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THE RELATIONSHIP BETWEEN INTROVERTED STUDENT BEHAVIOR AND TEACHER PERCEPTION OF STUDENT ENGAGEMENT

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THE RELATIONSHIP BETWEEN INTROVERTED STUDENT BEHAVIOR AND
TEACHER PERCEPTION OF STUDENT ENGAGEMENT

By

MEGAN M. DUBEE

A doctoral dissertation submitted to the
College of Education
in partial fulfillment of the requirements
for the degree Doctor of Education
in Curriculum and Instruction

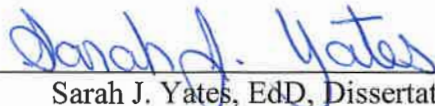
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by

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DEDICATION

To my parents who have been my #1 cheerleaders throughout my life.

To the one who told me that living fearlessly would be good for me; this project would never have happened without that text.

To the good folks at Academy of the Holy Names, particularly the introverts in the Class of 2022 who inspired this journey.

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Abstract

The purpose of this quantitative survey study was to investigate if a relationship exists between introverted student behavior and teacher perception of student engagement. The purposive sample was composed of high school teachers in the United States. Using the Engagement Rating Scale, teachers scored student engagement across four domains when considering two descriptions of students. One student was described using characteristics of an introvert; teachers then completed an identical version of the scale for a second student who was described using characteristics of an extravert. Independent samples *t*-tests were used to analysis differences in scores by personality type and revealed a significant relationship between teacher perception of overall student engagement and extraverted students. Analysis into the dimensions of student engagement suggested significantly higher teacher perceptions of agentic and emotional engagement for extraverted students but significantly higher teacher perceptions of behavioral and cognitive engagement for introverted students. These findings suggest that differentiating instruction and assessment may contribute towards better meeting the needs of students of all personality types.

Keywords: personality type, student engagement, Engagement Rating Scale, ERS, high school

TABLE OF CONTENTS

Dedication.....	iii
Acknowledgments	iv
Abstract.....	v
Table of Contents.....	vi
List of Tables	ix
I. INTRODUCTION.....	1
Background of the Study	2
Theoretical Framework.....	5
Lewin’s Personality Environment Fit Theory	5
Kahn’s Theory of Engagement.....	6
Problem Statement.....	7
Purpose Statement	7
Overview of Methodology.....	7
Research Questions	8
Research Hypotheses.....	8
Overview of Analyses.....	9
Preliminary Analysis	9
Data Analysis by Research Questions	9
Delimitations	9
Definition of Key Terms	9
Conclusion	10
II. REVIEW OF LITERATURE.....	11
Personality Type	11
Relationships	11
Introversion in the Workplace	14
Leadership	14
Harassment/Negative Attention.....	15

Introversion in the Classroom.....	16
Physical Environment.....	16
Active Learning.....	19
Knowledge Acquisition.....	26
Motivation.....	27
Silence.....	29
Engagement of Introverted Students.....	31
Summary.....	34
CHAPTER III: METHODOLOGY.....	36
Research Design and Methodology.....	36
Study Participants.....	36
Preliminary Analysis.....	37
Instrument.....	37
Research Question #1.....	38
Research Question #2.....	38
Data Collection Procedures.....	39
Summary.....	40
IV. RESULTS.....	42
Preliminary Findings.....	42
Internal Reliability.....	44
Findings by Research Question.....	45
Research Question #1.....	45
Research Question #2.....	47
Behavioral Engagement.....	47
Emotional Engagement.....	48
Agentic Engagement.....	49
Cognitive Engagement.....	51
Conclusion.....	52
V. DISCUSSION.....	53
Discussion of Preliminary Findings.....	54
Discussion by Research Question.....	55

Research Question 1	55
Research Question 2	56
Agentic Engagement	58
Cognitive Engagement	59
Study Limitations	61
Implications for Future Practice	61
Recommendations for Future Research.....	62
Conclusion	63
References	64
Appendix	72

LIST OF TABLES

Table	Page
Table 1: Descriptive Statistics Summary Table: Demographic Identifying Information	43
Table 2: Descriptive Statistics Summary Table: Engagement by Group and Domain	44
Table 3: Internal Reliability Table: Engagement (Introversion).....	45
Table 4: Internal Reliability Table: Engagement (Extraversion).....	45
Table 5: Summary Table: Perceptions of Overall Engagement by Personality-Type.....	46
Table 6: Summary Table: Perceptions of Behavioral Engagement by Group	48
Table 7: Summary Table: Perceptions of Emotional Engagement by Group	49
Table 8: Summary Table: Perceptions of Agentic Engagement by Group	51
Table 9: Summary Table: Perceptions of Cognitive Engagement by Group.....	52

I. INTRODUCTION

Following the educational trend of active learning, which according to research benefits students by including reading, discussing, and engaging higher order thinking skills, classrooms have been transformed from teacher-directed lecture halls to student-centered arenas of learning (Beichner, 2014; Copridge et al., 2021). This change requires students to be active participants in their learning and contributors to class dialogue (Major, 2020). As teachers try to de-center their classrooms, introverted students may find themselves lacking the quiet, reflective spaces of the past from which they could observe and reflect on the day's lesson.

The impact of personality has been studied in general society, the workplace, and the classroom. The Myers-Briggs Type Indicator, one popular instrument, places individuals on four continua: Introversion/Extraversion, Sensing/Intuition, Thinking/Feeling, and Judging/Perceiving (Meyers, 1998). An individual's personality type affects decision-making, relationships, and ultimately, life outcomes (Roberts et al., 2007).

Introversion refers to an individual's tendency to exhibit more self-reflective than outgoing behaviors such as verbal discourse (Eysenck, 1947; Jung, 1923; Tuovinen et al., 2020). Although all individuals manifest some degree of both introversion and extroversion, one trait tends to be more dominant. Though introverts may be described as shy, socially anxious, or quiet, the actual personality characteristic is more indicative of an individual's ability to gain strength and feel relaxed from time spent alone. Alternatively, extraverts experience relaxation

and feel recharged from time spent in groups.

For introverted students, an active learning classroom may increase anxiety and pressure to perform. The dynamic nature of active classrooms often fails to give the time necessary for introverted students to process information and develop a response (Rosheim, 2018). Baepler and Walker (2014) suggested the transition to active learning spaces changes the “social context” (p. 38) of classes. Because collaborative learning environments do not match with an introverted student’s personality traits, introverted students may experience greater levels of pressure and anxiety in classes that utilize active learning (Green et al., 2019). Expanding teachers’ perception of participation in the classroom affords students greater opportunities for learning and success (Rosheim, 2018). Instructors using active learning techniques without accounting for the needs of introverted learners may create an inequitable learning environment.

Background of the Study

Scholarly literature reflects a biological basis for the personality characteristics of introversion and extroversion. Differences in brain structure and neurotransmitter levels influence an individual’s inclination towards introversion or extraversion and may impact students’ choices in a collaborative setting (Park et al., 2019).

Kagan et al. (2007) investigated the role of the amygdala in reactivity in a longitudinal study. The amygdala contains four neuronal clusters which moderate reactions relating to different features of a stimulus. The initial investigation recorded behaviors of 500 infants in response to unfamiliar stimuli, and researchers then grouped infants into three categories based on their reactions. Highly reactive infants were more likely to cry and move when presented with stimuli while infants who cried minimally or did not react were labeled as low reactive. Those who showed mixed responses (crying while not moving) were put into a third group. The infants

participated in additional assessments throughout their childhood. From the original sample, 72 teenagers, between the ages of 14 and 17, participated in a follow-up laboratory study.

Spontaneous comments and smiles were recorded from video of the subjects' biometric testing and preparation for EEG and ERP assessments. Additionally, one of two interviewers asked the teenagers about sources of anxiety, reactions to familiar scenarios, and perceptions of personality traits; a coder rated talking, smiling, postural tension, and behavioral inhibition from video.

During and following the interview, the teenagers participated in *Q*-sort task ranking statements related to worry. Results demonstrated that while low reactive individuals fail to notice certain environmental stimuli, approximately 25% of individuals in the study perceived novel or threatening elements within their environment that trigger a fight-or-flight response in the amygdala. The rate of smiling for highly reactive students was significantly lower than for low reactive individuals ($F_{(1,68)} = 5.86; p = .01$). The study confirmed Kagan's counterintuitive hypothesis that highly reactive infants would grow into introverted adults with careful and serious personalities while low reactive infants became extraverted adults (Kagan et al., 2007).

Park et al. (2019) used resting state neuroimaging to explore how the associations between an event and one's mental state related to personality type. In a study of 94 healthy young people, researchers used resting-state neuroimaging to measure the functional connectivity between areas of the brain and described connectedness using clustering coefficients. Participants also completed a Gray-Wheelwright test to determine personality characteristics. The foundation for the vast social networks of extraverts may lie in the resting state functional network of the brain. Significant positive correlations were found between extroversion scores and clustering coefficients, indicating a potential basis for personality characteristics in the functional network of the brain (Park et al., 2019).

Shi et al. (2020) investigated the relationship between personality type and placebo or nocebo effects using functional magnetic resonance imaging (fMRI). Thirty participants in good health completed the Eysenck Personality Questionnaire, and researchers sorted individuals into an introvert group or an extravert group. Before the medical component of the study began, participants received training about pain ratings and the analgesic patches utilized in the study. Participants then completed an fMRI scan wearing an authentic patch or a placebo patch during an experience of acute lower back pain created via injection. Differences in the limbic system and prefrontal cortex as observed during the placebo and nocebo conditions suggested a neurological connection to personality type (Shi et al., 2020). Analysis reflected significant differences in visual analogue scale (VAS) scores of introverted and extraverted individuals as well as in their respective brain networks. When compared to introverts, extraverts are more likely to experience a placebo effect because of decreased connectivity between the limbic system and pain-related network (Shi et al., 2020).

As mounting research reflects a biological foundation for introversion, questions about classroom practice arise. Limited research addresses the relationship between personality type and student engagement. Classrooms have become increasingly collaborative as schools seek to mirror modern workspaces (Green et al., 2019; Wilson & Cotgrave, 2016). Wilson and Cotgrave (2016) determined personality type appeared to influence a student's preferences in a physical learning environment. According to Pesky et al. (2015), introverted students may view active, collaborative classrooms less favorably than traditional classrooms. Introverted students likewise exhibit less desire than extraverted students to spend time, both academically and socially, with their peers (Lösch & Rentzsch, 2018).

Classroom participation refers most often to the verbal contributions of students in class conversation; however, engagement can be measured across four dimensions: behavioral, emotional, agentic, and cognitive (Reeve, 2014). Introverted students may be penalized for their quiet tendencies in a classroom that defines participation solely by behavioral response. In many instances, students earn a grade for class participation, and their only opportunity to receive credit comes through speaking out loud. Rosheim (2018) studied quiet elementary school students through case studies and found quiet students prefer to participate in ways other than talking. When teachers implement structures such as discussion-based coursework which unknowingly benefits extraverted students, all students may suffer by missing out on contributions from introverts. Determining if a relationship exists between student behavior and teachers' perceptions of engagement lays a foundation for continued studies to explore classroom practices to support academic performance according to personality type.

Theoretical Framework

Lewin's Personality Environment Fit Theory

Kurt Lewin (1936) noted behavior is a function of personality and environment: "Every psychological event depends upon the state of the person and at the same time on the environment" (p. 12). According to Lewin's personality environment fit theory, the degree to which an environment suits a particular personality type influences the capacity to which an individual will behave in the setting (Lewin, 1936). According to Caplan and Van Harrison (1993), low-performing employees had lower Personality Environment (PE) fit average than high-performing employees ($r = .26$ and $r = .47$, respectively). Classroom environments that are a mismatch for student personality type may not enable a student to achieve peak potential.

Classroom teachers hold the primary responsibility for establishing classroom environments conducive to student engagement and learning.

Kahn's Theory of Engagement

Kahn (1990) posited engagement as shaped by an interconnected web of the individual, intrapersonal, group, intergroup, and organizational forces at play. Engagement involves the extent to which a person's preferred self is connected to others and the task at hand. An engaged individual participates physically, emotionally, and cognitively within the situation. On the contrary, disengagement relates to the removal of one's preferred self from the circumstances. Upon this withdrawal, the individual appears physically detached, emotionally severed, and cognitively disconnected (Kahn, 1990). Because engaging students in learning leads to increased academic outcomes, a teacher's ability not only to engage students but also to accurately gauge student engagement becomes a critical component of education (Metzger & Langley, 2020).

Although physical participation may be an obvious indicator of classroom engagement, agentic, emotional, and cognitive engagement may be harder to gauge. Methods of instruction and classroom practices require varying levels of student engagement (Strati et al., 2017). Because student learning hinges upon engagement in the learning scenario, teachers' perception of student engagement becomes a critical element of lesson development (Havik & Westergard, 2018; Heaslip et al., 2014). Havik and Westergard (2018) noted student behaviors, such as participating in class discussions, asking questions, and giving energy to the classroom, correspond with higher student engagement. All these behavioral engagement indicators align with the extraverted students. The present study focused on the role of personality, in conjunction with environment and instructional design, in student engagement.

Problem Statement

Green et al. (2019) called for future research regarding teachers' attitudes towards introverted students and "the resultant effect on academic performance" (p. 22) these students experience. By gauging the perceptions of high school teachers regarding their students' engagement using quantitative methods, the impact of classroom practices on participation and academic performance by personality type can better be understood.

Purpose Statement

The purpose of this quantitative study was to investigate a potential relationship between introverted student behavior and teacher perception of student engagement. At this stage in the research, introversion will be defined as a focus of one's energy toward the inner world (Eysenck, 1947; Jung, 1923; Tuovinen et al., 2020).

Overview of Methodology

A quantitative design using the Engagement-Rating Scale (ERS) was used. Before beginning research, approval was sought from the Institutional Review Board. High school teachers personally known to the researchers received an electronic invitation to participate in the study. Additional data was collected through snowballing via social media platforms. Each teacher was presented with two students to consider. One student reflects introverted tendencies: prefers solitude, selective when choosing social relationships, introspective, interested in deeper feelings, good listener, requires time alone to balance out energy, and easily overstimulated (Tuovinen et al., 2020). The other student displays the characteristics of an extravert: enjoys being social with other people, attached to one's own ideas, enjoys working with others, and functions well in highly stimulating environments (Tuovinen et al., 2020). Individual teachers

will complete a modified version of the ERS that contains statements reflecting the teacher's perception of that student's engagement.

Research Questions

This study addressed the following research questions:

1. To what degree do the perceptions of teachers differ on engagement by student personality type (introvert or extravert)?
2. Within the four dimensions of engagement, in which dimension was the greatest degree of effective difference between introverted and extraverted students?

Research Hypotheses

1. To what degree do the perceptions of teachers differ on engagement by personality type (introvert or extravert)?

H_0 : Null hypothesis. There will be no difference between teacher perception of student engagement for introverted students and for extraverted students.

H_a : Alternative hypothesis. There will be a statistically significant difference between teacher perception of overall student engagement favoring engagement of students considered as extravert.

2. Within the four dimensions of engagement, in which dimension was the greatest degree of effective difference between introverted and extraverted students?

H_0 : Null hypothesis. There will be no effective difference between introverted and extraverted students for any of the four dimensions of engagement.

H_a : Alternative hypothesis. Behavioral engagement will be the dimension in which there is the greatest degree of effective difference between introverted and extraverted students.

Overview of Analyses

Preliminary Analysis

The ERS measured teacher perception of student engagement across four domains: behavioral, emotional, agentic, and cognitive. Foundational analyses were conducted focusing upon evaluations of missing data and internal reliability. Descriptive statistics were run for ERS scoring by introverted student and extraverted student.

Data Analysis by Research Questions

An independent sample *t*-test was conducted to determine whether a significant difference exists between teachers' perceptions of introverted and extraverted student engagement. SPSS was utilized to define groups and compare findings (Field, 2018). A critical *p*-value of $\alpha \leq .05$ was adopted as the threshold for statistical significance of finding. The observed *p*-value was determined and compared to the critical *p*-value.

Delimitations

This study intended to determine the impact of student behavior on a teacher's perception of student engagement. As only high school teachers were surveyed, the results are not generalizable to other grade levels. Responses may reflect an average of teachers' perceptions rather than providing information regarding how teachers perceive individual students. Additionally, research findings are limited by the fact that data utilized for this study were self-reported. Respondents may score themselves higher on questions related to perception of students' engagement to not appear biased.

Definition of Key Terms

The following words and phrases are key terms for the study.

- **active learning:** “consists of students engaging in analysis, synthesis, and evaluation of the subject being taught” (Copridge et al., 2021, p. 206)
- **agentic engagement:** shows initiative, speaks up, expresses interest (Reeve, 2014)
- **behavioral engagement:** exerts high effort, works quickly, shows persistence, pays attention, on-task (Reeve, 2014)
- **cognitive engagement:** does more than copy teacher, planned approach to learning, uses thoughtful strategies (Reeve, 2014)
- **emotional engagement:** shows enthusiasm, good mood (Reeve, 2014)
- **introversion:** an individual’s tendency to exhibit more self-reflective than outgoing behaviors (Eysenck, 1947; Jung, 1923; Tuovinen et al., 2020)

Conclusion

The past two decades have seen the transformation of classrooms from passive lecture halls to active learning spaces (Beichner, 2014; Copridge et al., 2021). These dynamic new spaces change expectations both of teacher role and student participation. Active participation requires students to do more than simply attend to classroom discourse by actively contributing to classroom conversation (Major, 2020). As teachers attempt to navigate new strategies for active learning and engagement, introverted students may find themselves being asked to behave in ways inconsistent with their personality type and without adequate time for processing and reflection.

II. REVIEW OF LITERATURE

The purpose of this quantitative study was to investigate if a relationship exists between introverted student behavior and teacher perception of student engagement. At this stage in the research, introversion was as a focus of one's energy toward the inner world (Eysenck, 1947; Jung, 1923; Tuovinen et al., 2020).

Personality Type

Personality type influences an individual's preferences regarding how to work, where to work, and with whom to work (Duffy & Chartrand, 2016; Jonason & Sherman, 2020; Wzrus et al., 2016). According to Tuovinen et al. (2020), introverts prefer solitude, require time alone to balance out energy, and feel easily overstimulated. Lawn et al. (2019) demonstrated that extraversion remains a cultural preference in Western society. In such societies, extraverted individuals tended to demonstrate a higher degree of authenticity and, in turn, well-being (Lawn et al., 2019).

Relationships

Wzrus et al. (2016) explored the relationship between personality type and frequency of life situations. Participants, ($n = 378$) ages 14-86, received a cell phone on which they could be pinged throughout the duration of study. When pinged, individuals entered information regarding their current activities: what they were doing and with whom. Additionally, participants completed the Big Five Inventory to generate data related to personality type. Researchers

analyzed data using logistic multilevel regression models. Older individuals showed less prominent levels of extraversion ($\beta_{age} = -.17; p < .01$) and correlated positively with being with friends when pinged (Wzrus et al., 2016). These findings confirmed the hypothesis that extraverted individuals tend to choose experiences higher in social interaction than introverted individuals.

In some instances, students prefer working with specific individuals. Duffy and Chartrand (2015) explored the personality mechanism which allowed extraverts to build rapport with others. In two studies, female university students were asked to complete either one of two tasks: a photo description ($n = 84$) or a word-listing activity ($n = 100$). Participants also completed Goldberg's Mini-Markers to measure extraversion based on reverse scoring. In the experimental condition, the participant was told that successful completion of a given task was easier when they got along with a confederate. The confederate in the scenario engaged in easily mimicked behaviors. The researchers hypothesized extraverts would engage in higher levels of mimicry than introverts to build rapport (Duffy & Chartrand, 2015).

Data for both studies were analyzed using multiple regression analysis (Duffy & Chartrand, 2016). The first study explored mimicry in the presence of a shared goal. The model was significant ($F(3, 80) = 3.4; p = .02$). However, the simple slope of extraversion was significant only in the affiliation-goal-present condition ($b = 0.43; t(80) = 2.55; p = .01$). The second study examined the link between mimicry and rapport. This model was also significant ($F(3, 96) = 3.9; p = .01$). However, the simple slope of extraversion was again significant only in the affiliation-goal-present condition ($b = 0.54; t(96) = 2.39; p = .02$). In both studies, researchers found extraverts mimicked others to build rapport only when it was most advantageous to do so, particularly in the presence of a goal (Duffy & Chartrand, 2016). Understanding the behavioral

habits of students by personality type may enable teachers to create classroom relationship dynamics better suited to the success of all students.

In addition to providing a variety of learning experiences, teachers must also determine how to group students for collaborative tasks. Jonason and Sherman (2020) assessed individuals ($n = 237$) using the Short Dark Triad personality inventory, International Personality Item Pool, and S8* to calculate correlations between personality traits and perceptions of situations. Within the classroom situation, extraversion correlated positively with duty, intellect, positivity, and sociality. The way individuals see the world shapes who they are, and this perception, in turn, creates personality. Individual biases may influence how a person sees the world in which case personality would then capture this perspective (Jonason & Sherman, 2020). Situational interpretation may have implications, particularly for grouping, in classroom settings, and differences in how individuals perceive situations may be explained by personality traits.

Lawn et al. (2019) examined the authenticity and well-being of introverts in Western society where extraversion is culturally preferred. Lawn et al. (2019) referred to societies with a cultural preference for extraversion as having high extraversion-deficit belief. Alternatively, low extraversion-deficit belief referred to settings where no such preference existed. Participants ($n = 349$) ages 18-61 years old who were living in Australia completed three instruments from which researchers gathered data. The International Personality Item Pool (IPIP-NEO-120) assessed personality characteristics including introversion and extraversion while the Authenticity Scale and Mental Health Continuum-Short Form measured authenticity and overall well-being, respectively. After controlling for age and ethnicity, researchers analyzed relationships in data through an ordinary least squares regression called PROCESS. Introverts with low extraversion-deficit belief showed higher levels of authenticity, and authenticity plays a role in moderating the

positive relationship between personality type and flourishing (Lawn et al., 2019).

Personality type (introversion/extraversion) plays a role in individuals' preferences regarding collaborative work, partners or small group members, and rapport building (Duffy & Chartrand, 2016; Jonason & Sherman, 2020; Wzrus et al., 2016;). An extravert's preference for social situations may be explained by the ability to mimic others, particularly in circumstances where a goal is present (Duffy & Chartrand, 2016). Understanding students' personality type and work preferences may enable teachers to create learning environments which promote better academic outcomes.

Introversion in the Workplace

Leadership

According to Craciun and Sofian (2015), trends in employment favored extraverts for management positions, often overlooking the benefits offered by introverted workers. Using a case study design of a single individual manager characterized as an introvert through DECAS personality profiling along with an interview, the researchers explored the individual's difficulty in the situation of being a manager. Results of the DECAS profile reflected the participant's desire to help others although her peers perceived her as cold. She tended towards the idealistic which hindered her success in completing projects. The researchers concluded that the prudence and methodical nature of introverts may negatively impact motivation at work when employers prize only record-setting achievements and increased rank (Craciun & Sofian, 2015). These workplace findings may have implications for determining which individuals are highlighted in classroom communities.

Substantial literature has demonstrated that negative relationship between introverts and leadership in the workplace, and Spark et al. (2018) attempted to determine why such a

relationship exists. First-year college students studying business ($n = 184$) gathered in one room and completed the Big Five Mini-Markers personality assessment to determine introversion or extraversion traits along with a questionnaire regarding the participants' feelings towards completing the upcoming group task. Researchers labeled students who rated themselves as more likely to be stressed or anxious as having a negative forecasted affect. Participants then completed a group task and, after the task, completed an emergent leadership scale. Analysis of data sought to determine the effect of the mediator variable, forecast affect, and revealed a moderate positive relationship between extraversion and emergent leadership ($r = .27; p < .01$) with positive forecast effect (Spark et al., 2018).

Harassment/Negative Attention

Using meta-analysis, Nielson et al. (2017) examined correlations between personality indicators and harassment in the workplace. After researchers identified scholarly work on the relationship between personality traits (via Five Factor Method) and workplace harassment (mean $n = 386$), the Comprehensive Meta-Analysis software program ran statistical analysis on the data. A weak negative correlation was found between extraversion and workplace harassment ($r = -0.10$; Nielson et al., 2017). Given these findings regarding workplace maltreatment of introverts, studies should be conducted to determine if students receive the same treatment in schools because of their personality types.

McCord and Joseph (2020) conducted a review of literature to examine negative responses towards introverts in the workplace and proposed a framework to explain this phenomenon. Scholarly literature depicted introverts as a target of negative attention from co-workers in a variety of ways including social exclusion, overlooked performance, and mockery. Because personality traits are often believed to be controllable, introverts face targeted prejudice

and oppression (McCord & Joseph, 2020). Similarly, teachers who believe introversion is a choice may exhibit a preference towards students who "comply" with the extravert ideal.

Introversion in the Classroom

Physical Environment

Active learning classrooms and tasks require students to engage with the content of the course through discussion and collaborative group work rather than passively listening to a lecture. Neurological research has demonstrated the underlying role of biology in reactivity and introversion; however, introverts did not appear to be distracted by visual stimuli in the same way as auditory stimuli (Kagan et. al, 2007; Park et al., 2019; Shi et al., 2020; Virzi et al., 2018). Although the behaviors expected in an active learning environment align more closely with the personality characteristics of extraverts, Wilson and Cotgrave (2016) found no significant relationship between the preferences of extraverted students and active learning spaces. The actual physical layout of an active learning classroom benefited introverted students by allowing for smaller group discussions and individualized instruction (Copridge et al., 2021).

Virzi et al. (2018) studied the effect of personality type on visual stimuli and task performance. Students from a foundational psychology course ($n = 90$) completed the Eysenck Personality Questionnaire and were then asked to complete a recorded listening comprehension task in one of two experimental conditions. In the first condition, a muted video of ocean waves played in the background, while in the second, a muted Looney Tunes cartoon played. Participants then ranked their levels of distraction while performing the task. The researchers hypothesized extraverted individuals would be less distracted from the task by the muted videos than introverted individuals based on Eysenck's theory of personality and the higher cortical arousal threshold in extraverts (Virzi et al., 2018).

Virzi et al. (2018) used independent *t*-tests to analyze data relating personality type and distraction levels, and all three of the researchers' hypotheses were rejected. The correlation between extraversion score and distraction by the cartoon as well as the correlation between extraversion score and performance score in the condition with the cartoon were not significant. Also of note, the difference between performance scores for the ocean waves was not statistically different than the scores in the cartoon condition. Visual stimulation did not appear to increase distraction in the same way as Eysenck's theory described for auditory, gustatory, and somatosensory stimulation (Virzi et al., 2018).

In a study on how the learning environment impacts community building, Wilson and Cotgrave (2016) used the Big Five to measure personality type before participants ($n = 140$) responded to surveys on learning environment and community. NOVA and Kruskal-Wallis analyses revealed significant relationships in the data. Although several physical characteristics of learning spaces, including open social areas and informal spaces, correlated significantly with other personality measurements from the Big Five, no significant relationship was found between extraversion and learning environment (Wilson & Cotgrave, 2016). These findings suggested that while classroom structure and tasks comprise critical components of student satisfaction and success, actual physical environments do not play a significant role in student outcomes.

Copridge et al. (2021) examined the perceptions of faculty members teaching in Active Learning Centers (ALCs) at two universities. After conducting interviews with nine professors/lecturers, the researchers used thematic analysis and inductive coding to create 14 categories. Following discussion among the researchers, three key themes emerged from the categories: ALCs enable instructors to be more present, provide enhanced feedback, and initiate

increased conversation with students (Copridge et al., 2021).

The physical layout of an ALC allowed the professors to change sightlines based on student seating and the location of the instructor. By moving throughout the room, instructors do not allow students to be isolated or physically removed from the learning context. The closeness of instructor and student facilitates an enhanced relationship between professor and student. Environmental layout also fosters relationships between students as work is more easily shared between individuals or small groups. As one professor noted, students cannot remain anonymous in an ALC, instead they “must experience relational interactions” (Copridge et al., 2021, p. 215) both with other students and the instructor.

ALCs also afford instructors an opportunity to check in with small groups of students, to provide immediate clarification, and to allow students to become collaborators in constructing knowledge (Copridge et al., 2021). Because instructors are free to move throughout the learning space, they more readily anticipate and respond to student questions. Quick check-ins with students afford instructors the opportunity to assess understanding frequently on an individual level and then to target instruction and feedback to specific needs. In some groups, instructors can merely observe small group discussion as students collaborate and build knowledge, while in others, instructors may need to join the group for an extended period to address misconceptions (Copridge et al., 2021).

The small group nature of ALCs affords students an opportunity to develop intimate relationships which fosters a safe space for participation. According to one professor, the ALC “provides an opportunity for those that are outspoken to speak up but those that are quieter to participate in small group activities” (Copridge et al., 2021, pp. 216-217). ALCs help meet the classroom needs of introverted students through small group conversation which allows for

thought development and processing time as well as individual feedback from instructors to students.

Students in active learning classrooms participate in collaborative work and discussion-based tasks rather than passive teacher-driven direct instruction. Although biology plays a role in reactivity and introversion, visual stimuli does not seem to distract introverts in the same way as auditory, gustatory, and somatosensory stimuli (Virzi et al., 2018). The tasks of active learning environments appear to better match the preferences of extraverted students; however, according to Wilson and Cotgrave (2016), no significant relationship existed between active learning spaces and the extraverted students' learning preferences. The physical layout of an ALC enabled instructors to engage individually with students to construct knowledge, address misconceptions, and allow for extended processing time; all of which benefit introverted students (Copridge et al., 2021).

Active Learning

Well-developed active learning tasks include individual processing time for students to gather, reflect upon, and develop their thoughts before participating behaviorally in the activity (Persky et al., 2015). Pawlowska (2014) and Persky et al. (2015) found active learning tasks were not detrimental to introverted students, and, in fact, benefitted students of both personality types when properly constructed. Beneficial tasks include processing time for students before beginning discussion (Persky et al. 2015). When instructional models fail to include this reflection time, introverted students create it for themselves, often at the expense of great emotional strain and falling behind in the task (Green et al., 2019).

Personality type is an important consideration for teachers when constructing active learning tasks. Pawlowska et al. (2014) sought to build upon the historic findings of Pace and

Stern (1958) that student needs and environmental alignment predicted student achievement. Using data from undergraduate students ($n = 1763$) in psychology courses, researchers analyzed Big Five personality indicators, classroom environment measures, course satisfaction ratings, and grades in the course (Pawlowska et al., 2014).

Multilevel regression models determined whether personality type or classroom environment independently predicted academic performance or student satisfaction, while a polynomial regression model predicted the relationship between personality-classroom alignment and performance or satisfaction (Pawlowska et al., 2014). The multilevel regression model determined course satisfaction was maximized when extraversion, focus, and structure were high. Teachers who provided highly structured classrooms with clear expectations and objectives received high ratings from students of all personality types suggesting that classroom environments contribute meaningfully to student satisfaction and academic success. Student personality strongly predicted academic outcomes with slight extraversion corresponding to the greatest degree of success. Current educational models tend to favor a one-size-fits-all approach despite evidence a variety of environments benefits students of different personality types and academic content (Pawlowska et al., 2014).

Using an undergraduate English course, Green et al. (2019) examined the experiences of students in an active learning environment in a qualitative study. Through semi-structured interviews and asynchronous focus groups, researchers used epoch, triangulation, and member check strategies with participants to describe the experience of introverts in an active learning classroom. Analysis revealed two major related themes in students' experiences: introverted students' personality traits did not match the learning environment, yet students developed coping mechanisms to overcome the mismatch (Green et al., 2019).

Introverts' preference to observe before participating in an experience and need for additional processing time were largely ignored in the active classroom setting. A lack of time for observation and reflection led students to feel behind in the course and concerned about how their behaviors appeared (Green et al., 2019). Introverted students also cited their own embarrassment at being unable to spontaneously contribute to class discourse. Finally, introverts described feelings of nervousness, fatigue, and fear based on the structure of the active learning class (Green et al., 2019). The combination of such emotions caused great emotional expenditure, and students may divert attention away from engagement and decreased learning while attempting to preserve energy.

Despite the difficulties introverted students experienced, these students utilized strategies based on their strengths to adapt to the learning environment (Green et al., 2019). Environment and personality type mismatches regarded use of time, as introverted students felt a need for more time both to process new information and reflect upon connections between concepts. Many students' strategies involved taking time after class to reflect upon the class proceedings either via recording or from memory as a helpful strategy; though students created this time for themselves in different ways, they consistently described a post-class reflection period as most powerful for processing the day's content (Green, et al., 2019).

Davidson et al. (2015) examined specific strategies for enhancing learning in active, collaborative spaces with medical students. Using a hypothesized goodness of fit model, researchers rated medical classroom scenarios and student roles within them as low, medium, or highly consistent with an individual's personality type. For example, a cadaver lab highly suits the needs of introverts who pay close attention to detail, and moderately fits extravert needs because of the required teamwork. Based on the fit model, researchers proposed multiple

strategies to enhance learning for introverted students in collaborative settings, including advanced notice of expectations for verbal contribution, sufficient wait time between question asking and anticipated response, and pairing students for conversation before whole class talk. Although focused on the needs of introverts regarding processing time, the strategies likely foster enhanced learning for extraverted students as well. Noting the change in teaching style from passive lecture to interactive, Davidson et al. (2015) described a need for continued study into the “likely differential impact” (p. 103) on introverted learners.

Using a biology class ($n = 33$) at an American university, Beckerson et al. (2020) explored the impact of an active learning environment on individual performance as moderated by personality type. Students attended two active learning sessions in which they were randomly assigned to groups, given a specific role in the session, and completed post-session peer evaluations. For all other sessions, students participated in passive learning through video lectures. Participants completed the IPIP Big Five Markers questionnaire to determine personality characteristics (Beckerson et al., 2020).

Although results indicated all students earned higher test scores following active learning lessons, Beckerson et al. (2020) found this effect was more pronounced in extraverts. A three-way ANOVA demonstrated a significant relationship between personality type (introversion/extraversion) and academic performance based on learning environment ($F(2,81) = 3.6278; p = .03$). Upon deeper investigation, researchers found that questions regarding content taught in the active learning sessions were more likely to be answered incorrectly by introverted students and correctly by extraverted students (Beckerson et al., 2020). In contrast to Wilson and Cotgrave (2016), these findings demonstrated environment played an important role in the learning process; however, teaching strategies employed may explain the environmental

influence student achievement.

Potential explanations for the difference in student test scores by personality type include the small sample size used by Beckerson et al. (2020), lack of exposure and limited time to adapt to a new learning style for introverts, and overall composition of group based on personality type. Additionally, while test scores revealed significant differences in learning by personality type, student surveys intended to measure preference in learning environment showed similar patterns. Extraverts gave higher scores to the active learning environment than introverts. These findings appear to reflect the importance of a student's preferred learning environment on learning outcomes.

Persky et al. (2015) studied the progress of pharmacy students from an online pharmacokinetics course who participated in team-based learning modules for the first half of the course. In each module, three to four cases were presented in which students received a scenario, pharmacokinetic information, and multiple-choice questions. Students completed four individual, cumulative assessments before the final exam. Students completed the Motivated Strategies for Learning Questionnaire to gauge study habits and Myers-Briggs Type Indicator to assess personality characteristics. Latent curve modeling was used to analyze the data and determine factors related to variability in learning (Persky et al., 2015).

Persky et al. (2015) found within each team that the extraverted students controlled conversations regardless of their understanding of the material while introverted students stayed mostly quiet. Initially only grade point average (GPA) correlated significantly with rate of learning ($b = .22 \pm 0.11; p < .05$); however, after introducing personality traits to the model, this relationship disappeared suggesting metacognitive self-regulation contributes highly to rate of learning (Persky et al., 2015). Increased metacognitive self-regulation corresponds with

decreased rates of learning, and both the need for self-reflection and extended processing time can be described as characteristics of introverts (Cain, 2012). Persky et al. (2015) noted the learning of introverts may be unimpacted by active learning because truly collaborative environments include individual processing time before group conversation. These findings demonstrate collaborative environments may benefit learning for students of all personality types provided that these environments are well constructed.

Lösch and Rentzsch (2018) surveyed German eight grade students ($n = 358$) to gather data regarding individual personality type, grades in academic courses, and ratings about each of their classmates in academic and social realms. Researchers analyzed data to determine relationships between popularity, personality type, and preference in academic and social settings and personality types. Preference referred to how students rated their classmates as partners, while popularity indicated the rating that student received from peer as a suitable partner (Lösch & Rentzsch, 2018).

Extraverted students' desire for more social contact and time spent with peers than their introverted counterparts was reflected in higher social ($\beta = .28$; $SE = 0.05$; $p < .001$) and academic preferences ($\beta = .20$; $SE = 0.06$; $p = .001$). However, in terms of popularity, extraversion correlated with only social popularity not academic ($\beta = .29$; $SE = 0.06$; $p < .001$; Lösch and Rentzsch, 2018). These results indicate students seek out different qualities for partners in a classroom setting than in their free time. As a classroom context involves the targeted goal of learning, preference in the academic realm requires competence in achieving the task. Extraverted students may enjoy a higher social popularity, which aids in networking and relationship development, but students with better grades, regardless of personality type, were rated significantly higher in academic popularity ($\beta = .63$; $SE = 0.04$; $p < .001$; Lösch &

Rentzsch, 2018).

Skinner et al. (2016) conducted an ethnographic investigation into students' explanations of the roles played during project-based learning (PBL). First-year dental students ($n = 108$) participated in a two-phased study. In the first phase, students observed PBL groups during collaborative case study tasks; researchers conducted interviews with the students during phase two. Students' comments reflected the importance of silence in PBL: participants noted that quiet tendencies did not exclude students from contributing within the group because their contributions were often non-vocal. Furthermore, moments of quiet served multiple purposes including time for self-reflection, space for others to contribute, and opportunity for feedback (Skinner et al., 2016). These findings build upon those of Copridge et al. (2021) which suggested that introverted students require and benefit greatly from quiet processing time. Furthermore, other students in the class who are not introverts appear to recognize this need in their classmates and value their non-verbal contributions in collaborative learning situations.

Though Copridge et al. (2021) and Green et al. (2019) revealed the difficulties of active learning environments for introverted students, Persky et al. (2015) described how key characteristics of “a true collaborative learning environment” (p. 4), including time for individual reflection, aligned well with the needs of introverts. Students choose individuals to work with by academic status and the likelihood of positive academic outcomes (Lösch & Rentzsch, 2018). Effects of active learning may be more pronounced in extraverted students; however, active learning can benefit learning outcomes for students of all personality types when tasks are well constructed (Pawlowska, 2014; Persky et al., 2015). Although the chatter and high levels of behavioral engagement required in active learning tasks may appear to favor extraverted students, inclusion of periods for reflection and individual focus provides introverted students

with the additional processing time to feel at ease and successful (Dong et al., 2017; Persky et al., 2015). However, when instructional models fail to include processing time, introverted students invest time in emotional response rather than learning (Green et al., 2019).

Knowledge Acquisition

Akhavan et al. (2015) explored the relationship between knowledge acquisition strategies and personality type (introversion/extraversion). Participants ($n = 152$) completed a survey which included questions about demographics, opinions on the knowledge acquisition techniques, and Eysenck Personality Questionnaire items. Analysis using a Kolmogorov-Smirnov test revealed a significant strong, positive relationship between laddering ($r = 0.516$; $p < .05$), concept sorting ($r = 0.495$; $p < .05$), critical decision method (CDM; $r = 0.459$; $p < .05$), and mapping ($r = .450$; $p < .05$) as knowledge acquisition techniques and introversion. Results indicated introversion significantly alters knowledge acquisition technique preference by tending towards those which require substantial concentration and little verbal communication (Akhavan et al., 2015).

Following up on previous research which indicated personality type played a role in student success and motivation on a task, Nosratinia and Kolsum (2016) explored the impact of convergent and divergent tasks on writing performance in English as a Foreign Language (EFL) students. University EFL students ($n = 120$) in an essay writing course were selected based on their results from the Eysenck Personality Inventory. Divided first into equal introvert and extravert groups, each group was then subdivided as half received convergent tasks and the remainder received divergent tasks. For this study, the divergent task group was instructed to create multiple, opposing, or controversial possibilities while the convergent task group was required to reach an agreement. Students in all four groups participated in instructional sessions with the same instructor, materials, and duration (Nosratinia & Kolsum, 2016).

Students in both groups completed a posttest writing assignment which was assessed using the ESL Composition Profile (Nosratinia & Kolsum, 2016). Although participants in the divergent group achieved significantly higher scores on the posttest, no significant differences were found between introverted and extraverted students' scores in any condition ($F(1, 116) = 3.67; p = .058; \eta^2 = .031$). An independent samples t -test revealed introverts in the divergent task group scored significantly higher (with a moderate effect size) on the posttest than introverts in the convergent task group ($t(58) = 2.50; p = .015; r = .31$). Unlike other forms of learning and classroom participation, a student's writing ability does not seem to be affected by personality type (Nosratinia & Kolsum, 2016).

Motivation

Personality type alone does not significantly affect intelligence, aptitude, or motivation, nor do students in the classroom select partners based on social status (Joshi & Sharma, 2016; Lösch & Rentzsch, 2018). Game-based learning may enhance the motivation of introverted students leading to increased engagement and participation (Trajkovik et al., 2018). Trajkovik et al. (2018) examined the efficacy of game-based instruction on three domains: learning outcomes, student interest (motivation), and interactivity. Participants in the study were elementary school students ($n = 102$) participating in the "Grandma's games" project which aligned traditional games, such as "Hop-scotch" and "Hide and Seek," with the Macedonian curriculum (Trajkovik et al., 2018). Students completed both an adapted version of the Eysenck Personality Inventory and researcher-developed questionnaires regarding motivation and perceived experience while their teachers evaluated learning outcomes. Researchers analyzed the data and relationships using structural equation modeling (Trajkovik et al., 2018).

Because the only significant relationship involving student personality type was linked to motivation ($\beta = -0.02$; $p < 0.05$), personality type did not appear to play a role in learning outcome or student experience. These results indicate traditional games like those in the “Grandma’s games” project may enable introverted students to engage more readily in learning than formal learning activities. Integrating game-based learning into classroom routines can increase motivation, thus effecting a more dynamic collaborative learning environment (Trajkovik et al., 2018).

Joshi and Sharma (2016) examined the degree to which personality type impacted achievement motivation and aptitude. The researchers hypothesized that extraverts would score significantly higher than introverts in motivation and ability. Students ages 16-18 ($n = 120$) completed a DBDA-MA aptitude test, the Hindi adaptation of the Neymen-Kohilstedt test of Extraversion and Introversion, and the Achievement Motivation Scale. Using ANOVA for personality type and achievement motivation, the reported F -value of 0.12 was found to be insignificant. The F -value for ANOVA between personality type and mechanical ability of 0.32 was also found to be insignificant. Although introverts and extraverts may work differently, personality type alone does not significantly affect intelligence, aptitude, or motivation (Joshi and Sharma, 2016).

When making decisions about who to spend time with, students choose differently in social and academic settings. However, game-based instruction may enable introverted students to increase participation in the classroom (Trajkovik et al., 2018). According to research, intelligence, aptitude, and motivation are not significantly influenced by personality type (Joshi & Sharma, 2016).

Silence

Hanna (2021) explored whether silence is a critical dimension of student voice and how silence is used in classrooms by teachers and students alike. Researchers investigated how students and teachers experience, understand, and use silence in the classroom, in school, and in relationships with others. Data were collected through interviews and group discussions involving a total of 42 students and 27 teachers, and participants, both teachers and students, defined silence as an absence of noise. Analysis of data indicated silence played multiple roles within the classroom: respect, misunderstanding or confusion, processing time, and protection (Hanna, 2021).

According to the students, in situations where silence was combined with listening or a reverence for authority, silence was intended to convey respect (Hanna, 2021). Within certain classroom structures, silence was expected from students. One teacher noted her own power in the classroom and described herself as the mediator of knowledge such that it is “more important they listen to me than I listen to them” (Hanna, 2021, p. 9). For her, silence implied students were listening, and knowledge was imparted from the teacher (Hanna, 2021).

Students described not understanding the concept being taught as a reason for silence in the classroom. This use of silence may enable students to disengage from instruction and withdraw from the learning environment. At times, this teacher-imposed silence prevented students from asking questions to gain the understanding required to complete the task. However, other students remarked that silence may be a tool for additional processing rather than a pure lack of understanding. In these moments where additional processing time was needed, silence enabled students to better think through and select their words before asking or responding to a question (Hanna, 2021).

Finally, students described using silence to protect themselves from embarrassment. Though some students remained silent rather than be embarrassed at not knowing a correct response, other students did not want to offend classmates with their opinions (Hanna, 2021). Silence can also be utilized by students to resist instruction and disengage from classroom work. When students choose silence as a form of resistance or defiance, they increasingly exclude themselves from the work and community of the classroom which further silences their voices (Hanna, 2021).

Because silence can take on a variety of meanings which may not be shared by the teacher and students, an individual's reason for choosing to be silent in the classroom may be misunderstood or misconstrued (Hanna, 2021). Relationship between teacher and student underscored the importance of determining the cause for silence as respectful listening, confusion or disengagement, and self-protection. Although teachers largely understood silence through the lens of listening, students questioned the expected respect for authority but feared any resistance to passive knowledge instruction would be perceived as disrespectful (Hanna, 2021). Ultimately, as silence can easily be misinterpreted, prolonged silence may erode relationships and further strain the ability for teachers to develop meaningful dialogue with students.

Sedova and Navratilova (2020) attempted to explain when and how silent students participate in classrooms. Ninth-grade students in 32 classes in the Czech Republic completed literacy tests followed by researcher observations of Czech and language arts classes and student interviews. Four students and four teachers completed individual interviews with researchers. Analysis of teacher data revealed the teachers' understandings of student behavior and how teachers believe students participate in class (Sedova & Navratilova, 2020).

High-achieving students described themselves as engaged and happy to participate when they feel they understand the content well, whereas low-achieving students categorize themselves as poor learners (Sedova & Navratilova, 2020). Quiet low-achievers described themselves as timid and shy. Low-achieving students hesitate to participate in class because they fear that the other students are smarter, or their responses will be incorrect. Despite their own silence, quiet high achievers think participation augments learning while low achievers assume classroom communication is unrelated to learning outcomes. For this reason, low-achieving students tend to speak only when called upon by the teacher rather than volunteering themselves (Sedova & Navratilova, 2020).

Classroom communication fosters exploration of new ideas, connections between concepts, and enhanced learning through teacher feedback, and low-achieving students inhibit their own growth by not engaging (Sedova & Navratilova, 2020). Though both high- and low-achieving quiet students prefer not to raise their hands in class, teachers respond differently to the two groups. Teachers often call upon high-achieving students, particularly to respond to complicated questions. However, attempting to save low-achieving students from embarrassment, teachers called upon these students infrequently and only when asking basic questions (Sedova & Navratilova, 2020). Low achievers continue to fall further behind reinforcing their self-concept as low achieving.

Engagement of Introverted Students

Introverted students' hesitation to participate in classrooms extends beyond the social anxiety of raising a hand or speaking to the whole class. According to Dong et al. (2015), undergraduate students were as unlikely to utilize a clicker system as they were to verbally participate in classroom discourse. Rosheim (2018) noted introverts prefer to engage in academic

content through listening and quiet reflection rather than whole group conversation. Although a negative relationship exists between introverted students and social engagement, no such relationship exists for introverts and academic engagement; this suggests that introverts engage differently depending upon the circumstances (Tuovinen et al., 2020). Furthermore, Sulea et al. (2015) found no significant relationship between extraversion and engagement.

Exploring the relationship between personality type, basic need satisfaction, and well-being (defined by engagement, boredom, and burnout), Sulea et al. (2015) hypothesized that engagement would correlate positively with extraversion. Sulea et al. surveyed a sample of Romanian college students ($n = 255$) using items from the Utrecht Work Engagement Scale, Utrecht Boredom Scale, Maslach Burnout Inventory for Students, Mowen's Personality Scale, and the Need Satisfaction at Work Scale. Surprisingly, no significant relationship was found between extraversion and engagement. The researchers' use of introversion items from Mowen's Personality Scale and reversal of the scores limited these findings (Sulea et al., 2015).

Dong et al. (2017) explored the use of clicker systems to pause the lecture in a geographic information system course. Students were instructed to utilize the pause feature when they did not remember or understand the content and could use the break to reflect or complete practice. When a particular threshold of students clicking pause was reached, the instructor stopped lecturing to allow for questions or a break. In addition to collecting data regarding time elapsed in the lecture when pushing the pause button, reason for pushing pause, and level of content understanding, researchers also surveyed participants ($n = 109$) about personality type, trust in the instructor, and willingness to use the clicker system (Dong et al., 2017).

Results indicated the optimal time for instructors to halt the lecture was when half of the students had pushed pause (Dong et al., 2017). Willingness to use the clicker system had a strong

negative correlation to trust in instructor ($r = -.397$), while extraversion correlated positively with a willingness to use the system ($r = .319$). Recognizing introverts' tendency not to request a pause even when struggling with the content enables instructors to anticipate the need for breaks within the structure of lessons regardless of clicker data. These findings indicate the tendencies of introverted students to resist asking questions extends beyond verbal and social hesitancy (Dong et al., 2017).

Curious about the effects of learning through social interaction on introverted students, Tuovinen et al. (2020) examined the relationship between personality type and social engagement on academic engagement. Ninth grade students in Finland ($n = 862$) completed an electronic survey at school with items regarding social engagement outside of school as well as from the Big Five Personality Inventory, Rosenberg self-esteem scale, Schoolwork Engagement Inventory, and School Burnout Inventory (Tuovinen et al., 2020).

Statistical analysis revealed a significant negative relationship between introversion and social engagement ($r = -0.13$; $p < .01$); however, the relationship between introversion and schoolwork engagement was not significant (Tuovinen et al., 2020). These findings suggest introverted students experience engagement differently in social and academic settings. For introverts only, individuals with higher social engagement reported higher levels of self-esteem than individuals with lower social engagement, therefore higher social engagement may provide introverted students with additional confidence that students with low social engagement do not enjoy. Teacher awareness of student personality type enables them to provide appropriate supports for learning (Tuovinen et al., 2020).

Students who are labeled as “quiet” may be shy or introverted, labels which are not necessarily interchangeable. Shyness is a behavioral response to some previous experience while

introversion as a personality trait has a neurological basis. Rosheim (2018) selected three students from her sixth-grade class for an action research study. Students self-identified with introverted characteristics through an in-class survey. Having collected data from individual interviews, videoed small group learning sessions, and written student reflections, Rosheim (2018) performed multimodal analysis and found numerous instances of engagement outside of class discussion. Students noted a preference for listening over speaking in class and a desire for extended processing time. Having initially perceived a particular student as withdrawn during a poetry task, Rosheim (2018) later discovered “copious notes” (p. 667) on his page indicating substantial engagement with the activity. In addition to expanding her definition of participation through opportunities for writing and quiet reflection, Rosheim (2018) noted that understanding learning preferences changed the dynamic of her classroom to better recognize the needs of all students.

Engagement may appear differently in introverted students (Rosheim, 2018). For example, introverts prefer to listen and reflect in writing. However, Dong et al. (2015) found introverts were as hesitant to ask for a pause in the lecture using clickers as they were through raising their hands. Sulea et al. (2015) found no significant relationship between extraversion and engagement. Introverted students engage differently depending on the circumstances. Though introversion correlates negatively with social interaction, no such relationship exists with academic engagement (Tuovinen et al., 2020).

Summary

An individual’s preferences regarding how to work, where to work, and with whom to work result from differences in personality type (Duffy & Chartrand, 2016; Jonason & Sherman, 2020; Wzrus et al., 2016). Introverts preferred solitude, required time alone to balance out

energy, and felt easily overstimulated while extraverts focused their energy outward (Jung, 1923; Tuovinen et al., 2020). Lösch & Rentzsch (2018) found students preferred working with individuals based upon the likelihood of positive academic outcomes. Although active learning environments appear to align more closely with the behaviors of extraverted students, no significant relationship was found between extraverted students' learning preferences and active learning environments (Wilson & Cotgrave, 2016). Copridge et al. (2021) determined the physical environment of active learning classrooms benefited introverted students' preferences by allowing for individualized learning in smaller groups. Finally, well-developed tasks in active learning environments benefit students regardless of personality type (Pawlowska, 2014; Persky et al., 2015).

CHAPTER III: METHODOLOGY

The purpose of the study was to evaluate the degree of difference for student engagement by personality types of introversion and extroversion. Chapter III contains a presentation of the essential elements of the study's methodology. The following represents the essential elements of the study's research methodology

Research Design and Methodology

A non-experimental, quantitative research design was used to address the study's topic and research problem (Edmonds & Kennedy, 2017). The specific research methodology selected for study purposes was a survey research approach because of its advantage in amassing a considerable amount of data on a respective topic (Mills & Gay, 2019). Survey research, moreover, provides the advantages of generating noteworthy statistical power, flexibility, scalability, and overall efficiency in addressing a study's topic (Jones et. al., 2013).

Study Participants

The sample of study participants was accessed through a non-probability, convenient sampling technique as defined by Adams & Lawrence (2019). Study participants, delimited to certified teachers located in the southeast region of the United States, received an invitation via email to complete an online survey. Teachers were also invited to forward the link to the survey to their colleagues and post on social media to generate additional data. Participants were asked to provide demographic information such as gender, number of years teaching high school, type

of school environment, and academic discipline taught. The study's final, actionable sample of participants was 126.

Preliminary Analysis

Statistical power analysis using the G*Power software (3.1.9.2, Universität Düsseldorf, Germany) was conducted in advance of the study for sample size estimates for statistical significance testing purposes (Faul et. al, 2009). The study's statistical power analysis was delimited to anticipated medium and large effects in the analyses, a power ($1 - \beta$) index of .80, and a probability level of .05. Research questions one and two featured the use of the *t* test of independent means for statistical significance testing purposes (Field, 2018). A sample size range of 42 (anticipated large effect $d = .80$) to 102 (anticipated medium effect $d = .50$) was determined sufficient in detecting a statistically significant finding ($p \leq .05$) in the comparative analyses featured in research questions one and two.

Instrument

A researcher-adapted version of an existing, standardized research instrument, the Engagement Rating Scale (ERS), was used to collect data for the purpose of addressing the study's construct, research questions, and hypotheses. The ERS was deemed appropriate for use in addressing the study's construct with modifications specific to the study.

Research instrument validation was necessitated considering the adaptation of items from the ERS and was conducted through a three-phase process (Boateng, et. al, 2018). The content validity judgment phase was addressed through the adaptation of existing survey items on the ERS for study purposes. In the second phase, the study's research instrument was administered to a small number of study participants as a means of "piloting" the research instrument. Cronbach's alpha (α) was used for validation purposes through statistical means. An alpha level

of $\alpha \geq .70$ was sought at the outset of the study during the pilot study phase. Item analysis for item refined purposes or removal was envisioned for use in the wake of the pilot study if the alpha level fell below the .70 level. The alpha level achieved at the piloting phase of the study was beyond .70 for response sets associated with personality-type identifiers of introversion and extroversion and, as a result, provided the impetus for the final administration of the research instrument to all 126 study participants.

The third and final stage of the research instrument validation process was conducted through statistical means using the Cronbach's alpha (α) statistical technique for the complete administration of the research instrument.

Research Questions & Hypotheses

The following research questions and hypotheses were formally stated in the study.

Research Question #1

To what degree do the perceptions of teachers differ on engagement by student personality type (introvert or extravert)?

H_{a1}

There will be a statistically significant difference between teacher perception of overall student engagement favoring engagement of students considered as extravert.

Research Question #2

Within the four dimensions of engagement, in which dimension was the greatest degree of effective difference between introverted and extraverted students?

H_{a2}

Behavioral engagement will be the dimension in which there is the greatest degree of effective difference between introverted and extraverted students.

Data Collection Procedures

Study data were collected via the Google Forms platform. Study participants were sent a link to the research instrument survey via email. A snowball sampling approach (Fraenkel Wallen, & Hyun, 2019) was used in the sampling procedure whereby invitations to share the survey link via text message, email, or social media to others who met the study criteria were sent. Before entering the survey, participants acknowledged consent to participate using an online informed consent document. Study data were stored on a password-protected hard drive and encrypted on the Google Drive website. Although demographic characteristics were collected and utilized as part of the analysis, no personal identifying information was requested nor collected in the research instrument administration process.

Study participants were asked to rate the engagement of students using a 5-point Likert-type scale across four domains of the construct of engagement: behavioral engagement, emotional engagement, cognitive engagement, and agentic engagement. An overall mean engagement summary response level score (Myers et. al., 2017) was calculated for each study participant completing the survey for each described student. Mean scores within the domains of behavioral engagement, emotional engagement, cognitive engagement, and agentic engagement were also calculated. The survey also included demographic questions such as gender, number of years teaching high school, type of school environment, and academic discipline taught.

Study data were imported into the 28th version of IBM's Statistical Package for the Social Sciences (SPSS) for analysis purposes.

Data Analysis

Foundational analyses of a preliminary, segue nature were conducted prior to the formal analysis of the study's two research questions. Assessments of survey completion rate, internal

reliability of study participant response to survey items on the research instrument, and demographic identifier information were conducted using descriptive statistical techniques. The study's survey completion rate was analyzed using the descriptive statistical techniques of frequency counts (n) and percentages (%) for participant demographic information. Study participant response data within survey items on the research instrument was evaluated using measures of typicality, variability, and data normality. The internal reliability of study participant response to survey items on the study's research instrument was assessed using the Cronbach's alpha (α) statistical technique.

In research questions one and two, the descriptive statistical techniques of frequency counts (n), percentages (%), mean scores, and standard deviations (SD) were used. The t -test of independent means was used for statistical significance testing purposes in the comparison of mean scores featured in research questions one and two. The two major assumptions associated with the use of the t -test of independent means, homogeneity (equality) of variances and relative normality of data distribution, were assessed through statistical means. The assumption of homogeneity (equality) of variances was assessed through the interpretation of the Levene's F statistical technique. Levene F values of $p > .05$ were considered satisfying of the assumption of homogeneity (equality) of variances. Skew and kurtosis values were interpreted for normality of data array assessment purposes. Skew values not exceeding $-2.0/+ 2.0$ and kurtosis values not exceeding $-/+7.0$ were considered satisfying of the assumption of data distribution normality (George & Mallery, 2020).

Summary

Chapter III contained a presentation of the essential elements of the study's research methodology. A quantitative, non-experimental research design was used in the study. The

research methodology selected for study purposes was survey research. The study's participant sample of 126 provided sufficient statistical power for detecting statistically significant medium and large effects for the comparative analyses in research questions one and two. Descriptive and inferential statistical techniques were used to analyze study data at the preliminary, foundational level and for the study's research questions and hypotheses. Chapter IV contains the formal reporting of findings achieved in the study.

IV. RESULTS

Chapter IV contains a presentation of the findings achieved in the study. A non-experimental, quantitative research design was used to address the study's topic and research problem. The specific research methodology selected for use in the study was a survey research approach with two research questions and research hypotheses to address the study's research purpose. Study data were analyzed at the preliminary, introductory level using descriptive statistical techniques; then, the study's two research questions and hypotheses were addressed analytically using descriptive and inferential statistical techniques. The analysis and reporting of study data were accomplished using the 28th version of IBM's Statistical Package for the Social Sciences (SPSS).

The following represents the formal reporting of findings achieved in the study.

Preliminary Findings

Descriptive statistical techniques were used to assess the study's demographic identifying information of personality type, gender, and school of employment descriptor. The study's demographic information of grade-level grouping was specifically addressed using the descriptive statistical techniques of frequencies (*n*) and percentages (%).

Table 1 contains a summary of finding for the descriptive statistical analysis of the study’s demographic identifying information related to the primary grouping variable of respective personality type, study participant gender, and school descriptor.

Table 1

Descriptive Statistics Summary Table: Demographic Identifying Information

Demographic Variable	<i>n</i>	%	Cumulative %
Group			
Introvert	63	50.00	50.00
Extravert	63	50.00	100.00
Missing	0	0.00	100.00
Gender			
Female	100	79.37	79.37
Male	26	20.63	100.00
Missing	0	0.00	100.00
School Type			
Public	68	53.97	53.97
Private	34	26.98	80.95
Independent	24	19.05	100.00
Missing	0	0.00	100.00

Descriptive statistical techniques were used to assess the study’s response data, specifically using the descriptive statistical techniques of frequencies (*n*), measures of central tendency (mean scores), variability (minimum/maximum; standard deviations), standard errors of the mean (SE_M), and data normality (skew, kurtosis).

Table 2 contains a summary of finding for the descriptive statistical analysis of the study’s response set data associated domain of engagement and perceptions of student personality type.

Table 2*Descriptive Statistics Summary Table: Engagement by Group and Domain*

Engagement by Group/Domain	<i>M</i>	<i>SD</i>	<i>n</i>	<i>SE_M</i>	Min	Max	Skew	Kurtosis
Introvert								
Behavioral	3.94	0.74	63	0.09	2.00	5.00	-0.39	0.03
Emotional	3.13	0.96	63	0.12	2.00	5.00	0.30	-0.98
Agentic	3.03	1.15	63	0.14	1.00	5.00	0.13	-0.79
Cognitive	4.10	0.80	63	0.10	2.00	5.00	-0.75	0.35
Overall	3.55	0.70	63	0.09	2.00	5.00	-0.07	-0.69
Extravert								
Behavioral	3.68	0.78	63	0.10	2.00	5.00	-0.004	-0.49
Emotional	4.24	0.73	63	0.09	2.00	5.00	-0.65	-0.05
Agentic	4.02	0.79	63	0.10	2.00	5.00	-0.81	0.67
Cognitive	3.51	0.93	63	0.12	2.00	5.00	-0.20	-0.84
Overall	3.86	0.64	63	0.08	2.25	5.00	-0.40	-0.24

Internal Reliability

The internal reliability of study participant response to survey items on the research instrument was evaluated using the Cronbach's alpha (α) statistical technique (Field, 2018). The conventions of interpretation for Cronbach's alpha numeric values offered by George and Mallery (2020) were used to interpret the degree of internal reliability achieved in the study by perceived personality type. As a result, the internal reliability level achieved in the study for data associated with perceptions of engagement for students considered introverted and extraverted was considered adequate to very good.

Tables 3 and 4 contain a summary of finding for the internal reliability of study participant response to surveys items featured on the research instrument by perceived personality type of student.

Table 3*Internal Reliability Summary Table: Engagement (Introversion)*

Introversion	No. of Items	α	Lower Bound	Upper Bound
Engagement	4	.75	.67	.83

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

Table 4*Internal Reliability Summary Table: Engagement (Extroversion)*

Extroversion	No. of Items	α	Lower Bound	Upper Bound
Engagement	4	.79	.72	.86

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

Findings by Research Question

The study's research two research questions and hypotheses were addressed using descriptive and inferential statistical techniques. The probability level of $p \leq .05$ represented the threshold value for findings achieved in the analyses to be considered as statistically significant. Numeric effect size values (d) achieved in the analyses were interpreted qualitatively using the conventions of effect size interpretation proposed by Sawilowsky (2009). The following represents the findings achieved in the study by research question and hypothesis stated.

Research Question #1

To what degree do the perceptions of teachers differ on engagement by student personality type (introvert or extravert)?

The t -test of independent means was used to assess the statistical significance of mean score difference in perceptions of overall engagement by perceived personality type (introvert; extravert) of students served. The assumption of homogeneity of variances associated with the

use of the *t*-test of independent means was assessed using the Levene *F* value. The resultant of Levene's *F* value in the comparison was non-statistically significant ($F(1, 124) = 1.02, p = .31$), indicating the assumption of homogeneity of variances was satisfied.

The assumption of data normality associated with the use of *t*-testing was addressed through the interpretation of dependent variable skew and kurtosis values. Using the conventions of data normality referenced by George and Mallery (2020), the skew value of -0.07 and kurtosis value of -0.65 for perceptions of students identified as introverted were well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. The skew value of -0.41 and kurtosis value of -0.46 for perceptions of students identified as extraverted were well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. As a result, the assumption of data normality was satisfied for both data arrays featured in research question one's comparison.

The mean score difference of 0.31 favoring the perceptions of overall engagement of students considered as extraverts was statistically significant ($t_{(124)} = 2.63; p = .005$) and the magnitude of effect in the comparison was considered medium ($d = .47$).

Table 5

Summary Table: Perceptions of Overall Engagement by Personality-Type

Engagement	Introvert		Extravert		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Overall	3.55	0.70	3.86	0.64	-2.63	.005**	0.47

Note. *N* = 126. Degrees of freedom for the *t*-statistic = 124. *d* represents Cohen's *d*. ***p* < .01

Table 5 contains a summary of finding for the comparison of perceptions of overall engagement by personality of student personality type.

H_{a1}

There will be a statistically significant difference between teacher perception of overall student engagement favoring engagement of students considered as extravert.

Considering the statistically significant finding for perceptions of overall engagement favoring the overall engagement of students considered as extraverts, the alternative hypothesis in research question one was retained.

Research Question #2

Within the four dimensions of engagement, in which dimension was the greatest degree of effective difference between introverted and extraverted students?

Research question two was addressed in a layered analytic approach, focusing upon individual analyses for each of the four dimensions of engagement. The following represents the findings achieved in research question two by respective dimension of engagement.

Behavioral Engagement

The *t*-test of independent means was used to assess the statistical significance of mean score difference in perceptions of behavioral engagement by perceived personality type (introvert; extravert) of students served. The assumption of homogeneity of variances associated with the use of the *t*-test of independent means was assessed through the interpretation of the Levene *F* value. The resultant of Levene's *F* value in the comparison was non-statistically significant ($F(1, 124) = 3.14, p = .08$), indicating the assumption of homogeneity of variances was satisfied.

The assumption of data normality associated with the use of *t*-testing was addressed through the interpretation of dependent variable skew and kurtosis values. Using the conventions of data normality referenced by George and Mallery (2020), the skew value of -0.40 and kurtosis

value of 0.13 for perceptions of students identified as introverted were well within the parameters of ± 2.0 for skew and ± 7.0 for kurtosis for data normality. The skew value of -0.004 and kurtosis value of -0.43 for perceptions of students identified as extraverted were well within the parameters of ± 2.0 for skew and ± 7.0 for kurtosis for data normality. As a result, the assumption of data normality was satisfied for both data arrays featured in research question two's comparison for behavioral engagement.

The mean score difference of 0.26 favoring the perceptions of behavioral engagement of students considered as introverts was statistically significant ($t_{(124)} = 1.88; p = .03$). The magnitude of effect in the comparison was between small and medium ($d = .33$).

Table 6 contains a summary of finding for the comparison of perceptions of behavioral engagement by personality of student personality type.

Table 6

Summary Table: Perceptions of Behavioral Engagement by Group

Engagement	Introvert		Extravert		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Behavioral	3.94	0.74	3.68	0.78	1.88	.03*	0.33

Note. $N = 126$. Degrees of Freedom for the *t*-statistic = 124. *d* represents Cohen's *d*. * $p < .05$

Emotional Engagement

The *t*-test of independent means was used to assess the statistical significance of mean score difference in perceptions of emotional engagement by perceived personality type (introvert; extravert) of students served. The assumption of homogeneity of variances associated with the use of the *t*-test of independent means was assessed through the interpretation of the Levene *F* value. The resultant of Levene's *F* value in the comparison was statistically significant ($F(1, 116.12) = 3.14, p = .02$), indicating the assumption of homogeneity of variances was

violated thereby facilitating the interpretation of finding using values associated with homogeneity of variances not assumed.

The assumption of data normality associated with the use of *t*-testing was addressed through the interpretation of dependent variable skew and kurtosis values. Using the conventions of data normality referenced by George and Mallery (2020), the skew value of 0.31 and kurtosis value of -0.96 for perceptions of students identified as introverted were well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. The skew value of -0.66 and kurtosis value of 0.05 for perceptions of students identified as extraverted were well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. As a result, the assumption of data normality was satisfied for both data arrays featured in research question two’s comparison for emotional engagement.

The mean score difference of 1.11 favoring the perceptions of emotional engagement of students considered as extraverts was statistically significant ($t_{(116.12)} = 7.30; p < .001$) and the magnitude of effect in the comparison was very large ($d = 1.30$).

Table 7 contains a summary of finding for the comparison of perceptions of emotional engagement by personality of student personality type.

Table 7

Summary Table: Perceptions of Emotional Engagement by Group

Engagement	Introvert		Extravert		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Emotional	3.13	0.96	4.24	0.73	7.30	< .001	1.30

Note. *N* = 126. Degrees of freedom for the *t*-statistic = 116.12. *d* represents Cohen's *d*.

Agentic Engagement

The *t*-test of independent means was used to assess the statistical significance of mean score difference in perceptions of agentic engagement by perceived personality type (introvert;

extravert) of students served. The assumption of homogeneity of variances associated with the use of the t -test of independent means was assessed through the interpretation of the Levene F value. The resultant of Levene's F value in the comparison was statistically significant ($F(1, 110.11) = 11.51, p < .001$), indicating the assumption of homogeneity of variances was violated thereby facilitating the interpretation of finding using values associated with homogeneity of variances not assumed.

The assumption of data normality associated with the use of t -testing was addressed through the interpretation of dependent variable skew and kurtosis values. Using the conventions of data normality referenced by George and Mallery (2020), the skew value of 0.13 and kurtosis value of -0.75 for perceptions of students identified as introverted were well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. The skew value of -0.83 and kurtosis value of 0.83 for perceptions of students identified as extraverted were well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. As a result, the assumption of data normality was satisfied for both data arrays featured in research question two's comparison for agentic engagement.

The mean score difference of 0.99 favoring the perceptions of agentic engagement of students considered as extraverts was statistically significant ($t_{(110.11)} = 5.59; p < .001$) and the magnitude of effect in the comparison was between large and very large ($d = 1.00$).

Table 8 contains a summary of finding for the comparison of perceptions of agentic engagement by personality of student personality type.

Table 8*Summary Table: Perceptions of Agentic Engagement by Group*

Engagement	Introvert		Extravert		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Agentic	3.03	1.15	4.02	0.79	5.59	< .001	1.00

Note. *N* = 126. Degrees of Freedom for the *t*-statistic = 110.11. *d* represents Cohen's *d*.

Cognitive Engagement

The *t*-test of independent means was used to assess the statistical significance of mean score difference in perceptions of cognitive engagement by perceived personality type (introvert; extravert) of students served. The assumption of homogeneity of variances associated with the use of the *t*-test of independent means was assessed through the interpretation of the Levene *F* value. The resultant of Levene's *F* value in the comparison was non-statistically significant ($F(1, 124) = 2.99, p = .09$), indicating the assumption of homogeneity of variances was satisfied.

The assumption of data normality associated with the use of *t*-testing was addressed through the interpretation of dependent variable skew and kurtosis values. Using the conventions of data normality referenced by George and Mallery (2020), the skew value of 0.48 and kurtosis value of 3.51 for perceptions of students identified as introverted were well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. The skew value of -0.21 and kurtosis value of -0.80 for perceptions of students identified as extraverted were also well within the parameters of $-/+2.0$ for skew and $-/+7.0$ for kurtosis for data normality. As a result, the assumption of data normality was satisfied for both data arrays featured in research question two's comparison for agentic engagement.

The mean score difference of 0.59 favoring the perceptions of cognitive engagement of students considered as introverts was statistically significant ($t_{(124)} = 3.80; p < .001$). The magnitude of effect in the comparison was between medium and large ($d = .68$).

Table 9 contains a summary of finding for the comparison of perceptions of cognitive engagement by personality of student personality type.

Table 9

Summary Table: Perceptions of Cognitive Engagement by Group

Engagement	Introvert		Extravert		<i>t</i>	<i>p</i>	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>			
Cognitive	4.10	0.80	3.51	0.93	3.80	< .001	0.68

Note. *N* = 126. Degrees of freedom for the *t*-statistic = 124. *d* represents Cohen's *d*.

H_{a2}

Behavioral engagement will be the dimension in which there is the greatest degree of effective difference between introverted and extraverted students.

Considering the superior degree of effect in the emotional engagement comparison, the alternative hypothesis in research question two was rejected.

Conclusion

This study used a non-experimental, quantitative research design to address the topic and research problem. A survey research approach with two research questions and research hypotheses was used to address the study's research purpose. Study data were first analyzed at the preliminary, introductory level using descriptive statistical techniques. Next, the study's two research questions and hypotheses were addressed analytically using descriptive and inferential statistical techniques. The analysis and reporting of study data were accomplished using the 28th version of IBM's Statistical Package for the Social Sciences (SPSS).

V. DISCUSSION

Personality type influences an individual's preferences regarding social and work habits (Duffy & Chartrand, 2016; Jonason & Sherman, 2020; Wzrus et al., 2016). Research has shown that although active learning environments require students to participate through conversation and learning tasks (all of which are behaviors aligned with the personality characteristics of extraverts), extraverts are not significantly more likely to prefer this environment (Wilson & Cotgrave, 2016). And by allowing focused work in small groups, individual instruction and processing time, and reflective tasks, active classrooms may benefit introverted students (Copridge et al., 2021; Pawlowska, 2014; Persky et al., 2015). Researching the perceptions of teachers regarding student engagement according to personality type addressed the need and possibilities for differentiating instruction in the classroom.

The purpose of this quantitative study was to investigate if a relationship exists between introverted student behavior and teacher perception of student engagement. For the purposes of this research study, introversion was defined as a focus of one's energy toward the inner world (Eysenck, 1947; Jung, 1923; Tuovinen et al., 2020). The sample was high school teachers in the United States who were personally known to the researcher or researcher's contacts. An online survey was completed by 63 high school teachers through a snowball method using email and social media (Mills & Gay, 2019).

The primary independent variables in this study were personality type (introvert and extravert) by description. The primary dependent variable was the mean scores of engagement ratings according to the Engagement Rating Scale (ERS). Data were also analyzed to determine in which dimension of engagement was the degree of effective difference greatest between introverts and extraverts. Differential and inferential statistics were used to address the research questions and hypotheses. Chapter V contains a discussion of the findings achieved and reported on in Chapter IV. The findings discussed include those achieved at the preliminary analytic level and for analysis associated with the study's research questions.

Discussion of Preliminary Findings

During preliminary analysis, the researcher conducted the *t*-test of independent means to further examine relationships between variables. A critical *p*-value of $\alpha \leq .05$ was adopted as the threshold for statistical significance of findings. The evidence identified that teacher perceptions of overall engagement favored students considered as extraverts ($t_{(124)} = 2.63$; $p = .005$). Additional *t*-tests of independent means identified that teacher perceptions of agentic and emotional engagement favored students described by extraverted tendencies ($t_{(110.11)} = 5.59$; $p < .001$; $t_{(116.12)} = 7.30$; $p < .001$, respectively). However, teacher perceptions of behavioral and cognitive engagement favored students described by introverted tendencies ($t_{(124)} = 1.88$; $p = .03$; $t_{(124)} = 3.80$; $p < .001$, respectively).

The online survey consisted of 11 required response fields. Respondents were disproportionately female (79%) and worked in both public and private/independent school settings. The adequate to very good level of internal reliability for both personality types (introvert and extravert) was indicative of the study's construct being addressed accurately and reliably through the data produced by the research instrument. Due to the adequacy of the sample

size ($n = 63$), the study was sufficiently powered. As such, the instrument produced trustworthy and credible data for analysis. The data suggest that investigating teacher perception of student engagement can impact classroom experience and student learning outcomes.

Discussion by Research Question

Research Question 1

To what degree do the perceptions of teachers differ on engagement by student personality type (introvert or extravert)?

H_{a1}

There will be a statistically significant difference between teacher perception of overall student engagement favoring engagement of students considered as extravert.

In line with the hypothesis, teacher perception of overall engagement was statistically significant in favor of extraverted students ($t_{(124)} = 2.63; p = .005$) in the high school setting. However, the magnitude of effect in the comparison was medium ($d = .47$), indicating practical implications in the classroom may be limited. Teachers who expect student participation to be verbal and active would be more likely to rate the extraverted student higher on the ERS. When considering the profile of the described student, teachers may have imagined the introverted student as withdrawn, rarely participating, or disconnected from classroom discourse. Lewin's (1936) personality environment fit theory argues that an individual's behavior may be influenced by the degree to which the environment fits a personality type. The medium effect size of this study indicates existing differentiation in classroom practice and student choice in assignment type may have allowed teachers to create opportunities for students of both personality types to engage in a variety of ways.

Results of the present study contradict the findings of Sulea et al. (2015), which revealed

no significant relationship between extraversion and engagement. Findings from the current study that suggest teachers perceive a higher degree of overall engagement from extraverted students may reinforce the work of Persky et al. (2015) which found within each small group, extraverted students controlled conversations while introverted students remained quiet. Rosheim (2018), however, through multimodal analysis, determined introverts engage in ways beyond discussion. For example, introverted students demonstrate understanding particularly well through written response. Teacher perception of student engagement may be influenced by classroom structure and the format of assignments given (Rosheim, 2018).

Research Question 2

Within the four dimensions of engagement, in which dimension was the greatest degree of effective difference between introverted and extraverted students?

Research question two was addressed in a layered analytic approach, focusing upon individual analyses for each of the four dimensions of engagement. The following reports the discussion of findings for research question two by respective dimension of engagement.

Behavioral Engagement

Teacher perception of the difference in behavioral engagement was statistically significant in favor of introverted students ($t_{(124)} = 1.88; p = .03$) in the high school setting. However, the magnitude of effect in the comparison was between small and medium ($d = .33$), indicating practical implications in the classroom may be limited. Indicators for behavioral engagement include exerts high effort, works quickly, shows persistence in the face of difficulty or failure, pays attention, and on-task (Reeve, 2014). Because the effect size was between small and medium, the significance in the present study may be explained by a limited definition of behavioral engagement.

Differences in instrumentation may account for varying results with limited impact on classroom practice. Other instruments such as the one used by Fredericks et al. (2011) connect behavioral engagement with participation. Although Tuovinen et al. (2020) found a significant negative relationship introversion and social engagement, no significant relationship was found between introversion and schoolwork engagement.

The findings for this research question are interesting as the research instrument included working quickly as an indicator of behavioral engagement. A multitude of studies oppose the view of introverts as quick workers in pointing to introverted students' need for additional processing time (Copridge et al., 2021; Dong et al. 2017; Green et al., 2019; Persky et al., 2015; Skinner et al., 2016). Findings from the present study contradicted Coplan et al. (2011) and Reda (2009) who found teachers perceived quiet students as less intelligent or motivated.

Emotional Engagement

Teacher perception of the difference in emotional engagement was statistically significant in favor of extraverted students ($t_{(116.12)} = 7.30; p < .001$) in the high school setting. The magnitude of effect in the comparison was very large ($d = 1.30$), which indicates teachers recognize extraverted students as far more participative and excited learners as measured by the research instrument. Emotional engagement involves outward expression from students, a characteristic more noticeable in extraverts.

Indicators for emotional engagement on the research instrument include shows enthusiasm, is interested, shows enjoyment/good mood, and has fun (Reeve, 2014). A student who is animated about the course content, as indicated by hand raising or potentially shouting out, may garner more of the teacher's attention than a student ponders quietly off to the side. This interaction with the teacher may lead to a perception of extraverted students as more

emotionally engaged. These findings also reinforce Persky et al. (2015) who noted extraverted students answered questions, displaying eagerness and curiosity regardless of their understanding of the content, while introverts remained quiet even when they clearly understood the material.

Agentic Engagement

Teacher perception of the difference in agentic engagement was statistically significant in favor of extraverted students ($t_{(110.11)} = 5.59; p < .001$) in the high school setting. The magnitude of effect in the comparison was between large and very large ($d = 1.00$), indicating teachers perceive extraverted students to demonstrate agency in ways largely beyond introverted students. Indicators of agentic engagement according to the research instrument include shows initiative, speaks up, and expresses interest (Reeve, 2014). Extraverts likely demonstrate more agency in a manner consistent with the instrument indicators because of their personality type. Extraverted students are active in the classroom, frequently ask questions or create conversation, and interact routinely with those around them. Although introverts hesitate to respond even when they know the answer to a question, extraverted students often speak just to hear their own voices.

Spark et al. (2018) recognized the role of agency in noting a moderate positive effect between extraverted individuals and emergent leadership. Likewise, Duffy and Chartrand (2015) showed extraverts express agency through mimicry in creating a unified effort when presented with a goal. Dong et al. (2017) found introverts were hesitant to request a pause in the lecture even when struggling with the content, indicating the tendency of introverted students to resist asking questions even in anonymous formats. Introverted students' unwillingness to ask for help when needed demonstrates a lack of agency within their own learning. Hanna (2021) noted introverted students' use of silence when they do not understand the concept or to create additional processing time. Because silence marks an absence of noise, this use of agency may

not register with teachers as a way quiet students advocate for themselves within the learning environment.

Cognitive Engagement

Teacher perception of the difference in cognitive engagement was statistically significant in favor of introverted students ($t_{(124)} = 3.80; p < .001$) in the high school setting. However, the magnitude of effect in the comparison was between medium and large ($d = .68$), indicating teachers perceive many introverted students as more thoughtful about their learning than extraverted students. The limited effect size may reinforce the results of Nostratinia and Kolsum (2016), which found writing, a preferred method of demonstrating understanding, does not seem to be affected by personality type. Similarly, Sedova and Navratilova (2020) found teachers question introverted students differently based on perceived ability asking more difficult questions of high-achieving students.

Indicators of cognitive engagement according to the research instrument include planned approach to learning, use of thoughtful strategies, and doing more than copying the teacher (Reeve, 2014). Introverted students are characterized by thoughtful and reflective work habits that align well to the ERS criteria. Although introverted students may not routinely present outward characteristics of engagement, their quiet persistence underlies an intentional and thoughtful dedication to their learning. Rosheim (2018) reflected upon finding the notes of an introverted student which demonstrated serious cognitive engagement after initially believing the student to be disengaged from learning. Although introverted students may not seem overly enthusiastic towards a learning activity, teachers perceive their engagement through individual and reflective activities such as writing.

H_a2

Behavioral engagement will be the dimension in which there is the greatest degree of effective difference between introverted and extraverted students.

The alternative hypothesis in research question two was rejected as the agentic engagement demonstrated the largest degree of effect. Although the results of research question one indicated teacher perception of overall engagement were statistically significant in favor of extraverted students, the results of research question two regarding domains of engagement were mixed. For two dimensions, agentic engagement and emotional engagement, teachers perceived significantly higher extravert engagement. However, for the other dimensions, behavioral engagement and cognitive engagement, teachers perceived significantly higher engagement in introverted students, although with smaller effect sizes.

The change in perception based on dimension may also be explained by the findings of Green et al. (2019), which noted that when introverts' tendencies do not match a learning environment, the students will develop coping mechanisms to create favorable learning outcomes. Similarly, Khan (1990) argued engagement refers to an individual's participation in a situation, while disengagement refers to a disconnection from the circumstances. Teachers perceived higher engagement in students in all dimensions when the criteria best fit a student's personality type. These findings likewise align with Rosheim (2018) who noted that engagement appears differently in introverted students than in extraverted students. Introverted students engage in learning through thoughtful reflection, focused attention to a particular task, and written response. A change in teacher perception based on dimension of engagement may also be explained by the findings of Green et al. (2019), which noted when introverts' tendencies do not match a learning environment, the students will develop coping mechanisms to create favorable learning outcomes. Frequent coping mechanisms include making additional time for processing

or reflection during or after class and developing a self-review protocol after discussed based learning.

Study Limitations

The researcher acknowledges that certain limitations exist within the study. The sampling was convenient, though snowballed, which limits the ability to generalize findings to other populations as the sampled population was not specifically randomized. Similarly, only high school teachers in the United States participated in the survey so results are limited to this cohort. Because the study used a quantitative design, only rigid data were collected. As such, no deeper understandings beyond numeric responses can be realized. With new understandings from this research, additional qualitative research can better examine the nature of the relationship and assist teachers in developing more equitable classroom practices.

Implications for Future Practice

This study provides insights into high school teachers' perceptions of student engagement based on personality type. Perception of student engagement varies by dimension and related indicators. When considering student engagement, teachers should make note of the variety of ways in which students contribute within the classroom environment, particularly those which go beyond verbal or outward expression. It may also be the case that post-COVID, teachers, through their use of digital or asynchronous platforms to provide instruction and assessment in new ways, have broadened their views of what constitutes classroom engagement.

Strategies to enhance the experience of introverted students include wait time, sacred silence, curbing teacher talk, silent modeling, silent reflection (Thom, 2018). Teachers may perceive introverts as disengaged when introverted students create their own additional processing time. Teachers could remedy the situational mismatch by incorporating wait time

throughout lessons as well as reflective time for students to ponder newly acquired content. Teachers who value dialogue may see quietness as lack of participation because they fail to recognize silence as a form of participation or a way through which quiet students construct meaning (Medaille & Usinger, 2018). Providing students with opportunities to demonstrate understanding in ways beyond discussion may enable teachers to assess student learning.

When teachers use collaborative small groups, students may benefit from having explicit roles so that introverted students are not expected to report findings to the whole class but can still have their thoughts included. Such group work enables introverts to form intimate relational connects with select other students and provides opportunities for individualized attention from their instructor (Copridge et al., 2021). Because teachers may perceive quieter students as disengaged, particularly in contrast to outgoing and exuberant students, and small group discussions limit the number of students a teacher focuses on at one time, a small group format may allow teachers to interact with introverted students who would not otherwise garner attention.

Recommendations for Future Research

Recommendations for future studies include replicating the same study using K12 teachers to compare results from high school teachers to teachers from across the educational spectrum. Likewise, the present study could be replicated using randomization and a broader audience such as an entire school district or multiple districts within the state. A larger sample size and randomized sample would increase the generalizability of the results.

Future studies might use a qualitative or mixed methods approach by including interviews or focus groups to gain access to deeper insight regarding teacher perception of introverted student behavior, engagement, and learning. In addition to asking teachers'

perceptions of introverted students, future research may also ask teachers' perceptions of the instructor's role as it relates to student engagement. Particularly of interest, the type of classroom structure utilized by the teacher as expectations on the students as a learner may play a role in teacher perception of student engagement.

Conclusion

Researching the perceptions of teachers regarding student engagement according to personality type provides insight into classroom practice. Research has shown that an individual's preferences, particularly regarding social and work habits, are influenced by personality type (Duffy & Chartrand, 2016; Jonason & Sherman, 2020; Wzrus et al., 2016). Although active learning environments appear to require outward participation typical of extraverts, such as on-going dialogue and group tasks, research has shown extraverts are not significantly more likely to prefer the active learning environment (Wilson & Cotgrave, 2016). Introverted students benefit in active learning environments because of opportunities for individualized instruction, additional time for processing and reflection, and small group dynamics (Copridge, et al., 2021; Pawlowska, 2014; Persky et al., 2015). The findings of this study regarding the perceptions of teachers regarding student engagement according to personality type enables a deeper understanding of how teachers view students in the classroom and potential opportunities for differentiated instruction according to personality characteristics.

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Appendix

Instrument – Engagement Rating Scale (Adapted)

Consider a student who exhibits the following qualities: prefers solitude, selective when choosing social relationships, introspective, interested in deeper feelings, good listener, requires time alone to balance out energy, easily overstimulated

Complete the scales below based on your perception of that student.

	Never/ Not at all		Occasionally		Frequently/ Always
Behavioral Engagement: Works Hard <ul style="list-style-type: none"> • Exerts High Effort • Works Quickly • Shows Persistence in the Face of Difficulty or Failure • Pays Attention • On-Task 	1	2	3	4	5
Emotional Engagement: Works Enthusiastically <ul style="list-style-type: none"> • Shows Enthusiasm, Is Interested • Shows Enjoyment/Good Mood; Has Fun 	1	2	3	4	5
Agentic Engagement: Works Proactively <ul style="list-style-type: none"> • Shows Initiative; Proactive rather than Reactive • Speaks Up: Offers Input, Makes Suggestions, Asks Questions • Expresses Interests, Preferences to Others (including Teacher) 	1	2	3	4	5
Cognitive Engagement: Works Strategically <ul style="list-style-type: none"> • Does More Than Mindlessly Following (Copying) the Teacher • Planned Approach to Learning, Skill Development • Tries to Figure It Out/Thoughtful Strategies, rather than Random Guessing 	1	2	3	4	5

Consider a student who exhibits the following qualities: enjoys being social with other people, attached to one's own ideas, enjoys working with others, functions well in highly stimulating environments

Complete the scales below based on your perception of that student.

	Never/ Not at all		Occasionally		Frequently/ Always
Behavioral Engagement: Works Hard <ul style="list-style-type: none"> • Exerts High Effort • Works Quickly • Shows Persistence in the Face of Difficulty or Failure • Pays Attention • On-Task 	1	2	3	4	5
Emotional Engagement: Works Enthusiastically <ul style="list-style-type: none"> • Shows Enthusiasm, Is Interested • Shows Enjoyment/Good Mood; Has Fun 	1	2	3	4	5
Agentic Engagement: Works Proactively <ul style="list-style-type: none"> • Shows Initiative; Proactive rather than Reactive • Speaks Up: Offers Input, Makes Suggestions, Asks Questions • Expresses Interests, Preferences to Others (including Teacher) 	1	2	3	4	5
Cognitive Engagement: Works Strategically <ul style="list-style-type: none"> • Does More Than Mindlessly Following (Copying) the Teacher • Planned Approach to Learning, Skill Development • Tries to Figure It Out/Thoughtful Strategies, rather than Random Guessing 	1	2	3	4	5