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Motivation and Achievement of Middle School Mathematics Students

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Mathematics achievement among K-12 students has been a long-standing concern in schools across the United States. A possible solution to this mathematics achievement problem is student motivation. A survey was administered to 65 mathematics students at a Midwestern middle school to determine their beliefs and attitudes related to motivation and mathematics achievement. Significant positive correlations were found between internal motivation and self-reported mathematics grades, self-reported grades and enjoyment, self-reported grades and confidence, and self-reported grades and parental involvement. Independent t-tests between high- and low-achieving students found significant differences in beliefs regarding intrinsic motivation, extrinsic motivation, mathematics value, mathematics enjoyment, mathematics confidence, parental involvement, and parental intrinsic motivation. There were no statistically significant gender differences in achievement or attitudes towards mathematics.

Mathematics achievement among K-12 students has been a long-standing concern in schools across the United States. No Child Left Behind (NCLB) legislation, the more recent Common Core State Standards (CCSS) movement (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010), and Race to the Top placed an increased emphasis on mathematics achievement. However, many schools

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failed to meet Adequate Yearly Progress (AYP) as noted in a press release from the U.S. Department of Education (2011), which estimated 82% of schools would not meet AYP. Students from other countries have also out-performed U.S. students on international mathematics tests such as the Trends in International Mathematics and Science Study (TIMSS). In 2011, students from eight countries outperformed U.S. students with several countries' average scores over 100 points above the U.S. average (Mullis, Martin, Foy, & Arora, 2012). In addition, there was no significant increase in eighth grade mathematics scores of U.S. students in TIMSS from 2007 to 2011. Concerns about low participation, persistence rates, and rates of remediation needed for college-level mathematics were a central impetus for the development of the CCSS for mathematics (U.S. Department of Education, n.d.), acknowledging that too many students are entering college and careers without the necessary mathematics knowledge and skills to be successful and competitive.

A possible solution to this mathematics achievement problem is student motivation. Multiple studies have established a direct relationship between motivation and general academic achievement, but there is a gap in the research for middle-level students. Moreover, Dembo and Eaton (2000) established the middle-level grades as a critical point in the trajectory toward mathematics learning and beliefs about ability. Once a trajectory is set, it is unlikely to be altered, making middle level an important point of focus in research on mathematics achievement and motivation. This study used survey research to investigate the possible factors, differences, and relationships regarding the motivation of middle-level students and their mathematics achievement.

Review of Relevant Research

The Relationship between Motivation and Achievement

Motivation influences achievement (e.g., Ahmed, Minnaert, Van der Werf, & Kuyper, 2010; Cleary & Chen, 2009; Reynolds, 1991; Shores & Shannon, 2007; Steinmayr & Spinath, 2009; Woolley, Strutchens, Gilbert, & Martin, 2010).

In addition, Middleton and Spanias (1999) described various theoretical perspectives on the nature and role of motivation in school mathematics that ranged from behavioral through attribution and learned helplessness to more sophisticated goal and personal-construct theories. In particular, these authors found that students' perceptions of their success in mathematics shaped their motivational attitudes. Furthermore, the students' motivational attitudes developed early and remained stable over time. However, Middleton and Spanias noted that teachers can affect student achievement motivation through careful instructional design shaped by an understanding of existing inequities in mathematics education.

Extrinsic and Intrinsic Motivation

Although there are many different types of motivation, for this study we focused specifically on extrinsic and intrinsic motivation as defined by Pintrich, Smith, Garcia, and McKeachie (1991). They defined the concepts of intrinsic and extrinsic motivation to anchor the constructs in their development of the Motivated Strategies for Learning Questionnaire (MSLQ). Intrinsic goal orientation is the "degree to which the student perceives herself to be participating in a task for reasons such as challenge, curiosity, mastery" (Pintrich et al., 1991, p. 9). Meaning, students who are intrinsically motivated participate for the sake of learning instead of to obtain some other goal. Pintrich et al. saw extrinsic goal orientation as complementary to intrinsic goal orientation. Students with this orientation see the task as a means to an end and complete the task "for reasons such as grades, rewards, performance, evaluation by others, and competition" (p. 10). For example, students who study for a test to get a good grade are extrinsically motived by the reward of a grade, while students who study for a test because they are personally challenged by the material or just enjoy it are intrinsically motivated.

Previous studies established that students' intrinsic motivation could be positively influenced through teacher instructional approach, placement in an appropriately challenging mathematics course, and programming that attends

to positive beliefs about mathematics. The way teachers design and implement learning experiences matters. Mueller, Yankelewitz, and Maher (2011) determined that discussing and defending mathematics solutions of open-ended problems can improve intrinsic motivation. Problem-based learning and themed curriculum units also promoted student intrinsic motivation (Cerezo, 2004; Henderson & Landesman, 1995; Selover, Dorn, Dorn, & Brazel, 2003). Similarly, hands-on, active learning activities have increased students' intrinsic motivation to learn in various classroom and extra-curricular settings (Barak & Asad, 2012; Grolnick, Farkaas, Sohmer, Michaels, & Valsiner, 2007; Nugent, Barker, Grandgenett, & Adamchuk, 2010). In addition, when students had choices for solving problems and received support and freedom to work, intrinsic motivation increased (Deci, Vallerand, Pelletier, & Ryan, 1991). In a small study with 22 middle level students, Middleton (1995) noted there was a balance between student choice and teachers identifying learning experiences that were appropriately challenging.

Course placement impacts motivation as well. Intrinsic motivation increased when students took challenging mathematics courses (Cleary & Chen, 2009), and when students accomplished a difficult task, belief in mathematics ability rose in turn increasing motivation for mathematics learning (Middleton, 1995). Wolters, Denton, York, and Francis (2013) also found differences among adolescents who struggled academically and those who did not, finding that those who did not struggle were more likely to be motivated intrinsically, demonstrating that students need an appropriate level of challenge. Lastly, students, especially females, who participated in a program designed to encourage positive beliefs about mathematics, had significantly higher mathematics scores and positive beliefs about mathematics than students who did not participate in the program (Falco, Crethar, & Bauman, 2008).

Extrinsic motivation is often viewed as less desirable than intrinsic motivation, but research shows that extrinsic motivation affects adolescent academic performance. Although reported less frequently than factors such as ability, practice, and instructional approach, students identified extrinsic motivation

as having a positive influence on their academic performance (Flammer & Schmid, 2003). Also of importance is how adolescents, especially early adolescents, are motivated differently than other age groups. Wolters et al. (2013) hypothesized that early adolescents probably identified extrinsic motivation as important because students in this age group strive to please those in authority such as teachers and parents, and they are likely to want to conform to social norms. In addition, competition, a type of extrinsic motivation, had a positive relationship with seventh grade students' reading proficiency (Paige, 2011), and may reasonably be a motivator in other learning situations as well.

Factors that Affect Motivation to Learn

Student motivation, particularly in mathematics, is a complex construct involving multiple variables (Plenty & Heubeck, 2011). Plenty and Heubeck established that perceptions differed across the variables of gender, families and parenting, teacher support, and whether or not a student was deemed low or high-achieving.

Studies regarding the role gender may play in student academic performance and student beliefs about mathematics are inconclusive and often contradictory. Several small-scale studies found that boys scored higher on mathematics tests than girls (Chiu & Xihua, 2008; Dever & Karabenick, 2011; Preckel, Goetz, Pekrun, & Kleine, 2008; Vermeer, Boekaerts, & Seegers, 2000). Notably, Preckel et al. (2008) also that found that despite boys having higher test scores, girls have the same or higher mathematics grades as boys (Preckel et al., 2008). However, some large-scale, national and international studies, including a TIMSS and a meta-analysis of several national exams, found both male and female students had similar achievement in the area of mathematics (Barak & Asad, 2012; Reynolds, 1991).

Large-scale studies conducted in classrooms in both the U.S. (Dever & Karabenick, 2011) and Germany (Preckel et al., 2008) found that females have less interest in the field of mathematics than boys, and less interest can inhibit intrinsic motivation. Furthermore, in a study of 158 sixth-grade students, boys had

more confidence in their ability to solve mathematics problems than girls (Vermeer et al., 2000). However, Orhun (2007) found that although Turkish male and female students had different learning styles, there were no significant differences between academic achievement and attitude towards mathematics, when students were compared by each specific learning style.

Family characteristics and structure influence academic achievement and intrinsic motivation in the area of mathematics. In a study of over 100,000 fifteen-year-olds in 41 countries, students from two-parent families, with no or few siblings, and with no grandparents living with them, tended to do better academically than other students without those characteristics (Chiu & Xihua, 2008). In addition, students whose parents had advanced levels of education were more likely to have higher achievement (Dever & Karabenick, 2011; Reynolds, 1991).

Like family characteristics and structure, parental participation, support, and encouragement play a vital role in student motivation and achievement (Ahmed et al., 2010; Deci et al., 1991; Reynolds, 1991; Usher, 2009). Bandura and Barbaranelli (1996) studied middle-level students in Rome and determined that parental beliefs regarding work ethic and their hope for their child's future positively promoted academic achievement in students. High school students in Los Angeles reported similar results (Fan, Williams, & Wolters, 2012). In fact, parents may be one of the strongest influences on mathematics achievement because parents can encourage student effort, goal creation, and beliefs (Chouinard, Karsenti, & Roy, 2007). Parenting style can also influence the development of children's motivation orientation (Bronstein, Ginsburg, & Herrara, 2005). Children who received rewards for their performance tended to have extrinsic motivation orientation; whereas, children who were supported in being autonomous, such as monitoring their own homework and completing it independently, were more likely to hold an intrinsic motivational orientation and receive higher grades. Although extrinsic motivation has been found to improve academic achievement in some contexts (Flammer & Schmid, 2003; Paige, 2011; Zhu & Leung, 2011), most studies, including those of McDonald, Ing, and Marcoulides (2010), and Chiu and Xihua (2008), have found

that extrinsic motivation does not improve mathematics achievement.

In addition to parents, teachers and teaching also influence student motivation toward learning. Flammer and Schmid (2003) interviewed 210 Swiss children, aged 5 to 14, and found that adolescents attributed teacher-controlled factors as influencing their academic success or failure. Teacher-controlled factors appeared to impact struggling students more than students who did not struggle (Dotterer & Lowe, 2011). Finally, a study of 1,021 seventh grade students found that students' perceptions of parent and teacher learning goals predicted their learning goals (Friedel, Cortina, Turner, & Midgley, 2007).

The characteristics and beliefs of students also play an important role in academic achievement and motivation of students. Student attitudes, beliefs, and social concerns can either help or hinder both participation and performance, particularly in discussion-based classrooms (Jansen, 2006). In a study of 42 students in an Algebra II class in an urban, private school, Jones and Byrnes (2006) found a significant positive correlation between achievement in mathematics and prior knowledge, homework completion, and self-regulation. Additional studies have revealed that high student interest or motivation in the area of mathematics produces high test scores and student achievement in various contexts (Ahmed et al., 2010; Shores & Shannon, 2007; Singh, Granville, & Dika, 2002; Steinmayr & Spinath, 2009; Woolley et al., 2010). Cleary and Chen (2009) conducted a study of 880 suburban middle school students in the Northeast United States and found a positive correlation between student interest, motivation, and mathematics achievement. Middle school students showed greater motivation and achievement when they believed their intelligence could be shaped by their effort than those who believed their intelligence could not change (Blackwell, Trzesniewski, & Dweck, 2007). Singh et al. (2002) reported student mathematics attitudes and student motivation had direct effects on eighth grade students' mathematics achievement.

Motivation and achievement have been the topics of many studies; however, few studies have focused on the motivation

and achievement of middle school mathematics students. For example, Middleton (1995, 1999) conducted studies in the 1990s about middle level student motivation to learn mathematics that need further study. Additional research is needed to explore variables that may influence motivation such as gender, for which previous research was contradictory. This study sought to answer the following questions: (a) How does academic achievement relate to intrinsic motivation of middle school mathematics students?, (b) How do middle school mathematics students' motivational attitudes differ between high-achieving and low-achieving students?, and (c) What factors influence middle school mathematics students' motivation to achieve?

Methods

Participants

This study took place at a Midwestern public middle school serving 903 students. Approximately 19% of the students who attended the school qualified for free- or reduced-cost lunch, 7% of the students qualified for special education services, and 5% were English language learners. Special education, gifted, and English language learner classes were not included in this study. A majority of the students from the sample were Caucasian, with minority populations of African American, Asian, Hispanic, and Native American students. Of the 175 students invited to participate, 65 students, with parental permission, consented to participate in the study. Students were categorized by typical academic achievement, with high achieving students defined as those who typically earn grades of A or B and low achieving students defined as typically earning grades of less than B. See Table 1 for student demographic information.

Table 1
Demographic Characteristics of Participants

Characteristic	*N*	%
Year in School		
Grade 6	14	22
Grade 7	20	31
Grade 8	31	47

Table 1

Gender			
	Male	33	51
	Female	32	49
Typical Earned Grades			
	High Achieving (A and B)	46	71
	Low Achieving (<B)	19	29

Instruments

The student survey used for this study was developed from four previously validated surveys including the Longitudinal Study of American Youth (LSAY; Miller, 2011); the What Is Happening in This Classroom (WIHIC; Fraser, Fisher, & McRobbie, 1996); the Attitude Toward Math Inventory (ATMI; Tapia & Marsh, 2004); and the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al., 1991). To address the complexity of studying academic motivation for mathematics in middle school students, scales were combined from each of the aforementioned surveys to create an instrument with 10 scales, targeting factors identified in the literature as influencing both intrinsic and extrinsic motivation. Table 2 shows the instrument, variables used, and sample items.

The LSAY measures academic growth and attitudes of students in grades 7 through 12 (Miller, 2011). The original survey listed different parental characteristics and students marked "true," "false," or "not sure" to indicate if their parents matched the given description or not. For this study, two additional levels were added to the continuum, making it a 5-point scale (strongly disagree, disagree, neutral, agree, and strongly agree) to match the other survey items and to provide a means to compare the data. For bi-polar scales, which measure both direction and intensity, the optimal number of response categories is either five or seven (Dillman, Smyth, & Christian, 2009). In addition, the items were well suited to a continuum as afforded by a scale, allowing students to indicate to what degree the statements were true. For example, students may experience items such as, "My parents expect me to do well in mathematics," at different levels or inconsistently, and the modified scale allowed students to indicate the degree to which

they agree or disagree rather than just "true" or "false." Questions related to parental intrinsic and extrinsic motivational strategies, as well as parental support, were drawn from this survey.

Table 2
Instruments, Variables, and Questions Comprising Student Survey

LSAY	Parental Intrinsic Motivation	My parents expect me to do well in mathematics.
	Parental Extrinsic Motivation	My parents reward me for getting good grades.
	Parental Involvement	My parents have always encouraged me to work hard on math.
WIHIC	Teacher support	The teacher helps me when I have trouble with the work.
ATMI	Value	Mathematics is important in everyday life.
	Enjoyment	I have usually enjoyed studying mathematics in school.
	Confidence	I expect to do fairly well in any math class I take.
MSLQ	Self -Efficacy	If I study in appropriate ways, then I will be able to learn the material in this course.
	Intrinsic Motivation	In a class like this, I prefer course material that really challenges me so I can learn new things.
	Extrinsic Motivation	The most important thing for me right now is improving my overall grade point average, so my main concern in this class is getting a good grade.
	Control of Learning	If I don't understand the course material, it is because I didn't try hard enough.

The WIHIC questionnaire (Fraser et al., 1996) measures different factors related to student views of classroom environment. Students used a 5-point scale to rate different factors based on what they actually experienced in the classroom and what they preferred to experience in the classroom. This study used the teacher support subscale.

The ATMI survey measured student attitudes towards mathematics using four subscales: self-confidence, value, enjoyment, and motivation (Tapia & Marsh, 2004). For this study, the self-confidence, value, and enjoyment subscales were included using the original 5-point scale. These scales identified the beliefs of students regarding their mathematical ability to solve problems, the value they see in learning math, and the enjoyment they find in learning mathematics.

The MSLQ measured the motivational strategies and learning styles of students using 15 different subscales (Pintrich et al., 1991). This study employed the intrinsic motivation orientation, extrinsic motivation orientation, and control for learning subscales to identify the type(s) of motivation strategies that students possess as well as their self-efficacy beliefs regarding control of their own learning. The researchers modified the original seven-point scale to obtain consistency with the format of the survey in this study.

A free response question was also included. It asked students to write a response to the following, "What is the most important factor motivating you to achieve in math class?" The research team developed this question to allow students to provide personal insight into factors influencing their motivation.

Procedure

Email invitations were sent to eight middle-level mathematics teachers requesting that their students participate in this study during the late spring of 2013. Five teachers agreed to participate, and four teachers were randomly selected for the study. Two of each participating teachers' classes, excluding special education, gifted and English language learner classrooms, were randomly selected. Students completed the 20 minute-paper-based, anonymous survey during their regular mathematics class or during an advisory period.

Data Analysis

The quantitative data from the surveys were evaluated using descriptive statistics based on gender and self-reported

mathematics grades. The scores from the specific subscales were combined to give a complete picture of each subscale. In addition, the data analysis determined if there was a correlation between self-reported mathematics grades and each of the 10 subscales. Independent t-tests were run between males and females, as well as between high-achieving students earning grades of A and B and low-achieving students earning grades lower than B for each of the 10 subscales. Content analysis was used (Stemler, 2001) to analyze the open-ended item, which involved identifying words in the student responses related to extrinsic and intrinsic motivation and then classifying the content of the responses accordingly.

Results and Discussion

Research Question 1

A Pearson's r correlation analysis was conducted between the students' self-reported mathematics grade and their summed scores on the intrinsic motivation subscale to answer the question, "How does academic achievement relate to intrinsic motivation of middle school mathematics students?" Table 3 lists the results based on gender and grade. Grade 6, Grade 7, and low-achieving students were omitted due to insufficient sample size.

Table 3
Correlations between Gender, Grades and Intrinsic Motivation

Characteristic	*N*	*r*
All Students	65	.552**
Gender		
Male	33	.490*
Female	32	.609**
Usual Grades		
As and Bs	46	.206
Year in School		
Grade 8	31	.565**

Note: *p<.05**p<.001

The results of the correlational analysis presented in Table 3 show that four of the correlations were statistically significant, $p<.05$, with three significant using $p<.001$. The variance of intrinsic motivation for all students accounted for 30.5% of the variation in mathematics grades, for males 24.0%, for females 37.1%, and for eighth-grade students 31.9%. In other words, there was a strong positive correlation between intrinsic motivation for the sample of all students, for eighth-grade students, for males, and for females. This result aligned with data in previous studies, which have shown a positive correlation between achievement and intrinsic motivation (e.g., Ahmed et al., 2010; Cleary & Chen, 2009; Reynolds, 1991; Shores & Shannon, 2007; Steinmayr & Spinath, 2009; Woolley et al., 2010). The correlation was not significant for high-achieving students.

Research Question 2

The data were analyzed on student beliefs, including how they value mathematics, how much they enjoy mathematics, their confidence in mathematics, and their beliefs regarding taking control of their own learning to answer the question, "How does academic achievement relate to intrinsic motivation of middle school mathematics students?" Independent t-tests compared high-achieving students to low-achieving students in each of the 10 subscales (see Table 4).

High-achieving students consistently had more positive attitudes towards mathematics, more perceived parental support, and more perceived teacher support than low-achieving students. In each of the 10 subscales, high-achieving students had higher mean scores than low-achieving students. The largest differences between high-achieving and low-achieving student beliefs were in the subscales of mathematics value, mathematics enjoyment, mathematics confidence, and student intrinsic motivation. Strong effect sizes were evident in intrinsic motivation (d =.54), mathematics enjoyment (d =.59), and mathematics confidence (d =.66). Medium effect sizes were evident in extrinsic motivation (d =.30), mathematics value (d =.40), parental involvement (d =.31), and parental intrinsic

motivation (d =.31). Small effect sizes were evident in control of learning (d =.22), parental extrinsic motivation (d =.10), and teacher support (d =.23).

Table 4

Results of Questionnaire Subscales

	High-Achieving		Low-Achieving				
Subscale	*M*	*SD*	*M*	*SD*	*df*	*t*	*d*
Intrinsic Motivation	11.09	2.04	8.32	1.95	63	-5.04	.54*
Extrinsic Motivation	12.39	1.91	10.95	2.48	63	-2.53	.30*
Control of Learning	6.52	1.19	5.89	1.59	63	-1.75	.22
Mathematics Value	33.57	5.23	28.00	7.12	63	-3.50	.40*
Mathematics Enjoyment	28.89	7.18	17.89	6.32	62	-5.69	.59*
Mathematics Confidence	53.00	8.17	38.16	6.60	63	-7.02	.66*
Parental Involvement	25.57	3.52	23.11	3.45	61	-2.57	.31*
Parental Intrinsic Motivation	15.76	2.27	14.05	2.72	63	-2.60	.31*
Parental Extrinsic Motivation	16.30	2.84	15.68	2.40	61	-0.82	.10
Teacher Support	26.72	6.48	23.42	5.98	63	-1.91	.23

Note: *p<0.05

Significant differences were found between the high-achieving and low-achieving students in seven subscales, including those of student intrinsic motivation, student extrinsic motivation, mathematics value, mathematics enjoyment, mathematics confidence, parental involvement, and parental intrinsic motivation. There were no statistically significant differences in any of 10 subscales between males and females in their achievement or perceptions of mathematics.

In addition, a Pearson's r correlation was conducted between students' self-reported grades and each of the 10 subscales (see Table 5). The correlation for low-achieving students was not included due to insufficient sample size.

Table 5
Correlations between Students' Self-reported Grades and Subscales

Subscale	*N*	*r*
Intrinsic Motivation	46	.260
Extrinsic Motivation	46	-.014
Control of Learning	46	-.055
Mathematics Value	46	.257
Mathematics Enjoyment	46	.407***
Mathematics Confidence	46	.620***
Parental Involvement	44	.302**
Parental Intrinsic Motivation	46	.179
Parental Extrinsic Motivation	44	.034
Teacher Support	46	.287

Note: **p<.01, ***p<.001

Two notable strong correlations occurred between academic grade and enjoyment and academic grade and confidence. Mathematics enjoyment accounted for 16.6% of the variance in mathematics grades, and mathematics confidence accounted for 38.4% of the variance in mathematics grades. There was also a moderate correlation between self-reported grade and parental involvement, where parental involvement accounted for 9% of the variance in mathematics grades.

These results confirm what previous research studies have found regarding mathematics achievement and positive student beliefs. Students need to find purpose and value in what they are learning and to have positive mathematics experiences (Niehaus, Rudasill, & Adelson, 2011). In addition, if students have had positive mathematics achievement, they may be more likely to have confidence in their abilities, which also contributes to success in mathematics (Reynolds, 1991).

There was a statistically significant difference between high-achieving and low-achieving students on parental intrinsic motivation factors, but not on parental extrinsic motivation factors, which confirms previous research (McDonald et al., 2010). In addition, the lack of statistically significant differences between males and females for self-reported grades aligns with previous research, which has shown that males and females have similar achievement (Barak & Asad, 2012; Halat, 2006; Kane &

Mertz, 2012; Lindberg, Shibley, Hyde, & Peterson, 2010; Orhun, 2007; Reynolds, 1991).

Research Question 3

The responses to the open-ended item were analyzed using a content analysis approach to answer the question, "What factors influence middle school mathematics students' motivation to achieve?" The content of the responses were first categorized by extrinsic and intrinsic orientation. Further analysis determined the type of extrinsic or intrinsic motivation present. Sixty-seven of the 68 participants responded to the open-ended item. If a student provided more than one factor in the response, each factor was recorded separately. For example, "I want to get good grades and please my parents," included two extrinsically-oriented factors.

Extrinsically-oriented factors far outnumbered the intrinsically-oriented factors reported by students, 56 to 15. Extrinsic-oriented motivational factors fell into four broad categories: earning good grades (27 responses), pleasing parents (18 responses), receiving a reward such as cash or video game time (12 responses), and preparing for college or career (5 responses). Some responses were labeled in more than one category. For example, a student responded, "Get good grades. I get paid for good grades."

Intrinsically-oriented factors fell into two categories: feeling good about oneself (6 responses) and learning (10 responses). Intrinsically-oriented responses about feeling good about oneself-included statements such as, "to make myself proud," and "doing well makes me feel happy." Statements that were classified as being motivated by learning included, "to learn new things" and "to be able to learn many different ways of doing math."

This study bears out the findings of Wolters et al. (2013) and Flammer and Schmid (2003) that young adolescents are motivated by extrinsic factors. Wolters et al. (2013) went on to hypothesize that the developmental level of middle-level students, like those in this study, are still heavily influenced by wanting to please parents and teachers; therefore, making it

likely that they are extrinsically oriented. Notably, both high-achieving and low-achieving students in this study identified extrinsic factors more frequently than intrinsic factors.

When considering the results of this study, it is important to note the limitations. This study took place at one school in the Midwestern U.S., providing insight into one region. In addition, self-report student grades were used as a proxy for performance rather than standardized test scores or official records of student grades. In addition, although the teachers in this district had the same grading scale and uniform grading policies, there could have been minor variations in their grading practices.

Conclusions

This study confirmed what many educators already know: when middle level students do well mathematics, they experience higher enjoyment. In addition, when students do well, they have more confidence. Confidence and enjoyment with mathematics, in turn, leads to students doing well in that class (Middleton & Spanias, 1999). Finally, students who reported earning good grades, an A or B, also reported positive parent involvement and teacher support.

Administering scales from the LSAY (Miller, 2011), WIHIC (Fraser et al., 1996); ATMI (Tapia & Marsh, 2004), and MSLQ (Pintrich et al., 1991) at the middle level confirmed and extended research that currently exists. The findings confirm what is known generally about students and motivation, and they extend what is known about middle level students' motivation to learn mathematics. The results of this study and previous studies have implications for educators. Because the involvement and influence of parents in the education process is of vital importance, frequent communication with parents by educators can encourage both awareness and involvement. Being actively involved in a child's education and setting high expectations of students can affect mathematics achievement (Ahmed et al., 2010; Deci et al., 1991; Kim & Chung, 2012; Reynolds, 199; Usher, 2009; Zhao & Singh, 2011). Teachers and parents should set high expectations of their students and encourage interest in mathematics (Dever & Karabenick, 2011;

Woolley et al., 2010). Teachers can provide support to students (Ahmed et al., 2010; Sakiz, Pape, & Hoy, 2012; Usher, 2009) and create a classroom atmosphere that is conducive to learning, as well as provide students opportunities to learn and achieve. School administrators should be aware of the possible need for professional development for teachers regarding student motivation. Professional development can equip teachers to plan lessons and activities designed to motivate students, and it can bring about lasting change in instructional practices (Turner, Warzon, & Christensen, 2011).

Although there was a strong positive correlation between intrinsic motivation and achievement for the students in this study, it is important to note that extrinsic motivation yielded a moderate effect size, and extrinsic factors far outweighed intrinsic factors in the open-ended responses for which students reported what most influenced their motivation. However, the researchers acknowledge use of the word "achieve" in the open-ended question may have influenced the way the students responded to this question. They may have equated the concept of achievement with earned grade rather than motivation to learn. The emphasis parents and educators often place on grades adds complexity to the interpretation of responses because good or poor grades can be rewards or punishments, respectively. This study also extended what is known about extrinsic motivators for middle level students. Earning good grades, pleasing parents, avoiding punishment, and receiving a reward are well-established extrinsic motivators. This study also found getting a good job or attending a good school in the future were motivators for middle level mathematics students.

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