The Effects of Whole Brain Teaching on Student Motivation in Reading and Writing

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Abstract

Motivation in students can have a strong effect on student engagement and overall student success. Due to the impact of COVID-19, students have been less motivated and have fallen farther behind which increases the need to better motivate and engage students within the classroom. This quasi-experimental study which incorporated a pre- and post-test design explored the implementation of whole brain teaching strategies into reading and writing instruction for a sample of fourth to sixth graders. Whole brain teaching includes instruction focusing on the four primary sections of the brain with strategies merging abstract and conceptual models, emotional and intrinsic ideas, sequencing and organization, visual notions, and interpersonal concepts. Instruction focusing on these strategies provides learning opportunities for a variety of learner needs. The Elementary School Motivation Scale (ESMS) was used to measure student motivation for schoolwork following both reading and writing instruction after the implementation of whole brain learning strategies. Results indicated that student motivation significantly increased in both reading and writing after the implementation.

Keywords: student motivation, whole brain teaching, engagement, ESMS

The Effects of Whole Brain Teaching on Student Motivation in Reading and Writing

Motivation can strengthen student success and comes from the enjoyment that students gain from being engaged in the lesson material and in exploring the world around them (Wabiser, 2022). Furthermore, Spence (2022) concluded that every educator should be continuously looking for new strategies to engage and motivate their students. Embedding motivation strategies in the classroom that allow for individual learning styles of students can connect students further to their interests (Bawaneh et al., 2012; McCombs & Whistler, 1997). For this to be successful, students' personalities, learning styles, and interests; as well as their individual needs (i.e., physical, emotional, psychological, social, academic) need to be met (Bawaneh et al., 2012; Navir, 2017). When students are given equitable learning opportunities, based on their individual needs, they will feel more motivated to learn and participate in the instruction (Bawaneh et al., 2012).

Educators must consider new instructional methods that focus on students of all learning styles and encourage students to actively participate in the learning process (Silverstein, 2013; Smith, 2018). Research has shown that not every student learns in the same way or has the same intelligence (Ismah et al., 2022). Factors that may impact student learning include students preferred learning styles, the rate at which each student learns, their current developmental level, as well as the impact that gender can have on student performance and engagement (Smith, 2018). Smith further stated that these factors must be considered if educators are to effectively motivate every student to be engaged in the learning process. Duta (2021) asserts that student interests and expectations for success are also influential factors:

> The state of motivation to learn exists when student engagement in a particular activity is guided by the intention of acquiring the knowledge or mastering the skill that the activity is designed to teach. In particular, students are more likely to want to learn when they appreciate the value of classroom activities and when they believe they

will succeed if they apply reasonable effort. (p. 29)

Motivation is a key factor in student behavior, stimulation, and the ability to continue toward achieving targeted goals within the learning process (Bawaneh et al., 2012). Furthermore, there are three primary designations for determining levels of motivation: lack of motivation, extrinsic motivation, and intrinsic motivation. Extrinsic motivation in an individual is the demonstration of specific actions due to an external influence, such as a reward or the satisfaction of their ego. Intrinsic motivation is the demonstration of a specific behavior due to enjoyment, interest, or the instinct to succeed (Ryan & Deci, 2000). Given the impact motivation has on achievement (Bawaneh et al., 2012; Duta, 2021; Ryan & Deci, 2000) and the gap in current literature regarding the impact of whole brain teaching on motivation and achievement, there is a continued need to explore further the connections between neuroscience and educational strategies.

Literature Review

A lack of motivation is a major factor that decreases student learning, and hence, educators have worked to identify instructional methods and factors that might increase motivation in students (Bawaneh et al., 2012). One approach to increasing student motivation was the implementation of alternative instructional methods, which include the use of whole brain teaching, introduced by Herrmann (1989), and have been used to prevent boredom and a lack of motivation within classrooms (Bawaneh et al., 2012). This type of instruction focuses on the four primary sections of the brain (Bawaneh et al., 2012). Bawaneh et al. (2012) further explained that the upper section deals with abstract and conceptual concepts, while the lower section deals with emotional and intrinsic ideas. Specifically, the upper-left part deals with logic and quantity, the lower left part deals with sequence and organization, the right upper part deals with conceptual and visual notions, and the lower right part deals with interpersonal and emotional concepts. Instruction focusing on this knowledge provides learning opportunities for a variety of learners within the same lessons.

This method of instruction, known as "Whole Brain Teaching," as indicated by Biffle (2013), can make learning fun and engaging for students throughout the entire learning process. This strategy has also been shown to eliminate passive learning and improve student engagement (Elfiky, 2022; Priyadarshini et al., 2019). Whole brain teaching has been connected to effectiveness in areas of classroom management, critical thinking, and differentiated instruction (Silverstein, 2013). This method of instruction utilizes different parts of the brain, similar to Gardner's (1993) theory of multiple intelligences.

Whole brain teaching can also be adapted to a variety of curricula (Silverstein, 2013), thus creating an avenue for schools across the U.S. to increase student engagement and motivation (Smith, 2018). Biffle (2013) reported a 12% increase in reading over a three-month period of whole brain teaching implementation, and Smith (2018) reported a 28% improvement on state-mandated math tests. A study was conducted in 2013 that examined the effects of whole brain teaching, in which eight experienced educators began using whole brain teaching strategies and reported positive outcomes, such as higher retention and comprehension of material, improved levels of engagement, improved levels of student participation, and a decrease in the number of disciplinary actions taken during instruction (Silverstein, 2013). Furthermore, these eight participants reported that students appeared more confident, less stressed, enjoyed learning, responded positively to the new strategies, adapted quickly, and showed excitement toward learning (Silverstein, 2013). Whole brain teaching allows for more choice, control, and movement of students because the activities created for the lessons are centered around these elements (Smith, 2018).

The whole brain teaching approach focuses on seven core teaching techniques (Biffle, 2013; Clark, 2016; Elfiky, 2022) and includes the utilization of (a) call-and-response techniques, (b) classroom rules, (c) engagement, (d) competition scorekeeping, (e) mimicking, (d) key phrases for redirection, and (f) partner team-teaching. Whole brain teaching has been associated with both increased student engagement (Elfiky, 2022)

and motivation (Nayir, 2017). Students show signs of stronger motivation for learning when they are engaged and motivated to learn (Navir, 2017).

Whole brain teaching is based on Vygotsky's (1978) social learning theory, in which he showed the importance of social interaction in the process of learning and development (Bridges, 2019; Tompkins, 2014). The social learning theory consists of a more knowledgeable person teaching someone within the zone of proximal development. This zone consists of a person's ability to learn with help and is based on the individual's independent abilities without assistance and has been considered the time where optimal instruction is most likely to occur (Bridges, 2019; Vygotsky, 1978). This theory aligns with whole brain teaching strategies such as the "teach, okay" strategy, where students learn from the teacher and then teach their partner what they've just learned. The teaching students become more knowledgeable as they must know more than their partners (Biffle, 2013). Neuroscience connects biology, cognitive science, and education to support stronger methods of learning and instruction (Jensen, 2008; Kharsati & Prakasha, 2017). According to Kharsati & Prakasha (2017), "Neuroscience enables us to identify key indicators for educational outcomes and provides a scientific basis for evaluating different teaching approaches" (p. 76).

Statement of the Problem

In 2020, COVID-19 made a lasting impact on the country and with regard to student learning. In the fall of 2020, the Tennessee Department of Education (TDOE) projected an estimated decrease of 50% in reading proficiency scores of third graders and a projected 65% decrease in math (Tennessee Department of Education [TDOE], 2022). The TDOE also projected that because of the March school closures in 2020, learning loss would be 2.5 times the normal summer rate. In 2021, the Policy Analysts for California Education (PACE), further determined the impact of COVID-19 on student learning by comparing scores from fall 2019 to winter 2021, assessing approximately 100,000 unique students across 19 California

schools (Pier et al., 2021). Pier et al. (2021) noted that learning decreased for every grade assessed (Grades 4-8), in both math and English, among all three tests that were administered (MAP, Star, and i-Ready). Specifically, a greater amount of learning loss occurred among economically disadvantaged students, English learners, and Latinx students (Pier et al., 2021). Pier et al. (2021) also found that those who were previously low achieving experienced greater learning lags than students who were not previously low achieving.

In 2022, the National Center for Education Statistics (NCES) administered the Long-term Trend (LTT) reading and mathematics assessments for 9-year-old students, to examine student achievement surrounding the COVID-19 pandemic. The National Assessment of Educational Progress (NAEP) stated that in 2022, the largest drop in reading scores since 1990 had occurred as well as the first-ever drop in mathematics scores (NCES, 2022). The NCES (2022) also reported that students who were low performing had greater decreases than students who were not low performing previously.

Purpose of the Study

Given the drops in achievement over the past five years and decreased motivation related to the loss of learning during the COVID-19 pandemic (Duta, 2021), data from this study will add to the literature regarding the effects of whole brain teaching on students in the general education classroom. Duta reported that due to COVID-19 and the increased utilization of virtual classes, students had a lack of motivation for learning and instruction. Omadan (2021) noted the importance of student motivation regarding student learning, especially after the COVID-19 pandemic. Given the loss of student learning noted in the literature (NCES, 2022; Pier et al., 2021) and the strong connection between motivation and learning (Omadan, 2021), instruction for all students, which has traditionally incorporated direct instruction, should be re-examined, along with the benefits of whole brain teaching, to determine what type of instruction might best suit students following the onset of the COVID-19 pandemic. Aligned with this purpose, this

study was guided by the following question: What is the impact on student motivation in (a) reading and (b) writing after the implementation of whole brain teaching?

Furthermore, this study addressed literature in which authors raised concerns over whole brain teaching due to a lack of research. The connections between whole brain teaching and the neuroscience of the brain have caused some researchers to question the use of neuroscience in education given a lack of credible information (Purdy & Morrison, 2009; Varma et al., 2008). Some researchers believe that neuroscience research findings have been overgeneralized to meet educational needs (Bruer, 1997). Critics of whole brain teaching also feel that while there is some evidence of the effectiveness of these classroom strategies, there have been few research studies conducted to validate its effectiveness (Falls, 2016; VanHosen, 2017). The topic of whole brain teaching is a relatively new concept because research in this area has focused on brain-based learning and not whole brain teaching (Bridges, 2019). While some researchers have been skeptical, the results of whole brain teaching strategies have been seen in classrooms and have gained popularity among educators over the years; thus, further research is needed to show the continued advancement and development in the field of neuroscience (Gocen, 2021). Gocen (2021), following an exploration of the impact of neuroscience in the field of leadership, also stated:

> Neuroscience, or brain science, opens up new areas for leadership in the educational field by enabling us to better understand the reasons behind the chemical processes occurring in the brain and in administrative steps such as human motivation and decision-making. (p. 63)

Methodology

This quantitative study explored data from a convenient sample of students from one class at one public Montessori elementary school in a West Tennessee school district. The 41 students were in the fourth, fifth, and sixth grades, and all had the same teacher. A quasi-experimental research design with a pre- and post-test survey was utilized to compare the

data of student responses before and after the implementation of whole brain teaching to determine if whole brain strategies were associated with higher student motivation. After Institutional Review Board (IRB) approval was obtained and approved by the school, parents were informed of the study and provided an opportunity to consent. If parents consented, students were informed and provided the opportunity to ask questions in their English class prior to giving their consent. One English class was selected and chosen to incorporate whole brain learning strategies due to the teacher's familiarity with whole brain learning techniques. Students were introduced to new learning strategies during classroom instruction and were taught the rules and procedures associated with these strategies (e.g., reciting class rules each period, teacher mirroring—key lesson concepts using words and actions of the teacher, re-teaching concepts to peer partners using physical movements). Classroom rules were communicated and carried out as a whole group, through hand motions, as described by Biffle (2013). Communicated rules included following directions quickly, raising their hand for permission to speak, raising their hand to leave their seat, making smart choices, and making the dear team stronger. These rules were communicated to the class at the beginning of each lesson. Regarding mirroring, which Clark (2016) described as a technique that requires the teacher to connect motions as well as variations in inflection and tone to key ideas from the lesson, students were required to mimic the teacher by connecting ideas from the lesson as shown by the teacher. Peer teaching started with call-and-response techniques between the students and the teacher. For example, the teacher would say "Teach!" and the students responded in unison with "Okay!". When the students responded, they immediately turned to their designated partner and began to teach the key ideas of the lesson to that peer, using the same inflection and hand motions provided by the teacher. These three whole brain teaching techniques were chosen because of their basic nature, the ease at which they could be taught and communicated to students, and because of their consistency when applying them to instruction across different grade levels.

The Elementary School Motivation Scale (ESMS) (Guay et al., 2005) was used to determine student motivation toward their schoolwork in reading and writing. Guay et al. (2005) found acceptable reliability specifically regarding reading motivation (a = .73) while Ramos et al. (2002) found sufficient reliability ranging from 0.701– 0.901. Students were given an 18-item survey that included a Likert scale to determine their levels of intrinsic motivation, identified self-regulation, and perceived external regulation as pertaining to the areas of reading and writing (See Appendix A). Each child had to rate each item on the survey according to the following scale: *no always* (1), *no sometimes* (2), *do not know* (3), *yes sometimes* (4), *yes always* (5). Students completed the test on paper in approximately five minutes and turned it in to the teacher. This questionnaire was filled out twice (i.e., once before the intervention and once following the intervention) on an anonymous basis, while the teacher monitored all students to ensure they were completing the assessment with fidelity.

The Cronbach's alpha coefficient was evaluated using the guidelines suggested by George and Mallery (2018) where > .9 excellent, > .8 good, > .7 acceptable, > .6 questionable, > .5 poor, and ≤ .5 unacceptable. The items for motivation (reading) had a Cronbach's alpha coefficient of .75, indicating acceptable reliability. Table 1 presents the results of the reliability analysis.

TABLE 1
Reliability Table for Motivation (Reading)

Scale	No. of Items	*a*	Lower Bound	Upper Bound
Motivation (Reading)	9	.75	.69	.82

Note: The lower and upper bounds of Cronbach's a were calculated using a 95.00% confidence interval.

A Cronbach alpha coefficient was calculated for the Motivation (Writing) scale, which consisted of 13 items measuring motivational constructs (e.g., intrinsic, self-regulation, perceived external). The Cronbach's alpha coefficient was evaluated using the guidelines suggested by George and Mallery (2018) where > .9 excellent, > .8 good, > .7 acceptable, > .6

questionable, > .5 poor, and ≤ .5 unacceptable. The items for motivation (writing) had a Cronbach's alpha coefficient of .73, indicating acceptable reliability. Table 2 presents the results of the reliability analysis.

TABLE 2
Reliability Table for Motivation (Writing)

Scale	No. of Items	*a*	Lower Bound	Upper Bound
Motivation (Writing)	9	.73	.65	.80

Note: The lower and upper bounds of Cronbach's a were calculated using a 95.00% confidence interval.

Results

Demographic information was collected for the student population frequencies and percentages were calculated for each nominal variable. The most represented grade level was sixth (n = 17, 42%), while the population consisted of more males (n = 23, 56%) than females (n = 18, 44%). Frequencies and percentages are presented in Table 3.

TABLE 3
Frequency Table for Nominal Variables

Variable	*n*	%
Grade		
4th	12	29%
5th	12	29%
6th	17	42%
Gender		
Male	23	56%
Female	18	44%

Writing Motivation

A two-tailed paired samples t-test was conducted to examine whether the mean difference between the writing motivation pre- and post-test scores was significantly different from zero. A normal distribution of scores was first checked for

the data set. A Shapiro-Wilk test was conducted to determine whether the differences in the scores could have been produced by a normal distribution (Razali & Wah, 2011). The results of the Shapiro-Wilk test were not significant based on an alpha value of .05, $W = 0.98$, $p = .648$, which suggests the possibility that the differences in the scores were produced by a normal distribution cannot be ruled out, indicating the normality assumption was met.

TABLE 4
Two-Tailed Paired Samples t-test for the Difference Between Motivation in Writing

Motivation in Writing (Pretest)		Motivation in Writing (Posttest)				
M	*SD*	*M*	*SD*	*t*	*p*	*d*
25.15	6.68	26.34	6.84	-3.22	.003	0.50

Note: N=41. Degrees of Freedom for the t-statistic=40. *d* represents Cohen's *d*.

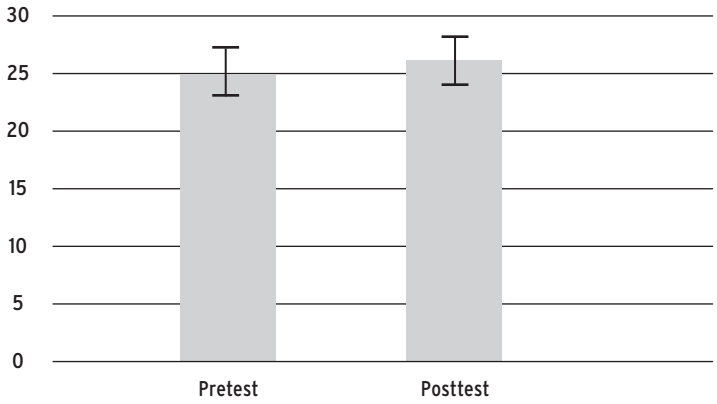
The result of the two-tailed paired samples t-test was significant based on an alpha value of .05, $t(40) = -3.22$, $p = .003$, indicating the null hypothesis can be rejected. This finding suggests the mean of the motivation score on the writing posttest was significantly higher than the mean of the pretest. The results are presented in Table 4. A bar plot of the means is presented in Figure 1.

A summary of all scores, pre and post, for motivation related to reading and writing appears in Table 5.

TABLE 5
Summary Scores Table for Reading and Writing

Variable	*M*	*SD*	*n*	*SEm*	Min	Max	Skewness	Kurtosis
Motivation in Reading (pretest)	26.54	7.06	41	1.10	16.00	44.00	0.57	-0.24
Motivation in Reading (posttest)	28.76	7.14	41	1.12	18.00	45.00	0.55	-0.49
Motivation in Writing (pretest)	25.15	6.68	41	1.04	10.00	39.00	-0.36	-0.39
Motivation in Writing (posttest)	26.34	6.84	41	1.07	11.00	39.00	-0.43	-0.49

FIGURE 1
The Means of the Motivation in Writing with 95.00% CI Error Bars Noting Significant Increase



Reading Motivation

A two-tailed paired samples t-test was conducted to examine whether the mean difference between the reading motivation scores between the pre- and post-test scores was significantly different from zero. A normal distribution of scores was first checked for the data set. A Shapiro-Wilk test was conducted to determine whether the differences in the scores could have been produced by a normal distribution (Razali & Wah, 2011). The results of the Shapiro-Wilk test were significant, $W = 0.94$, $p = .024$. This result suggests the differences in the scores are unlikely to have been produced by a normal distribution, indicating the normality assumption is violated. Given the violated assumption, a two-tailed Wilcoxon signed rank test was conducted to examine whether there was a significant difference between the pre- and post-test scores. The two-tailed Wilcoxon signed rank test is a non-parametric alternative to the paired samples t-test and does not share its distributional assumptions (Conover & Iman, 1981).

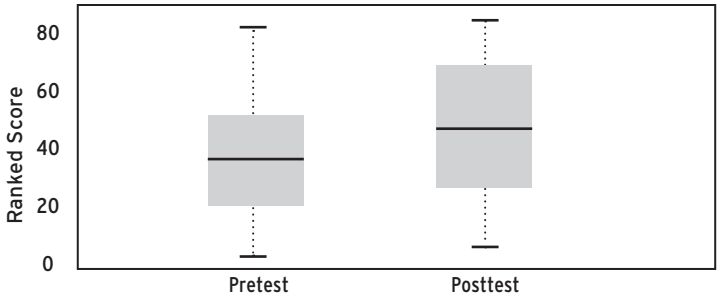
The results of the two-tailed Wilcoxon signed rank test were significant based on an alpha value of .05, $V = 34.00$, $z = -5.00$, $p < .001$. This indicates that the differences between the pre- and posttest scores are not likely due to random variation. The median of the motivation in the reading posttest ($Mdn = 28.00$)

was significantly higher than the median of the pretest (Mdn = 26.00). Figure 2 presents a boxplot of the ranked values of the pre- and post-test scores.

Discussion

FIGURE 2

Ranked Values of the Motivation in Reading Noting Significant Increase



This study found that motivation in reading and writing classes was significantly higher when whole brain strategies were utilized, which may have been tied to the presence of a more active learning model. Elfiky (2022) and Priyadarshini et al. (2019) would attribute this increase in motivation to improved student engagement due to an active learning environment which is a characteristic of whole brain learning strategies. This increase in motivation may further contribute to the falling achievement scores as noted by NAEP (2022). Literature has suggested a positive connection between achievement and whole brain learning strategies given the impact it can have on both student motivation and engagement (Biffle, 2013; Navir, 2017; Silverstein, 2013; Smith, 2018).

This study adds to the literature on student motivation that may help address the extreme drop in achievement that Pier et al. (2021) and NAEP (2022) noted had occurred during the onset of the COVID-19 pandemic. Strategies connected to whole brain learning such as the use of class rules that are consistently recited with connected physical movements, student mirroring of the teacher, and the students teaching each other key concepts of the lesson could be used to help motivate students after the learning loss that may have occurred since

COVID-19. The whole brain teaching methods used in this study did show a connection to higher gains in motivation toward reading and writing. Due to the simple nature of the whole brain teaching methods and the ease with which they can be implemented, this strategy could be taught easily and implemented in a variety of educational settings.

Recommendations and Implications

Given the data from this study, it is recommended that education stakeholders explore the possible implementation of whole brain learning strategies which includes the utilization of (a) call-and-response techniques, (b) classroom rules, (c) engagement, (d) competition scorekeeping, (e) mimicking, (d) key phrases for redirection, and (f) partner team-teaching. Specifically, strategies connected to whole brain learning such as the use of class rules that are consistently recited with connected physical movements and modeled by the teachers could help students retain content knowledge and avoid learning loss. These strategies should be embedded and taught throughout education preparation program (EPP) coursework to give future teachers both the ability and efficacy to develop whole brain strategies to utilize in future classrooms.

Strategies connected to whole brain learning such as the use of class rules that are consistently recited with connected physical movements, student mirroring of the teacher, and the students teaching each other key concepts of the lesson could be used to help motivate students after the learning loss that may have occurred since COVID-19. The whole brain teaching methods used in this study did show a connection to higher gains in motivation toward reading and writing. Due to the ease with which whole brain strategies can be embedded into all classrooms, these strategies could be taught to all teachers for implementation in a variety of educational settings.

Limitations and Future Research

Further research should be conducted with a larger sample size since these results are not generalizable to all populations given the lack of random selection and the low sample size.

Future studies should be conducted with students from multiple areas, backgrounds, special education needs, grade levels, and schools to better determine the effect whole brain teaching may have on diverse learners. Another notable limitation of the study was the length of time (one month) for which the whole brain learning strategies were implemented between the pre- and post-tests. Even though data showed a statistically significant increase in motivation after one-month, future studies would benefit from a longer implementation of whole brain learning strategies to better determine how these methods impact student motivation. Furthermore, there was no control group and only one dependent variable explored (i.e., motivation). Literature has shown a positive relationship between motivation and achievement (Bawaneh et al., 2012; Duta 2021; Silverstein, 2013; Smith, 2018; Wabiser, 2022), however, future studies exploring whole brain learning may further add to the gap in the literature connecting whole brain teaching and student achievement. Another limitation noted was that all students attended the same school and grades. Furthermore, the literature alludes to other factors that may impact motivation, such as intrinsic motivation to stay engaged in the instruction and extrinsic motivation (i.e., praise, rewards) that could impact student motivation (Ryan & Deci, 2000); however, this study did not explore those factors.

Conclusion

This study examined the effects of whole brain teaching implementation on student motivation toward reading and writing. From a sample of fourth through sixth grade students, motivation increased significantly after only one month of whole brain teaching strategies embedded into English and language arts classes. There is a need for district and school personnel to heighten the exploration of diverse whole brain learning strategies within K-12 classrooms and teacher preparation programs to prepare teachers to implement active learning strategies that may increase both motivation and achievement for diverse learners. Data from this study adds to the current literature and may provide research-based evidence for strategies

that may support student success, especially in response to decreased student motivation and achievement as a result of the COVID-19 pandemic (Duta, 2021; NAEP, 2022; Pier et al., 2021; TDOE, 2022). The methods used in this study were connected to higher gains in motivation toward reading and writing; thus it may be beneficial for educators to explore strategies connected to whole brain learning to help motivate students.

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Appendix A
Elementary School Motivation Survey (ESMS)

Write the initials of your first and last name and 1 if you're taking the pretest or a 2 if you're taking the posttest.

Initials and Number Here: _____

Circle the corresponding number that you agree with.

(1) No Always
(2) No Sometimes
(3) Do Not Know
(4) Yes Sometimes
(5) Yes Always

Reading

Intrinsic Motivation

I like reading.	(1) (2) (3) (4) (5)
Reading interests me a lot.	(1) (2) (3) (4) (5)
I read even when I am not obliged to do so.	(1) (2) (3) (4) (5)

Identified Regulation

Reading will allow me to learn many useful things.	(1) (2) (3) (4) (5)
I chose to read to learn many things.	(1) (2) (3) (4) (5)
In life, it's important to learn how to read.	(1) (2) (3) (4) (5)

External Regulation

I read to get a nice reward.	(1) (2) (3) (4) (5)
I read to please my parents or my teacher.	(1) (2) (3) (4) (5)
I read to show others how good I am.	(1) (2) (3) (4) (5)

Writing

Intrinsic Motivation

I like writing.	(1) (2) (3) (4) (5)
Writing interests me a lot.	(1) (2) (3) (4) (5)
I write even when I am not obliged to do so.	(1) (2) (3) (4) (5)

Identified Regulation

Writing will allow me to learn many useful things.	(1) (2) (3) (4) (5)
I chose to write to learn many things.	(1) (2) (3) (4) (5)
In life it's important to learn how to write.	(1) (2) (3) (4) (5)

External Regulation

I write to get a nice reward.	(1) (2) (3) (4) (5)
I write to please my parents or my teacher.	(1) (2) (3) (4) (5)
I write to show others how good I am.	(1) (2) (3) (4) (5)