbers and operations, but also expressions such as 14×7, $14 \times n$, or $5 + 14 \times n$. Another activity might involve working with verbally presented problems, which present fewer challenges for meaning making than do symbolic problems (Koedinger & Nathan, 2004). Once students successfully solve verbally presented problems, they could then be guided to apply their solution processes to corresponding symbolic problems, or to symbolize those verbally presented problems.

In brief, our findings document gaps in middle school students' conceptual understanding of algebraic equations, and they highlight the importance of fostering connections between symbols and their referents among middle school students. More broadly, our findings support Kaput et al.'s (2008) argument that although algebraic symbols are powerful tools that can foster students' algebraic reasoning, we should not cut short the process of symbolization if our aim is to promote meaning-making and conceptual understanding.

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Appendix

Equations Used in the Equation-Solving Task
$17 + 54 = n$
$67 - 41 = n$
$5 \times 19 = n$
$28 + n = 74$
$84 - n = 53$
$7 \times n = 91$
$42 + 26 - 13 = n$
$4 \times 12 + 21 = n$
$16 \times 5 - 27 = n$
$35 + n - 18 = 46$
$5 \times n + 23 = 93$
$13 \times n - 22 = 56$

Equations Used in the Story-Writing Task
Version A

Number set 1	Number set 2
$19 + 33 = n$	$43 + 18 = n$
$63 + n - 13 = 91$	$37 + n - 15 = 46$
$45 - n = 21$	$93 - n = 61$
$21 \times 4 - 17 = n$	$14 \times 7 - 23 = n$
$6 \times 13 = n$	$4 \times 21 = n$
$6 \times n + 23 = 89$	$4 \times n + 25 = 77$

Version B

Number set 1	Number set 2
$93 - 32 = n$	$45 - 24 = n$
$37 + 24 - 15 = n$	$63 + 41 - 13 = n$
$43 + n = 61$	$19 + n = 52$
$4 \times 13 + 25 = n$	$6 \times 11 + 23 = n$
$4 \times n = 84$	$6 \times n = 78$
$14 \times n - 23 = 75$	$21 \times n - 17 = 67$

Character Strengths and Psychological Wellbeing among Students of Teacher Education

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Character Strengths and Psychological Wellbeing among Students of Teacher Education

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Abstract

The relation between character strengths and psychological well-being can have an important effect on students' academic performance. We examined relationships between character strengths and psychological well-being as assessed by the Values in Action Inventory of Strengths and Brief Symptom Inventory. A sample of 98 teacher education students participated. The participants showed high scores in character strength scales. The five character strengths with the highest scores were kindness, fairness, teamwork, love, and honesty. The participants scored higher in character strengths that focused on other people than in the strengths that focused on the self, and higher on the so-called "strengths of the heart" than on "strengths of the head". In our study, the character strengths most closely associated with well-being were love, humour, fairness, honesty, curiosity, and self-regulation. In conclusion, the character strengths are positively related to university students' psychological well-being.

Keywords: Character strengths, psychological well-being, university students, teacher education.

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Fortalezas de Carácter y Bienestar Psicológico en Estudiantes de Educación

Josep Gustems y Caterina Calderon
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Resumen

La relación entre fortalezas de carácter y bienestar psicológico puede tener una importante repercusión en el rendimiento académico de los estudiantes. Hemos examinado las relaciones entre las fortalezas de carácter evaluadas mediante el Values in Action Inventory of Strengths y el bienestar psicológico mediante el Brief Symptom Inventory. La muestra estuvo compuesta por 98 estudiantes de formación de maestros. Los participantes mostraron altas puntuaciones en las fortalezas de carácter. Las cinco fortalezas de carácter más altas fueron bondad, justicia, trabajo en equipo, amor y honestidad. Los estudiantes obtuvieron puntuaciones más elevadas en fortalezas de carácter orientadas a los demás más que orientadas en sí mismo, y más orientadas al corazón (emoción) que a la mente. En nuestro estudio, las fortalezas de carácter más estrechamente relacionadas con el bienestar fueron el amor, el humor, la igualdad, la honestidad, la curiosidad y el autocontrol. En conclusión, las fortalezas de carácter se relacionan positivamente con el bienestar psicológico de los estudiantes.

Palabras clave: fortalezas de carácter, bienestar psicológico, estudiantes universitarios, formación de magisterio.

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The purpose of this study was to examine character strengths in relation to psychological well-being among students of teacher education. The study of psychological well-being has been extensively evaluated (Diener & Seligman, 2002; Cassullo & Castro, 2000). Psychological well-being has been related with positive and negative affect and life satisfaction (Stok, Okun, & Benin, 1986); it has been studied through anxiety, depressed mood and negative affectivity, observing that the expression of negative feelings or the presence of negative emotional states were associated with lower psychological well-being (Plancherel & Bolognini, 1995). The presence of lower levels of aanxiety has been related positively with approach coping (Griffith, Dubow, & Ippolito, 2000), and character strengths (Peterson & Seligman, 2004). Negative affect and depression usually related more to strengths weakening (Huta & Hawley, 2010).

The study of character strengths is conducted within the branch of psychology known as positive psychology and although until relatively recently positive psychology lacked "a cumulative empirical body of research" (Seligman & Csikszentmihalyi, 2000; Shimai, Otake, Park, Peterson, & Segliman, 2006), there is now a growing body of conceptual and empirical work dedicated to the subject. This has allowed researchers to reach a more precise definition of the outline of human well-being (Vázquez, Hervás, Rahona, & Gómez, 2009) and to focus more fully on protective factors than on risk factors when identifying the human strengths, virtues and positive emotions that explain personal well-being. In this regard, the study of character strengths shows that positive emotions broaden [people's] repertoires of desired actions (Fredrickson, Cohn, Coffey, Pek, & Finkel, 2008) and that positive emotions like joy or contentment facilitate the exploration of new life circumstances and interaction with others, favouring the growth of intellectual, emotional and social resources (Fredrickson, 2001).

One of the main aims of positive psychology is to help individuals cultivate and maintain a sense of personal well-being (Peterson & Seligman, 2004) and its central tenet is that character strengths contribute to individual well-being and happiness. One of the tools researchers used to measure these strengths is the self-report questionnaire the Values in Action Inventory of

Strengths (VIA-IS), which asks participants to consider the degree to which a series of statements describes what they are like. By identifying their strengths and virtues, the VIA-IS can help university students make the most of their stronger character traits (Peterson & Seligman, 2004).

As Hamrick, Evans and Schuh observe, "the college experience is widely regarded as offering many opportunities for students to develop" (Hamrick, Evans, & Schuh, 2002) in psychologically beneficial ways in terms of their values, skills, attitudes, knowledge, beliefs, identity and character traits. Pascarella and Terenzini (1991) found that students with greater interest in cultural and artistic activities were psychologically more mature, had a more positive self-image and experienced greater well-being. However, study environments can often be stressful (Zajacova, Lynch, & Espenshade, 2005) and involve a process of separation from the family, a heavy course load, the need to adapt to unusual circumstances or begin to work in a professional environment (Beck, Taylor, & Robbins, 2003; Carr, Colthurst, Coyle, & Elliot, 2012). It is therefore important for students to know their character strengths and understand that by developing these they will be able to think more positively about the stress they experience, reinforce their commitment to learning and, one day, apply this knowledge in the practice of their profession as teachers (Korthagen, 2004).

The character strengths and personal satisfaction of university students has long been viewed as a key outcome of higher education (Lounsbury, Saudargas, Gibson, & Leong, 2005). Student satisfaction is related to "a variety of other variables in which educators place great value" (Benjamin & Hollings, 1997), such as university services, quality of teaching, living arrangements, involvement in campus activities, course load, and goals and motivation. Students who use their strengths more report "higher levels of […] psychological well-being" (Linley, Nielsen, Gillet, & Biswas-Diener, 2010). In particular, the character strengths that individuals focus on other people or that are associated with their emotions are the strengths that most directly support personal well-being (Hutcherson, Seppala, & Gross, 2008; Park & Peterson, 2008a) and the development of "strong ties to friends and family" has been seen as a necessary condition for well-being (Diener & Seligman, 2002). The strengths love, curiosity, and gratitude have also been observed as "consistently and robustly associated with life satisfaction" and with positive mood (Park, Peterson, & Seligman, 2004). Finally, the most

motivated and dedicated students also score the highest in perseverance, zest and humour (Peterson, Park, & Sweeney, 2008). On the other hand, among the character strengths that least relates to life satisfaction researchers have observed modesty, creativity, appreciation of beauty, judgment, and love for learning (Park *et al.,* 2004).

Universities are ideal settings for studying character strengths because these strengths are clearly involved in students' personal well-being, act as buffers and play an important role in motivating study. The subject of the present study was the relationship between psychological well-being and character strengths among students of teacher education. For example, wisdom virtue has been related with creativity, motivation, knowledge, and subjective well-being (Csikszentmihalyi, 1990; Avey *et al*., 2012). Among high school students, strengths oriented towards others (e.g., forgiveness, prudence) predicted fewer depression symptoms, while the strengths of Transcendence (e.g., gratitude) predicted greater life satisfaction (Gillham *et al*., 2011). In light of the literature reviewed above, we examined relationships between character strengths as assessed by the VIA-IS and BSI (Brief Symptom Inventory). We had three objectives: to describe students' character strengths, examine the relation between these strengths and BSI scales (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and Global Severity Index), and analyze the strengths which explained psychological well-being among the students.

Methods

Participants

Undergraduate students of teacher education (N = 98) at Barcelona (Spain) completed the survey during class time as part of psychological research that was administered. All the participants were first- or second-year students. The data were collected in the autumn and spring semesters of 2011 and 2012 respectively. Females represented 98% of the total sample. They were aged between 19 to 42 years (M = 23.5; SD = 4.0). In terms of family socio-economic status (FSS) (based on Hollingshead, 1975), 8 students (9.3%)

were low FSS, 16 (18.6%) were medium-low FSS, 20 (23.3%) were medium FSS, 26 (30.2%) were medium-high FSS and 16 (18.6%) were high FSS.

Materials
The questionnaires employed in this study were the following:

Values in Action Inventory of Strengths (VIA-IS, Peterson and Seligman, 2004). The VIA-IS is a 240-item measure of character strengths, with each of 24 character strengths assessed by 10 items. The inventory is typically administered online, with an administration time of around 30-40 min. Students were instructed to answer each item in relation to '*whether the statement describes what you are like'*, and responses are fully anchored on a five Likert scale (1 = *very much unlike me;* 5 = *very much like me).* It includes six virtues: wisdom, courage, humanity, justice, temperance and transcendence. The *wisdom* virtue contains five character strengths [Creativity (thinking of novel and productive ways to do things), Curiosity (taking an interest in all of ongoing experience), Perspective (understanding world, wise counsel to others), Judgment (weighing all evidence fairly), and Love of Learning (mastering new skills and knowledge)]. The *courage* virtue contains four character strengths [Perseverance (completing tasks one starts), Bravery (not shrinking from threat or difficulty), Honesty (presenting oneself in a genuine way), and Zest (approaching life with excitement and energy)]. The *humanity* virtue contains three character strengths [Social intelligence (understanding social world), Kindness (helping and taking care of others), and Love (valuing close relations with others)]. The *justice* virtue contains three character strengths [Leadership (organizing group activity), Fairness (treating everyone fairly and justly), and Teamwork (being a good team member)]. The *temperance* virtue contains four character strengths [Forgiveness (forgiving those who have done wrong), Self-regulation (regulating feelings and actions), Prudence (being careful about one's choices), and Humility (not overvaluing self)]. The *transcendence* virtue contains five character strengths [Spirituality (beliefs about purpose and meaning), Appreciation of beauty (awareness of excellence), Hope (expecting the best in the future and working to achieve it), Gratitude (thankfulness for good things), and Humor (seeing light side of life, linking to laugh)]. Scores for each of the 24 strengths have a potential range of 10

through 50, with higher scores indicating a greater endorsement of the strength. All subscales have been found to have acceptable internal consistency reliability (all $\alpha > .70$; Peterson, Park, & Seligman, 2006). In the present research, Cronbach's alpha coefficients for VIA-IS were as follows: Wisdom ($\alpha = .79$), Courage ($\alpha = .87$), Humanity ($\alpha = .47$), Justice ($\alpha = .86$), Temperance ($\alpha = .60$), and Transcendence ($\alpha = .82$).

Brief Symptom Inventory (BSI, Derogatis and Spencer, 1982). The Spanish adaptation (Ruipérez, Ibáñez, Lorente, Moro, & Ortet, 2001) of Brief Symptom Inventory (BSI) was employed. The BSI is a 53-item self-report inventory designed to reflect the psychological symptom patterns of psychiatric and general community groups. The participants responded to the questionnaire using a five-point Likert scale from zero (*not at all*) to four (*extremely*). It includes nine symptom dimensions (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism), as well as a scale the Global Severity Index (GSI). Somatization dimension reflects distress arising from perceptions of bodily dysfunction. Obsessive-Compulsive dimension includes thoughts and actions the subject experienced as irresistible, irrational and involuntary. Interpersonal Sensitivity dimension focuses on feelings of personal inadequacy and inferiority, particularly in comparison with other. Depression dimension includes characteristic clinical symptoms as dysphoria, loss of energy and hopelessness. General signs such as nervousness and tension are included in Anxiety dimension, as are panic attacks and feelings of terror. Hostility dimension includes thoughts, feelings, or actions that are characteristic of the negative affect state of anger. Phobic Anxiety is defined as a persistent fear response –to a specific person place, object, or situation- that is irrational and disproportionate to the stimulus and leads to avoidance or escape behaviour. Paranoid Ideation dimension represents paranoid behaviour fundamentally as a disordered mode of thinking. Psychoticism scale was developed to represent the construct as a continuous dimension of human experience and Global Severity Index measure the overall level of psychological distress. The BSI has shown good construct validity and good test-retest reliability for the nine symptom dimensions, ranging from .68 for the Somatization scale to .91 for

the Phobic Anxiety scale (Derogatis, 1993). It is widely used in clinical and educational research (Khalil, Moser, Lennie, & Frazier, 2011).

Socioeconomic variables. By recording the level of education and current occupation of each student's parents it was possible to determine the family's socio-economic status by using Hollingshead's (1975) two-factor index of social position. The combination of parents' education and profession enables the family's social position to be classified across five social levels: high (range 55 to 66), medium-high (40 to 54), medium (30 to 39), medium-low (20 to 29) and low (8 to 19).

Design and procedure
The participants completed the screening instrument during their regular class periods, with their teachers' permission. They also received information about the screening procedures and the study itself. They were also told that their participation was completely voluntary and they could choose not to participate or not to answer any specific questions that made them uncomfortable and they all gave written informed consent. Anonymity and confidentiality were guaranteed by using identification codes for all the data obtained and three quarters of the students contacted (72.8%) agreed to take part. Those who declined to participate did not differ in age, socioeconomic status, or grade level from those who participated, but the rate of voluntary participation was higher amongst women than amongst men. The study was conducted in line with the guidelines of the Belmont Report (1978) and the Code of good research practice (University of Barcelona, 2010).

Data analysis
In the case of quantitative variables, the participants' characteristics were described using means and standard deviations. Bivariate correlations were calculated between BSI scales (Brief Symptom Inventory) and strengths of character (using the symptom dimensions somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism and the distress index the Global Severity Index). Linear regression analyses were used to predict the relationship between presence of character strengths and BSI scales. The

Statistical Package for Social Sciences (SPSS) version 16.0 was used for data processing. In all cases, statistical significance was set at p <.05.

Results

Character Strength Scales in Students of Teacher Education
The first objective was to describe students' character strengths.
Character strength scores ranging from spirituality (M = 2.79) to kindness (M = 4.44). The six character strengths with the highest scores were kindness (M = 4.44), fairness (M = 4.23), teamwork (M = 4.23), love (M = 4.08), honesty (M = 4.03), and leadership (M = 4.03). And the six character strengths with the lower scores were spirituality (M = 2.79), self-regulation (M = 3.46), perspective (M = 3.62), creativity (M = 3.63), bravery (M = 3.76) and prudence (M = 3.76). The participants scored higher in character strengths that focused on other people (e.g., kindness [M = 4.44], fairness [M = 4.23], teamwork [M = 4.23]), strengths included within the virtues of humanity and justice, that in the strengths that focused on the self (e.g., creativity [M = 3.63], bravery [M = 3.76], prudence [M = 3.76]), see Table 1 and Table 2.

Correlations between BSI Scales (Brief Symptom Inventory) and Character Strengths
The second objective was to examine the relationship between BSI scale (somatization, obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, psychoticism, and Global Severity Index) and character strengths among students of teacher education. Eight scales of BSI correlated with character strengths. Examined within the categories of BSI, the following correlations were observed. The obsession-compulsive scale was correlated negatively with five strengths: perseverance (r = -.195, p = .036), bravery (r = -.224, p = .019), honesty (r = -.314, p = .002), social intelligence (r = -.188, p = .042), and hope (r = -.252, p = .010).
   The interpersonal sensitivity scale was correlated negatively with social intelligence (r = -.233, p = .015). The depression scale was correlated negatively with honesty (r = -.198, r = .034) and humility (r = -2.67, p =

.007). The anxiety scale was correlated positively with leadership (r = .194, p = .037), teamwork (r = .197, p = .035), gratitude (r = .227, p = .018). The hostility scale was correlated negatively with fairness (r = -.300, p = .003) and humility (r = -.193, p = .038). The anxiety phobic scale was correlated negatively with curiosity (r = -.285, p = .004), judgment (r = -.222, p = .020), perseverance (r = -.236, p = .014), and hope (r = -.181, p = .047). The paranoid ideation scale was correlated negatively with eight character strengths: curiosity (r = -.234, p = .015), perseverance (r = -.194, p = .037), honesty (r = -.181, p = .048), zest (r = -2.68, p = .006), social intelligence (r = -.330, p = .001), fairness (r = -.205, p = .029), appreciation of beauty (r = -.181, p = .047), and hope (r = -.207, p = .028). The Global Severity Index was correlated negatively with curiosity (r = -.218, p = .022), perseverance (r = -.180, p = .049), social intelligence (r = -.228, p = .018), and humility (r = -.186, p = .044). However, no statistically significant correlations were found between the somatization and psychoticism with character strengths; see Table 1 and Table 2.

Table 1.

Correlations between Brief Symptom Inventory (BSI) and character strengths of Wisdom, Courage,and Humanity virtues (VIA-IS).

Brief Symptom Inventory (BSI)	Character strengths (VIA-IS)											
	Wisdom virtue					Courage virtue				Humanity virtue		
	Cr	Cu	P	Jud	LL	Pers	Br	Ho	Ze	So	Ki	Lov
Somatization	.036	-.083	.082	-.014	.064	-.013	-.005	-.069	-.134	.101	.15	.025
Obsessive	.019	-.127	-.052	-.029	-.031	-.195*	-.224*	-.314*	-.136	-.188*	-.032	.052
Inter. Sensit.	-.05	-.16	-.028	-.131	-.061	-.17	-.102	-.12	-.169	-.233*	.044	.057
Depression	-.043	-.085	-.089	-.083	-.072	-.046	-.115	-.198*	-.129	.135	.049	.091
Anxiety	.073	.076	.12	.105	.151	.022	.128	.117	.112	.123	.13	.007
Hostility	.019	-.127	-.146	-.11	-.129	-.151	-.159	-.177	-.133	-.157	-.173	-.047
Anx. Phobic	-.016	-.285*	-.103	-.222*	-.109	-.236*	-.065	-.071	-.163	-.095	-.098	.056
Paranoid	.051	-.234*	-.077	-.157	-.007	-.194*	-.171	-.181*	-.268*	-.330*	-.091	.174
Psychoticism	.089	-.118	-.047	-.102	-.07	-.143	-.071	-.151	-.044	-.144	-.004	.029
GSI	-.028	-.218*	-.087	-.163	-.057	-.180*	-.073	-.161	-.169	-.228*	.007	.058
M	3.63	4.01	3.62	3.80	3.90	4.01	3.76	4.03	3.99	4.22	4.44	4.08
(SD)	(.5)	(.2)	(.4)	(.4)	(.5)	(.6)	(.5)	(.3)	(.4)	(.3)	(.2)	(.5)

Abbreviations: Cr, creativity; Cu, curiosity; P, perspective; J, judgment; LL, love of learning; Pers, perseverance; Br, bravery; Ho, honesty; Ze, zest; So, social intelligence; Ki, kindness; Lov, love; GSI, Global Severity Index; M, Media; SD, Standard Deviation.

* p<.05; ** p<.01

Table 2.

Correlations between Brief Symptom Inventory (BSI) and character strengths of Justice, Temperance and Transcendence virtues (VIA-IS)

Brief Symptom Inventory (BSI)	Character strengths (VIA-IS)											
	Justice virtue			Temperance virtue				Transcendence virtue				
	Lea	Fa	Te	Fo	Se	Pr	Hu	Sp	Ab	Ho	Gr	Hum
Somatization	.029	-.059	-.02	-.029	.07	.011	-.112	.063	-.095	-.073	.158	-.029
Obsessive	-.114	.007	-.081	-.073	-.096	-.051	-.022	-.019	-.168	-.252*	-.037	-.131
Inter. Sensit.	-.022	-.091	-.166	-.008	.042	.071	-.17	-.086	-.107	-.147	-.006	-.078
Depression	-.006	-.093	-.045	-.07	-.108	-.086	-.267*	.028	-.174	-.155	.084	-.14
Anxiety	.194*	.093	.197*	.032	.074	.172	-.001	.132	.046	.083	.227*	.003
Hostility	-.171	-.300*	-.171	-.167	-.15	-.02	-.193*	-.047	-.133	-.067	.019	-.171
Anx. Phobic	-.115	-.132	-.082	-.152	.035	-.021	-.138	-.047	-.152	-.181*	-.108	-.094
Paranoid	-.113	-.205*	-.121	-.07	-.067	-.069	-.102	-.163	-.181*	-.207*	.114	-.16
Psychoticism	-.069	-.116	-.123	-.014	-.042	.017	-.105	.13	.06	-.12	-.035	-.025
GSI	-.019	-.09	-.134	-.076	.06	.055	-.186*	-.041	-.143	-.135	.079	-.132
M	4.03	4.22	4.23	3.85	3.46	3.76	3.79	2.79	3.78	3.89	3.88	3.97
(SD)	(.4)	(.4)	(.3)	(.5)	(.5)	(.4)	(.5)	(.6)	(.5)	(.5)	(.4)	(.4)

Abbreviations: Lea, leadership; Fa, fairness; Te, teamwork; Fo, forgiveness, Se, self-regulation; Pr, prudence; Hu, humility; Sp, spirituality; Ab, appreciation of beauty; Ho, hope; Gr, gratitude; Hum, humour; GSI, Global Severity Index; M, Media; SD, Standard Deviation.

* p<.05; ** p<.01

Variables (Character Strengths) that Explain BSI scales (Brief Symptom Inventory) in Students of Teacher Education

The third objective was to analyze the strengths that explained psychological well-being among the students. The results of the linear regression indicated that 9.8% of the variance in obsession-compulsion (F = 9.136, p = .003) was described by honesty (Courage); 5.6% of the variance in hostility (F = 6.044, p = .016) was explained by fairness (Justice); 5.7% of the variance in phobic anxiety (F = 4.977, p = .028) was described by curiosity (Wisdom); and 10.7% of the variance in paranoid ideation (F = 6.078, p = .003) was explained by courage together with social intelligence (Courage and Humanity virtues, respectively). (See Table 3)

Table 3.
Linear regression analysis to determine the relationship between BSI scales and the independent study variables (character strengths, VIA-IS); corrected R (R^2), non-standardized coefficient (B), standard error, and standardized beta coefficient (β); analysis of variance and significance level.

Independent variables	Dependent variables	R^2	B	SE B	β	F	p
Constant	Obsession-	.098	3.887	.902			
Honesty (courage)	compulsion		-.673	.223	-.313	9.136	.003
Constant	Hostility	.056	2.411	.697			
Fairness (justice)			-.406	.165	-.259	6.044	.016
Constant	Anxiety	.057	1.555	.529			
Curiosity (wisdom)	phobic		-.295	.132	-.238	4.977	.028
Constant	Paranoid		2.312	.606			
Zest (Courage)	ideation	.107	-.437	.152	-.297		
Social int. (humanity)			.049	.021	.237	6.078	.003

Dependent variables: BSI scales (obsession-compulsion, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and the Global Severity Index).
Independent variables (predictors): character strengths of VIA-IS.

Discussion

The first objective of this study was to describe students' character strengths. The participants showed high scores in character strength scales. The six character strengths with the highest scores were kindness, fairness, teamwork, love, honesty, and leadership. The participants scored higher in character strengths that focused on other people (e.g., fairness, teamwork) than in the strengths that focused on the self, and higher on the so-called "strengths of the heart" (e.g., kindness, love) than on "strengths of the head" (e.g., honesty, perseverance). Indeed, strengths focused on others have been observed to increase feelings of social connection and positivity towards others (Hutcherson *et al*., 2008), as well as positive emotions, sense of purpose, and mindfulness in general (Fredrickson *et al.,* 2008). The strengths of the heart are also more clearly associated with well-being than the strengths of the head (Park & Peterson, 2008b; Park *et al.,* 2004).

The second objective was to examine the relationship between BSI scales and character strengths among students of teacher education. Our results indicate that psychological well-being was related by strengths which involved maintaining good relations with others, just as paranoid ideation, obsession-compulsion and psychological distress negatively correlated with strengths focused on the self (e.g., zest, curiosity). As well, Diener and Seligman (2002) found that well-being was related to the presence of good interpersonal relations and an active involvement in the social community (Peterson, 2006). This finding confirms that the happiest people were the most gregarious and outgoing and maintained more satisfactory interpersonal relationships (Diener & Seligman, 2002).

The third objective was to analyze the strengths which explained psychological well-being among the students. In our study, the character strengths most closely associated with well-being were curiosity, honesty, zest, social intelligence and fairness. In particular, participants with high scores in curiosity revealed lower levels of phobic anxiety, paranoid symptoms and psychological distress. This finding confirms the proposal that curiosity is an important component of well-being and life satisfaction (Park *et al.,* 2004) and that it is associated with the pleasure route to happiness (Peterson, Ruch, Beerman, Park, & Seligman, 2007). People with high scores in curiosity use more effective coping strategies to deal with potentially stressful situations and rely on wider social networks (Vazquez *et al.,* 2009). This is in line with the findings of previous studies, in which curiosity has been associated with the meaning and engagement routes to

happiness (Peterson *et al*., 2007). Curiosity is the strength most closely related to life satisfaction and well-being at work (Park *et al.,* 2004).

In our study, the participants who scored higher in honesty and zest and in strengths focused on others and on the head revealed lower levels of obsession-compulsion, depression and paranoid ideation. Park and Peterson also found that honesty was clearly related to fewer externalizing problems such as aggression (Park & Peterson, 2008a). In a crossectional study, Proctor, Maltby and Linley (2011) found that zest and hope were significant positive predictors of life satisfaction in 135 undergraduate university students. Previous research has demonstrated a robust association between the 'strengths of the heart' (hope, zest, gratitude, love and curiosity) and life satisfaction in a UK sample (Park *et al*., 2004; Peterson *et al*., 2007).

Those who scored high in social intelligence (empathy) revealed lower levels of obsession-compulsion, interpersonal sensitivity, paranoid ideation and global severity index. Social intelligence can also act as a buffer against the adverse psychological consequences of stress (Folkman & Moskowitz, 2000) and protect physical health (Pennix *et al*., 2001; Reed, Kemeny, Taylor, & Visscher, 1999). In a longitudinal study, Park and Peterson found that the most effective teachers (judged according to their students' level of learning using standardized tests) scored highest in social intelligence, zest, and humour (Park & Peterson, 2009). In the general population, Diener and Seligman found that "very happy people have the ability to move upward in mood when good situations present themselves" (Diener & Seligman, 2002).

Those who scored high in fairness (i.e., strengths focused on the self) revealed lower levels of hostility and phobic anxiety. This is in line with the findings of previous studies, in which fairness acted as a buffer against the negative effects of stress and trauma (Park & Peterson, 2009). This confirms the correlation made by other studies between moral reasoning development (fairness) and the ability to see the different sides of an argument or to solve an argument and facilitate relationships with others (Berkowitz & Gibbs, 1983).

In our study, no relation was found between somatic symptoms, psychoticism and character strengths. This may have been due to our participant profile (all were university students) and the fact that this was not a clinical sample. However, other authors have related somatic symptoms and character strengths. Emmons and McCullough, for instance, have related gratitude with increases in well-being in patients with neuromuscular illnesses (Emmons & McCullough, 2003).

Taken as a whole, our findings indicate that character strengths are positively related to university students' psychological well-being and this

confirms the proposals made in previous studies (Dahlsgaard, Peterson, & Seligman, 2005; Park, Peterson, & Seligman, 2006; Peterson *et al.,* 2008). In particular, strengths that are focused on others and strengths of the heart would appear to be closely tied to psychological well-being (Diener & Seligman, 2002; Park *et al.,* 2004).

The relation between character strengths and psychological well-being can have an important effect on students' academic performance (Lounsbury, Fisher, Levy, & Welsh, 2009; Shohani &Solne, 2013). The university environment offers students ample opportunity to build on their character strengths (for example, through student–teacher relationships, participation in learning communities, and developmental advising) and to obtain favourable academic results. It offers them the opportunity to feel more wholly integrated in a particular context and attain a greater sense of subjective well-being. With regard to this environment, however, one important outstanding question for research is the relationship between character strengths and university completion or dropout rates.

Important conclusions can be drawn from the present study for practitioners, university students, teachers, student advisers and related personnel. University teachers use character strengths in their teaching to help students attain the learning outcomes of higher education. A variety of activity types and interventions can help the teacher to increase positive psychology based on character strengths (Linley & Joseph, 2004; Seligman, Steen, Park, & Peterson, 2005; Seligman, Ernst, Gilhman, Reivich, &Linkins, 2009). Some relatively simple techniques can be used, such as reflection on the notions and implications of character strengths. Alternatively, questions about how we use specific character strengths in our teaching can provide advice for teachers on teacher character strengths (e.g., "How did your teacher work with students as a community of learners in which everyone was treated fairly and with respect?") or on student character strengths, (e.g., "Through what prisms should I be examining my students' learning and my own teaching?"). Furthermore, procedures can be designed to increase positive actions and experiences (McGovern, 2011).

Finally, it should be said that our findings remain somewhat limited by the fact that only one university was used in this study and by the fact that almost all the participants were women. Nevertheless, our results are consistent with those studies that have observed a clear relationship between character strengths and psychological well-being among university students. We conclude, therefore, that the university environment offers an excellent opportunity for individuals to develop their character strengths.

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Justice and Human Development

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Justice and Human Development

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Abstract

Psychologists have studied certain elements of wellness, and various aspects of fairness, but they have seldom studied the interaction between the two. As a result, it is not surprising that there is a paucity of educational, community, clinical and social interventions to promote wellness and fairness in concert. In this paper I present a framework of justice consisting of substantive and contextual types. Distributive and procedural justice constitute the two main types of justice. Interpersonal, organizational, cultural and communal justice are contextual types which embed within them the two substantive aspects of justice. I explore how these various kinds of justice impact human development across six facets of well-being: interpersonal, communal, occupational, physical, psychological and economic. I claim that for children and adults to achieve optimal human development, these facets of well-being must be supported by various types of justice.

Keywords: human development, justice, well-being, fairness, education.

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Justicia y Desarrollo Humano

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Resumen

Los psicólogos han estudiado ciertos elementos del bienestar y de la justicia, pero muy pocas veces han estudiado la interacción entre ambos. Como resultado, no es sorprendente que exista una gran escasez de intervenciones educativas, comunitarias, clínicas y sociales para promover el bienestar y la justicia. En este artículo presento una estructura de justicia que puede ser de dos tipos: sustantivos y contextuales. La justicia distributiva y la procedimental constituyen los dos tipos esenciales de justicia. La justicia interpersonal, organizativa, cultural y comunal son tipos contextuales que integran dentro de sí mismos los dos aspectos sustantivos de la justicia. Exploro en el artículo como los diversos tipos de justicia impactan en el desarrollo humano a través de las seis facetas del bienestar. Afirmo que para que la infancia y personas adultas obtengan el máximo desarrollo humano, estos aspectos de bienestar deben estar respaldados por varios tipos de justicia.

Palabras clave: desarrollo humano, justicia, bienestar, equidad, educación.

To enhance educational and developmental outcomes, professionals and activists must understand the relationship between wellness and fairness. Furthermore, they need to devise interventions that enhance systems of well-being, such as schools; and fair policies, such as inclusion (Prilleltensky, 2012; Zajda, Majhanovich, Rust, & Sabina, 2006). I recommend concentrating on justice to balance the current narrow focus on cognitive, perceptual, and overall individual variables (cf. Tough, 2012). The current thrust in psychology to focus on neurocognitive functions on one hand, and positive psychology on the other, risks obviating dynamics of justice which remain powerful determinants of learning (Ehrenreich, 2009). To demonstrate the role of justice in human development, I introduce a framework for personal well-being. Following it I present a model of justice that distinguishes between substantive and contextual types. Towards the end I draw implications for various players involved in education and human development.

The Multifaceted Nature of Human Development

The goal of human development is to promote well-being. Well-being consists of six separate domains: Interpersonal, Communal, Occupational, Physical, Psychological, and Economic (I COPPE), as well as overall well-being (Prilleltensky, Dietz, Prilleltensky, Myers, et al, in press). Our research demonstrates that there is a significant correlation between the specific domains and overall well-being. Thus, well-being is a positive state of affairs brought about by the satisfaction of needs across the spectrum of I COPPE needs.

   Previous studies support the seven factor definition of well-being; that is, I COPPE plus overall (Chmiel, Brunner, Martin, & Schalke, 2012; Cohen, 1999; Diener, Scollon, & Lucas, 2009; Nieboer, Lindenberg, Boomsma, & Van Bruggen, 2005; Prilleltensky, Dietz, Prilleltensky, Myers, et al, in press; Rath & Harter, 2010). In our studies, we measured subjective well-being, but satisfaction in all of these domains requires also the presence of objective resources, such as economic means of survival, and nutritious foods for physical well-being (Nussbaum, 2011; Sen, 2009). There are

various traditions for assessing well-being, with some leaning more on the objective side and some on the subjective. In my view, both approaches are complementary. It is possible for individuals to feel well and report high levels of life satisfaction despite adverse objective conditions, such as great poverty. At the same time, it is possible for individuals with great objective and material resources to report very low psychological well-being (Graham, 2009). To achieve a full picture of well-being, we need information on subjective and objective appraisals. Based on studies of subjective and objective indicators we know that people need both to achieve optimal development (Diener, Helliwell, & Kahneman, 2010; Nussbaum, 2011). Following the order of the I COPPE domains, we elaborate on these needs.

Interpersonal well-being requires coping successfully with two challenges: How to foster positive relationships and how to resolve conflict. Some of the benefits of attaining positive interpersonal relations include physical health, low levels of stress, optimistic outlook on life, resilience, self-efficacy, and a higher likelihood of being happy (Buettner, 2010; Cohen, 2004; Rosenberg, 2012). But not all friendships or associations are good for you. Interpersonal life is so powerful that relating to certain people might result in deleterious consequences for you. For example, if you have a direct connection with someone who smokes, your chances of smoking yourself are 61%. If your friend becomes obese your chances of becoming obese increase by 57% (Rath & Harter, 2010).

There are obvious barriers to achieving and maintaining positive relations with others, such as poor listening, lack of assertiveness, aggression, and bullying. These are barriers that can be overcome mostly with proper training and enlightened policies and practices. Schools and families play a crucial role in the development of social skills and the establishment of policies and practices that foster empathy and discourage bullying. Personal skills and structural norms go hand in hand (Tuckman & Monetti, 2011). The former without the latter cannot protect children on the playground from abuse and bullying. In turn, the latter without the former would fail to train children how to assert themselves and create a climate of respect.

The advent of social emotional learning signals progress in the right direction. Students need to be taught essential skills such as self-regulation, emotional literacy, and communication skills to establish, maintain, and restore positive relationships. Connecting with other children and adults in a

manner that fosters empathy, caring and compassion can go a long way towards creating satisfying relationships. To connect, we need to teach children and adults communication skills such as non-judgmental listening, empathic responses, and assertiveness. Like reading, writing and mathematics, social skills require a methodic approach and cannot be left to chance.

Communal well-being refers to satisfaction with one's place in a geographic or relational community. Children as well as adults need a sense of community to thrive. Belonging and mattering are very important in well-being. We want people to know how to help individuals and how to build a better community for all (Block, 2008). There are certain benefits to creating cohesive communities. Research shows that places with more social capital, or dense networks, experience higher levels of health, welfare, education and tolerance than places with low levels of social capital. Moreover, regions with low levels of social capital tend to have higher levels of crime (Putnam, 2000, 2001).

Building and having a supportive community can help individuals overcome serious challenges, such as alcoholism and obesity. Studies show that the best way to lose weight and overcome addictions is to do it in the company of friends (Rosenberg, 2012). Group settings are more powerful than individual interventions, and groups of friends are more effective than groups of strangers (Rath & Harter, 2010).

Community well-being is a paradigmatic example of the complementarity of subjective and objective appraisals. In the nineties, Colombians reported the highest level of satisfaction in the world. This was at the same time that they reported the highest rate of murders per capita, highest levels of random violence and highest number of kidnappings in the world. A similar picture emerges in Mexico in the first decade of this century. Mexicans reported the highest levels of satisfaction but also the highest levels of random violence, drug related killings and corruption. If we were to judge either country on subjective or objective data alone, we would get an incomplete and deceiving picture. Looking only at the subjective reports would lead us to think that they are oblivious to their surroundings. Judging only from the objective crime rates, we would expect both populations to live in a constant state of fear or depression. In actual fact, what happened is that during these years both countries experienced a surge

in democracy, which, accompanied by traditional high levels of social support and family cohesion, account for the high levels of happiness (Inglehart, 2010; Inglehart et al., 2008).

Children and youth yearn to belong to groups of friends in schools, neighborhoods and sport associations. The social development of children and teens is predicated on being accepted and appreciated by peers. Rejection by peers comes with the heavy price of isolation, ostracism, and low self-image. Schools and informal education settings play a vital role in implementing policies of inclusion that lead to climates of acceptance and mutual respect (Sahlberg, 2011; Tuckman & Monetti, 2011).

Sense of community is a key ingredient in mattering. Mattering is a feeling that what we do and who we are matters to other people. It is the perception that what we do has meaning for other people. Mattering is related to meaning-making, which derives from life projects having to do with recognition and impact. Recognition means that our presence, our ideas and our actions are felt and acknowledged by other people in the community. Impact, in turn, means that we can exert influence in our community.

Recognition sits between invisibility and sense of entitlement. We abhor feelings of invisibility because they make us feel ignored. We do what we can to escape feelings of invisibility. On the other hand, we tend to stay away from people with a great sense of entitlement because they are very self-centered and do not afford much space for other people or ideas. We want to be recognized, but what we do not want to feel ignored or entitled. When we are entitled we tend to ignore other people and their fundamental right to be accepted, acknowledged, and appreciated.

The second aspect of mattering is having an impact in the community. As with recognition, impact exists along a continuum. On one hand there is helplessness or the sense that we do cannot effect any change around us. On the other hand there is domination, or the thirst to exert control over those around us. Neither extreme is healthy for us. In my view, we feel that we matter in socially productive ways when we feel recognized and effective. Ideal communities, schools, and families make us feel that we matter and that we can make a difference in the world.

Mattering derives from the accumulation of experiences of self-efficacy over time. It behooves all of us, teachers, parents, peers, and relatives to

nurture it in children, friends, and family members. An ideal community is one that responds to the needs of all members to be recognized regardless of level of ability, gender, sexual orientation, race or cognitive competencies. Similarly, a great community is one that controls dominating members from exerting undue control over others.

Occupational well-being revolves around two challenges: how to be organized and how to feel engaged and use personal strengths. Organization is crucial to self-efficacy, which is associated with psychological health. Engagement, in turn, is related to better physical and psychological health. Men who live to 95 tend not to retire until they are 80 years old. As engagement at work increases and people feel more useful, cholesterol and triglycerides go down. On the contrary, as engagement goes down, through unemployment for instance, people report more physical diseases and depression (Clark, 2010; Harter, Schmidt, & Keyes, 2003; Rath & Harter, 2010).

For children and youth, their main occupation is schooling. It is the responsibility of teachers, parents and administrators to make sure kids feel engaged and use their strengths. One of the main outcomes of a good education is increased self-efficacy, which can lead to a productive career and better mental health. Self-efficacy is conducive to a sense of control, which is highly related to psychological and physical well-being (Bandura, 1997, 2006).

As noted earlier, self-efficacy is a building block of mattering. The more we feel effective and impactful in the world, the greater our level of confidence and our predisposition to take risks.

Physical well-being refers to satisfaction with personal levels of vitality and functionality. There are three essential avenues to physical wellness: proper nutrition, physical activity, and adequate sleep. Unfortunately, millions of people around the world suffer from obesity and a host of diseases related to poor nutrition and lack of exercise. Despite all we know about nutrition and physical activity, hundreds of millions of people suffer from preventable diseases. Food can be a great healer or a great killer (Campbell & Campbell, 2006). In the United States, obesity is an epidemic affecting children and youth. This is directly related to poor eating habits and lack of physical activity. Whereas some of these behaviors can be attributed to personal variables such as poor impulse control and lack of

education, environmental influences such as advertising and food deserts cannot be ignored (Campbell, 2013).

It is easy to blame individuals for their physical ailments. However, we cannot ignore environmental influences such as advertising in schools and on TV. To promote physical well-being we need to create environmental cues that are healthy, such as plenty of fruits and vegetables in schools and at home. We also need to model to children physical activity. Most people believe that they have more willpower than they really do. Instead of expounding the virtues of willpower we need to work collaboratively to build environments that model physical well-being and expose children to proper nutrition.

Psychological well-being refers to the ability to foster positive emotions and meaning in life, and the capacity to cope with stress. People who report higher levels of positive emotions are more sociable, cooperative, charitable, flexible, productive, resilient, and overall healthier than those on the opposite end of the spectrum (Buettner, 2010; Fredrickson, 2009; Rath & Harter, 2010; Seligman, 2011).

Poor psychological health is characterized by poor self-esteem, helplessness, low self-efficacy, poor impulse control, negative self-talk and mental health issues (Prilleltensky & Prilleltensky, 2006). External circumstances are often to blame for these negative outcomes. They include bullying, abuse and scorn. At the core of psychological well-being is a sense of control. The more we feel in control of our lives and environments, the healthier we are. These negative circumstances erode our sense of control and self-efficacy. Studies reviewed by Marmot (2004) and others (Levy & Sidel, 2006) demonstrate the connection between objective levels of well-being, such as income and education, and psychological health. People with higher levels of education and income report significant lower levels of hostility, isolation, poor self-efficacy, depressive symptoms and negative events in life. We have to protect children not only from adverse experiences such as psychological, physical and emotional abuse, but also from poverty and lack of literacy (Duncan & Murnane, 2011; Kozol, 2012).

Like sense of community, psychological well-being is related to mattering. Having a sense of control, as noted earlier, makes us feel impactful, one of the two essential ingredients in mattering.

Economic well-being refers to satisfaction with financial security and ability to manage money. While a certain level of economic security is crucial for well-being, we know that money is not the only precursor to happiness. According to some research, money is not even one of the most important ones (Dunn & Norton, 2013). Studies show that after a certain threshold, money stops increasing our subjective well-being (Graham, 2009). What money can do for our happiness though, is to improve our well-being by making sure we can purchase memorable experiences – not objects. Studies also show that the best way to use money to increase our well-being is to spend it on others, not on ourselves (Dunn & Norton, 2013).

Children and youth are exposed to a consumerist culture that basically forces them to spend money to acquire the latest gadget. Parents are pressured to acquiesce with cultural norms of acquisition. Much work needs to be done to make sure children learn how to save and how to make the most of money.

Our studies show that these six domains of well-being are significantly correlated with overall well-being (Prilleltensky, Dietz, Prilleltensky, Myers et al., in press). Research also shows that all aspects of well-being must be present for optimal human development. Our multidimensional framework honors the complexity of life and the multitude of needs that people must satisfy to flourish (Prilleltensky and Prilleltensky, 2006).

There is much synergy across the I COPPE domains of wellness. As noted above, it is easier to achieve physical wellness goals when you engage the interpersonal, communal, and social support of others (Rosenberg, 2012). Similarly, it is easier to eat healthier when you have the economic resources to buy organic food. Along the same vein, sharp occupational skills, such as organization, and psychological attributes, such as self-efficacy, can contribute to economic security.

Subjective well-being derives from positive feelings, emotions, and cognitions; and from positive experiences in families, schools, and communities. These experiences are related to justice (Prilleltensky, 2012). As I will try to demonstrate in the next section, for people to thrive across the I COPPE spectrum, conditions of fairness must prevail.

The Multifaceted Nature of Justice

Philosophy and psychology offer various classifications of justice (Arfken & Yen, 2014; Louis, Mavor, La Macchia, & Amiot, 2014; Sandel, 2009; Sen, 2009; Tornblom & Vermunt, 2007). In my view, there are two general categories: substantive and contextual. Substantive includes distributive and procedural justice. Contextual entails the application of substantive types in various contexts, such as relationships, families, schools, workplaces, and communities.

The reason I call distributive and procedural substantive types of justice is because they address two fundamental aspects of fairness: what and how. Distributive justice is about the fair and equitable allocation of resources, burdens, pains and gains (Miller, 1999; Sandel, 2009). This type of justice is concerned with the "what." What to grant individuals or groups is the central concern here. Procedural justice, in turn, deals with the "how." How do we make decisions affecting various parties, and how do they participate in the process. Therefore, distributive justice is mainly about outcomes, and procedural is chiefly about processes (Laden, 2013; Reich, 2013; Tornblom & Vermunt, 2007).

To achieve distributive justice, certain criteria must be invoked; for example, merit, need or effort. If we are to distribute a social good, such as a scholarship, we must balance all three considerations: effort, need and merit. It would be justified to give a scholarship to the student who obtained better grades (merit consideration), provided that all students received the same opportunities in life. If some students did not have good educational experiences, or their parents could not afford to send them to extracurricular activities, they may not have been able to achieve educational outcomes according to their potential, but due to no fault of their own. Therefore, it would be unfair to penalize them for something they are not responsible for. It is entirely possible that two students worked equally hard in school (effort consideration), but that some did not have the resources to obtain enrichment (need consideration) and therefore did not perform as well (merit consideration). As can be seen, it is important to ponder the dynamic interplay among need, effort, and merit before allocating an educational good, such as a scholarship. These are all distributive justice questions (Facione, Scherer, & Attig, 1978; Reich, 2013).

When it comes to procedural justice, different criteria apply. To achieve procedural justice, we must take into account whether people affected by the decision have been consulted (participation consideration) and whether the process has been fair to all (impartiality consideration). Procedural justice is not just about following rules, but rather about a proactive process of meaningful engagement and democratic participation in decisions affecting our lives. Have people been consulted? Have students participated in decisions affecting their well-being in school? Have their voices been heard? These are all procedural justice questions (Apple, 2010; Ayers, Quinn, & Stovall, 2009).

In my view, questions of distributive and procedural justice take place in specific contexts, such as families, schools, and workplaces. There is a vast literature on organizational justice (Colquitt, 2001), but not so much on family justice. There are many publications on educational inequities, but they are not, in my opinion, fine-grained enough to understand the multifaceted nature of justice in education and human development. We need a refined understanding of various types of justice and how they impact human development.

Contextual types of justice deal with substantive aspects of fairness in particular settings. Essential settings for human development are family, school, workplace, community, and government. Distributive and procedural questions take place in relationships within families. Decisions such as who gets what, and how do members arrive at that decision, pervade families. To be concrete, families make a certain amount of money. The money can be used to send one of the children to music lessons, or for the father to indulge in a drinking habit. This is a distributive justice question. How does the decision get made is a procedural question. Does the father consult with the mother? Do the children have a say?

Another instance of family injustice is developmental. This kind of injustice takes place when a person, by virtue of her power or authority abuses or takes advantage of another who is developmentally vulnerable, such as elderly parents or young children. This may also be called generational injustice.

In schools, distributive and procedural dilemmas abound, but so do opportunities to practice fairness. Hundreds of decisions are made in classrooms every day. Do students participate in them? Do teachers have a

say about a new curriculum, or is it foisted upon them by school boards? Who decides who gets awards and privileges? What are the criteria? To the extent that we talk about school or educational justice we are talking about distributional and procedural issues (Apple, 2010; Laden, 2013; Reich, 2013).

There is a vast literature on workplace fairness pointing to four elements of justice: informational, relational, distributive and procedural justice (Colquitt, 2001). While we have already discussed the last two, the first two require some elaboration. Informational justice refers to transparency, and relational justice pertains to dignity and respect. All these elements apply equally well to schools, which are a particular type of workplace with a unique mission: to educate students.

Community justice consists of several subtypes, all dealing with distributive or procedural issues. Cultural justice, for example, refers to the treatment of all racial and minority groups in society with equal respect (procedural justice), and affording them all equal opportunities, such as jobs and education (distributive justice) (Powell, 2012). It may be argued that granting dignity is another form of justice. While dignity is not a material good, it is definitely a subjective good, in which case we may claim that it is a form of distributive justice. When minority groups are granted the dignity and respect they deserve, we engage in distributive justice of a subjective good, as opposed to a material good such as financial support for refugees.

Another type is retributive justice, which deals with accountability for transgressions, or paying the price for a crime (distributive concern). Corruption is a particular case of community injustice, in which a particular group violates distributive (e.g., not paying taxes) and procedural rules (e.g., disrespect for norms of conviviality).

At the governmental level, educational, health, and welfare policies have profound consequences for wellness and fairness. Funding for schools, which in some parts of the United States depends on local taxes, can be highly unequal. Regions with a high tax base can support schools in ways that poor communities could never afford (Henig, Malone, & Reville, 2012). Also in the United States, some cities and states channel public dollars to charter schools, which receive public funds but are independently run. Some of these schools discriminate against students with disabilities or immigrants for fear that they would depress the overall scores and rankings of the

schools (Ravitch, 2010; 2013). Access to a well-funded school is a distributive question. Education is an objective good that can be translated into better jobs and better pay, but it is also a subjective good that confers status, confidence, and prestige.

The whole policy decision-making process is one big procedural question. In the United States, private foundations exert an outsized influence on the federal government. Through connections and funding, these private entities have the ability to dictate public policy. Meanwhile, parents, teachers and students have little or no say on closings of schools or the introduction of new curricula (Ravitch, 2010, 2013).

As can be seen, the two main substantive aspects of justice, distributive and procedural, figure prominently in relationships, families, schools and government. Decisions made at each one of these ecological levels can and do have profound effects on human development.

Towards Action

To promote human development in a methodic fashion, we need to connect social justice to specific aspects of well-being in various settings. Each one of us is a recipient as well as an agent of human development and justice. It is up to all of us involved in education and human development to make sure that distributive, procedural, interpersonal, cultural, and developmental types of justice are enacted in family, school, and community contexts to promote well-being across the various domains of life.

Policy makers must balance their focus on intrapersonal variables in education with an emphasis on (a) the creation and dissemination of systems of human development and (b) the implementation of fair policies and practices. Educational achievement is a cooperative enterprise among teachers, parents, administrators, professional helpers and the community at large (Levin, 2008; Mediratta, Shah, & McAlister, 2009). Instead of always trying to change the child, we should try to change the structures and the forms of parental participation in education.

There is much that educators can do to improve systems of educational well-being and practices of fairness, such as paying attention to school climate, availability of resources, professional development, and provision

of time for team work. Likewise, they can make sure students and parents have a voice.

When it comes to procedural fairness, there must be vehicles for the meaningful involvement of parents and community members in the life of the school. In many western countries, the obsession with test scores prevents so called distractions such as parental involvement, arts, physical education, or enrichment.

Educational and school psychologists play an important role in deciphering for parents and teachers the relationship among variables impacting educational outcomes. In that role, they are communicators and educators in the most genuine sense of the word. Their role often is to explain to parents and teachers what is happening with the education of their child. If the focus of psychologists is exclusively on cognitive processes, nobody will pay attention to systems of well-being, such as school or family climate, or policies and practices of fairness, such as parental engagement in educational processes (Prilleltensky & Nelson, 2002).

Community activists often target the wrong group. It is fashionable, at least in the United States, to blame teachers for the educational state of the country. Activists must understand the triangle formed by individual human development, systems of educational well-being, and fair policies and practices.

Conclusion

Opportunities, resources, structures and processes make up systems of human development. The extent to which these systems have a positive effect on children and youth depends on the fairness of prevailing policies and practices (Nussbaum, 2011; Powell, 2012). Each one of the I COPPE domains of life is influenced by one or more types of justice. For students to benefit from high quality systems they must have fair access to them; and once in them, they must benefit from, as well as promote, interpersonal, cultural, developmental, retributive, and procedural justice.

All over the world there are excellent educational institutions that only few families can enjoy due to cost and other barriers (Attewell & Newman, 2010; Darling- Hammond, 2010). Racial discrimination persists even when minority children can access these institutions (Fuligni, 2007). Changes in

distributive, procedural, cultural, interpersonal, and developmental fairness would have to take place to make the benefits of stellar organizations available to all. The burning question, surprisingly, is not how to create high functioning educational environments, for many of them already exist, but how to make their benefits available to all children. It is up to us, agents of human development, to shine a light on educational justice to illuminate a brighter future for all children and youth.

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Adolescent Mental Health: Prevention and Intervention

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Review

Ogden, T & Amlund Hagen, K. (2014*). Adolescent Mental Health: Prevention and Intervention.* New York: Routledge.

Adolescence is a developmental period characterized not only by the presence of risk factors, but also by the emergence of new strengths, challenges and opportunities to discover. Professor Terje Ogden and Kristine Amlund Hagen offer in this interesting and comprehensive book a positive vision of adolescence, as a period in which most people develop in a healthy way, achieving good school adjustment, maintaining good relations with their families and with their peers, and developing high psychological well-being. In addition, the authors pay special attention to schools as a contexts of particular relevance in adolescent development, because of the presence in them of specific risk and protective factors and because they are excellent environments to implement intervention strategies in the prevention of mental health problems and for mental health promotion.

Professor Terje Ogden works as Research Director at the Norwegian Center for Child Behavioral Development in the University of Oslo (Norway), and professor Kristine Amlund Hagen is Resear Director at the Center for Child and Adolescent Mental Health of South-East Norway. Both authors are contributing their extensive experience in mental health in adolescence, both in the development of several mental health problems as in the implementation and effectiveness evaluation of preventive and treatment interventions.

The book begins with a brief introduction to adolescence, describing the changes that occur at the biological, cognitive and emotional levels, and highlighting, following an ecological and transactional model, the three contexts of relationships in which this development takes place: school, family and peers. Then, the authors provide a simple and complete definition and description of different types of treatments and preventive interventions,

underlining the importance of practices based on scientific evidence. In addition, Ogden and Amlund Hagen debate on the importance of examining the mechanisms of change (or mediators) and the conditions that may affect the effectiveness of an intervention (moderators).

After this conceptual and methodological introduction, three relevant mental health problems in adolescence are described: the externalizing problems (such as aggressiveness, antisocial behavior and delinquency), the internalizing problems (such as anxiety and depression) and alcohol and drug consumption. Every chapter details some definitions, some explanatory theories, the most significant risk factors and the most effective interventions in treatment and prevention. Furthermore, the authors illustrate these interventions with the description of cases in which we can see all the programs' and treatments' characteristics in practical ways.

In the genesis and development of adolescents' mental health problems, school is one of the contexts with greater relevance, as well as family and peers. In the transition from primary education to secondary education some significant changes and challenges emerge to be faced by the adolescent. The characteristics of this transition and the characteristics of the school environment (such as the quality of the context, the quality of relationships with peers and with teachers or the student perceptions on the barriers and facilitators of mental health) can promote new paths of growth or may encourage the emergence of new risk factors for the development of mental health problems, such as depressive symptoms, aggressiveness or substance consumption. But, on the other hand, mental health also acts as a determinant of academic adjustment, thereby establishing bidirectional relationships.

Some of the most interesting contributions of this book are, without any doubt, the description of models for intervention in the area of adolescent mental health from school environments, and the systematic review of interventions in mental health promotion and prevention that have found more empirical support. The Expanded School Mental Health model, the Deployment-focused model and the Integrated Three-tiered Public Health model are analyzed. Among the evidence-based interventions reviewed are the School-wide Positive Behavior Support model, some anti-bullying interventions, and aspects related to teacher-classroom management. On the other hand, Ogden and Amlund Hagen also describe some models and

interventions to promote social competence and social skills among adolescents.

Finally, some special challenges of helping adolescents with mental health needs are discussed, such as treating multi-problem adolescents. The work of Ogden and Hagen is specially inspiring for professionals working in the field of education with adolescents, either teachers or school principals, and for mental health professionals. It is a very complete, clear and motivating approach to mental health in adolescence and to the relevance of school in its development.

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