What if Reading Is Easy but Unimportant? How Students' Patterns of Affirming and
Undermining Motivation for Reading Information Texts Predict Different Reading Outcomes

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Abstract

Many affirming and undermining motivations affect students as they read information texts, but few researchers have explored how these motivations are patterned within students. In this study we used cluster analysis to classify middle school students ($n = 1,134$) based on their patterns of self-efficacy, perceived difficulty, value, and devalue for reading school information texts. We then compared how the patterns predicted students' language arts grades, science information text comprehension, and dedication to reading school information texts. We found and validated a four-cluster solution. One cluster included a pattern of high affirming and low undermining motivations, and another included low affirming and high undermining motivations. Students with these patterns earned the highest and lowest scores, respectively, on all outcomes. A third pattern showed high self-efficacy/low difficulty with low value/high devalue, and a fourth showed moderate levels of all four motivational constructs. Students with the high efficacy and devalue pattern showed high information text comprehension but relatively low dedication. Students with the moderate pattern showed high dedication but low initial information text comprehension. Students with these two patterns earned similar grades. We discuss the implications of our findings for motivation theories and for school instruction that involves information text reading.

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1. Introduction

Adolescents engage in multiple literacy activities both in and out of school (Alvermann, 2001, 2002; Johannessen & McCann, 2009). However, those who lack motivation to read texts for school engage less in this type of reading and ultimately show lower reading comprehension skills than do their more positively motivated peers (Alvermann, 2002; Guthrie & Klauda, 2012; Guthrie & Wigfield, 2000). Unfortunately, many students report that the information texts they read in school are difficult, boring, and irrelevant to their everyday lives (Alvermann, 2001, 2002; Guthrie & Davis, 2003; Guthrie, Klauda, & Morrison, 2012; Guthrie, Wigfield, & Klauda, 2012). This is a major concern because many middle and high school teachers continue to use information texts as primary or supplementary reading materials in many subjects (Chiappetta, Ganesh, Lee, & Phillips, 2006; Guthrie & Klauda, 2014; O'Brien, Stewart, & Beach, 2009). The National Governor's Association (NGA; 2005) has recognized this problem, listing low motivation first on a list of factors that cause reading problems among students in grades four through 12. They recommended that researchers and educational practitioners take steps so that students are more motivated to read information texts in school.

How do researchers define reading motivation? Many view motivation as multifaceted, because adolescent readers engage in different kinds of school-based literacy activities for multiple reasons (Alvermann, 2009; Guthrie, Wigfield, & You, 2012; Johannessen & McCann, 2009; Moje, Overby, Tsvaer, & Morris, 2008). Despite the richness of these conceptualizations, most researchers studying students' reading motivation have taken a variable-centered approach, examining how one or more specific motivational constructs relate to reading comprehension or

engagement. Because of the complexity of reading motivation, it is important to examine also whether there are meaningful *patterns* among the multiple motivations that affect students as they read, and to assess whether those patterns affect students' reading outcomes. We take this approach in the present study.

We base this study in two influential theories of achievement motivation, Eccles and colleagues' expectancy-value model of achievement choices (Eccles-Parsons et al, 1983; Eccles & Wigfield, 2002; Wigfield, Tonks, & Klauda, 2016) and Bandura's (1997) social cognitive theory. These theorists posit that students' beliefs about their competence to complete a given academic task impact their motivation to do the task as well as different achievement outcomes. Students' competence-related beliefs, such as their self-efficacy, are shown to predict strongly their grades, test scores, and their other achievement outcomes in reading (Wigfield & Cambria, 2010; Wigfield et al., 2016).

In expectancy-value theory, Eccles and her colleagues (Eccles-Parsons et al., 1983; Eccles, 2005; Wigfield et al., 2016) also posit that students' subjective value for different achievement tasks (called "value" throughout this paper) predicts their academic outcomes. Value is defined as how useful a task is to students, whether succeeding on the task is important to their sense of self and goals, and how interesting they find the task. In particular, students' value predicts the amount of time they spend reading and their choices of whether to take more reading-focused courses (Durik, Vida, & Eccles, 2006; Wigfield & Cambria, 2010, Wigfield et al., 2016).

Both Eccles and colleagues and Bandura and colleagues posit that students' levels of competence-related beliefs and value are influenced by many factors, in particular their previous school successes and failures (for reviews, see Bandura, 1997; Eccles & Wigfield, 2002; Schunk

& Pajares, 2009; Wigfield et al., 2016). These researchers also have shown that students' competence-related beliefs and value vary both within and across individuals and over time; that is, they are malleable. Despite this malleability, much research has shown that (particularly by the middle of elementary school) students who have more positive competence-related beliefs and value for different academic activities tend to achieve better and choose more challenging academic activities during their subsequent years in school (Bandura 1997; Schunk & Pajares, 2009; Wigfield et al., 2015; Wigfield et al., 2016).

Building on the work from expectancy-value and social cognitive theories, some researchers distinguish positive, or “affirming” motivations from negative, or “undermining” motivations (Guthrie, Coddington, & Wigfield, 2009; Ryan & Deci, 2000; Wigfield, Cambria, & Ho, 2012). They argue that affirming motivations predict positive achievement and engagement, whereas undermining motivations predict disengagement, avoidance, and poor achievement. Based on initial results of work distinguishing these, we focus on two pairs of affirming and undermining motivations in the present study: self-efficacy and perceived task difficulty, and value and devalue.

Perceived difficulty refers to how hard students think it is to read. Guthrie and colleagues have posited that task difficulty is distinct from self-efficacy because some students might doubt their efficacy to read a given text *and* also believe that the text is very difficult, whereas other students might have low efficacy but not perceive the text to be difficult (e.g., Guthrie, Klauda, & Ho, 2013). Wigfield et al. (2012) confirmed that these two constructs are factorially distinct, and Guthrie et al. (2013) showed that they predict unique amounts of variance in reading outcomes. Both Chapman and Tunmer (1995) and Seifert and O’Keefe (2001) found that

students' perceptions that reading is difficult related negatively to their reading affect and positively to their avoidance of reading.

Guthrie, Wigfield, and colleagues (Guthrie et al., 2013; Wigfield et al., 2012) defined devalue as students' sense that texts are not important or relevant for their future success. Guthrie et al. posited that value and devalue are distinct, because some students might not see value in certain texts and also actively devalue reading them, whereas others find little value in these texts but do not actively devalue them. Again, Wigfield et al. (2012) confirmed that these two constructs are distinct factorially, and Guthrie et al. (2013) showed that they uniquely predict variance in reading outcomes. Devalue predicts negative outcomes such as lower reading engagement and reading achievement (Taylor, Casten, Flickinger, Roberts, and Fulmore, 1994).

1.1. Person-centered analyses of motivation

As noted above, most researchers studying reading motivation have used variable centered approaches (e.g., Durik et al., 2006). That is, they have tested how particular motivational variables from expectancy-value and social cognitive theories predict outcomes, controlling for other variables (e.g., Meece, Wigfield, & Eccles; 1990; Pintrich and De Groot, 1990; Trautwein et al., 2012). A different analytic approach is to assess whether there are groups of students with identifiable *patterns* of affirming and undermining motivations, and then to examine whether those students vary in their achievement outcomes (e.g., Bergman, Magnusson, & El-Khoury, 2003). Such person-centered approaches are gaining popularity in the field but have not been used often in the work on motivation for reading information texts. Researchers taking person-centered approaches do not view patterns in motivation as fixed or trait-like; rather, they can change over time, similar to the motivational constructs discussed above.

As noted earlier, person-centered research is useful because multiple affirming and undermining motivations affect students simultaneously (Guthrie Wigfield, & Klauda, 2012; Wigfield & Guthrie, 1997). Evaluating how one or two affirming or undermining motivations relate to outcomes does not present a complete picture of these relations. Person-centered approaches can answer research questions that variable-centered analyses cannot, such as whether students show meaningful patterns of affirming and undermining motivations with respect to reading, what those patterns look like, and how those patterns might differ by gender or ethnicity.

Person-centered analyses are especially useful for exploring how multiple affirming and undermining motivations together predict differences in achievement outcomes. These analyses allow a researcher to examine how a few common and salient patterns of motivational constructs for a group of students relate to outcomes (Bergman & Trost, 2006; Laursen & Hoff, 2006; Roeser & Peck, 2003). In contrast, researchers would need to create many interaction terms to capture how multiple motivational constructs might interrelate to predict outcomes using variable-centered methods. It can be difficult to interpret many interaction terms together in the same model. Furthermore, it is not clear which modeled relationships actually represent students' experiences. For example, researchers might use variable-centered analyses to model how a student would achieve who has high self-efficacy and high perceived difficulty, but few students might actually exhibit this pattern in a classroom.

Previous researchers have used person-centered approaches to study these types of questions, and they have found that early and middle adolescent students show identifiable, meaningful patterns of competence-related beliefs and task value. Linnenbrink-Garcia, Pugh, Koskey, and Stewart (2012) investigated patterns of high school students' competence-related

beliefs, task value, and prior knowledge in biology. Using cluster analysis, Linnenbrink-Garcia et al. (2012) identified four patterns. One included low interest, competence-related beliefs, and prior knowledge, two included moderate levels of these constructs and moderate or high knowledge, and a fourth had high levels of these constructs and high knowledge. There were gender differences in how the patterns related to achievement: Females were more likely to experience conceptual change in science when they showed the pattern with high levels of motivation, but males were likely to experience conceptual change when they showed the patterns with moderate or high levels. Conley (2012) found seven clusters of middle school students who had different patterns of competence-related beliefs, four types of task value, and goal orientations in math. One had low levels of mastery goals, competence-related beliefs, and interest, attainment and utility value, three had moderate levels of these constructs, and three had high levels of these constructs but different levels of perceived cost. Students with patterns including high levels of the other motivations and lower perceived cost had higher math achievement than those in patterns including lower levels of the motivations or higher perceived cost.

Simpkins and Davis-Kean (2005) examined patterns of competence-related beliefs and task value among high school math and science students. They found three patterns in which students showed high, moderate, or low levels of competence-related beliefs and value, and a fourth in which students had high competence-related beliefs but moderate value. Students showing the patterns that included high competence-related beliefs took more advanced math or physical science courses than other students. In science, more males than females showed patterns that included high competence-related beliefs, and in the pattern with high competence-related beliefs and high value, males took more classes than females. In math, females took more

classes than males if they showed the patterns that included low or moderate competence-related beliefs.

One person-centered study has explored early adolescents' competence-related beliefs and value for reading. Baker and Wigfield (1999) found seven clusters of 5th and 6th grade students' reading motivation, based on their responses to a questionnaire assessing 11 motivations. These included reading self-efficacy, importance of reading, reading avoidance, intrinsic and extrinsic motivations for reading, and social motivations for reading such as competition. One pattern included high scores on all the motivational constructs except avoidance and was related to the most reading activity, and two patterns included low levels of all the constructs except avoidance and were associated with the least reading activity. Students showing a pattern that included low perceived competition and low avoidance also showed higher reading achievement than students with patterns including overall high or low levels of most of the motivations.

We found one person-centered study that explicitly included undermining motivations, but it did not address competence-related beliefs or task value. Guthrie, Coddington, et al. (2009) created groups of fifth grade students based on their patterns of intrinsic motivation and avoidance for reading school texts: (a) high intrinsic motivation and high avoidance; (b) high intrinsic motivation and low avoidance; (c): low intrinsic motivation and high avoidance; and (d) low intrinsic motivation and low avoidance. African American and European American students were equally likely to show the different patterns. Students who had a pattern of low avoidance and high intrinsic motivation showed higher reading achievement than the other students.

1.2 Focusing on school information text reading

We focus in this study on students' patterns of motivation for information text reading, because as noted earlier, teachers frequently use information texts in many subjects starting in middle school. We define "information texts" as expository texts that have a primary purpose of providing information about the natural or social world (Duke, 2004).

As just discussed, researchers have begun to explore patterns of students' self-efficacy beliefs, difficulty perceptions, value, and devalue of reading. However, to date no one has explored patterns of these variables concerning school information texts. This is important to explore because students' motivation is domain specific both across different subjects (e.g., math versus reading; Wigfield et al., 2015; Wolters & Pintrich, 1998), and within a particular subject (e.g., motivation for reading information texts versus motivation for reading narrative texts; Guthrie et al., 2007; Ho & Guthrie, 2013). Thus students' patterns of affirming and undermining motivations likely vary across different genres of reading.

In the schools used for the present study, students mostly read information texts in their history, science, and language arts classes (Guthrie & Klauda, 2014). We do not know for sure what teachers told students with respect to *why* they should read a given text at a given time, but in general students likely were directed to read information texts in order to learn more about science or history in their classes, or so they could learn historical or other background information relevant to a given narrative text. In this study, students' motivation for reading school information texts was measured in general rather than with respect to specific disciplines of reading, because there is overlap in the processes and reading strategies required to learn information across disciplines (Shanahan, Shanahan, and Misischia, 2011). In particular, both history and science texts are structured hierarchically, such that concepts build on one another, and both types of texts require contextualized interpretation of terms and phrases (Guthrie &

Klauda, 2014). Thus students' motivation is likely similar across these disciplines of information text reading, at least to a degree.

As noted earlier previous work has shown that middle school students view school information books negatively (Alvermann, 2001; Guthrie & Davis, 2003; Guthrie, Wigfield, & Klauda, 2012; Guthrie, Wigfield, & You, 2012). Given these results, person-centered analyses may show that a large proportion of students have patterns of motivation for information text reading that put them at risk for negative academic outcomes in classes frequently incorporating these texts. Therefore, many students may come to devalue information texts and find them to be difficult, to feel capable to read the texts but also devalue them, or to recognize that the texts have value but also perceive them to be difficult. Any of those students then might show lower reading engagement or achievement with respect to information texts than do students who have high self-efficacy/ low perceived difficulty and high value/low devalue for reading these texts

As discussed above, students' self-efficacy beliefs and task value predict different outcomes: efficacy predicts achievement in reading whereas students' value predicts reading engagement. Because both of these kinds of motivation variables were included in our patterns, we assessed reading outcomes related to both achievement and engagement. We used a measure of students' grades in reading/language arts in order to assess how patterns related to a broad outcome measure of reading achievement in a class that included some information text reading. We also explored the outcome of students' dedication to reading school information texts. Guthrie, Klauda, and Morrison (2012) defined dedication as "the disposition to read widely and thoroughly, while committing effort, time, and persistence to reading activities" (p. 2). They stated that dedication is one of the processes by which students become engaged in reading. We thus assume that dedication is an outcome resulting from motivation rather than being a

motivational construct in and of itself (see also Skinner, Kindermann, Connell, & Wellborn, 2009; Wigfield and Guthrie, 2010).

We also looked at students' science information text comprehension test scores as an outcome. Science text comprehension was measured (rather than on reading comprehension across disciplines) because students who are not positively motivated to read information texts in school may struggle to comprehend texts in science particularly. Students and adults need to read successfully information texts to engage in the scientific process and to understand scientific concepts (Norris & Phillips 2003, 2012). However, science teachers rarely provide students with overt instruction regarding strategies to understand and critique what they read in science texts (Guthrie & Davis, 2003; Moje et al., 2008). Science textbooks also contain much technical language that is difficult for students to interpret (Penney et al., 2003), making comprehension particularly difficult.

1.3. Gender and ethnic differences in pattern membership

Researchers have called for more attention to gender and ethnic differences when studying individual differences in motivation and academic outcomes (e.g., Murdock, 2009; Meece, Glienke, & Askew, 2009). We had a large and diverse sample in this study, so we tested whether our observed patterns differed between boys and girls and between African American and European American students. With respect to gender, researchers such as Baker and Wigfield (1999) and Jacobs et al. (2002) generally have found that girls' competence-related beliefs and value for reading are more positive than those of boys. One person-centered study has looked at gender differences in students' motivation, in the subject of science. As noted above they found some gender differences in the patterns (Simpkins & Davis-Kean, 2005) such that more males had patterns that included high competence-related beliefs.

In the present study we focused on ethnic differences between African American and European American students because those two ethnic groups were the most highly represented in our sample. Researchers have found some differences in affirming and undermining motivations for reading between these two groups. Baker and Wigfield (1999) found that 5th and 6th grade African American students reported higher reading self-efficacy and importance of reading than did White students. Also, Wigfield et al. (2012) found (in the dataset examined in the present study) that African American students had higher intrinsic motivation for reading information texts. However, in a study using person-centered analyses, Guthrie, Coddington, et al. (2009) found no ethnic differences in students' patterns of motivation for reading school-based texts. We followed the recommendations of Graham (1994), Murdock (2009), and others and considered ethnic differences in conjunction with students' socioeconomic status (SES). This is because there are often confounds between ethnicity and SES and so it is critical to examine both variables if there is variation in each within a given sample.

1.4. What explains the relations of some patterns of affirming and undermining motivations with later achievement?

A number of researches have examined what kinds of variables explain, or mediate, the relations between students' motivation and later outcomes. For instance, Guthrie, Wigfield, & You (2012) and Wigfield and Guthrie (2010) proposed that students' motivation leads to greater engagement in reading, which ultimately influences their reading achievement and involvement with reading. Durik et al. (2006) documented this in their study of how students' motivation for reading related to their performance and choice six years later. As noted above we obtained language arts grades from the end of the next school year following the study. Thus we tested whether students' dedication, a variable analogous to engagement, mediated the relationship

between their patterns of affirming and undermining motivations and their later grades. We predicted that if students have patterns of motivation that predict high dedication to reading, they would earn higher reading grades later on in school as a result. Conversely, student with patterns of motivation that related to relatively lower levels of dedication may ultimately earn lower reading grades over time.

1.5. The present study

In this study, we addressed the following research questions:

1. Can meaningful patterns in middle school students' self-efficacy, perceived difficulty, value, and devalue for reading school information texts be identified?
2. Are there gender differences in which patterns students have?
3. Are there variations between African American and European American students in which patterns students have, and do these differ between low- versus high-SES students?
4. Do students with the different patterns vary in their language arts grades, science information text reading comprehension, and dedication to reading school information texts six weeks later, or language arts grades one year later?
5. Does students' dedication to reading mediate the relationship between pattern membership and language arts grades one year later?

2. Method

2.1. Participants

Participants were 1,185 seventh-grade students enrolled in 57 separate language arts classes in one rural school district from a Mid-Atlantic state. Students were 47.1% female, 78.3% European American, 19.3% African American, and 24.3% qualified for free or reduced price

lunch. We did not use data from the Asian American ($n = 29$) or American Indian ($n=3$) students in the sample because our primary hypotheses concerned African American and European American students. Data was obtained as part of the Reading Engagement for Adolescent Learning (REAL) project, which explores students' motivation and reading comprehension in middle school. As part of REAL, 73.9% of students received the Concept-Oriented Reading Instruction (CORI) intervention during the time period over which this data was collected (the effects of this intervention are not central to the present study, see Guthrie, Wigfield, & Klauda, 2012; Guthrie et al., 2013; see Procedure section for more details on this point). All participants were treated in accordance with APA ethical guidelines.

2.2. Measures

2.2.1. Reading motivation

Students' motivation was assessed in April, 2010, using the Motivation for Reading Information Books in School questionnaire (MRIB-S; see Wigfield et al., 2012 for description of the development of this measure; see Appendix for list of items used). Students completed the motivation measures before the CORI intervention began (see Procedure section for more information). Each subscale contains seven items assessed with 4-point Likert scales, with responses ranging from 1- "Not at all true of me" to 4- "Very true of me". The MRIB-S focuses on students' motivation for reading information books in school. As discussed in the introduction, a unique aspect of this measure is that Guthrie, Wigfield, and colleagues (e.g., Guthrie, Wigfield, & Klauda, 2012) characterized motivational constructs with respect to whether they "affirmed" students' performance and engagement, or "undermined" it, and developed items to measure four "affirming" and four "undermining" motivations. Guthrie, Klauda, and Ho (2013) and Wigfield et al.'s (2012) factor analytic work with this measure

showed that the eight subscales all were factorially distinct and not different ends of the same underlying latent constructs.

In the present study we were most interested in students' competence-related beliefs and value, and so we used the affirming motivational subscales (self-efficacy, 7 items, $\alpha = .82$ and value of reading information texts, 7 items, $\alpha = .85$) and undermining subscales (perceived difficulty, 7 items, $\alpha = .85$ and devalue of reading information texts, 7 items, $\alpha = .87$) assessing these constructs. The *self-efficacy in reading* items asked students how well they expected to do when completing reading tasks using school information texts (sample item: "I can figure out what unfamiliar words mean in information books for school."). The *perceived difficulty in reading* items assessed how challenging and difficult students found reading information texts to be (sample item: "It is hard for me to discuss the information books that I read for school."). The *value of reading* items asked students how useful and important they found their reading activities for school to be (sample item: "Reading information books for school is very important to me."). The *devalue of reading* items asked whether students thought the information text reading they did in school was unimportant, uninteresting, and not useful (sample item: "I don't want to read information books in school.").

Students were told to answer questions with the information texts they read in school in mind. As noted earlier, students typically read information texts in science, history, and language arts classes; the latter also included narrative texts and mostly used information texts to provide historical context to those. Given this, the research team assumed that students would be thinking about school information texts in these disciplines when completing the questionnaires. This measurement approach is consistent with that of other motivation researchers who have reliably measured motivation either at the level of reading overall or at the level of a particular genre,

without attending to the discipline on which that reading focused (e.g., Baker & Wigfield, 1999; Guthrie & Klauda, 2014; Guthrie et al., 2009; Wigfield & Guthrie, 1997).

2.2.2. Reading outcomes

2.2.2.1. Language arts grades

Students' quarterly language arts letter grades were collected at the end of the first academic year of the REAL project (2010) and again one year later (2011). Students' letter grades represented a composite score of tests, quizzes, and homework assignments in students' language arts classes and were assigned by classroom teachers. Grades were coded on a 1-5 scale (A = 5, B = 4, etc).

Some researchers question the reliability and validity of teacher-assigned grades as an outcome variable (e.g., Harlen, 2005). We acknowledge this concern, but we believe it is important to include student grades as an outcome in the present study for two reasons. First, teacher-assigned grades are one of the most salient pieces of information that students use in determining their beliefs about their ability; thus they are important with respect to students' motivation (Schunk & Pajares, 2009; Wigfield et al., 2015). Second, adolescents' grades are strong predictors of their later grades and college graduation rates, often more so than are standardized test scores (e.g., Geiser & Santelices, 2007). Thus information text comprehension scores alone do not suffice to understand how patterns of affirming and undermining motivations relate to students' later outcomes.

2.2.2.2. Science information text comprehension (ITC)

Students' comprehension skills for reading science information texts were assessed in June, 2010, using a researcher-developed measure that focused on animal and plant survival; students studied these topics during the time period of this study. Each test contained five

reading passages with five multiple choice items each. The test included two relatively easy passages (Flesch-Kincaid reading grade levels of 4.7 - 7.3), with items focused on paraphrasing sentences and understanding words and concepts. It also included three harder passages (reading grade levels of 7.2 – 12.0), with items that focused on identifying main ideas, demonstrating understanding of sub-concepts, summarizing, and engaging in causal reasoning. Students received one of two forms of the test (they completed the other form in April, 2010, but we do not analyze data from this test administration). Test forms were counter-balanced so that equal numbers of students from each school received each form at each of two time points. Between the two time points and the two forms of the test, the reliability of the test items ranged from $\alpha = .78$ to $.82$ (Guthrie et al., 2013). An expert in science education provided validity checks for the content of this measure during its development (see Guthrie et al., 2013, for more information).

2.2.2.3. Dedication to reading information texts

Students' dedication to reading school information texts was measured in June, 2010 (six weeks after collecting the initial motivation measures). As noted above, Guthrie, Wigfield, and Klauda (2012) defined dedication as students' disposition towards and willingness to participate in reading activities. We assessed dedication using 12 items developed by Guthrie, Wigfield, and Klauda (2012); students responded using four point Likert scales (see Appendix for wording of items). Items on this scale assessed students' reports of how much they put forth persistence, effort, and time when reading school information texts. We created a composite sum score of students' responses ($\alpha = .90$).

2.2.2.4. Previous reading achievement

Students' prior reading achievement was assessed in April, 2009 (one year before the initial motivation measures were collected) with the 2009 Maryland State Assessment (MSA

2009) in Reading. This test assesses students' reading skills, including their abilities to summarize and identify information from written texts, draw conclusions about written texts, and respond in writing to questions about different texts. Scores ranged from 240 to 650 and were obtained from the school district's central administrative office.

2.2.2.5. Demographic characteristics

Data regarding students' ethnicity, socioeconomic status (measured in terms of whether or not students were eligible to receive free or reduced price lunch), and gender were obtained from the school district's central administrative office.

2.3. Data collection procedure

Students' language arts teachers gave participating students the measures of motivation in April, 2010, during two consecutive class periods, assisted by a member of the research staff. In June 2010, teachers administered measures of information text comprehension and dedication, and school administrators provided students' grades and demographic data to the research staff.

Between April and June of 2010, about 74% of students in this sample received CORI, which consisted of daily instructional supports for information text reading comprehension and motivation (see Guthrie et al., 2013; Guthrie, Wigfield, & Klauda, 2012, for complete description of the CORI program). Students in CORI received a six-week curriculum about animal and plant life, and the teacher did one specific activity each day to increase students' affirming motivation for information text reading (intrinsic motivation, value, self-efficacy, and pro-social motivation) or decrease their undermining motivation (avoidance, devalue, perceived difficulty, and anti-social motivation). For example, the teacher might allow students to choose one of four texts to read, in order to provide them with autonomy support. The teacher also did a daily activity emphasizing cognitive strategy use when reading information texts (e.g., she

helped her students make a concept map). Control group students received the school district's regular language arts instruction during this time, which focused primarily on reading narrative texts. Previous research with this dataset has demonstrated that students who received CORI in this sample had higher motivation for reading school information texts and higher science information text reading comprehension at post-test than students in the control group did. Additionally, CORI students showed more dedication to reading school information texts, which predicted later higher science ITC scores (see Guthrie et al., 2013; Guthrie, Wigfield, & Klauda, 2012, for these results).

The purpose of this study was to explore patterns of affirming and undermining motivations and how they predicted reading outcomes; it was not to evaluate the effects of CORI. Thus we conducted cluster analysis with data that collapsed together students who received CORI and students who were in the control group. We collapsed the groups because the motivation measures were given *before* the intervention began; thus the nature of any clusters we observed would not be expected to differ between CORI and control students. In terms of predicting outcomes, as just noted, CORI did change students' mean levels of motivation and achievement (Guthrie et al., 2013). However, previous researchers have found that its effects were similar for lower and higher achieving students (Guthrie, McRae, et al., 2009). Thus we did not think it was likely that we would find interactions between receiving CORI versus being in the control group and having a particular pattern, when predicting the reading outcomes. We conducted several statistical tests to ensure that it was appropriate to collapse these two groups together, that the nature of our observed clusters looked similar between these two groups, and that cluster membership predicted achievement in the same way across both groups. We describe these further in the Results section.

2.4. Data analytic strategy

We used cluster analysis (see Bergman et al., 2003) to classify students based on their raw scores for the four variables of value, devalue, self-efficacy, and perceived difficulty. The overarching goal of cluster analysis is to categorize individuals into homogeneous clusters based on their values for a set of variables; cluster analysis maximizes the differences in those variables between clusters and the similarities in those variables within clusters. In accordance with Hair, Anderson, Tatham, and Black (1998)'s recommendation, we clustered students on the aforementioned variables using two sequential clustering procedures (also see Bergman et al., 2003; Hayenga & Corpus, 2010; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009). The first of the two procedures was a hierarchical agglomerative cluster analysis using Ward's method, which determined how many clusters were appropriate for the data and what the general centroid values of those clusters looked like (see Bergman et al., 2003; Hair & Black, 2000, for guidelines on this method). In the second clustering procedure, we used k-means cluster analysis (Hair et al., 1998; MacQueen, 1967). In this procedure, the researcher can specify the number of clusters to use for classification, and the starting centroid values for the different clusters, based on the results of the hierarchical clustering. Thus, the k-means procedure refines the results from the hierarchical procedure to maximize similarity within and dissimilarity between clusters (Hair et al., 1998).

The clusters produced by the k-means procedure provided the final cluster membership for each student, on which we conducted a double-split cross validation procedure (Breckenridge, 2000). To conduct this procedure, we split the data into two random halves and ran all clustering procedures separately on both halves. This allowed us to determine whether

similar cases were classified similarly in both halves and whether a four-cluster solution was appropriate for both halves.

To evaluate how the clusters predicted each academic outcome, we used one-way analysis of covariance (ANCOVA) with cluster membership as the main predictor and each outcome as the dependent variable. To evaluate whether dedication predicted the relationship between cluster membership and grades, we used an SPSS macro that assumes a multi-categorical independent variable. We discuss the specifics of these analyses below.

3. Results

A small number of participants were missing data on one or more motivational variables (4.3% overall; 3.5% value, 3.8% devalue, 3.1% difficulty, 3.2% efficacy). Thus the final sample size for clustering was $N = 1,134$. Participants who did not provide data on one or more of the outcome measures were included in all analyses for which they did have the required data (11.3% for 2009 MSA scores, 5.8% for dedication, 0.4% for 2010 grades, and 7.3% for 2011 grades). On the motivation and dedication questionnaires, we computed a mean score as long as a student answered a majority of the items assessing a particular construct (4 out of 7 items for each motivational construct, and 7 out of 12 items for dedication). This technique is considered to be appropriate with scales that have high reliability and that clearly measure one well-defined construct (Schafer & Graham, 2002). We computed this type of score for 5.4% of participants on the motivation questionnaires and 4.1% of participants on the dedication questionnaire.

Table 1 presents descriptive statistics and correlations for all variables. The significant relationships observed among variables were consistent with prior research; affirming motivational constructs correlated positively with the reading outcomes, and undermining constructs correlated negatively with those outcomes. Students' reading self-efficacy and value

correlated positively with one another and negatively with perceived difficulty and devalue. The three achievement outcomes were significantly but moderately positively correlated, suggesting that these outcomes are related but distinct ways of gauging reading skills. We note that students' value and devalue of reading were strongly negatively correlated, as were their self-efficacy and perceived difficulty. We determined based on this information that it was unlikely that a cluster would be characterized by, for example, high self-efficacy without perceived low difficulty also being in that cluster; however we still believe that data from the undermining variables contributed unique information to our analyses (see Discussion section).

3.1. Cluster analysis

As discussed earlier, we created clusters of students based on their levels of affirming and undermining motivations measured in April, before the CORI program was implemented. We first used a hierarchical agglomerative cluster analysis (with Ward's method) to determine what number of clusters most clearly categorized students in this sample; this method supported a four-cluster solution. To decide on the number of clusters, we explored results for the sample as a whole. We also split the sample into two random halves and examined the results separately for each half. For each half and overall, we inspected the dendograms and changes in fusion coefficients, which provide indicators of what clusters are combined and how similar clusters are when they are combined in each subsequent step of hierarchical clustering (Bergman et al., 2003; see Table 2 for fusion coefficients from the overall sample). These metrics indicated very dissimilar clusters being combined if we were to include only two or three clusters in our final solution. We then explored whether different cluster solutions explained approximately 50% or more of variance in each clustering variable (Hayenga & Corpus, 2010; Vansteenkiste et al., 2009; Wormington, Corpus, & Anderson, 2012). We determined that either a four, five, or six

cluster solution would both meet this recommendation and provide clusters that were theoretically interpretable.

Finally, we explored the nature of the four-, five-, and six-cluster solutions to determine whether they were meaningful and replicable. Overall and in the two random halves of the sample, we found the same four-cluster solution. One cluster of students had high affirming and low undermining motivation, one had low affirming and high undermining motivation, one had higher efficacy than value and lower difficulty than devalue, and one had moderate levels of all four variables. Five- and six- cluster solutions did not show the same consistency. Overall and in one of the random halves of the sample, the five-cluster solution divided students who had high affirming and low undermining motivation into two sub-groups, and the six-cluster solution divided this group even further. In the other half of the sample, the five-cluster solution divided students with low affirming and high undermining motivation into two sub-groups, and the six-cluster solution divided students with high affirming and low undermining motivation into two sub-groups. We determined that a four-cluster solution was most appropriate for this data since we found these clusters most consistently.

We refined the four-cluster solution with k-means cluster analysis (Hair et al., 1998; MacQueen, 1967), using the cluster centroid values from the hierarchical analysis as starting points. The final four-cluster solution explained 48.6 % of variance in self-efficacy, 57.2% of variance in perceived difficulty, 60.8% of variance in value, and 66.3% of variance in devalue. This amount of variance meets recommended criteria used in previous research (Hayenga & Corpus, 2010; Vansteenkiste et al., 2009; Wormington et al., 2012). We confirmed the stability and replicability of the four-cluster solution by conducting a double-split cross-validation

procedure in accordance with Breckenridge (2000)'s generally accepted recommendations; this confirmed that two random halves of the data showed similar cluster solutions ($\kappa = .80$)

3.2. Comparing clusters between the control and CORI groups

In addition to comparing two random halves of the sample, we also tested whether our cluster solution was equally applicable to students in the CORI and control groups before using the solution that collapsed the groups together. We first ran the two-step clustering procedures separately within each group and confirmed that a four-cluster solution was appropriate to describe each group, and that the final clusters explained at least 50% of the variance in each of the clustering variables within each group. Second, we visually inspected this data to verify that the nature of each cluster we observed looked similar across the two groups.

Last, we tested whether the frequency of membership in a particular cluster differed between groups (e.g., do the same proportion of students belong to each of the clusters within the CORI group compared to within the control group?). Overall, students' cluster membership did differ between the CORI and control groups, $\chi^2 = 8.14, p = .04$. To determine the extent of this difference, we conducted a two-sample Configural Frequency Analysis (Von Eye, 1990). This analysis allowed us to separately test whether the proportion of students in *each* cluster (1 through 4) significantly differed between the CORI versus control groups. We found that only the cluster defined by high undermining motivation (i.e., the low affirming - high undermining cluster, see below) showed significant differences between the CORI and control groups. Approximately 14 fewer CORI students than expected and 14 more control group students than expected belonged to this cluster. Because this was a small number of students relative to the total number of students in the cluster ($n = 218$), and because the other clusters did not differ as a function of CORI versus control group status, we decided it was appropriate to conduct the rest

of our analysis on the whole sample. However, we tested for an interaction between CORI or control group membership and cluster membership when predicting each achievement outcome to further ensure that results could be generalized between the two groups.

3.3. Research question 1: Description of the final clusters

The means of each motivational variable within each cluster are presented in Table 3 and Figure 1. In order to characterize the four-cluster solution, we examined mean raw scores and standardized z-scores for each motivational variable. Raw scores provide a sense of students' levels of motivational variables *relative to the response scale*. A student can have a much higher value of a construct than his peers yet report a level of the construct that is objectively moderate. Thus raw scores are needed to interpret the extent to which students endorsed different items measuring each construct (Moeller, 2015; Moeller, Keiner, & Grassinger, 2015). On the other hand, items assessing one construct might be worded in a different or more extreme way than items assessing another. This makes raw scores incomplete indicators of differences between students in different clusters (Moeller, Keiner, & Grassinger, 2015). We thus also used z-scores to provide complementary information regarding students' levels of the different affirming and undermining motivations *relative to other students*.

Two clusters contained students with patterns that represented high levels of affirming or high levels of undermining motivation. Students in the *high affirming - low undermining* cluster ($n = 348$) had high self-efficacy for reading, and low perceived difficulty, as well as high value of reading and low devalue. The z-scores for efficacy ($z = 0.62$) and value ($z = 0.92$) were high and positive, suggesting higher levels of these motivations than other students. The z-scores for devalue ($z = -1.06$) and difficulty ($z = -0.69$) were low, suggesting lower levels of these motivations than other students. By contrast, students in the *low affirming - high undermining*

cluster ($n = 218$) reported low self-efficacy for reading, and high perceived difficulty, as well as low value of reading and high devalue. This cluster had low z-scores for self-efficacy ($z = -1.16$) and value ($z = -1.19$), and high z-scores for difficulty ($z = 0.99$) and devalue ($z = 1.10$). This suggests higher undermining and lower affirming motivation relative to the other students.

Students in the third cluster had very different levels of self-efficacy from value, and of perceived task difficulty from devalue. Students in the *high efficacy and devalue* cluster ($n = 233$) had high self-efficacy for reading information texts and low perceived difficulty of reading. These students also had low value of reading and high devalue. The z scores for all four variables suggested that these students' self-efficacy ($z = 0.62$) was higher than other students but their value ($z = -0.55$) was lower, and difficulty was lower ($z = -0.78$) but devalue was higher ($z = 0.63$). As in the other clusters all four motivational variables are important within this group, but we label it with the two variables that most differentiate it from the other clusters.

The *moderate* cluster ($n = 335$), as the name suggests, had moderate levels of all four motivational variables. However it is important to note that the z-scores for these moderate responses represented relatively higher or lower levels of different motivations compared to the rest of the sample. In particular, these students reported average levels of devalue ($z = -0.04$), but they showed higher value ($z = 0.18$) and perceived difficulty ($z = 0.61$) relative to the other students in the sample. They also had lower self-efficacy than did other students ($z = -0.30$). Although the patterns in this cluster do not represent very high or low levels of motivation, students in this cluster experienced somewhat higher perceived difficulty, somewhat higher value, and somewhat lower self-efficacy than the students in the other clusters.

3.4. Research questions 2 and 3: Are there gender or ethnic differences in cluster membership?

To evaluate Research Questions 2 and 3, we tested whether female versus male students or African American versus European American students were disproportionately likely to belong to a particular cluster. Using crosstabs, we found that cluster membership did not differ as a function of gender, but it did differ as a function of ethnicity, $\chi^2 = 19.53, p < .001$. To address this difference further, we conducted a two-sample configural frequency analyses (Von Eye, 1990; see above for details) with African American and European American students as the samples. We found that the high efficacy and devalue, moderate, and low affirming - high undermining clusters all significantly varied with respect to ethnic makeup. There were approximately seven fewer African American students than expected in the high efficacy and devalue cluster (total $n = 335$), 15 fewer than expected in the low affirming - high undermining cluster (total $n = 218$), and 14 more than expected in the moderate cluster (total $n = 335$).

We next explored whether the observed ethnic differences were similar for students in both high- and low-SES groups by re-running the analyses of ethnicity x cluster separately within the high-SES and low-SES groups. We considered students of any ethnicity who were eligible to receive free or reduced price lunch to be in the low-SES group ($n = 260$), and students of any ethnicity who were not eligible to be in the high-SES group ($n = 857$). Among the low-SES students, there was a significant overall ethnic difference, $\chi^2 = 18.30, p < .001$. A follow-up configural frequency analysis demonstrated that approximately 10 more African American students than expected were in the moderate cluster (n for this cluster among low-SES students = 87), and approximately 13 fewer African American students than expected were in the low affirming - high undermining cluster (n for this cluster among low-SES students = 53). Cluster membership did not differ by ethnicity for high-SES students.

We also tested whether there were overall mean differences in each of the four clustering *variables* as a function of ethnicity or gender. The female students had higher mean levels of task value than did the males $t(1142) = 3.17, p = .002, d = 0.19$, and higher mean levels of perceived difficulty, $t(1146) = 2.16, p = .03, d = 0.13$. They did not differ from male students in their mean levels of self-efficacy or devalue. For ethnicity, African American students had higher value, $t(1114) = 5.02, p < .001, d = 0.38$, and lower devalue, $t(1110) = -4.73, p < .001, d = 0.36$, than European American students.

3.5. Research question 4: Does cluster membership predict reading outcomes?

We next tested whether cluster membership predicted the three different information text achievement outcomes (see Figure 2). We used one-way analysis of covariance (ANCOVA) with cluster membership as the main predictor and each outcome as the dependent variable, controlling for students' 2009 MSA scores (standardized), gender (dummy coded: male = 0; female = 1), ethnicity (dummy coded: European American = 0; African American = 1), and intervention group membership (dummy coded: CORI = 0; Control = 1), in all analyses. Before running our models, we tested for the interaction of cluster membership with gender, ethnicity, and CORI versus control group membership. We conducted a separate set of analyses for each potential interaction and each outcome, controlling for the other variables. None of these interactions were significant, so we included these variables only as covariates in the final analyses.

Students were nested within teachers in our sample, so in addition to the results reported here, we also evaluated the relationship between cluster membership and reading outcomes using multiple regression models that accounted for this complex sampling design. We utilized a robust standard error estimation approach to evaluate these models in MPlus (i.e., "type =

complex”). We regressed each outcome variable on the predictor of cluster membership (dummy coded using three terms with the low affirming - high undermining cluster as a reference group), using the same covariates as used in the models reported here. The results showed the same pattern of findings as what are reported below.

3.5.1. Science information text comprehension (ITC)

Students’ ITC scores differed overall by cluster, as shown in Figure 2, $F(3, 942) = 11.36$, $p < .001$, $\eta^2_p = .04$; we used pairwise comparisons (with a Bonferroni adjustment for multiple comparisons) to determine which differences were significant. Students in the high affirming - low undermining and high efficacy and devalue clusters had equally high ITC scores. Students in these two clusters also had significantly higher ITC scores than did students in the low affirming - high undermining clusters, Cohen’s d ’s = 0.55 and 0.84, respectively (for all differences, $p < .002$). They also had higher scores than students in the moderate cluster, Cohen’s d ’s = 0.48 and 0.73, respectively (for all differences, $p < .002$). Students in the moderate and low affirming - high undermining two groups did not differ in reported dedication.

There were also main effects of the covariates included in the model. European American students earned higher ITC scores than did African American students, $F(1, 942) = 17.72$, $p < .001$, $\eta^2_p = .02$, as did male students, $F(1, 942) = 17.11$, $p < .001$, $\eta^2_p = .02$, and students with higher MSA 2009 scores, $F(1, 942) = 685.27$, $p < .001$, $\eta^2_p = .42$. There was no main effect of intervention condition.

3.5.2. 2010 and 2011 language arts grades

Students’ 2010 language arts grades differed as a function of cluster membership, as shown in Figure 2, $F(3, 977) = 4.11$, $p = .01$, $\eta^2_p = .01$. Pairwise comparisons (using a Bonferroni adjustment for multiple comparisons) revealed that students in the high affirming - low

undermining cluster earned grades that were significantly higher than students in the low affirming - high undermining cluster, Cohen's $d = 0.48$. These groups represented students who had the highest and the lowest grades, respectively. Students in the high efficacy and devalue cluster earned the second highest grades, and students in the moderate cluster earned the third highest, but the grades of these two groups did not differ significantly from any of the other clusters.

Again, there were effects of the covariates in the model. Students with higher MSA 2009 scores earned higher grades in 2010, $F(1, 977) = 105.57, p < .001, \eta^2_p = .10$, as did female students, $F(1, 977) = 52.97, p < .001, \eta^2_p = .05$, and CORI students, $F(1, 977) = 22.115, p < .001, \eta^2_p = .02$. There was no main effect of ethnicity.

Students' 2011 language arts grades also differed by cluster membership, $F(3, 919) = 5.69, p = .001, \eta^2_p = .02$. Students in the high affirming - low undermining, high efficacy and devalue, and moderate clusters had grades that did not differ significantly from one another. All these students' grades were similar to their grades in 2010, and all were marginally or significantly higher than the grades of students in the low affirming - high undermining cluster, Cohen's d 's = 0.58, 0.51, and 0.21, respectively. Students' grades in the low affirming - high undermining cluster appeared to decrease between 2010 and 2011.

European American students, $F(1, 919) = 3.851, p = .05, \eta^2_p = .004$, students with higher previous achievement, $F(1, 919) = 139.54, p < .001, \eta^2_p = .13$, CORI students, $F(1, 919) = 55.08, p < .001, \eta^2_p = .06$, and female students, $F(1, 919) = 18.32, p < .001, \eta^2_p = .02$, all earned significantly higher grades.

3.5.3. Dedication to reading information texts

Students' dedication to reading information texts differed as a function of cluster membership, as shown in Figure 2, $F(3, 934) = 106.61, p < .001, \eta^2_p = .26$. Pairwise comparisons (using a Bonferroni adjustment for multiple comparisons) determined that all groups differed from one another ($p < .001$). Students in the high affirming - low undermining cluster had significantly higher dedication relative to each group. Cohen's d 's were as follows: 0.65 for this group and the moderate cluster, 1.03 when compared to the high efficacy and devalue cluster, and 1.69 when compared to the low affirming - high undermining cluster. Students in the moderate cluster had the second highest dedication scores and their scores were significantly higher than those in the high efficacy and devalue cluster, $d = 0.41$, and the low affirming - high undermining cluster, $d = 1.04$. Students in the high efficacy and devalue cluster were next, and their dedication was significantly higher than that of students in the low affirming - high undermining cluster, $d = 0.58$; this latter group was lowest in dedication overall.

Females had higher dedication scores than males, $F(1, 934) = 17.69, p < .001, \eta^2_p = .02$, and CORI students had higher dedication scores than control group students, $F(1, 934) = 45.32, p < .001, \eta^2_p = .05$. Dedication did not vary by ethnicity or previous achievement.

3.5. Research question 5: Does dedication mediate the relationship between cluster membership and language arts grades one year later?

We tested whether dedication to reading in 2010 mediated the relations between cluster membership and 2011 grades. As noted above, we ran this analysis in order to test whether having higher dedication would help students with some patterns of motivation to earn higher grades over time. The cluster membership variable which was our predictor in this analysis was multi-categorical (and not continuous). Thus we first dummy-coded this variable into three separate predictor terms, which represented each cluster versus a reference group. The low

affirming - high undermining cluster served as the reference group in this case, because students in this cluster showed the lowest levels of dedication to reading. We estimated whether dedication served as a mediator separately for each cluster as compared to the reference cluster (see Hayes & Preacher, 2014, for details of this analysis). A depiction of the mediation model we tested can be found in Figure 3.

We utilized the *MEDIATE* macro in SPSS version 23 to run our mediation analysis (see Hayes & Preacher, 2014). *MEDIATE* uses regression to model the effects of membership in each cluster versus the reference cluster: (a) directly on the outcome variable (2011 grades), (b) directly on the mediating variable (dedication), and (c) indirectly on the outcome variable via the mediating variable. All estimates are based on a bootstrapping procedure with 1000 bootstrap resamples. Compared to tests that assume a normal distribution of indirect effects (e.g., the Sobel test), bootstrap methods can be a more accurate means of assessing mediation (see Shrout & Bolger, 2002). The output of this procedure includes a 95% confidence interval for each estimate, which can be used to test significance.

The confidence intervals that we obtained for the indirect effect of mediation did not include zero, for all three clusters compared to the reference group cluster [for high affirming - low undermining, C. I. = (.12, .35), $M = .23$; for high efficacy and devalue, C. I. = (.05, .16), $M = .10$; for moderate, C. I. = (.08, .23), $M = .15$]. This suggests that all of the indirect effects in question could be considered significant at $p < .05$ (Shrout & Bolger, 2002). Therefore dedication can be considered to mediate the relationship between membership in each cluster (compared to membership in the low affirming - high undermining cluster) and students' 2011 grades.

4. Discussion

The present study extends existing research on adolescent students' reading motivation in important ways by showing that students have different patterns of affirming and undermining motivations regarding their school information text reading. Furthermore, students having different patterns varied in their reading outcomes, a finding that has important implications for understanding which students will be more likely to achieve well in courses that incorporate much information text reading. Below we discuss results for each research question in turn and consider implications of our results for the two major theories guiding the study.

To address Research Question 1, we examined whether meaningful patterns of students' affirming and undermining motivations for information text reading could be identified. We found four distinct patterns that contained relatively equal numbers of students, described as follows: (a) high affirming and low undermining motivation; (b) low affirming and high undermining motivation; (c) high self-efficacy and low perceived difficulty but also high devalue and low value; and (d) moderate levels of all four constructs. These results build on variable-centered work by showing that not only are there mean-level differences in students' affirming and undermining motivations for information text reading, but there are also clearly identifiable patterns in them. Some of the patterns tie closely to what we know from variable-centered research in expectancy-value theory and social cognitive theory; other patterns provide insights into the nature of students' motivation for information text reading that are not often discussed in these theoretical models.

The high affirming - low undermining and low affirming - high undermining patterns are consistent with previous variable-centered expectancy-value and social cognitive theory-based research on students' self-efficacy and task value in reading. That research showed that some children have high mean levels of these affirming motivations, whereas others have low levels,

and that in general competence-related beliefs and value relate positively to each other (e.g., Baker & Wigfield, 1999; Jacobs et al., 2002; Wigfield et al., 1997; Wigfield & Guthrie, 1997). These patterns also are similar to those of other person-centered studies in different achievement domains showing that some children have overall high patterns in their levels of different affirming motivations, and others have overall lower patterns (Conley, 2012; Dennissen, Zarrett, & Eccles, 2007; Linnenbrink-Garcia et al., 2012; Simpkins & Davis-Kean, 2005).

By including undermining motivations, we were able to obtain a fuller understanding of the nature of students' motivation within these two patterns and the other two that we discuss next. As we discuss later, students with the high affirming - low undermining pattern had the most positive reading outcomes in this study, and students with the low affirming - high undermining pattern showed the most negative. Students with the high affirming - low undermining pattern not only showed high self-efficacy and valued information text reading highly, but they also had low levels of avoidance of these texts and so were free of some potentially influential barriers to their learning. Students with the low affirming - high undermining pattern, in contrast, were not just low in self-efficacy and value, but they also actively avoided reading information texts because they found them to be difficult and strongly devalued them; this seemed to hinder their ability to engage with the texts. Undermining motivations have been studied in self-determination theory in the form of amotivation (Ryan & Deci, 2000), and in goal orientation theory in the form of avoidance goals (Senko, Hulleman, & Harackiewicz, 2011), but few researchers have referenced these constructs in expectancy-value or social cognitive theory. More theorists working within these theories should consider ways to include undermining constructs in their models.

A novel contribution of this study concerns the other two patterns we identified. Students with the high efficacy and devalue pattern believed they were capable of reading information texts and perceived them to be easy, but valued them relatively little and in fact strongly devalued them. We believe that this group emerged in our study in large part because of the particular kind of reading we studied. As noted in the introduction, middle school students often perceive the information text reading they do in school to be boring, difficult, and irrelevant to their everyday lives (Alvermann, 2001, 2002; Guthrie, Klauda, & Morrison, 2012). Thus even very competent students might fail to perceive information texts as valuable. The mostly variable-centered research within expectancy-value and social cognitive theories, which has not often examined undermining motivations, generally reports that students' competence-related beliefs and value relate positively to one another (Eccles & Wigfield, 1995; Jacobs et al., 2002; Marsh, Trautwein, Ludtke, Koller, & Baumert, 2005). Our results show although there are positive overall relationships between these constructs, it is possible for many students to show high levels of self-efficacy beliefs/ low perceived difficulty along with low value/high devalue for this particular kind of reading.

The fourth cluster of students had moderate levels of all four constructs. Interestingly, however, the average z-scores for the constructs within this cluster demonstrated that these students exhibited somewhat higher perceived difficulty and lower self-efficacy, and somewhat higher value, relative to students in other clusters. Thus this group's levels of self-efficacy differed from their levels of value, and difficulty differed from devalue, to a degree. As we discuss below, this pattern of motivation could have negative consequences. This pattern might have emerged because at least some students with somewhat low competence-related beliefs are aware of the importance of information texts to their future (Eccles & Wigfield, 1995). However,

previous research suggests that students who value tasks at which they do not feel competent are at risk for lower self-esteem (Harter, 1990; Covington, 1992). Over time they sometimes deal with this threat by lowering the value they ascribe to a particular academic domain, so that their competence-related beliefs and task value grow closer together (Eccles & Wigfield, 2002).

It is important to note that other researchers doing person-centered studies of students' motivation either did not find students with these latter two patterns of competence-related beliefs and value, or they found similar patterns but for only a small proportion of students (Baker & Wigfield, 1999; Conley 2012, Simpkins & Davis-Kean, 2005). We likely found more students with these patterns because as discussed above, students overall receive little instructional support for their information text reading in subjects like science, so they may be likely to report negative perceptions of it. Also, our study is unique in including both affirming and undermining motivations, which could further explain the different patterns we observed.

4.1. Differences in patterns of motivation by gender and ethnicity

Research Question 2 concerned possible gender differences in patterns of motivation. We found that female students showed higher overall value and perceived difficulty than did males. However, males and females were equally represented across all four patterns, including the moderate pattern. Thus women did not more often have a pattern in which they perceived *both* high difficulty and high value of reading.

Why might we find mean level differences by gender but not differences in students' patterns of value and perceived difficulty? One potential explanation is that researchers conducting variable-centered studies grounded in expectancy-value and social cognitive theories typically report that girls have higher competence-related beliefs and task value than their male counterparts for reading and other literacy activities (Pajares & Valiente, 2001; Wigfield et al.,

1997). However, many girls perceive science to be more difficult than do males (Nagengast et al, 2016). Information text reading combines elements from both reading and the discipline in which that reading is based (e.g., science), so it is possible that some female students perceive information text reading to be like science and thus show higher perceived difficulty than men do. Different female students might perceive it to be more like other kinds of reading and thus value it more than male students do. The patterns were not based only on students' motivation for science information text reading, so it is difficult to draw definitive conclusions on this point.

In our analyses to address Research Question 3 concerning ethnic differences in patterns of motivation, we found that African American students were disproportionately more likely than European American students to have the moderate pattern, and disproportionately less likely to have the high efficacy and devalue and low affirming - high undermining patterns. When we re-ran this analysis separately within high- and low-SES groups, it seemed that these ethnic differences were driven by differences among lower-SES students.

Our findings match some variable-centered work done by researchers using this dataset and others, who have found that African American students report higher task value for reading (Baker & Wigfield, 1999; Guthrie, Wigfield, & Klauda, 2012; McKenna, Kear, & Ellsworth, 1995) even though they often achieve less well in reading. Some researchers have suggested that African American parents strongly value education, emphasizing it as a path to social mobility and academic success; perhaps these parents transmit high overall value of school to their children (Eccles, Wong, & Peck, 2006; Mickleson, 1990; Wentzel, 1998). This may be particularly true in low-SES families, for whom social mobility is quite important. However, in general our results contradict findings by other researchers, who have argued that both low- and

high-SES African American students are likely to value school *less* than do European American students, for various reasons (Osborne, 1997; see Murdock, 2009 for review of this work).

What explains the different findings in this study and the others? Our focus on motivation for reading information texts is one possibility; other studies have focused on other types of reading motivation, or on motivation more generally. Perhaps in certain domains low-SES African American students report higher task value and lower devalue, but in other domains they show lower task value and higher devalue. However, we do not have a definitive explanation for why our results differ from prior work. As Graham (1994) discussed, there is much within group variation in African American students' motivation that needs to be explored. We encourage future researchers studying African American's students' motivation in reading and other areas to explore this variation more fully, in order to build on the results reported here. Given that some of the findings are counterintuitive with respect to relations of motivation and achievement, qualitative research exploring the nature of motivation in low- and high-SES African American students could be especially informative.

4.2. Relationship of patterns of motivation with information text reading outcomes

Turning to Research Question 4, we found that the clusters varied in the different reading outcomes we assessed. For ITC, students with the high affirming - low undermining and high efficacy and devalue patterns had equally high comprehension scores, whereas those with the other patterns had equally low scores. Previous research has shown that students' competence-related beliefs including their self-efficacy are the strongest predictors of reading achievement even when accounting for value (e.g., Durik et al., 2006; Trautwein et al., 2012; see Schunk & Pajares, 2009, and Wigfield et al., 2016, for review). Our findings support these conclusions and

extend them to demonstrate that students with *patterns* that include high self-efficacy and low perceived difficulty of reading have higher ITC scores.

One unexpected finding is that students with the low affirming - high undermining pattern had the same ITC scores as students with the moderate pattern. As noted above, researchers taking variable-centered approaches within expectancy-value and social cognitive theories have found that students with higher self-efficacy and/or lower perceived difficulty achieve better. Our findings suggest that these general relations may not apply to all students. Students with the moderate pattern did not report particularly strong motivation towards or away from reading. Perhaps in the absence of strong motivation regarding the ITC assessment, which was not graded, students did not engage with it and thus did not earn higher scores than did students with the low affirming - high undermining pattern. Previous research has not examined this issue, so we encourage researchers to explore it further.

For students' 2010 and 2011 Language Arts grades, students with the high affirming - low undermining pattern had higher grades than students with the low affirming - high undermining pattern. This result also occurred for ITC scores and corresponds to findings from variable-centered research suggesting that higher levels of affirming motivational constructs predict better performance than lower ones, or undermining ones (Guthrie, Wigfield, & Klauda, 2012; Schunk & Pajares, 2009; Wigfield et al., 2016). Again, our work extends those findings by suggesting that students with a *pattern* including higher levels of both affirming constructs and lower levels of both undermining constructs earn higher grades.

Students with the high efficacy and devalue pattern had the same grades as students with the moderate pattern in 2010 and 2011. In 2010 these students' grades fell in between the other patterns. In 2011, these students' grades were higher than those of the low affirming - high

undermining pattern and equal to those of the high affirming - low undermining pattern. These results differ from those observed for ITC, for which students with the high efficacy and devalue pattern earned higher scores. One explanation is that ITC scores were focused on science information text reading, whereas language arts grades were based on multiple disciplines of information text reading. As noted above, science information text reading may be particularly challenging and thus it may be more difficult for students to excel at it. Another possibility is that language arts grades are based on exam scores, which require high ability to comprehend information texts, and on homework and assignment scores, which require high dedication to reading. As we discuss below, students with the moderate pattern show relatively high dedication to reading information texts. It is possible that these students earned high grades because they were more likely to complete reading assignments and choose to engage in reading. Students with the high efficacy and devalue pattern likely earned high grades because they had high information text comprehension and performed well on the tests and assignments that they did complete.

Finally, concerning students' reported dedication to reading, students with the high affirming - low undermining pattern reported higher dedication to reading information texts than did those with the low affirming - high undermining pattern. These results are consistent with other expectancy-value and social cognitive theory based studies using variable- and person-centered analyses, which have shown that students with more positive competence-related beliefs and value are more dedicated and engaged in their learning activities (Durik et al., 2006; Guthrie & Wigfield, 2000; Guthrie, Wigfield, & You, 2012; Skinner et al., 2009). They also match what we found for students' grades and ITC scores.

Students with the other patterns scored in between the other two groups with respect to their dedication, but students with the moderate pattern reported higher dedication than students with the high efficacy and devalue pattern. Expectancy-value and social cognitive theory-based researchers doing variable-centered studies have found that students' value and self-efficacy both predict their engagement with reading, but value predicts it more strongly (e.g., Durik et al., 2006). Our results extend that work by suggesting that students who have *patterns* including high value/low devalue, and to a lesser extent high efficacy/low difficulty, reported higher dedication. Why might this have occurred? As discussed earlier, students with the high efficacy and devalue pattern are efficacious about their reading, but given their sense it is not useful they may not be dedicated to reading. In contrast, students with the moderate pattern report more value for reading than students with the efficacy and devalue pattern, so they may better see why they should engage in information text reading activities. It is important to note that students self-reported their dedication to reading. Researchers should assess dedication and reading engagement in other ways, such as teacher ratings, to see if the findings correspond to ours.

To answer Research Question 5, we assessed whether students' dedication to reading mediated the relationship between their patterns of affirming and undermining motivations and their later grades. Students with the high affirming - low undermining, moderate, and high efficacy and devalue patterns had grades that increased one year later relative to those with the low affirming - high undermining pattern. Results of the mediation analyses showed that students' dedication to reading indeed did mediate the relationships between having each of these three patterns (compared to having the low affirming - high undermining pattern) and students' later grades. This finding of mediation supports variable-centered research suggesting that when students are more highly engaged they achieve better later in school (Durik et al.,

2006; see Guthrie & Wigfield, 2000 for review). It extends that work to show that certain groups of students have patterns of motivation that predict higher dedication, and those students are poised to earn higher grades later in school as a result.

4.3. Theoretical and educational implications

As discussed throughout the preceding sections, our findings support and extend existing variable and person-centered research based in expectancy-value and social-cognitive theories by demonstrating that students have distinct patterns of affirming and undermining motivations which relate differently to their reading outcomes, that many students have patterns which include mismatches between their levels of self-efficacy and value or between difficulty and devalue, and that students' affirming and undermining motivations both contribute to these patterns. Most expectancy-value theorists and researchers have not discussed or studied the interplay of multiple motivational variables contained in this theoretical framework. The same is true for research based in social cognitive theory, as Bandura (1997) and others primarily have studied the single construct of self-efficacy and its relations to outcomes.

Beyond the points described above, we encourage researchers working in both theoretical traditions to explore the implications of our findings and findings of other person-centered research for their theoretical models in two additional ways (see also Roeser & Peck, 2003). First, expectancy-value and social cognitive theorists and researchers typically describe overall relationships among the central constructs in their frameworks. Person-centered researchers can examine whether these overall relationships hold true for all students in a given sample, who might start with different patterns of affirming and undermining motivations. For example, findings from variable-centered research suggest that self-efficacy relates positively to students' reading achievement, and difficulty relates negatively (e.g., Guthrie et al., 2013). We found that

students with patterns including high self-efficacy and low perceived difficulty earned higher ITC scores. However, students with the moderate pattern did not have higher ITC scores than students with the low affirming - high undermining pattern, despite having higher self-efficacy/ lower difficulty. By testing relationships for students with different patterns, researchers can add nuance to existing models focused on overall relations and improve their predictive power.

Second, social-cognitive and expectancy-value theorists are interested in studying the antecedents and consequences of motivation. Researchers taking a person-centered approach can explore the antecedents and consequences of particular *patterns* of affirming and undermining motivations. For example, it would be interesting to see how the parent and teacher beliefs included as antecedents of students' competence-related beliefs and value in expectancy-value theory predict whether students with low value/ high devalue for information text reading will show the low affirming - high undermining or the high efficacy and devalue pattern.

Our findings also have implications for educational practice by demonstrating what patterns of affirming and undermining motivations are typical for middle school students as they read information texts. Notably, nearly three-quarters of students had patterns that might cause somewhat negative consequences for their information text reading outcomes. Students with a low affirming - high undermining pattern may be likely to perform poorly on many different outcomes. Students with a high efficacy - high devalue pattern may do well on initial achievement outcomes, but they could risk poorer performance over time. Because they have somewhat lower dedication to reading, these students might eventually choose to take fewer advanced courses in which information text reading is prevalent or engage less with their coursework, hindering their achievement. Finally, students with the moderate pattern have high dedication to reading information texts that can promote long-term positive effects including

better grades over time; however these students may show low initial reading comprehension. This finding is somewhat troubling, because it suggests that many students might experience barriers to optimal achievement if they are enrolled in courses that require a large amount of information text reading.

4.4. Recommendations for future research and conclusion

We encourage future researchers to explore patterns of these four affirming and undermining motivations in other academic domains. They can determine whether fewer students show inconsistent patterns of motivation in domains that they generally view more favorably (e.g., narrative text reading). Also, we explored only four motivational constructs in our analyses. We encourage researchers to incorporate other affirming and undermining motivations in future studies using person-centered analyses. Finally, students' motivation for *school* information texts was measured in this study, but *science* information text comprehension and students' grades in *language arts* were measured. We assume that students have a general perception of information text reading that extends across multiple disciplines, for the reasons we outlined in the Introduction. These measures were reliable and related in interesting ways to the outcomes we obtained. However, it is possible that students also have discipline-specific perceptions of information text reading motivation that differentially affected their outcomes. In the future researchers may want to measure motivation more specifically with respect to the type of information texts students are reading.

In conclusion, we found four identifiable patterns in students' value, devalue, self-efficacy, and perceived difficulty for reading information texts. The nature of these patterns and their relationships with achievement help inform research conducted within expectancy-value theory, by adding nuance the overall trends that variable-centered research reports. Furthermore,

by understanding which patterns exist and how they relate to different outcomes, teachers can be better informed about the diversity of motivational experiences that students seem to have as they read information texts. Finally, our results suggest that low-SES students show differences by ethnicity in terms of which patterns they hold. These findings can help inform how to support best the motivation and achievement of different students as they read these texts.

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Table 1.

Variable Descriptive Statistics and Intercorrelations

	Mean	SD	N	1.	2.	3.	4.	5.	6.	7.	8.
1. 2009 MSA Reading	417.03	32.33	1051								
2. 4 th Quarter Reading Grades (2009)	3.89	1.17	1180	.39**							
3. 4 th Quarter Reading Grades (2010)	3.81	1.10	1099	.46**	.51**						
4. Dedication (June)	2.87	0.65	1116	.11**	.23**	.21**					
5. ITC (June)	15.95	4.74	1132	.70**	.35**	.40**	.10**				
6. Self-Efficacy (April)	2.90	0.56	1147	.31**	.20**	.22**	.35**	.33**			
7. Perceived Difficulty (April)	2.21	0.65	1148	-.31**	-.19**	-.21**	-.27**	-.34**	-.70**		
8. Value (April)	2.66	0.65	1144	.02	.11**	.12**	.59**	.02	.41**	-.27**	
9. Devalue (April)	2.57	0.73	1140	.003	-.11**	-.09**	-.51**	-.02	-.30**	.34**	-.73**

** $p < .01$

Table 2.

Cluster Fusion Coefficients

Number of Clusters	Fusion Coefficient
2	1904.441
3	1192.71
4	1002.03
5	885.82
6	776.78
7	704.22
8	632.28

Table 3.

Mean Scores for Clusters

		1. High Affirming - Low Undermining		2. Low Affirming - High Undermining		3. High Efficacy and Devalue		4. Moderate	
		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
Self-Efficacy	<i>Raw Score</i>	3.25	0.39	2.24	0.48	3.25	0.37	2.73	0.39
	<i>Z-Score</i>	0.62	0.69	-1.16	0.85	0.62	0.66	-0.30	0.68
Perceived Difficulty	<i>Raw Score</i>	1.77	0.44	2.86	0.48	1.71	0.37	2.61	0.40
	<i>Z-Score</i>	-0.69	0.68	0.99	0.74	-0.78	0.57	0.61	0.61
Value	<i>Raw Score</i>	3.26	0.37	1.90	0.44	2.31	0.41	2.78	0.41
	<i>Z-Score</i>	0.92	0.57	-1.19	0.67	-0.55	0.64	0.18	0.63
Devalue	<i>Raw Score</i>	1.80	0.42	3.37	0.40	3.04	0.47	2.55	0.41
	<i>Z-score</i>	-1.06	0.57	1.10	0.54	0.63	0.65	-0.04	0.57

Figure 1. Mean Scores for Clusters

Figure 2. Achievement Differences by Clusters. Scores shown are adjusted means, and error bars reflect ± 2 SE of each mean.

Figure 3. Depiction of Mediation Model Used to Test Research Question 5