

Florida State University Libraries

Electronic Theses, Treatises and Dissertations

The Graduate School

2022

Youth Peer Processes as Mediators of the Relation between Youth Anxious Solitude and Young Adult Problematic Media Use

Jessie Shafer

FLORIDA STATE UNIVERSITY
COLLEGE OF HEALTH AND HUMAN SCIENCES

YOUTH PEER PROCESSES AS MEDIATORS OF THE RELATION BETWEEN YOUTH
ANXIOUS SOLITUDE AND YOUNG ADULT PROBLEMATIC MEDIA USE

By
JESSIE K SHAFER

A Dissertation submitted to the
Department of Human Development and Family Science
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

2022

Jessie Shafer defended this dissertation on March 23, 2022.

The members of the supervisory committee were:

Heidi Gazelle
Professor Directing Dissertation

Ulla Bunz
University Representative

Ming Cui
Committee Member

Frank Fincham
Committee Member

The Graduate School has verified and approved the above-named committee members, and certifies that the dissertation has been approved in accordance with university requirements.

This dissertation is dedicated to my fiancé, Andrew, who has been a constant source of support, love, and encouragement during the challenges of graduate school and life. Words cannot begin to express how thankful I am to have you in my life. This work is also dedicated to my best friend, Amber, who always lends an ear whenever I need to vent about graduate school and life in general. Finally, I would like to thank my family; my mother, Laura, my sister, Gabrielle, and my uncle and aunt, David and Jenn, for always believing in me and encouraging me to pursue my dreams. I love you all so much. Thank you.

ACKNOWLEDGMENTS

Throughout the writing of this dissertation, I have received a great deal of support and assistance.

I would first like to thank my advisor, Dr. Heidi Gazelle, whose expertise was invaluable in formulating the research questions and methodology. Your insightful feedback pushed me to sharpen my thinking and brought my work to a higher level.

I would like to acknowledge my dissertation committee, Dr. Ming Cui, Dr. Frank Fincham, and Dr. Ulla Bunz, for their valuable guidance throughout the dissertation writing process. Your encouragement and feedback have helped me develop as a graduate student and scholar.

I would also like to thank the Eunice Kennedy Shriver National Institute of Child Health and Human Development for funding the most recent wave of data collection used in this dissertation (grant number: 1 R03 HD104881-01-A1; PI: Heidi Gazelle); and the National Institute of Mental Health for funding the youth portion of the study (grant number: 1K01MH076237; PI: Heidi Gazelle).

And finally, I would like to express my appreciation for the study participants. My research would not be possible without you.

TABLE OF CONTENTS

LIST OF TABLES	vii
LIST OF FIGURES	viii
ABSTRACT	ix
CHAPTER 1 INTRODUCTION	1
Anxious Solitude and Peer Exclusion	1
The Current Study	3
CHAPTER 2 LITERATURE REVIEW	5
Theoretical Models.....	5
Empirical Research	9
Knowledge Gaps	18
The Current Study	20
CHAPTER 3 METHOD	24
Research Design.....	24
Participants.....	25
Procedure.....	25
Measures	26
CHAPTER 4 RESULTS	31
Analytic Plan.....	31
Preliminary Analyses	33
Identifying Youth Peer Exclusion Trajectory Classes	34
Testing Youth Anxious Solitude and Peer Exclusion Trajectory Classes as Predictors and Mediators of Young Adult Media Use	38
Effect Sizes.....	44

CHAPTER 5 DISCUSSION.....	46
Interpersonal Mediation of Links between Youth Anxious Solitude/Peer Exclusion and Young Adult Media Use	46
Direct Links Between Youth Trajectory Classes and Young Adult Media Use.....	51
Youth Anxious Solitude and Peer Exclusion Trajectories.....	56
Strengths, Limitations, and Future Directions	58
Conclusion	61
APPENDIX A TABLES.....	63
APPENDIX B FIGURES	70
APPENDIX C IRB APPROVAL	78
APPENDIX D STUDY CONSENT FORM.....	82
APPENDIX E YOUNG ADULT QUESTIONNAIRE	86
REFERENCES	88
BIOGRAPHICAL SKETCH	97

LIST OF TABLES

Table 1	Descriptive Statistics and Correlations of Study Variables ($N = 118$).....	63
Table 2	Percent of Elementary School Trajectory Class Members in Each Middle School Trajectory Class.....	65
Table 3	Model Fit Indices.....	66
Table 4	Effect Size: Explained Variance (R^2) by Direct Effect Models.....	67
Table 5	Effect Size: Explained Variance (R^2) by Mediation Models (Bayes Estimation)	68

LIST OF FIGURES

Figure 1	Conceptual model proposing that the links from increasing elementary school trajectories of anxious solitude/peer exclusion to elevated young adult media use are mediated by increasing middle school trajectories of anxious solitude and peer exclusion.....	70
Figure 2	Peer-reported anxious solitude latent trajectory classes from (A) the fall of 3 rd grade to the end of elementary school in the spring in 5 th grade and (B) from the start of middle school in the fall of 6 th grade to the end of 7 th grade.....	71
Figure 3	Peer-reported peer exclusion latent trajectory classes from (A) the fall of 3 rd grade to the end of elementary school in the spring in 5 th grade and (B) from the start of middle school in the fall of 6 th grade to the end of 7 th grade.....	72
Figure 4	Direct effect models: Path analysis model of elementary school (3 rd – 5 th grade) trajectory class membership and young adult (age 21-25) excessive and problematic media use for anxious solitude and peer exclusion.	73
Figure 5	Hypothesized mediation model: Path analysis mediation model of elementary school (3 rd – 5 th grade) anxious solitude trajectory class membership (predictor), middle school (6 th – 7 th grade) peer exclusion trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).....	74
Figure 6	First alternative mediation model: Path analysis mediation model of elementary school (3 rd – 5 th grade) peer exclusion trajectory class membership (predictor), middle school (6 th – 7 th grade) anxious solitude trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).	75
Figure 7	Second alternative mediation model: Path analysis mediation model of elementary school (3 rd – 5 th grade) anxious solitude trajectory class membership (predictor), middle school (6 th – 7 th grade) anxious solitude trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).....	76
Figure 8	Third alternative mediation model: Path analysis mediation model of elementary school (3 rd – 5 th grade) peer exclusion trajectory class membership (predictor), middle school (6 th – 7 th grade) peer exclusion trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).....	77

ABSTRACT

Over the past few decades, media and technology use have become increasingly significant components of everyday life. Given media's ubiquitous usage across the lifespan, it is important to understand what puts individuals at risk for engaging in problematic media use. Thus, the current study aimed to explore youth affective-behavioral vulnerability and peer processes as predictors of excessive and problematic media use in young adulthood. Specifically, anxious solitude and peer exclusion trajectory classes in elementary school (3rd to 5th grade) were explored as predictors of young adult media behaviors. Further, membership in anxious solitude and peer exclusion trajectory classes in middle school (6th to 7th grade) were tested as explanatory processes (mediators) in the link between elementary school trajectory class membership and young adult media use.

For the trajectory class analysis, participants were 688 youths who had taken part in the Multiple Trajectories in Anxious Solitary Youth study (female $n = 354$; 51.5%). Latent class growth analysis (LCGA) was used to identify trajectories of peer-reported peer exclusion in childhood (trajectories of peer-reported anxious solitude with this data have been identified in the extant literature; Gazelle & Faldowski, 2019). Separate analyses were conducted for elementary and middle school to allow for different trajectory patterns to emerge after the middle school transition. Three peer exclusion trajectory classes were identified in elementary school (*low-stable*, *moderate-stable*, and *high-increasing*) and two in middle school (*low-stable* and *high-increasing*) with latent class growth analyses (LCGA). In Gazelle and Faldowski's (2019) study, two anxious solitude trajectory classes were identified in elementary school (*moderate-decreasing* and *high-increasing*) and three in middle school (*low-stable*, *low-increasing*, and *high-decreasing*).

For the main analysis, participants were 118 young adults (female $n = 76$; 64%; M age at survey completion = 22.8 years, $SD = 0.84$) who had been prospectively assessed from 3rd to 7th grade in the Multiple Trajectories in Anxious Solitary Youth study. Structural equation modeling (SEM) was used to investigate the influence of anxious solitude and peer exclusion trajectory class membership (in elementary school) on excessive and problematic media use in young adulthood. Further, middle school trajectory classes (both anxious solitude and peer exclusion) were tested as mediators of this link. In partial support of the direct effect hypotheses, membership in the elementary school *high-increasing anxious solitude* trajectory class and *high-increasing peer exclusion* trajectory class predicted more hours per day spent playing video games in young adulthood. Additionally, elementary school *moderate-stable peer exclusion* trajectory class membership predicted more time spent using social media and the internet for entertainment in young adulthood. Finally, although the mediation hypothesis was not supported, mediation analyses revealed that middle school *low-increasing anxious solitude* trajectory class membership *fully mediated* the link between elementary school *high-increasing anxious solitude* trajectory class membership and more time playing video games in young adulthood. Further, middle school *high-increasing peer exclusion* trajectory class membership *partially mediated* the link between elementary school *high-increasing peer exclusion* trajectory class and less time using social media in young adulthood.

This study suggests that young adults with a history of anxious solitude or peer exclusion in elementary school may be especially vulnerable to excessive media use as young adults. Further, this study highlights how continuity and different developmental pathways of anxious solitude and peer exclusion may explain why some anxious solitary and excluded youths spend

more (or less) time using media than their anxious solitary and excluded counterparts.

Limitations, future research directions, and implications of the study are discussed.

CHAPTER 1

INTRODUCTION

Digital media use is a growing global phenomenon that is a significant component of work (e.g., Vayre & Vonthron, 2019), education (e.g., Engelbrecht, Llinares, & Borba, 2020), leisure (e.g., Zach & Lissitsa, 2016), and both adolescent and young adult development (Bjornsen, 2018; Michikyan & Suarez-Orozco, 2016). The prevalence of the Internet in our daily lives is clear: data show that roughly 81% of U.S. adults report using the Internet daily and only 7% report that they do not use the Internet at all (Perrin & Atske, 2021a; 2021b). Given how embedded media has become in everyday functioning, it is important to consider when media use becomes detrimental to human development and which populations are particularly vulnerable to developing maladaptive media behaviors such as excessive and problematic media use. Three models aim to conceptualize this phenomenon are the *Compensatory Media Use Model* (Kardefelt-Winther, 2014), a model which frames individuals as motivated to use media to compensate for negative life situations and to meet psychological needs (i.e., social needs and affect regulation); and the *Stress Generation Model* (Hammen, 2006; Rudolph & Hammen, 1999), a model that highlights the role of the individual in contributing to their own stress; and the *Chronic Stress Model* (Ladd et al., 2019), a model in which stress promotes processes that induce individual vulnerability.

Anxious Solitude and Peer Exclusion

Young adults with a history of youth anxious solitude or peer exclusion may be especially vulnerable to developing maladaptive media behaviors. *Anxious solitude* is an affective-behavioral profile characterized by elevated rates of solitary onlooking behavior, social anxiety, social hesitancy, and verbal inhibition among familiar peers (Gazelle & Ladd, 2003).

Anxious solitary youth want to interact with their peers, but they are held back by social anxiety or social evaluative concerns (Gazelle & Ladd, 2003). These behaviors, in turn, often lead to a lack of satisfying interpersonal relationships and fewer interpersonal interactions compared to non-anxious solitary youth (Rubin, Bowker, & Gazelle, 2010). Extant research (both concurrent and short-term longitudinal) suggests that anxious solitary individuals may be vulnerable to developing excessive and problematic media use in adolescence and young adulthood (e.g., Chak & Leung, 2004; Tian et al., 2019). However, the long-term impact of *youth* anxious solitude trajectories on problematic media use in young adulthood is unknown.

Additionally, peer exclusion (an interpersonal stressor) may be an important factor in the link between anxious solitude and both problematic and excessive media use. Evidence, though limited, suggests that peer exclusion is linked to problematic media use in both adolescent and young adult samples (e.g., Ergun & Alkan, 2020; Lim, 2019). Further, research has shown that the link between anxious solitude and problematic media use was partially mediated through interpersonal stress (interpersonal relationship problems), loneliness, and maladaptive cognitions (i.e., exaggerated beliefs about the benefits of the internet for escaping negative emotions and evaluations associated with face-to-face interactions; Tian et al., 2019). Therefore, other types of interpersonal stress (i.e., peer exclusion) might also help explain the link between youth anxious solitude and excessive/problematic media use in young adulthood. Research also suggests that anxious solitary youth who are excluded feel lonely due to a lack of social interaction, social support and social helplessness (Gazelle, 2013). Thus, their unmet psychological needs may not only stem from their anxious solitary tendencies, but also from missing out on social interactions due to being excluded by peers. To date, no studies have explicitly investigated the role of youth peer exclusion in the link between youth anxious solitude and young adult excessive and

problematic media use. However, researchers have identified a strong link between anxious solitude and peer exclusion (e.g., Gazelle & Ladd, 2003; Gazelle & Faldowski, 2019; Gazelle & Cui, 2020), As such, it is worth exploring the potential for youth peer exclusion trajectories to mediate the link between youth anxious solitude trajectories and young adult media use.

The Current Study

I propose to investigate the long-term impact of youth anxious solitude and peer exclusion trajectories on young adult excessive and problematic media use. Anxious solitude and peer exclusion were measured through peer reports in both elementary (3rd – 5th grades) and middle school (6th -7th grades); and Latent Class Growth Analysis (LCGA) was used to model anxious solitude and peer exclusion trajectories across these periods. A person-centered approach was utilized to capture information about within-person change over time (i.e., subgroups based on patterns of change in anxious solitude and peer exclusion over time; Jung & Wickrama, 2008). Additionally, media use (i.e., time spent using the internet for entertainment, on social media, and playing video games) and problematic media use were measured in young adulthood to test if youth peer exclusion or anxious solitude trajectories predict problematic media use in young adulthood.

By investigating the connection between youth anxious solitude, youth peer exclusion, and young adult media use, we can achieve a better understanding of interpersonal processes that place vulnerable youth at risk for adjustment problems in young adulthood. Specifically, this study will test: (1) trajectories of youth anxious solitude and peer exclusion as direct predictors of excessive or problematic media use in young adulthood, and (2) peer exclusion trajectory class membership as a mediator of the link between youth anxious solitude trajectory class and young adult media use. This research has the potential to provide valuable information about

vulnerability to excessive and problematic media consumption in contemporary society as well as inform prevention efforts aimed at providing individuals and families with information to make informed decisions about their media and technology use.

CHAPTER 2

LITERATURE REVIEW

Theoretical Models

Three theories (two of which are competing theories) aim to explain why some anxious solitary and excluded youths are vulnerable to developing excessive and problematic media use in young adulthood: the *Compensatory Media Use Model* (Kardefelt-Winther, 2014) and either the *Stress Generation Model* (Hammen, 2006; Rudolph & Hammen, 1999) or the *Chronic Stress Model* (Ladd et al., 2019).

Compensatory Media Use Model

Compensatory media use (CMU) is a framework for studying excessive and problematic media use. CMU theory posits that compensation, rather than compulsion (e.g., Greenfield, 1999) or addiction (e.g., Young, 1998), may better explain why certain people spend excessive amounts of time using media and experience maladjustment as a result (Kardefelt-Winther, 2014). According to this model, negative life situations (in particular psychosocial vulnerabilities such as social anxiety and stress) give rise to *motivations* for using media to alleviate negative feelings. Turning to media to alleviate negative feelings could lead to negative consequences and addiction-like symptoms if the amount of compensation required to alleviate negative feelings is large (thus requiring more time spent using media). Motivations for using media (e.g., escapism) have been investigated in past research without a CMU framework, however, motivations in the CMU model are grounded in un-met psychological needs rather than more generalized motivations. The CMU framework suggests that social/relatedness needs may be the biggest motivator for engaging in problematic media use (Kardefelt-Winther, 2014); however, extant

research suggests that other psychological needs (i.e., affect regulation; Pallavicini et al., 2018) are also strong motivators for engaging in media use.

The CMU Model is linked to a long history of psychological needs-based models. *Self-Determination Theory* (SDT; Deci & Ryan, 2002) is a psychological needs-based framework for the study of human motivation, psychological growth, and vulnerability. Specifically, SDT argues that the satisfaction of basic psychological needs for autonomy, competence, and relatedness fosters well-being, whereas the frustration of basic psychological needs evokes ill-being and increases vulnerability to psychopathology (Deci & Ryan, 2002; Vansteenkiste & Ryan, 2013). SDT is derived from an organismic dialectical perspective (which posits that humans are active organisms with natural developmental tendencies towards growth and that there are social-contextual factors that support/hinder this innate tendency). Consequently, SDT emphasizes interaction between an active, integrating human nature and social contexts that can either nurture (i.e., need satisfaction) or impede (i.e., need frustration) the organism's active development. Humans are assumed to have a natural tendency towards growth in environments that satisfy their psychological needs; however, they are also at risk for ill-being and psychopathology when exposed to environments that thwart (or frustrate) their psychological needs. Thus, need satisfaction and need frustration are crucial mechanisms in optimal and non-optimal functioning, respectively.

Taken together, the CMU model suggests that psychosocial *vulnerability* and *stressors* (e.g., anxious solitude and peer exclusion) place individuals at *risk* for problematic media use (i.e., excessive time spent on media, obsession with media, neglect of offline relationships and responsibilities, etc.) and that this link is due to the individual's motivations (i.e., unmet

psychological needs) for consuming media. In other words, this model frames psychological functioning as a function of individual vulnerability/stressors and unmet psychological needs.

Stress Generation Model vs. Chronic Stress Model

Although the CMU model links psychosocial vulnerability (i.e., social anxiety and stress) to problematic media use, it does not specify how individual vulnerability and stressors may influence each other and how their combined influence impacts problematic media use. Two competing models can be used as a framework for this gap: the *Stress Generation Model* (Hammen, 2006; Rudolph & Hammen, 1999) and the *Chronic Stress Model* (Ladd et al., 2019).

Stress Generation Model

The stress generation model focuses on the role of the individual in contributing to their own stress rather than passively experiencing stress that they cannot control (Hammen, 2006; Rudolph & Hammen, 1999). While originally developed for depression research, stress generation is not specific to depressive disorders and can be applied to individuals with various interpersonal vulnerabilities (Hammen, 2006). Stress generation theory provides researchers a way to conceptualize processes that explain why individuals with interpersonal vulnerabilities experience more stressful life events than individuals without these vulnerabilities. According to this model, individuals with interpersonal vulnerabilities generate stressors, particularly interpersonal stress, in their lives due to their characteristics, situation, or behaviors (Hammen, 2006). In other words, individual vulnerability predates interpersonal stress and thus contributes to the occurrence of the stressor. For example, behavioral manifestations of anxious solitude (individual vulnerability), such as shyness, verbal inhibition, and elevated solitary-onlooking behavior contribute to the occurrence of peer exclusion (interpersonal stress) because they signal vulnerability to peers and inspire peer dislike (Gazelle & Ladd, 2003).

Chronic Stress Model

In contrast to the stress generation model, the chronic stress model proposes that interpersonal stress precedes individual vulnerability. Specifically, interpersonal stressors (i.e., peer exclusion) promote processes that induce vulnerability (i.e., anxious solitude; Ladd et al., 2019). According to the chronic stress model, interpersonal stressors produce anticipatory distress about future encounters (i.e., social anxiety and negative evaluative concerns), which in turn, discourages future participation in social interaction (i.e., increases solitude and withdrawal from peers). Additionally, repeated exposure to these interpersonal stressors maintains and even exacerbates individual vulnerability over time. Thus, according to the chronic stress model, stress due to continued exclusion by one's peers causes youths to worry about continued peer mistreatment, and this continued concern produces social anxiety about future peer interaction and subsequently results in withdrawal from peers (i.e., anxious solitude). This is supported by research on developmental trajectories of peer exclusion and anxious solitude in which peer exclusion was found to precede and predict incremental increases in anxious solitude over time (e.g., Gazelle & Cui, 2020).

The stress generation and chronic stress models complement the model of compensatory media use because they highlight (a) how individual vulnerability and interpersonal stressors may influence each other (i.e., do vulnerable youth generate their own stressors or do stressors predate individual vulnerability?) and (b) how the combined influence of individual vulnerability and stress may impact the development of problematic media use. The focus of CMU theory is on how individual vulnerability and stressful life situations give rise to motivations for using media (i.e., to alleviate negative feelings and meet psychological needs). However, it does not

specify how individual vulnerability and stress are linked to one another. Thus, the inclusion of the stress generation model and the chronic stress model serves to fill that gap.

Conceptual Model

Thus, according to the CMU model and the stress generation/chronic stress models, young adults with a history of youth anxious solitude may be more likely than non-anxious solitary youth to experience problems in their interpersonal relationships (i.e., peer exclusion) that subsequently lead to unmet psychological needs. This, in turn, may influence these individuals to use media to alleviate feelings of social dissatisfaction or negative affect. Alternatively, being excluded by one's peers may create an environment that fosters the development of anxious solitary behaviors. Similarly, these behaviors may drive youths to use media to meet their social needs or to alleviate negative affect (i.e., Gazelle, 2013). If these youth find that using media (i.e., socializing in online communities or distraction through video games) is successful in regulating negative affect and/or meeting their social needs, they may start to use media excessively. This, in turn, eventually leads to the development of maladaptive media behaviors and beliefs (i.e., the internet is the only way to alleviate the dissatisfaction I feel in my interpersonal relationships because it distracts me from my offline life; Tian et al., 2019). In other words, once these youths believe that media is the only way to meet their psychological needs, they will continue to use media for these purposes, which can eventually result in excessive and problematic media use in young adulthood (for conceptual model, see Figure 1 in Appendix B).

Empirical Research

It is important to not only present a conceptual model of the link between anxious solitude, peer exclusion, and problematic media use but also to empirically test these models.

Individual Vulnerability: Anxious Solitude

Anxious Solitude (AS) is a form of individual vulnerability that may place youths at risk for later excessive and problematic media use. Anxious solitude is an affective-behavioral profile characterized by elevated rates of solitary onlooking behavior and social anxiety (affect) among familiar peers due to social evaluative concerns (Gazelle & Ladd, 2003). Anxious solitary children are conflicted by their *desire to interact with their peers* and their *social hesitancy due to social anxiety* (Gazelle & Rudolph, 2004). In other words, anxious solitary children want to interact with peers but maintain their solitude due to concern about how they will be perceived and treated by their peers. Anxious solitude is a specific type of social withdrawal that occurs in the presence of *familiar peers* rather than among strangers or in novel situations. Further, it is the most common form of social withdrawal in childhood (Coplan et al., 2013). Anxious solitary children make up approximately 10-15% of normative community samples (Gazelle et al., 2005).

Anxious Solitude Trajectory Classes

Extant research has shown that youth can demonstrate different patterns of anxious solitude over the course of development. Using the same sample as the current study, Gazelle and Faldowski (2019) modeled multiple patterns of peer-reported anxious solitude over the course of 5 years (3rd to 7th grade). Separate trajectory classes were computed for elementary school (3rd to 5th grade) and middle school (6th to 7th grade) to allow for change in anxious solitude trajectories after the middle school transition. Using latent class growth analysis (LCGA), two patterns of anxious solitude were identified in elementary school: a high-increasing anxious solitude trajectory class and a moderate-decreasing anxious solitude trajectory class. The *high-increasing anxious solitude trajectory class* (20% of sample) is characterized by high anxious solitude in the fall of 3rd grade that increases from the spring of 3rd grade to the end of

elementary school (spring of 5th grade). The *moderate-decreasing anxious solitude trajectory class* (80% of sample) is characterized by moderately elevated anxious solitude in the fall of 3rd grade that declines through the fall of 4th grade and the maintenance of low levels through the end of elementary school.

Next, LCGA of middle school youth identified three patterns of anxious solitude: a low-stable anxious solitude trajectory class, a low-increasing anxious solitude trajectory class, and a high-decreasing anxious solitude trajectory class (Gazelle & Faldowski, 2019). The *low-stable anxious solitude trajectory class* (59% of sample) is characterized by low anxious solitude in the fall of 6th grade and maintenance of low anxious solitude throughout the end of 7th grade (spring of 7th grade). The *low-increasing anxious solitude trajectory class* (34% of sample) is characterized by mildly elevated anxious solitude in the fall of 6th grade followed by a moderate increase in anxious solitude between spring of 6th grade and fall of 7th grade and the maintenance of moderately elevated anxious solitude through the end of 7th grade. Finally, the *high-decreasing anxious solitude trajectory class* (7% of sample) is characterized by elevated anxious solitude in the fall of 6th grade followed by a decrease in anxious solitude from spring of 6th grade to fall of 7th grade and maintenance of modestly elevated anxious solitude through the end of 7th grade. Similar trajectory patterns in both elementary and middle school have been identified in different samples (e.g., Booth-LaForce et al., 2012; Eggum et al., 2009; Gazelle & Ladd, 2003; Oh et al., 2008).

For the current study, Gazelle and Faldowski's (2019) anxious solitude trajectory classes will be used, rather than waves of repeated measures data, for two reasons: (a) using trajectory classes is consistent with a developmental approach by allowing for the prediction of adult media use based on longitudinal patterns of youth anxious solitude, and (b) using trajectory classes is

consistent with a person-centered approach to research (Jung & Wickrama, 2008). Thus, the proposed study will focus on the link between childhood trajectories of anxious solitude and young adult media use. However, investigating the direct link between anxious solitude trajectories and media use is not enough to understand *why* some anxious solitary children may be susceptible to excessive and problematic media consumption and other anxious solitary youth are not.

Peer Exclusion and Anxious Solitude

Peer exclusion occurs when youths ignore or leave a peer out of social interactions. This can occur both directly (e.g., directly telling a peer that they cannot join in and play) and indirectly (e.g., not approaching a peer to initiate play; Gazelle & Ladd, 2003). A key distinction between anxious solitude and peer exclusion is that anxious solitary behavior originates from the child (i.e., socially anxious affect), whereas peer exclusion originates from peers (i.e., the interpersonal environment; Gazelle & Cui, 2020).

Extant research on anxious solitude and peer exclusion suggests a complex bidirectional relation. Evidence suggests that youth anxious solitude predicts stable elevation, but not increase, in peer exclusion over time (Gazelle & Cui, 2020; Gazelle & Druhen-Shell, 2017; Gazelle & Ladd, 2003; Shell et al., 2014), whereas youth peer exclusion predicts both the stable elevation and incremental increase in anxious solitude over time (Booth-LaForce et al., 2012; Booth-LaForce & Oxford, 2008; Gazelle & Cui, 2020; Gazelle & Faldowski, 2019; Gazelle & Ladd, 2003; Oh et al., 2008). Research on the link between anxious solitude trajectory classes and peer exclusion found that peer exclusion is an interpersonal stressor that maintains and intensifies youths' anxious tendencies over time (Gazelle & Faldowski, 2019). Thus, to establish a more complete understanding of this complex phenomenon, the current study will also explore peer

exclusion both as a predictor of young adult media use and as a potential mediator of the link between youth anxious solitude and young adult media use.

Media Use in Young Adulthood

Young adulthood (age 18 – mid/late 20s) has been identified as an important period for the development of excessive and problematic media use (Sussman & Arnett, 2014). Certain lifestyle factors and characteristics associated with young adulthood might explain why this age group is at an elevated risk for maladaptive media use.

First, media is readily accessible, and widely used, by young adults. Research on media use and behaviors continues to find that younger individuals (including young adults), compared to older individuals, are more likely to use media and technology (Lenhart et al., 2010), and spend much more time using new media and technology (Watson, 2020). This trend is in line with research conducted as early as the 2000s, which indicated that interactive technologies were especially popular among young adults at that time (e.g., Rideout et al., 2005). By 2010, approximately 92% of 18-to-24-year-olds that did not attend college, and nearly 100% of college students, reported using the internet in their daily lives (Smith, Rainie, & Zickuhr, 2011). More recently, research has indicated that approximately 43% of young adults' daily waking time is allocated to consuming media (The Nielsen Company, 2018). Because media is so ubiquitous among young adults, it likely has an important impact on their daily functioning.

Second, young adulthood is a time with a significant focus on independence (Arnett, 2014). As such, young adults experience decreased parental control, guidance, and monitoring. Without parental constraints on media use, young adults have more freedom to choose when and how long they want to spend using media and technology. This could eventually become problematic if their unconstrained use interferes with offline responsibilities. For all these

reasons, the developmental period of young adulthood is of specific interest when investigating excessive and problematic media use.

Links Between Anxious Solitude, Peer Exclusion, and Problematic Media Use in Young Adulthood

Why might anxious solitary and excluded youth be at greater risk for excessive and problematic media use? Further, why might anxious solitary youth who are *also* excluded be at an even greater risk for developing excessive and problematic media use compared to their non-excluded counterparts? The extant literature on anxious solitude, interpersonal stress, and problematic media use can provide some insight into these questions.

Interpersonal Mediation: Anxious Solitude, Stress, and Problematic Media Use

To date, only one study has investigated the mediating role of interpersonal stress (i.e., interpersonal relationship problems) in the link between anxious solitude and problematic media use. Findings from this study indicate that interpersonal relationship problems (e.g., “most of my friends do not care about me”), loneliness, and maladaptive cognitions (i.e., exaggerated beliefs about the benefits of the internet for escaping negative emotions and evaluations associated with face-to-face interactions; Tian et al., 2019) mediated the association between young adult anxious solitude and problematic media use. One way to think about this mediating effect is in terms of a missing out mechanism. Specifically, the authors argue that young adults with a history of anxious solitude tend to have fewer friends and are more likely to experience problems in their interpersonal relationships (Tian et al., 2019). This may be due to missing out on social interactions and relations in their youth, thus missing out on the development of important social skills. Delays in social skills make it hard for anxious solitary youth to form high-quality friendships; and when they do form friendships, they are more likely to experience interpersonal

problems (Zhao et al., 2012). Interpersonal problems cause these young adults to miss out on more social interaction and prevent them from meeting their psychological needs. They thus turn to media to meet their social needs and alleviate their loneliness. These young adults continue to use media excessively due to maladaptive cognitions (i.e., the internet is the only way to alleviate loneliness), which eventually results in problematic media use. Yet, although evidence for the mediating effect of interpersonal stress is mostly absent in the research, separate direct links from anxious solitude and peer exclusion to problematic media use have been established in the empirical literature, which is explored below.

Longitudinal Research

In the longitudinal research, anxious solitude was shown to increase vulnerability to problematic media use in multiple studies. One study found that adolescent anxious solitude predicted problematic media use later in adolescence for females, but not males (Ko et al., 2009). Two studies found a direct, predictive pathway from anxious withdrawal in childhood to problematic media use in adolescence for both boys and girls (Cho et al., 2013; Gentile et al., 2011). Finally, one study found longitudinal pathways from adolescent and young adult (but not older adult) anxious solitude to problematic media use two years later (Kowert et al., 2015). Only one study did not find a significant predictive pathway from anxious withdrawal (measured in young adulthood) to later problematic media use (Nelson et al., 2016). Non-significance in this study may be due to the way that social withdrawal was divided into subgroups (shy, unsociable, and avoidant), as the characteristics of anxious solitude were split between multiple groups (i.e., shy and avoidant). Much like the previously mentioned interpretation by Tian and colleagues, all authors (with the exception of Gentile and colleagues) provide a similar interpretation of the link between anxious solitude and problematic media use. They suggest that online environments are

less threatening than face-to-face environments and provide anxious solitary individuals a way to meet social needs that are unmet in their offline lives. Additionally, while anxious solitude was not associated with problematic media use in their study, Nelson and colleagues (2016) found that anxious solitary young adults emailed more than normative-sociable young adults. Much like the other authors, they speculate that anxious solitary individuals may be drawn to online communication as it is a less threatening way to meet social needs. Unfortunately, none of the research on the link between peer exclusion and problematic media use was longitudinal.

Cross-Sectional Research

In cross-sectional research, anxious solitude was consistently shown to be positively related to problematic media use in *adolescence* (Chak & Leung, 2004; Prizant-Passal et al., 2016; Hong et al., 2019; Wang et al., 2020; Yuija et al., 2017), *young adulthood* (Casale & Fioravanti, 2015; Chak & Leung, 2004; De Leo & Wulfert, 2013; Lee & Leeson, 2015; Lee & Stapinski, 2012; Odaci & Celik, 2013; Prizant-Passal et al., 2016; Yucens & Uzer, 2018), and *adulthood* (Lee & Stapinski, 2012; Prizant-Passal et al., 2016). The authors' interpretations (apart from Chak & Leung, 2004) are similar to that of the longitudinal researchers. They suggest that anxious solitary individuals are drawn to media because it is less threatening than face-to-face interactions. Anxious solitary individuals can cope with their fears of rejection (negative evaluative concerns) and meet their social needs through internet-mediated interaction. However, Chak and Leung report that men in their sample did not find it easier to interact online than offline, and thus proposed that anxious solitary individuals may be drawn to use media by leisure and recreational activity rather than to meet their social needs. This interpretation is in line with other research that has found affect regulation (afforded by these leisure activities) to be a strong motivation for engaging in some forms of media use (i.e., Pallavicini et al., 2018).

As for the cross-sectional research on peer exclusion and problematic media use, results are limited and mixed. In two studies, peer exclusion was found to be positively linked to problematic media use in adolescence (Ergun & Alkan, 2020) and adulthood (Lim, 2019). However, a third study on female adolescents did not find a significant relation between peer exclusion and problematic media use (Bagir et al., 2020). In one study, the authors suggest that excluded teens may be lonely and thus, may turn to media to alleviate their loneliness; however, the analysis could not test this direction of effect (Ergun & Alkan, 2020). The authors of the second study suggest that adults who are socially excluded are not meeting their social needs (Lim, 2019). As such, they turn to media (in the case of this study, Facebook) to establish social connections they would not otherwise develop offline.

Gender Differences in Anxious Solitude, Peer Exclusion, and Media Behaviors

Research on anxious solitude and interpersonal stress in anxious solitary samples suggests that gender may have important implications for the developmental trajectory of youth interpersonal problems and subsequent adult adjustment. In one study, anxious solitary girls who displayed additional positive (i.e., agreeable) and neutral characteristics, compared to their male counterparts, experienced fewer peer difficulties (Gazelle, 2008). Further, studies have indicated that anxious solitary boys, compared to girls, are more likely to experience peer mistreatment because anxious solitary behaviors are a violation of male gender norms (i.e., being aggressive or dominant; Coplan et al., 2001; Gazelle & Ladd, 2003). However, as was pointed out in previous research (e.g., Gazelle & Shell, 2017), it is unclear whether gender differences in anxious solitude and peer exclusion will persist into young adulthood as gender differences were identified in middle childhood (anxious solitary boys were at greater risk for peer exclusion;

Gazelle & Ladd, 2003) but not in early adolescence (Bowker et al., 2012; Gazelle & Rudolph, 2004).

Research on media and technology also suggests that gender influences different types of problematic media use in adolescence and young adulthood. Male internet users were shown to be at greater risk for excessive video game play and addiction (Chak & Leung, 2004; Wittek et al., 2016), whereas female internet users tend to prefer social media applications (Chak & Leung, 2004; Weiser, 2000) and are at greater risk for excessive social media use and addiction (Monacis et al., 2017; Simsek et al., 2019). Again, this may be explained by gender norms, as female friendships tend to include more socializing and communication whereas male friendships are based more on shared activities (Felmlee et al., 2012).

Gender effects in the hypothesized models will not be emphasized as analyses will have insufficient power when the model is divided by gender (due to small cell sizes). As such, gender will only be included as a control variable. However, based on extant research, I expect that gender will have an influence on video game play and social media use such that young adult males will report more video game play and young adult females more social media use.

Knowledge Gaps

Are young adults with childhood histories of anxious solitude *or* peer exclusion more susceptible to excessive and problematic media use? Furthermore, does the experience of peer exclusion *in addition to* anxious solitude explain the link between youth anxious solitude and young adult media use? Empirical data gathered since the 1990s and 2000s has shed light on some aspects of these research questions. Yet, while the literature on linkages between anxious solitude and vulnerability to problematic media use has grown over the past two decades (and peer exclusion more recently), there is much left unanswered.

To begin, most of the extant research on this topic has only assessed the direct association between anxious solitude and problematic media use (Casale & Fioravanti, 2015; Chak & Leung, 2004; De Leo & Wulfert, 2013; Hong et al., 2019; Lee & Leeson, 2015; Lee & Stapinski, 2012; Odaci & Celik, 2013; Prizant-Passal et al., 2016; Wang et al., 2020; Yucens & Uzer, 2018; Yuija et al., 2017); and only 6 studies were found that investigated short-term longitudinal links between anxious solitude and problematic media use (Cho et al., 2013; Gentile et al., 2011; Ko et al., 2009; Kowert et al., 2015; Nelson et al., 2016; Tian et al., 2019). Furthermore, of these short-term longitudinal studies, only one examined mediating mechanisms in the association between anxious solitude and problematic media use (Tian et al., 2019), and none studied participants from childhood to young adulthood. Research on the link between peer exclusion and problematic media use is even more limited, with only 3 studies, to my knowledge, having investigated the concurrent link between peer exclusion and problematic media use (Bagir et al., 2020; Ergun & Alkan, 2020; Lim, 2019), and no longitudinal studies. Finally, the generalizability of this research to a contemporary American sample is limited as most studies on the link between anxious solitude, peer exclusion, and problematic media use have been conducted outside of the United States (only 3/20 studies cited in this paper were based on American samples). Taken together, what we know about the link between youth anxious solitude, youth peer exclusion, and young adult problematic media use in America, as well as the underlying mediating and moderating mechanisms that explain these developmental pathways, is limited by the abundance of cross-sectional and international studies. More research with a contemporary American sample is needed.

The Current Study

The goal of the current study is to investigate vulnerability to excessive and problematic media use among young adults with a history of youth (3rd – 7th grade) anxious solitude and peer exclusion. As noted, extant research has revealed direct associations, both concurrent and short-term longitudinal, between anxious solitude and problematic media use in the young adult developmental period (e.g., Casale & Fioravanti, 2015; Prizant-Passal, Shechner, & Aderka, 2016; Wang et al., 2020). However, interpersonal stress has received limited attention both as a risk factor for problematic media use and as a potential mediator of the link between anxious solitude and problematic media use, and peer exclusion has received little to no attention. This is an important gap to address, as missing out on interpersonal interactions and relations in youth has resounding effects on the development of social skills and the continuity of anxious solitude throughout childhood and into early adolescence (Gazelle & Faldowski, 2019). Thus, to explore the impact of continuity and change in youth anxious solitude as well as peer exclusion on young adult media use, multiple trajectories of anxious solitude and peer exclusion from 3rd to 5th grade and from 6th to 7th were investigated. Trajectories were modeled for elementary and middle school separately because children can show different developmental trajectories during these two time periods (e.g., Gazelle & Faldowski, 2019). For some youths, the middle school transition may act as a turning point in which previously high or increasing levels of anxious solitude or peer exclusion may become low and decreasing (or vice versa). Based on this evidence, I expect that:

Continuity in Anxious Solitude Trajectory Class Hypothesis: *Most youths in the elementary school high-increasing anxious solitude trajectory class will subsequently be*

in the middle school high-decreasing or low-increasing anxious solitude trajectory class. Conversely, *most* youths in the elementary school moderate-decreasing anxious solitude trajectory class will subsequently be in the middle school low-stable anxious solitude trajectory class.

Continuity in Peer Exclusion Trajectory Class Hypothesis: *Most* youths in the elementary school high and/or increasing peer exclusion trajectory class will subsequently be in the middle school high and/or increasing peer exclusion trajectory class. Conversely, *most* youths in the elementary school low and/or decreasing peer exclusion trajectory class will subsequently be in the middle school low and/or decreasing peer exclusion trajectory class.

Young adults with a history of anxious solitude in youth are also less likely to have friends and more likely to experience problems with interpersonal relationships due to low confidence, inadequate social skills, and social evaluative concerns (e.g., Huan et al., 2014; Wang et al., 2020). However, the desire for social connection may drive anxious solitary (and even excluded) individuals to meet their social needs through other mediums, such as the internet and other media (e.g., social media, forums, video gaming, etc.) (e.g., Ergun & Alkan, 2020; Hong et al., 2019; Lim et al., 2019; Wang et al., 2020; Tian et al., 2019). As the compensatory media use model suggests, anxious solitary and excluded individuals may try to compensate for their lack of social connection by engaging in online interactions (e.g., Tian et al., 2017). Searching for social connections becomes even more relevant in young adulthood when individuals enter new social contexts without the safety and security of familiar others (Arnett, 2014). If this method of establishing social connections proves a more comfortable, and less

threatening, medium for social interaction (e.g., Lee & Stapinski, 2012; Young & Lo, 2012) it could develop into problematic behavior over time if the individual comes to rely on media to meet their social needs and they neglect their offline responsibilities in favor of their online life. Alternatively, anxious solitary and excluded youth may turn to media to regulate negative affect (i.e., alleviate negative feelings associated with anxious solitary behavior or being excluded). If media is successful at relieving negative affect, it could also develop into problematic behavior over time should these youth come to rely on media to deal with their emotions. Based on this rationale, I expect that:

Direct Effect of Anxious Solitude Hypothesis: Membership in the high-increasing anxious solitude trajectory class in elementary school will predict (a) greater symptoms of PMU and (b) more time spent using media in young adulthood.

Direct effects of Peer Exclusion Hypothesis: Membership in the high and/or increasing elementary school peer exclusion trajectory class will predict (a) greater symptoms of PMU and (b) more time spent using media in young adulthood.

Further, young adults with a childhood history of anxious solitude may be especially vulnerable to developing problematic media use when they have also experienced peer mistreatment, such as exclusion. The experience of both anxious solitude and peer exclusion would further contribute to youth missing out on social relations and interactions, thus preventing them from developing appropriate social skills and having their social needs met. Because anxious solitary individuals have the desire to socialize, but have been excluded by their peers, they may be drawn to media because it is less threatening than trying to initiate face-to-

face interactions. Through internet-mediated interactions, anxious solitary individuals can cope with their experience of peer mistreatment and/or have their social needs met which, if excessively used, may come to interfere with offline responsibilities, thus becoming problematic. Alternatively, the experience of being excluded (in addition to anxious solitude) might also result in negative affect. As a result, anxious solitary youth who are excluded may be drawn to media and technology because it provides relief for negative emotions, which could become problematic over time if used excessively. Thus, it is expected that:

Mediation Hypothesis: Membership in the high and/or increasing middle school peer exclusion trajectory class will mediate the link between membership in the high-increasing elementary school anxious solitude trajectory class and (a) elevated symptoms of PMU and (b) more time spent using media in young adulthood.

The conceptual model of the links between youth anxious solitude trajectory classes, youth peer exclusion trajectory classes, and young adult media use is depicted in Figure 1 in Appendix B.

CHAPTER 3

METHOD

Research Design

This prospective longitudinal study connected anxious solitude and peer exclusion data on a sample of youth from 3rd through 7th grade to a young adult follow-up assessment focusing on excessive and problematic internet use at ages 21-25. Specifically, 11 waves of data were condensed into three periods for analysis (period 1: elementary school; period 2: middle school; and period 3: young adulthood). The first period consisted of 6 waves of data that were collected in the latter part of elementary school (period 1: 3rd to 5th grade), the second period consisted of 4 waves of data that were collected in the first two years of middle school (period 2: 6th to 7th grade), and the third period consisted of 1 wave of data collected during young adulthood (wave 3: age 21-25). Following IRB approvals, the elementary and middle school data were collected twice a year, once during the fall semester and again during the spring semester whereas young adult data were collected once (per participant) between the ages of 21 to 25.

In addition to direct links from youth anxious solitude and peer exclusion to young adult media use, mediation will also be investigated. A person-centered approach was utilized to capture information about trajectory classes based on varying levels of anxious solitude and peer exclusion (i.e., interindividual differences) and to capture how levels of anxious solitude and peer exclusion changed over time (i.e., intraindividual differences) (Jung & Wickrama, 2008). To test links between membership in anxious solitude trajectory classes (elementary and middle school), membership in peer exclusion trajectory classes (elementary and middle school), and media use/problematic media use (young adulthood), trajectory classes were coded as categorical variables and entered into each model.

Participants

Participants were young adults (age 21-25 yrs) in a new wave of data collection (Gazelle, Cui, Ohannessian, 2022) who were part of the Multiple Trajectories in AS Youth study (age 8-13 yrs) led by Dr. Heidi Gazelle ($n = 118/282$; female: $n = 75$, 64%; 73% European American, 12% African American, 13% Latinx, and 2% Asian American). Initial measurement in the Fall of 3rd grade was conducted with students in 46 3rd grade classrooms in 7 public schools in the southeastern US. Selected youth were prospectively followed and completed multi-method assessments from 3rd-7th grade, while children from the screening sample participated in peer nominations only from 3rd-7th grade. For the young adult wave of data collection, participants were recruited from the *selected sample* ($n = 230$; female: $n = 131$, 57%) and *youth with elevated anxious solitude* from the larger peer nomination *screening sample* ($n = 52$; female $n = 38$, 58%; Total $N = 282$). Approximately half of the selected sample were selected for elevated peer-reported anxious solitude ($\geq +1 SD$) in 3rd, 4th, or 5th grade. The other half were *demographically matched* (gender, age, ethnicity, classroom) youth who scored below the *anxious solitude cutoff* ($< +1 SD$) in elementary school (3rd grade for most participants).

Procedure

Youth Procedure

To measure youth anxious solitude and peer exclusion, peer nominations were conducted during the fall and spring semesters of 3rd through 7th grade. All nominations were read out loud by research assistants. Children were prompted to select classmates' names on their individual rosters which listed the names of children in their class (elementary school) or grade (middle school) who had active informed parental consent to participate. Children were allowed

unlimited nominations, including opposite-sex nominations, because this method has been shown to result in superior psychometric properties (Terry & Coie, 1991).

Young Adult Procedure

To measure young adult media use, multiple methods were used to recontact young adults from the 230 *selected sample* and the 52 high-anxious solitude youth from the *screening sample*. Methods were based on contact information collected during the original Multiple Trajectories in Anxious Solitary Youth study (i.e., parents' names, addresses, phone numbers, and email addresses) and new information gathered from search engines, such as Instant Checkmate and BeenVerified. Specific methods that were utilized include calling, texting, emailing, sending physical mail, and sending social media messages to both parents and young adult participants. Participation occurred online for the young adult wave of data collection (age 21-25). Young adult participants completed several questionnaires covering topics such as social anxiety, interpersonal relationships, and symptoms of problematic media use. After completing the survey, participants received monetary compensation of \$30.00 in the form of an Amazon electronic gift card in thanks.

Measures

Youth Measures

Anxious Solitude

Composite scores for elementary and middle school anxious solitude were comprised of three peer nominations (brackets indicate differences in middle school prompts): (1) “children who act really shy around other kids. They seem to be nervous or afraid to be around other kids and they do not talk much. They often play alone at recess [at lunch they often sit alone or don't have anyone to talk to];” (2) “children who watch what other kids are doing but don't join in. At

recess they watch other kids playing but they play by themselves [at lunch they watch other kids talking but don't join into the conversation];” (3) “children who are very quiet. They don't have much to say to other kids” (elementary $M = -0.02$, $SD = 0.70$; middle school $M = 0.00$, $SD = 0.95$). Anxious solitude composites were calculated as the sum of peer nominations received at each time point. Composite scores used for LCGA analysis demonstrated both reliability ($\alpha = 0.76 - 0.96$) and stability ($r_s = 0.64 - 0.96$, $p_s \leq .01$) at each time point (Gazelle & Faldowski, 2019).

Latent Class Growth Analysis was used to identify two anxious solitude trajectory classes in elementary school and three in middle school (Gazelle & Faldowski, 2019). For the elementary school anxious solitude trajectory classes: 80% of the sample fell into the *moderate-decreasing* trajectory class (coded as “0”) and 20% of the sample were identified in the *high-increasing* anxious solitude trajectory class (coded as “1”). For middle school anxious solitude trajectory classes: 59% of the sample was categorized in the *low-stable* anxious solitude trajectory class (coded as “00”); 34% fell into the *low-increasing* anxious solitude trajectory class (coded as “01”); and 7% of the sample was assigned to the *high-decreasing* anxious solitude trajectory class (coded as “10”). Two sets of dummy codes were created to capture middle school anxious solitude trajectory classes, with the low-stable group as the comparison group.

Peer Exclusion

Composite scores for elementary and middle school peer exclusion were comprised of two peer nominations (brackets indicate differences in middle school prompts): (1) “children who get left out when other kids are talking or playing [hanging out] together. They don't get invited to parties or chosen to be on teams or to be work partners;” and (2) “children who ask if

they can play [hang out] and other kids say ‘no’ and won’t let them” (elementary $M = -0.01$, $SD = 0.73$; middle school $M = -0.01$, $SD = 0.83$). Peer exclusion composites were calculated as the sum of peer nominations received at each time point. Composite scores demonstrated both reliability ($\alpha = 0.78 - 0.95$) and stability ($r_s = 0.52 - 0.92$, $p_s \leq .01$) throughout elementary and middle school. Correlation analyses supported anxious solitude and peer exclusion as two distinct constructs, though composites were moderately to highly correlated (elementary school: $r_s = 0.46 - 0.66$; $p_s < .001$; middle school: $r_s = 0.65 - 0.79$; $p_s < .001$). A multitrait-multimethod matrix supported peer exclusion’s convergent ($Mr = .29$) and divergent validity (Spangler & Gazelle, 2009).

For the current study, latent peer exclusion trajectory classes were identified using LCGA. The coding procedure was similar to what was used for the anxious solitude trajectory classes (i.e., trajectory class with lowest levels of peer exclusion were coded as “0” whereas the trajectory class with the highest level of peer exclusion will be coded with “1”). Multiple dummy codes will be used for trajectory classes with more than 2 groups.

Demographics

Demographic variables such as gender, race/ethnicity, and SES during youth were collected from parents and participants during the original Multiple Trajectories in Anxious Solitary Youth research project. Demographic variables will be used in preliminary analyses to identify differences between those who completed the young adult survey and those who did not.

Young Adult Measures

Symptoms of Problematic Media Use

Young adult problematic media use was measured using the Problematic Internet Use Questionnaire – Short Form (PIUQ-SF) (Demetrovics et al., 2016). The PIUQ-SF assesses

symptoms of problematic internet use, such as *obsession* (e.g., “How often does it happen to you that you feel depressed, moody, or nervous when you are not on the Internet/playing video games and these feelings stop once you are back online?”), *neglect of offline life* (e.g., “How often do people in your life complain about spending too much time online/playing video games?”), and *inability to control media use* (e.g., “How often does it happen to you that you wish to decrease the amount of time spent online/playing video games but you do not succeed?”). The PIUQ-SF does not directly assess compensatory media use but rather focuses on the symptoms of problematic media use. The compensatory nature of the problematic media use is an assumption for the current study but may be tested directly in future research if the present study produces promising results.

The PIUQ-SF was modified to reflect both Internet and video game habits rather than only Internet use (e.g., How often do you feel tense, irritated, or stressed if you cannot use the Internet and/or play video games for as long as you want to?), as some participants may display symptoms of addiction to video games, but not the internet in general (e.g., Wang et al., 2020). The PIUQ-SF is comprised of 6 questions which are rated on a 5-point Likert scale ranging from “Never” (1) to “Always” (5). The full PIUQ contains three subscales: Obsession, Neglect, and Control Disorder; however, only the total score will be used in the current study as each subscale is only made up of 2 items on the short form. The PIUQ-SF was shown to be both a reliable ($\alpha = .80$) and valid measure (Göktaş et al., 2018).

Time Spent Using Specific Media

Young adult participants were also asked to report the amount of time that they spend consuming different types of media. These questions will serve to capture the extent of media use by participants on a typical day (e.g., On a typical day, how many hours do you spend: (1)

using the internet for *entertainment* purposes, excluding internet based/online games and social media; (2) on *social media*, including sites such as Instagram, Snapchat, & Facebook; and (3) playing *video games*, including internet based or online games such as Fortnite and League of Legends). Time spent using media was split into separate categories as research suggests that different types of problematic media use (i.e., social media use vs. video game play) constitute distinct addictive behaviors (Andreassen et al., 2016). For example, problematic social media use and problematic video game addiction were shown to have a low intercorrelation (Andreassen et al., 2016) and problematic internet use (in general) was shown to be distinct from problematic gaming (e.g., Kiraly et al., 2014). Thus, time spent using different mediums will be assessed separately.

CHAPTER 4

RESULTS

Analytic Plan

Youth Anxious Solitude and Peer Exclusion Trajectory Classes

Anxious Solitude Trajectory Classes

Elementary and middle school anxious solitude trajectory classes were identified by Gazelle and Faldowski (2019) with LCGA using the Multiple Trajectories of Anxious Solitary Youth data (Figure 2 in Appendix B). This method allowed for heterogeneity between classes but not within classes. In other words, all individual growth trajectories within a class are homogeneous. This is important because it allows researchers to capture information about interindividual differences in intraindividual change over time (Jung & Wickrama, 2008). For elementary school anxious solitude trajectory classes (3rd – 5th grade), a 2-class solution was identified as optimal (Gazelle & Faldowski, 2019). For the middle school anxious solitude trajectory classes (6th – 7th grade), a 3- class solution was identified as optimal (Gazelle & Faldowski, 2019). (for more details, see Gazelle & Faldowski, 2019).

Peer Exclusion Trajectory Classes

To identify elementary and middle school peer exclusion trajectory classes, multiple trajectories of peer exclusion were modeled with LCGA in Mplus 8 (Muthén & Muthén 1998–2018). Like Gazelle and Faldowski (2019), separate LCGAs were computed for elementary and middle school to capture potential change in the number of latent trajectory classes and trajectory patterns after the middle school transition. This decision was informed by previous piecewise growth curve analyses, conducted with the same sample as the current study, which identified a dramatic drop in peer exclusion after the middle school transition (Shell et al., 2014) and

developmental trajectories of anxious solitude in elementary and middle school (Gazelle & Faldowski, 2019).

The steps taken to identify latent trajectory classes were those outlined by Jung and Wickrama in their practical guide for conducting LCGA in Mplus (for details, see Jung & Wickrama, 2008). Because the peer exclusion measures were based on peer nominations (i.e., count data) and data were recorded over time, additional steps needed to be taken. First, a specific command was used in Mplus to alert the program that the data being used was in the form of counts. Additionally, the type of regression to be modeled must also be designated to ensure that the correct modeling is being used. For the present analysis, negative binomial regression modeling was chosen as it is ideal for modeling repeated measures count data with an overabundance of low values typically associated with non-normative characteristics like anxious solitude and peer exclusion (Gazelle & Faldowski, 2019). Next, to account for differences in exposure to peer nominations over time, offset (also referred to as exposure) predictor variables were created and included in the model. The offset variables quantified variation in the number of nominators per classroom (elementary school) or team (middle school) as the natural log of the number of peer nominators (Hilbe, 2014).

Testing Youth Anxious Solitude and Peer Exclusion Trajectories as Predictors and Mediators of Young Adult Media Use

Structural equation modeling (SEM) was used to test (a) elementary school anxious solitude and peer exclusion trajectory class membership as *direct* predictors of young adult media use and (b) middle school peer exclusion trajectory class membership as a *mediator* of the link between elementary school anxious solitude trajectory class membership and young adult media use. Alternative mediation models will also be tested (i.e., anxious solitude trajectory class

mediator) to improve our understanding of, and confidence in, the mediation results (Selig & Preacher, 2009).

Mplus 8 (Muthén & Muthén 1998–2018) was used to run SEM analyses using Bayes estimation. Bayes estimation was chosen because maximum likelihood estimation does not allow for the calculation of the indirect effect with binary latent mediators. However, by using Bayes estimation, and designating the mediator as a latent variable in the Mplus code, indirect effects can be manually calculated using categorical latent variables (Muthén & Muthén 1998–2018). Additionally, trajectory classes were coded as categorical Bayes variables (e.g., elementary school anxious solitude: 1 = high increasing trajectory class, 0 = moderate decreasing trajectory class) and multiple dummy codes will be used for variables with more than 2 trajectory classes, before being entered into the model. Control variables will be determined based on the results of the preliminary analyses.

Preliminary Analyses

Descriptive statistics and Pearson correlations are reported in Table 1 (Appendix A). Little's MCAR test was conducted to determine whether data were missing completely at random, and results of the test revealed that data were missing completely at random, $\chi^2(9) = 16.63, p = .06$. Analysis of the sample that has currently completed the follow-up survey at age 21-25 ($n = 118$) vs. agreed but not yet completed ($n = 19$) and not-yet-contacted ($n = 145$), revealed that completers versus others *do not differ* in age (*m age* at t1= 8.64 vs. 8.70 yrs, $F = .32, ns$) and elementary school anxious solitude trajectory class (high-increasing AS: 45% vs. 52%; $X^2 = 1.86, ns$). However, completers versus non-completers were more likely to be of *ethnic majority status* (European American: 73% vs. 52%; $X^2 = 12.70, p < .001$); *higher SES* (no free or reduced lunch status: 78% vs. 65%; $X^2 = 5.70, p < .05$); and *female* (64% vs. 52%; $X^2 =$

4.26, $p < .05$). As such, ethnic majority status, SES (in youth), and gender will be statistically controlled in the main analysis. Age in young adulthood will also be statistically controlled because participation in the young adult portion of the study occurred over the span of two years.

Identifying Youth Peer Exclusion Trajectory Classes

To identify latent trajectory classes of peer exclusion, the full screening sample of the original youth study ($N = 688$) was used, as the entire screening sample participated in peer nominations.

Elementary School Peer Exclusion Trajectory Classes

LCGA of elementary school peer exclusion from 3rd to 5th grade revealed 1-, 2-, 3- and 4-class solutions. Solutions were tested and compared for fit using both Bayesian Information Criterion (BIC) and Lo-Mendell-Rubin adjusted Likelihood Ratio Test (LRT). BIC results indicated that the 3- class model produced the second lowest value (1- class model: 8,583.50, 2-class model: 7,879.88, 3- class model: 7,760.01, and 4-class model: 7,731.71), indicating acceptable fit. Further, LRT results indicated that the 3-class model produced a significant improvement in fit when compared to the 2-class model ($LRT = 137.74, p \leq 0.01$), but the 4-class model did not produce a significant improvement in fit compared to the 3- class model ($LRT = 50.50, ns$). Based on these factors and interpretability (Jung & Wickrama 2008), the 3-class solution was identified as the most optimal (Figure 3 in Appendix B).

The 3-class solution identified a *high-increasing* peer exclusion trajectory class (17% of the sample, $n = 120$), a *moderate-stable* peer exclusion trajectory class (20% of the sample, $n = 132$), and a *low-stable* peer exclusion trajectory class (63% of the sample, $n = 436$). The probabilities of a child being assigned to each trajectory class (high-increasing trajectory class = 94%; moderate-stable trajectory class = 84%; low-stable trajectory class = 97%) indicated high

confidence in class assignment. The *high-increasing peer exclusion trajectory class* is characterized by high peer exclusion in the fall and spring of 3rd grade, followed by a slight decline in the fall of 4th grade, then an increase in peer exclusion through the end of elementary school. The *moderate-stable peer exclusion trajectory class* is characterized by moderately elevated peer exclusion in the fall of 3rd grade that remains relatively stable through the end of elementary school. Finally, the *low-stable peer exclusion trajectory class* is characterized by low levels of peer exclusion in the fall of 3rd grade that remains relatively stable through the end of elementary school.

Middle School Peer Exclusion Trajectory Classes

For the middle school peer exclusion trajectory classes (6th – 7th grade), 1-, 2-, and 3-class solutions were tested and compared for fit using LCGA. BIC results indicated that the 2-class model produced the second lowest value (1- class model: 5,999.47, 2- class model: 5,383.06, and 3- class model: 5,300.00), indicating acceptable fit. Furthermore, the adjusted LRT results indicated that the 2- class model produced a significant improvement to model fit when compared to the 1- class model (LRT = 613.71, $p \leq 0.001$), but the 3- class solution did not produce a significant improvement to model fit compared to the 2- class solution (LRT = 101.00, *ns*). Based on these results and interpretability, the 2- class solution was identified as most optimal (Figure 3 in Appendix B).

The 2- class solution identified a *high-increasing* peer exclusion trajectory class (13% of the sample, $n = 66$) and a *low-stable* peer exclusion trajectory class (87% of the sample, $n = 437$). The probabilities of a child being assigned to each trajectory class (high-increasing trajectory class = 97%; and low-stable trajectory class = 99%) indicated high confidence in class assignment. The *middle school high-increasing peer exclusion trajectory class* is characterized

by high peer exclusion in the fall and spring of 6th grade followed by a significant increase in peer exclusion through the spring of 7th grade. The *middle school low-stable peer exclusion trajectory class* is characterized by low peer exclusion from the beginning of middle school through the end of 7th grade.

Elementary School Trajectory Class Predictors of Middle School Trajectory Class

Membership

Multinomial logistic regression was used to test the capability of elementary school trajectory classes ($N = 688$) to predict middle school trajectory classes ($N = 503$, 73% of elementary school sample). Analyses indicated that elementary school peer exclusion trajectory class membership correctly predicted middle school peer exclusion class membership 88% of the time (meaning correct classification would be achieved by chance only 12% of the time). For anxious solitude trajectory classes, analyses indicated that elementary school anxious solitude trajectory class membership correctly predicted middle school anxious solitude class membership 66% of the time (meaning correct classification would be achieved by chance only 33% of the time). Additionally, elementary school anxious solitude trajectory class membership correctly predicted middle school peer exclusion class membership 87% of the time, and elementary school peer exclusion trajectory class membership correctly predicted middle school anxious solitude trajectory class membership 62% of the time. Taken together, knowledge of the elementary school trajectory classes greatly increased the accuracy of predicting middle school trajectory classes.

Further, analyses also revealed a systematic relation between elementary and middle school peer exclusion trajectory class membership, $\chi^2(2) = 101.21, p < .001$; and between elementary and middle school anxious solitude trajectory class ($\chi^2(2) = 61.03, p < .001$). As

hypothesized, *both* peer exclusion and anxious solitude trajectories showed *both* continuity and discontinuity after the middle school transition (Table 2 in Appendix A). Accordingly, the odds of a youth in the elementary school high-increasing peer exclusion trajectory class ending up in the high-increasing (compared to low-stable) peer exclusion trajectory class in middle school was 23.25 times higher than a youth in the elementary school low-stable peer exclusion trajectory class ($p < .001$, 95% CI: 11.66, 46.38). Further, the odds of a youth in the elementary school moderate-stable peer exclusion trajectory class ending up in the high-increasing (compared to low-stable) peer exclusion trajectory class in middle school was 2.64 times higher than youths in the elementary school low-stable peer exclusion trajectory class ($p < .05$, 95% CI: 1.09, 6.40). As regards anxious solitude, the odds of a youth in the elementary school high-increasing anxious solitude trajectory class ending up in the high-decreasing (compared to low-stable) anxious solitude trajectory class in middle school was 9.86 times higher than a youth in the elementary school moderate-decreasing anxious solitude trajectory class ($p < .001$, 95% CI: 4.51, 21.56). Further, the odds of a youth in the high-increasing anxious solitude trajectory class in elementary school ending up in the low-increasing (compared to low-stable) anxious solitude trajectory class in middle school was 5.10 times higher than a youth in the elementary school moderate-decreasing anxious solitude trajectory class ($p < .001$, 95% CI: 3.11, 8.36).

Though not hypothesized, systematic relations between elementary school peer exclusion and middle school anxious solitude trajectory class ($\chi^2(4) = 29.79$, $p < .001$); and between elementary school anxious solitude and middle school peer exclusion trajectory class ($\chi^2(1) = 44.31$, $p < .001$) were also explored using multinomial logistic regression. Similar to the analysis on anxious solitude and peer exclusion trajectory classes (separately) in elementary and middle school, *both* continuity and discontinuity after the middle school transition were identified with

regard to high/increasing vs. low/decreasing peer exclusion and anxious solitude (Table 2 in Appendix A).

Testing Youth Anxious Solitude and Peer Exclusion Trajectory Classes as Predictors and Mediators of Young Adult Media Use

Direct Prediction Effects

The influence of youth anxious solitude and peer exclusion trajectory classes on multiple measures of young adult media use was examined with SEM. First, direct effects from elementary school trajectory class membership to young adult measures of media use were tested. Evaluation of fit indices for both the anxious solitude and peer exclusion models suggest good fit (Table 3 in Appendix A). In the anxious solitude model, membership in the elementary school high-increasing (compared to moderate-decreasing) anxious solitude trajectory class was significantly associated with more time spent playing video games in young adulthood ($\beta = .32, p < .001$). Paths from elementary school anxious solitude trajectory class to time spent using social media, time spent using the internet for entertainment, and symptoms of problematic media use were non-significant ($p > .05$). In the peer exclusion model, membership in the elementary school high-increasing peer exclusion trajectory class (compared to the low-stable trajectory class) was linked to more time spent playing video games in young adulthood ($\beta = .37, p < .001$). Additionally, membership in the elementary school moderate-stable peer exclusion trajectory class (compared to the low-stable trajectory class) significantly predicted more time spent using the internet for entertainment ($\beta = .23, p < .05$) and social media ($\beta = .28, p < .001$). The remaining paths from elementary school peer exclusion trajectory class (high-increasing and moderate-stable) to young adult media use were non-significant ($p > .05$) (Figure 4 in Appendix B).

Initial models revealed that SES and race/ethnicity were not significantly associated with any media use measures, so they were removed from both models, however, significant paths from young adult age and gender were retained. In the anxious solitude model, older age at survey completion was significantly associated with more time spent using the internet for entertainment and playing video games ($\beta = .24, p < .01$; and $\beta = .22, p < .01$; respectively). Gender was also significantly associated with time spent playing video games, such that being male was associated with spending more time playing video games ($M = 2.24$ vs. 0.70 ; $\beta = .27, p < .001$). The same main effect of gender was also identified in the peer exclusion model ($\beta = .23, p < .01$), however, the main effect of age at survey completion on internet use for entertainment became non-significant after removing SES and race/ethnicity from the peer exclusion model ($\beta = .15, p = .06$).

Mediation Models

In addition to understanding direct links, I also sought to investigate potential processes by which youth trajectory class membership influences media use in young adulthood. Thus, the next step in the main analysis was to test if middle school trajectory class membership was *instigated* by elementary school trajectory class membership but then also significantly *influenced* media use in young adulthood via mediation analysis (Hayes & Rockwood, 2017; Igartua & Hayes, 2021). Initially, one model combining all criterion variables was estimated, however, the model fit the data poorly (Table 3 in Appendix A). The model was divided to test each mediation effect separately for better parsimony and model fit.

Hypothesized Model: Elementary School AS Trajectory Class → Middle School PE Trajectory Class → Young Adult Media Use

SEM using Bayesian estimation was used to determine if middle school peer exclusion trajectory class membership mediated the link between elementary school anxious solitude trajectory class membership and young adult media use. First, a path between the predictor variable (elementary school anxious solitude trajectory class) and a mediator variable (middle school peer exclusion trajectory class) was added to the anxious solitude direct effects model and tested. Next, a path between the mediator variable (middle school peer exclusion trajectory class) and the criterion variable (time spent playing video games in young adulthood) was also added to the model and tested. Results of the mediation test revealed that membership in the elementary school high-increasing anxious solitude trajectory class (compared to the moderate-decreasing trajectory class) predicted both *more* time spent playing video games in young adulthood ($\beta = .22, p < .05$) and membership in the middle school high-increasing (compared to low-stable) peer exclusion trajectory class ($\beta = .41, p < .01$). However, the path from middle school high-increasing peer exclusion trajectory class (mediator) to video game play in young adulthood was non-significant ($\beta = .16, p > .05$), indicating that mediation did not occur (Figure 5 in Appendix B). Evaluation of the Bayesian Posterior Predictive P-value (PPP) for the final model suggests a good fit to the data (Table 3 in Appendix A).

First Alternative Model: Elementary School PE Trajectory Class → Middle School AS Trajectory Class → Young Adult Media Use

In addition to the hypothesized mediation model, several alternative models were tested (Selig & Preacher, 2009). The first alternative model examined middle school anxious solitude trajectory class membership as a mediator of the link between elementary school peer exclusion

trajectory class membership and young adult media use. Because both elementary school peer exclusion and middle school anxious solitude are made up of three trajectory classes, two dummy coded variables were created for each (anxious solitude and peer exclusion) and entered into the model. Middle school anxious solitude trajectory classes were entered into the peer exclusion direct effects model as mediator variables, and both male gender and age at young adult survey completion were included as control variables.

Results of the final model (Figure 6 in Appendix B) revealed that membership in the elementary school moderate-stable peer exclusion trajectory class (compared to the low-stable peer exclusion trajectory class) predicted *more* time spent using social media in young adulthood ($\beta = .36, p < .01$), however, it did not predict membership in any of the middle school anxious solitude trajectory classes. Membership in the elementary school high-increasing peer exclusion trajectory class (compared to the low-stable peer exclusion trajectory class) predicted membership in the middle school high-decreasing anxious solitude trajectory class and *more* time spent playing video games in young adulthood ($\beta = .38, p < .01$ and $\beta = .30, p < .01$, respectively). However, membership in the middle school high-decreasing anxious solitude trajectory class did not predict any measure of young adult media use, indicating that mediation did not occur.

Interestingly, although middle school low-increasing (compared to low-stable) anxious solitude trajectory class membership was not predicted by elementary school peer exclusion trajectory class membership, it predicted *more* time spent playing video games ($\beta = .30, p < .01$), *more* time using the internet for entertainment ($\beta = .26, p < .05$), and *less* time spent using social media ($\beta = -.29, p < .05$) in young adulthood. Evaluation of the Bayesian PPP for the final model suggests a good fit to the data (Table 3 in Appendix A).

Second Alternative Model: Elementary School AS Trajectory Class → Middle School AS Trajectory Class → Young Adult Media Use

The second alternative model examined the mediating effect of middle school anxious solitude trajectory class membership in the link between elementary school anxious solitude trajectory class membership and young adult media use. Middle school anxious solitude trajectory classes were entered into the anxious solitude direct effects model as mediator variables with gender and age at young adult survey completion included as control variables.

Results of the final model (Figure 7 in Appendix B) revealed that membership in the elementary school high-increasing anxious solitude trajectory class (compared to the moderate-decreasing trajectory class) predicted membership in the middle school low-increasing (compared to low-stable) anxious solitude trajectory class ($\beta = .40, p < .001$). Additionally, membership in the middle school low-increasing anxious solitude trajectory class (compared to the low-stable trajectory class) was linked to *more* time spent playing video games in young adulthood ($\beta = .30, p < .05$). Importantly, the significant direct path between elementary school high-increasing (compared to moderate-stable) anxious solitude trajectory class membership and greater time spent playing video games in young adulthood became non-significant with the addition of the mediator variable ($\beta = .16, p > .05$), indicating that membership in the middle school low-increasing (compared to low-stable) anxious solitude trajectory class *fully mediated* the link between elementary school high-increasing (compared to moderate-decreasing) anxious solitude trajectory class membership and time spent playing video games in young adulthood (indirect effect: $b = .48, p < .05$). Evaluation of the Bayesian PPP for the final model suggests an excellent fit to the data (Table 3 in Appendix A).

Final Alternative Model: Elementary School PE Trajectory Class → Middle School PE Trajectory Class → Young Adult Media Use

The final alternative model examined the mediating influence of middle school peer exclusion trajectory class membership in the link between elementary school peer exclusion trajectory class membership and young adult media use. Middle school peer exclusion trajectory class was entered into the peer exclusion direct effects model as a mediator and male gender and age at young adult survey completion were included as control variables.

Results of the final model (Figure 8 in Appendix B) indicate that membership in the elementary school moderate-stable peer exclusion trajectory class (compared to the low-stable trajectory class) predicted *more* time spent using social media in young adulthood ($\beta = .38, p < .001$). Additionally, membership in the elementary school high-increasing peer exclusion trajectory class (compared to the low-stable trajectory class) was linked to *more* time spent playing video games and using social media in young adulthood ($\beta = .28, p < .05$ and $\beta = .34, p < .05$, respectively) and membership in the middle school high-increasing (compared to low-stable) peer exclusion trajectory class ($\beta = .64, p < .001$). Importantly, the link between middle school high-increasing (compared to low-stable) peer exclusion trajectory class membership and *less* time spent using social media use in young adulthood was significant ($\beta = -.62, p < .05$). Results of the indirect effects test were significant ($b = -2.69, p < .05$); and the indirect effect displayed the same sign as the total effect (total effect = $c' + a*b \rightarrow 2.46 - 2.69 = -0.23$) indicating that *partial mediation* (not suppression) occurred (Rucker et al., 2011). Evaluation of the Bayesian PPP for the final model suggests an excellent fit to the data (Table 3 in Appendix A).

Effect Sizes

R^2 statistics were calculated to represent the variance explained for each endogenous variable in each model (Table 4 and Table 5 in Appendix A). “Small” (≥ 0.02), “medium” (≥ 0.13), and “large” (≥ 0.26) effect sizes were evaluated according to established criteria (Hu & Bentler, 1999; Cohen, 2013). One consistency across all models was that they each accounted for significant variance in young adult video game play, with effect sizes ranging from medium (20%) to large (34%). However, the direct effect models (both anxious solitude and peer exclusion) did not account for significant variance in any other measure of young adult media use (Table 4 in Appendix A).

Mediation models were more varied (Table 5 in Appendix A). Three of the four mediation models accounted for significant variance in time spent using the internet for entertainment purposes in young adulthood, with medium effect sizes ranging from 16% to 20%. Two of the four mediation models accounted for significant variance in middle school peer exclusion trajectory class membership (high-increasing vs. low-stable) and in time spent using social media in young adulthood. Explained variance for middle school peer exclusion trajectory class membership ranged from medium (16%) to large (40%) effect sizes, whereas effect sizes for social media use in young adulthood were both large (34% and 36%). Finally, two models accounted for significant variance in middle school anxious solitude trajectory class. Specifically, one model accounted for variance in low-increasing vs. low-stable class membership, while the second model accounted for variance in high-decreasing vs. low stable class membership. Roughly 16% of the variance (a medium effect size) was explained by each model.

Taken together, although the direct effect models revealed non-significant effect sizes except for prediction of young adult video game play, the mediation models feature medium to large total effects for both anxious solitude and peer exclusion trajectory classes, as well as for multiple measures of media use in young adulthood.

CHAPTER 5

DISCUSSION

The aim of the current study was to explore youth affective-behavioral vulnerability and peer processes as risk factors for excessive and problematic media use in young adulthood. Further, the current study tested middle school anxious solitude and peer exclusion trajectory class membership as explanatory mechanisms in the link between elementary school anxious solitude/peer exclusion trajectory class membership and young adult media use. This was done by examining the relation between youth anxious solitude and peer exclusion trajectory classes (in both elementary and middle school) and young adult media use (both time spent engaging with specific mediums and symptoms of problematic media use). This study provided both novel and important information on youth trajectories of anxious solitude and peer exclusion as predictors of excessive media use in young adulthood.

Interpersonal Mediation of Links between Youth Anxious Solitude/Peer Exclusion and Young Adult Media Use

The last part of this investigation focused on the potential mediating role of middle school peer exclusion trajectory class membership in the link between elementary school anxious solitude trajectory class membership and young adult media use; however, multiple alternative models were also investigated. Interestingly, results of the current study support both the chronic stress model and the stress generation model. Specifically, membership in certain elementary school anxious solitude trajectory classes predicted membership in certain middle school peer exclusion trajectory classes and vice versa (Figures 5 & 6 in Appendix B). This combination is consistent with a *transactional model* of anxious solitude development (Gazelle & Rubin, 2019; Gazelle & Cui, 2020; Rubin et al., 2009). Specifically, interpersonal stressors (i.e., peer

exclusion) contribute to the growth and continuity of anxious solitude while anxious solitary behaviors (i.e., social anxiety and social hesitancy) simultaneously contribute to the growth and continuity of interpersonal stressors. Thus, anxious solitary behavior both influences, and is influenced by, interpersonal stressors over time. But what does this mean for the development of excessive and problematic media use in young adulthood?

Youth Anxious Solitude and Peer Exclusion Relations

Contrary to the mediation hypothesis and extant literature on the link between anxious solitude, interpersonal stress, and problematic media use (Tian et al., 2019), middle school peer exclusion trajectory class membership did *not* mediate the link between elementary school anxious solitude trajectory class membership and young adult media use. Elementary school high-increasing (compared to moderate-decreasing) anxious solitude trajectory class membership directly predicted excessive time spent playing video games in young adulthood. However, when middle school peer exclusion trajectory class was added to the anxious solitude model as a mediator, elementary school high-increasing (compared to moderate-decreasing) anxious solitude class membership predicted membership in the middle school high-increasing (compared to low-stable) peer exclusion trajectory class, but membership in the middle school peer exclusion trajectory class did *not* predict time spent playing video games in young adulthood (Figure 5 in Appendix B). Similarly, elementary school high-increasing (compared to low-stable) peer exclusion trajectory class membership directly predicted more time spent playing video games in young adulthood. However, when middle school anxious solitude trajectory class was added to the peer exclusion model as a mediator, elementary school high-increasing (compared to low-stable) peer exclusion class membership predicted membership in the middle school high-decreasing (compared to low-stable) anxious solitude trajectory class, but

membership in the middle school anxious solitude trajectory class did *not* predict time spent playing video games in young adulthood (Figure 6 in Appendix B). Thus, in both cases, neither mediation nor indirect effects were present.

One possible explanation for this finding is that experiencing both anxious solitude and peer exclusion together might not add any additional risk for more media use in young adulthood than the two experiences already bring separately. Indeed, childhood shyness and social withdrawal have been shown to be strong predictors of adult maladjustment across many studies (i.e., Caspi et al., 1989; Serbin et al., 1998; Schmidt et al., 2017). Though the research is not as extensive, youth peer exclusion has been shown to be a predictor of adjustment problems in young adulthood as well (i.e., Grutter & Buchmann, 2021). Perhaps, the lack of high-quality friendships among youths with anxious solitude (Zhao et al., 2012), or the desire to socialize and connect with others among youths who are excluded by their peers (DeWall & Richman, 2011), may alone be enough to influence media behaviors (particularly time spent playing video games) in young adulthood. However, further research is needed to support this claim.

Continuity in Youth Anxious Solitude and Peer Exclusion

This study not only focused on relations between youth anxious solitude and peer exclusion, but also on the continuity of youth anxious solitude and peer exclusion separately. Results of the current study revealed that middle school low-increasing (compared to low-stable) anxious solitude trajectory class membership *fully explained* the link between elementary school high-increasing (compared to moderate-decreasing) anxious solitude trajectory class and *more* time spent playing video games in young adulthood (Figure 7 in Appendix B). Additionally, middle school high-increasing (compared to low-stable) peer exclusion trajectory class membership was shown to *partially explain* the link between elementary school high-increasing

(compared to moderate-decreasing) peer exclusion trajectory class and *less* time spent using social media in young adulthood (Figure 8 in Appendix B) These findings suggest that the continuity of anxious solitude and peer exclusion (separately) from elementary to middle school have an important influence on media use later in life. This is in line with previous research documenting the continuity of anxious solitude and peer exclusion from early childhood to early adolescence (e.g., Gazelle & Cui, 2020).

Differential developmental pathways *after* the middle school transition might explain why some young adults with a youth history of anxious solitude spend more time playing video games and why some young adults with a youth history of peer exclusion spend less time using social media. Past research on trajectories of anxious solitude suggests that the middle school transition provides youths who displayed anxious solitary tendencies in elementary school an opportunity to improve peer relations in a new environment (Gazelle & Faldowski, 2019). For some anxious solitary youths, the middle school transition afforded improved peer relations that subsequently resulted in low-stable levels of anxious solitary behavior. However, for many other anxious solitary youths, the middle school transition was marked by high levels of anxious solitude or an initially low level of anxious solitude followed by increasing anxious solitude over time. Based on findings from the current study, the same may be said of excluded youths.

For anxious solitary youths, 57% of the youths in the elementary school high-increasing anxious solitude trajectory classes ended up in the middle school low-increasing anxious solitude trajectory class (Gazelle & Faldowski, 2019). Youths who follow this pathway demonstrated an increase in time spent playing video games in young adulthood. Perhaps young adults who followed this specific pathway of anxious solitude development in youth are drawn to video games to regulate negative affect caused by years of heightened anxious solitude. Anxious

solitary children want to interact with their peers but remain alone due to concerns about how they will be perceived and treated (Gazelle & Ladd, 2003). Not being able to interact with classmates in middle school (after experiencing similar issues in elementary school) may have resulted in these youths experiencing negative affect (e.g., Lay et al., 2019). Over time, these individuals may develop different ways of regulating negative affect (i.e., meeting psychological needs), such as playing video games (Pallavicini et al., 2018). Additionally, the continued display of anxious solitary behaviors in middle school may be indicative of an underlying problem with social-cognitive skills (e.g., Rubin et al., 2006), which in turn, may drive youths to play multi-player video games where socialization may seem less threatening compared to face-to-face interaction (e.g., Lee & Stapinski, 2012; Young & Lo, 2012).

For youths who were excluded by their peers, results of the current study revealed that half of the youths in the elementary school high-increasing peer exclusion trajectory class subsequently ended up in the high-increasing peer exclusion trajectory class in middle school. For the youths that follow this developmental pathway, experiencing high levels of exclusion in elementary school may have stunted the development of important social-cognitive skills needed to develop and maintain peer relations (e.g., Rubin et al., 2006), resulting in elevated peer exclusion in middle school. The continuous experience of elevated peer exclusion in elementary and middle school might result in negative expectations for socializing. Subsequently, negative expectations for socializing may drive excluded youths away from social media use as a way to regulate negative affect (i.e., meet psychological needs) due to the experience of elevated peer exclusion throughout youth. If this method proves effective for regulating affect, youths may continue to avoid social media throughout adolescence and into young adulthood

Taken together, these findings (a) provide evidence for the long-term impact of youth anxious solitude and peer exclusion trajectory classes on young adult media use and (b) highlight the importance of differential developmental pathways *after* the middle school transition. Specifically, youths in the middle school low-increasing anxious solitude trajectory class who were also in the elementary school high-increasing anxious solitude trajectory class spent *more* time playing video games in young adulthood than youths who were not in the low-increasing anxious solitude trajectory class in middle school. Further, youths in the middle school high-increasing peer exclusion trajectory class who were also in the elementary school high-increasing peer exclusion trajectory class spent *less* time using social media in young adulthood than youths who were not in the high-increasing peer exclusion trajectory class in middle school. Although it is unclear if the links uncovered in this research are due to social needs or affect regulation, the findings of this study suggest that the link between youth vulnerability, youth interpersonal stress, and young adult media use may be driven, at least in part, by the desire to satisfy psychological needs. However, more research is needed to fully understand and support this claim.

Direct Links Between Youth Trajectory Classes and Young Adult Media Use

Youth Anxious Solitude and Young Adult Media Use

In partial support of the anxious solitude direct effect hypothesis, membership in the elementary school high-increasing anxious solitude trajectory class (compared to the moderate-decreasing class) predicted more time (hours per day) spent playing video games in young adulthood. On average, young adults who were in the elementary school high-increasing anxious solitude trajectory class spent 1.9 hours per day playing video games as young adults, whereas young adults who were in the moderate decreasing class spent an average of 0.7 hours per day

playing video games. This elevated time can be concerning, as research shows that time spent playing video games can displace time spent engaging in other activities (particularly academic activities), such as attending class (Ward, 2018) and doing homework (Burgess et al., 2012).

Because membership in the elementary school high-increasing anxious solitude trajectory class did not predict symptoms of problematic media use, it is hard to determine if this time spent playing video games is problematic. Yet even though the problematic nature of this behavior is unclear, a link between youth anxious solitude and young adult video game play exists. Extant research on this link suggests that anxious solitary youth use media to socialize with others in a less threatening environment (compared to face-to-face interaction, e.g., Casale & Fioravanti, 2015; Prizant-Passal et al., 2016; Yucens & Uzer, 2018). Given that the measure of video game play used in the current study did not distinguish between single-player and multi-player games, it is not possible to determine if anxious solitary youth were drawn to solitary (i.e., single-player) or social (i.e., multiplayer) play. However, if these young adults were drawn to video games for social purposes, it may also make sense for anxious solitude trajectory class membership to also predict time spent using social media, but it did not. Rather, findings from the current study are more in line with Chak and Leung's (2004) study, which found that young adult men with anxious solitary tendencies did not find it easier to interact in an online space compared to an offline space. They proposed that anxious solitary individuals may be drawn to media by leisure and recreational activity rather than to meet their social needs. Perhaps young adults with a youth history of anxious solitude are drawn to play video games not to meet their social needs, but to meet their psychological need to regulate affect through the recreation and leisure afforded by video games (e.g., Villani et al., 2018).

Alternatively, young adults with a youth history of anxious solitude may not have developed high-quality friendships throughout their life. This may be because they were unable to develop appropriate social skills due to their anxious solitary behaviors (Wang et al., 2020), or because anxious solitary young adults are more likely to experience peer relationship difficulties in general (Zhao et al., 2012). Regardless of the reason, the lack of high-quality friendships in young adulthood might translate to more solitary leisure/recreation time and less time spent socializing with friends. Because young adults with a history of youth anxious solitude may spend less of their leisure time socializing, they may instead turn to media for leisure, and thus spend more time playing video games than young adults with more high-quality friendships.

Youth Peer Exclusion and Young Adult Media Use

In partial support of the peer exclusion direct effect hypothesis, membership in the high-increasing (compared to low-stable) peer exclusion trajectory class in elementary school predicted more hours per day spent playing video games in young adulthood compared to the low-stable peer exclusion trajectory class. Further, membership in the moderate-stable (compared to low-stable) peer exclusion trajectory class predicted more time spent using social media and entertainment media in young adulthood compared to the low-stable trajectory class. However, symptoms of problematic media use in young adulthood were not associated with membership in any elementary school peer exclusion trajectory class. Therefore, it cannot be determined if the media use identified in young adulthood is problematic.

On average, young adults who were in the elementary school high-increasing peer exclusion trajectory class spent 2.24 hours per day playing video games compared to young adults in the elementary school low-stable peer exclusion trajectory class that spent only 0.6 hours per day playing video games. Additionally, young adults who were in the moderate-stable

peer exclusion trajectory class in elementary school spent an average of 4.69 hours per day using social media and 4.79 hours per day on entertainment media compared to young adults that were in the low-stable peer exclusion trajectory class in elementary school, who spent 2.5 and 2.7 hours per day using social media and entertainment internet, respectively.

Contrary to the findings on elementary school anxious solitude trajectory class membership, young adults with a youth history of moderate-stable (compared to low-stable) peer exclusion reported more time spent using social media in addition to more time spent using the internet for entertainment. As such, it is possible young adults who experience at least moderate levels of peer exclusion in their youth may be drawn to the social aspects of leisure media as well. Video games and even entertainment sites can also implement various social functions. It is possible that young adults with a history of youth peer exclusion may play multi-player/social video games to meet new people. Similarly, some entertainment media also includes social functionality such as sharing your thoughts on the entertainment you are engaging with via commenting and even watching live-streamers (a live transmission of an event over the internet) with thousands of others whom you can engage with in real-time chat.

Perhaps young adults with a history of peer exclusion in elementary school turn to social aspects of media to develop new friendships (i.e., meeting people using social media apps, playing online video games, or watching a live-stream with live-chat). The internet may seem like the optimal place for young adults with a history of peer exclusion to make friends (and meet their social needs) for several reasons. Research shows that young people find it easier to communicate their insecurities and self-disclose in an online space, which may be important for young adults who have experienced peer exclusion (e.g., Antheunis, Valkenburg, & Peter, 2007). Additionally, young adults who experienced peer difficulties can find others similar to

themselves, or who share similar interests, in an online space through shared video games, shared online groups, and even through following similar people on social media (e.g., Cole & Griffiths, 2007; Yau & Reich, 2020).

Demographic Predictors of Young Adult Media Use

In addition to elementary school trajectory class membership, age at survey completion and gender were also shown to influence young adult media use. In the anxious solitude model, older participants spent more hours per day using the internet for entertainment and playing video games than younger participants. Interestingly, this finding is the exact opposite of what we know about internet users, particularly those who use the computer for leisure. Research on age differences in video game play and computer leisure activity ubiquitously report that younger individuals tend to spend more time engaging in these leisure activities than older individuals (Clement, 2021a). One possible explanation for this finding is that older young adults may have more time for leisure after graduating from college, and thus spend more time engaging in leisure activities. Alternatively, something about this unique sample (over-selected for elevated anxious solitary behaviors) may explain this contradictory finding. However, the current study lacks sufficient power to conduct further analyses, so we are unable to test this hypothesis.

Finally, in both the anxious solitude and peer exclusion models, gender was shown to influence the number of hours spent playing video games, such that male participants spent more time playing video games than female participants. This finding is not surprising, as men have consistently been shown to spend more time playing video games compared to women (Brown, 2017; Clement, 2021b).

Youth Anxious Solitude and Peer Exclusion Trajectories

In support of both the continuity in peer exclusion trajectory class and the continuity in anxious solitude trajectory class hypotheses, most of the participants displayed continuity in their trajectory class membership (Table 2 in Appendix A). Unsurprisingly, however, some youths in the current study displayed discontinuity in their anxious solitude and peer exclusion trajectory class membership.

Regarding continuity, half of the youths in the elementary school high-increasing peer exclusion trajectory classes subsequently ended up in the middle school high-increasing peer exclusion trajectory classes. Additionally, 96% of the youths in the elementary school low-stable peer exclusion trajectory class subsequently ended up in the middle school low-stable peer exclusion trajectory class. As for anxious solitude, of the youths in the elementary school high-increasing anxious solitude trajectory class: 16% subsequently ended up in the middle school high-decreasing trajectory class and 57% subsequently ended up in the low-increasing anxious solitude trajectory class in middle school. Further, 68% of the youths in the elementary school moderate-decreasing anxious solitude trajectory class subsequently ended up in the low-stable anxious solitude trajectory class in middle school.

Regarding discontinuity, half of the youths in the elementary school high-increasing peer exclusion trajectory classes subsequently ended up in the middle school low-stable peer exclusion trajectory classes. Whereas only 4% of the youths in the elementary school low-stable peer exclusion trajectory class ended up in the middle school high-increasing peer exclusion trajectory class. As for anxious solitude, 27% of the youths in the elementary school high-increasing anxious solitude trajectory class subsequently ended up in the low-stable anxious solitude trajectory class in middle school. Further, 4% of the youths in the elementary school

moderate-decreasing anxious solitude trajectory class subsequently ended up in the high-decreasing anxious solitude trajectory class in middle school.

Overall, these findings suggest that while most youths in elementary and middle school experience low levels of anxious solitude and peer exclusion, the transition to middle school may act as a positive or negative turning point for some children who experienced anxious solitude or peer exclusion in elementary school. A positive turning point is evidenced by the greater proportion of youths in middle school that were grouped in trajectory classes comprised of lower levels of peer exclusion and anxious solitude compared to youths in elementary school (anxious solitude: 93% in middle school vs 80% in elementary school; peer exclusion: 84% in middle school vs 62% in elementary school). Whereas a negative turning point can be seen among the small proportion of youths that started in the low-stable peer exclusion trajectory class in elementary school and subsequently ended in the high-increasing peer exclusion trajectory class in middle school (4%) and the youths that started in the moderate-decreasing anxious solitude trajectory class in elementary school and subsequently ended in the high-decreasing anxious solitude class in middle school (4%). As suggested in previous research, it may be that the changing environment (i.e., moving from elementary school to middle school) provides youths who were anxious solitary or excluded by their peers an opportunity to establish new friendships among a new group of peers and thus improve their peer relations (Shell et al., 2014). Conversely, some youths may have been unable to establish new peer relationships after the middle school transition, and thus, worsened their peer relations. These findings are a testimony to the importance of accounting for ecological transitions, such as the middle school transition, in understanding continuity and change in peer processes.

Strengths, Limitations, and Future Directions

Strengths

The greatest strength of the current study is that it was uniquely positioned to address important questions about the long-term impact of youth anxious solitude and peer exclusion trajectories on young adult media use. The focus of this research was on adults with histories of youth anxious solitude and peer exclusion. Anxious solitary youth make up approximately 10-15% of normative community samples (Gazelle et al., 2005); making anxious solitude the most common type of social withdrawal (Coplan et al., 2013). Although a sizeable literature exists on anxious solitude, most of the longitudinal research on this type of social withdrawal focuses on direct links to adult adjustment. Additionally, many longitudinal studies only measure anxious solitude at one time point in youth to predict adult adjustment, thus neglecting developmental patterns of anxious solitude. Further, not much research exists on the mediating mechanisms and processes that explain the link between youth anxious solitude and young adult development. Research on peer exclusion is even more limited, with only three studies (to date) having investigated the concurrent link between peer exclusion and problematic media use.

To address these gaps in the literature, the current study used peer-reported repeated measures data and a longitudinal mediation design. By utilizing this type of data and study design, this study sought to explain: (a) if patterns of elementary school anxious solitude and peer exclusion predict excessive and problematic media use in young adulthood, and (b) if middle school peer exclusion or anxious solitude mediated these links. Future research should continue to investigate divergent developmental trajectories of youth vulnerability and peer processes over time to better understand how and why young adults develop maladaptive behaviors. Understanding these patterns will be crucial for intervention efforts aimed at

preventing maladaptive adult outcomes of youth anxious solitude such as internalizing difficulties (e.g., Tang et al., 2017), delays in adult developmental milestones (e.g., Caspi, Elder, & Bem, 1988), and intergenerational transfer of risk (e.g., Serbin et al., 1998).

Additionally, research should continue to investigate how media and technology use influence, and are influenced by, individual and social processes. In our technology-saturated world, many adults are *hopeful* (i.e., belief in increased connection, digital commerce, and intellectual empowerment) yet also *apprehensive* (i.e., concern regarding addiction/overuse, distrust of material, and dangers associated with technology) about the role of media and technology in our everyday functioning (Anderson & Rainie, 2018). As such, it is important for researchers to continue investigating the role of media and technology in human development to help individuals and families make the most informed decisions about their media and technology consumption.

Limitations

One limitation of the current study is the sample size. The current sample is too small to detect certain effects, particularly in models involving trajectory class variables with more than two trajectory classes (i.e., elementary school peer exclusion and middle school anxious solitude). For example, only 10 participants in the current sample have been categorized in the high-decreasing anxious solitude trajectory class in middle school. Similarly, the moderate-stable peer exclusion trajectory class in elementary school was composed of only 12 members of the current sample. These small sample sizes might explain why some paths associated with these variables were not significant (e.g., why membership in the elementary school high-increasing anxious solitude trajectory class did not predict membership in the middle school high-decreasing anxious solitude trajectory class).

Another limitation of this study is the length of time between the child data and young adult data. There is a gap of 10 years between when the youth data and the young adult data were collected, and this missing time contains important transitions such as the transition to high school and the transition to college or the workforce. However, it should be noted that while there is a gap between time points, we have been able to establish contact with 51% (119/230) of our selected sample and 31% (16/52) of our elevated AS screening sample. Furthermore, 99% (133/135) of those individuals have agreed to participate. Thus, while the length of time may initially be a limitation, our rates of participation show that it is possible to reach acceptable participation rates, even with the 10-year time gap. Of course, future research would benefit from including waves of data collection throughout adolescence in addition to in childhood and young adulthood.

A third limitation of the study is that media use was not measured in childhood as the original youth study was not designed to test media use. Without this youth data, we are unable to plot trajectories of media use over time or control for media behaviors in childhood. Future research should include youth measures of media use to fully understand the link between youth peer processes and media use.

A final limitation is that social versus solitary media use was not distinguished in the current study. Without this distinction, we cannot definitively determine the motivations of young adults with a history of anxious solitude and peer exclusion for spending more time using media. Are young adults with a history of childhood anxious solitude and/or peer exclusion drawn to video game play due to the social aspects of gaming (i.e., socializing with others while playing multiplayer games online) or do they spend more time playing single-player video games to regulate negative affect due to their experiences? Similar questions can be asked of

entertainment media as well, given that some entertainment media can be interactive such as watching live streams with a chat room function or watching/engaging in media with friends via shared streaming applications such as “Watch Together” (via Facebook) or “Watch Party” (via Amazon Prime). Future research will need to distinguish between social and solitary media use to answer these questions.

Conclusion

The current study provides a first look into how young adults with a history of anxious solitude and/or peer exclusion in elementary school may be especially vulnerable to engaging in excessive media use later in life. Further, this study also highlights how different developmental pathways of anxious solitude and peer exclusion may explain why some anxious solitary and excluded youths spend more (or less) time using media than other anxious solitary and excluded youths. Specifically, findings from the current study revealed that: (a) membership in the elementary school high-increasing anxious solitude trajectory class (compared to the moderate-decreasing anxious solitude trajectory class) predicted more time (per day) spent playing video games in young adulthood; and (b) membership in the elementary school moderate-stable peer exclusion trajectory class (compared to the low-stable peer exclusion trajectory class) predicted more time spent using the internet for entertainment and more time spent using social media.

Further, mediation analyses revealed that: (a) membership in the middle school low-increasing anxious solitude trajectory class *fully mediated* the link between elementary school high-increasing anxious solitude trajectory class membership and *more* time playing video games in young adulthood; (b) membership in the middle school high-decreasing anxious solitude trajectory class *indirectly* linked elementary school high-increasing peer exclusion trajectory class membership to *less* time spent using social media in young adulthood; and (c)

membership in the middle school high-increasing peer exclusion trajectory class *partially mediated* the link between elementary school high-increasing peer exclusion trajectory class and *less* time using social media in young adulthood. This could mean that *higher levels* of anxious solitude and peer exclusion may *decrease* risk for developing problematic social media use in young adulthood, but *increase* risk for excessive video game play later in life. However, findings will need to be replicated before they are considered established. If these findings are replicated, however, they have the potential to provide valuable information about the long-term impact of individual vulnerability and peer processes as well as inform prevention efforts aimed at providing individuals and families with information to make informed decisions about their media and technology consumption.

APPENDIX A

TABLES

Table 1

Descriptive Statistics and Correlations of Study Variables (N = 118)

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. AS Eclass	--												
2. AS Mclass	.42***	--											
3. PE Eclass	.44***	.39***	--										
4. PE Mclass	.32***	.53***	.59***	--									
5. Entertainment Media	.17	.15	.13	.17	--								
6. Social Media Use	-.11	-.11	-.00	-.13	.33***	--							
7. Video Game Play	.31**	.30**	.40***	.25*	.46***	-.01	--						
8. PMU	-.05	.09	-.04	-.01	.00	.20*	.12	--					
9. Age in 3 rd Grade	-.11	-.19	.10	-.03	.24*	.12	.20*	.02	--				
10. Age in YA (Control)	-.02	-.15	.11	-.08	.24*	.10	.19	-.00	.66***	--			
11. Gender (Control)	.02	.15	.26**	.20*	.19	-.13	.37***	-.01	.12	.20*	--		
12. SES (Free Lunch)	-.03	-.01	.19*	.02	.10	.14	.08	-.08	.02	.12	.20*	--	

(Table Continues)

Table 1 - Continued

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
13. Ethnic Minority	-.01	-.17	.02	-.07	.12	.19	-.05	-.07	.07	.23*	.01	.25**	--
<i>M</i>	--	--	--	--	3.13	2.70	1.25	9.47	8.63	22.83	--	--	--
<i>SD</i>	--	--	--	--	2.97	3.07	1.98	3.30	0.45	0.84	--	--	--

Note. *** $p < .001$, ** $p < .01$, * $p < .05$; Two-tailed tests; AS = anxious solitude; PE = peer exclusion; YA = young adulthood; Gender = Male; Control = Variables used as control variables in final models.

Table 2

Percent of Elementary School Trajectory Class Members in Each Middle School Trajectory Class

ES Trajectory Class (<i>N</i>)	MS Trajectory Class	Percent (<i>n</i>)
Hi-Incr Peer Exclusion (<i>N</i> = 91)	Hi-Incr Peer Exclusion	50% (<i>n</i> = 45)
	Lo-Stab Peer Exclusion	50% (<i>n</i> = 46)
	Hi-Decr Anxious Solitude	12% (<i>n</i> = 11)
	Lo-Incr Anxious Solitude	51% (<i>n</i> = 46)
	Lo-Stab Anxious Solitude	37% (<i>n</i> = 34)
Mod-Stab Peer Exclusion (<i>N</i> = 90)	Hi-Incr Peer Exclusion	10% (<i>n</i> = 9)
	Lo-Stab Peer Exclusion	90% (<i>n</i> = 81)
	Hi-Decr Anxious Solitude	10% (<i>n</i> = 9)
	Lo-Incr Anxious Solitude	37% (<i>n</i> = 33)
	Lo-Stab Anxious Solitude	53% (<i>n</i> = 48)
Lo-Stab Peer Exclusion (<i>N</i> = 322)	Hi-Incr Peer Exclusion	4% (<i>n</i> = 13)
	Lo-Stab Peer Exclusion	96% (<i>n</i> = 309)
	Hi-Decr Anxious Solitude	4% (<i>n</i> = 13)
	Lo-Incr Anxious Solitude	29% (<i>n</i> = 93)
	Lo-Stab Anxious Solitude	67% (<i>n</i> = 216)
Hi-Incr Anxious Solitude (<i>N</i> = 107)	Hi-Incr Peer Exclusion	35% (<i>n</i> = 37)
	Lo-Stab Peer Exclusion	65% (<i>n</i> = 70)
	Hi-Decr Anxious Solitude	16% (<i>n</i> = 17)
	Lo-Incr Anxious Solitude	57% (<i>n</i> = 61)
	Lo-Stab Anxious Solitude	27% (<i>n</i> = 29)
Mod-Decr Anxious Solitude (<i>N</i> = 396)	Hi-Incr Peer Exclusion	8% (<i>n</i> = 30)
	Lo-Stab Peer Exclusion	92% (<i>n</i> = 366)
	Hi-Decr Anxious Solitude	4% (<i>n</i> = 16)
	Lo-Incr Anxious Solitude	28% (<i>n</i> = 111)
	Lo-Stab Anxious Solitude	68% (<i>n</i> = 269)

Note. ES = Elementary School; MS = Middle School; Hi-Incr = High-Increasing; Hi-Decr = High-Decreasing; Lo-Incr = Low-Increasing; Lo-Stab = Low-Stable; Mod-Stab = Moderate-Stable; Mod-Decr = Moderate-Decreasing.

Table 3

Model Fit Indices

Model	χ^2	<i>df</i>	CFI	RMSEA	SRMR	BPPP
Ideal Standards	NS	N/A	> .90	< .06	< .08	≈ .50
AS Direct Effect	9.57, <i>ns</i>	6	.95	.07	.05	--
PE Direct Effect	7.99, <i>ns</i>	6	.98	.05	.04	--
Combined Model	--	--	--	--	--	.11
Mediation: AS-PE	--	--	--	--	--	.36
Mediation: PE-AS	--	--	--	--	--	.42
Mediation: AS-AS	--	--	--	--	--	.44
Mediation: PE-PE	--	--	--	--	--	.48

Note. *ns* = not significant; χ^2 = Chi-square statistic; *df* = degrees of freedom; CFI = Comparative Fit Index; RMSEA = Root-Mean-Square-Error of Approximation; SRMR = Standardized Root-Mean-Square Residual. BPPP = Bayesian Posterior Predictive P-value. AS = anxious solitude; PE = peer exclusion. Bayes estimation does not provide χ^2 , CFI, RMSEA, and SRMR, thus these fit indices are missing from all models that used Bayes estimation (mediation models).

Table 4

Effect Size: Explained Variance (R^2) by Direct Effect Models

Variable and Period of Data Collection	R^2	<i>S.E.</i>	$R^2/S.E.$	<i>p</i>
Direct Effect Model – Anxious Solitude				
Internet Use (Entertainment) - YA	0.06 ^s	0.04	1.40	0.161
Social Media Use - YA	0.01 ^s	0.02	0.42	0.676
Video Game Play - YA	0.20 ^m	0.07	2.98	0.003
Problematic Media Use - YA	0.00 ^s	0.01	0.29	0.774
Direct Effect Model – Peer Exclusion				
Internet Use (Entertainment) - YA	0.09 ^s	0.05	1.72	0.086
Social Media Use - YA	0.08 ^s	0.05	1.57	0.116
Video Game Play - YA	0.23 ^m	0.07	3.23	0.001
Problematic Media Use - YA	0.01 ^s	0.02	0.66	0.511

Note. Superscripts (^{s,m,l}) denote small (≥ 0.02), medium (≥ 0.13), and large (≥ 0.26) effect size. YA = Young Adulthood. **Bold** *p*-values indicate variance explained is significant.

Table 5

Effect Size: Explained Variance (R^2) by Mediation Models (Bayes Estimation)

Variable and Period of Data Collection	R^2	<i>S.D.</i>	<i>p</i>	<i>95% C.I.</i>
Mediation Model – AS Predictor, PE Mediator				
Hi-Incr PE Trajectory Class - MS	0.16 ^m	0.08	0.000	(0.03,0.31)
Internet Use (Entertainment) - YA	0.09 ^s	0.06	0.000	(0.00,0.21)
Social Media Use - YA	0.11 ^s	0.12	0.000	(0.00,0.38)
Video Game Play - YA	0.21 ^m	0.06	0.000	(0.09,0.34)
Problematic Media Use - YA	0.01 ^s	0.03	0.000	(0.00,0.09)
Mediation Model – PE Predictor, AS Mediator				
Hi-Decr AS Trajectory Class - MS	0.16 ^m	0.09	0.000	(0.01,0.34)
Lo-Incr AS Trajectory Class - MS	0.07 ^s	0.05	0.000	(0.00,0.17)
Internet Use (Entertainment) - YA	0.20 ^m	0.08	0.000	(0.06,0.36)
Social Media Use - YA	0.35 ^l	0.17	0.000	(0.07,0.68)
Video Game Play - YA	0.34 ^l	0.08	0.000	(0.19,0.49)
Problematic Media Use - YA	0.02 ^s	0.03	0.000	(0.00,0.10)
Mediation Model – AS Predictor, AS Mediator				
Hi-Decr AS Trajectory Class - MS	0.07 ^s	0.07	0.000	(0.00,0.23)
Lo-Incr AS Trajectory Class - MS	0.16 ^m	0.07	0.000	(0.03,0.30)
Internet Use (Entertainment) - YA	0.19 ^m	0.08	0.000	(0.06,0.34)
Social Media Use - YA	0.19 ^m	0.17	0.000	(0.00,0.55)
Video Game Play - YA	0.33 ^l	0.08	0.000	(0.17,0.49)

(Table Continues)

Table 5 - Continued

Variable and Period of Data Collection	R^2	$S.D.$	p	95% $C.I.$
Problematic Media Use - YA	0.05 ^m	0.06	0.000	(0.00,0.19)
Mediation Model – PE Predictor, PE Mediator				
HI-Incr PE Trajectory Class - MS	0.40 ^l	0.10	0.000	(0.21,0.58)
Internet Use (Entertainment) - YA	0.16 ^m	0.07	0.000	(0.05,0.30)
Social Media Use - YA	0.33 ^l	0.15	0.000	(0.08,0.64)
Video Game Play - YA	0.27 ^l	0.07	0.000	(0.14,0.40)
Problematic Media Use - YA	0.05 ^s	0.04	0.000	(0.00,0.14)

Note. Superscripts (^{s,m,l}) denote small (0.02), medium (0.13), and large (0.26) effect size. PE = Peer Exclusion, AS = Anxious Solitude, MS = Middle School, YA = Young Adulthood. $S.D.$ = Posterior Standard Deviation, $C.I.$ = Confidence Interval. Hi-Incr = High-Increasing; Hi-Decr = High-Decreasing; Lo-Incr = Low-Increasing; Lo-Stab = Low-Stable; Mod-Stab = Moderate-Stable; Mod-Decr = Moderate-Decreasing. **Bold** C.I. indicates variance explained is significant (i.e., C.I. does *not* contain 0).

APPENDIX B

FIGURES

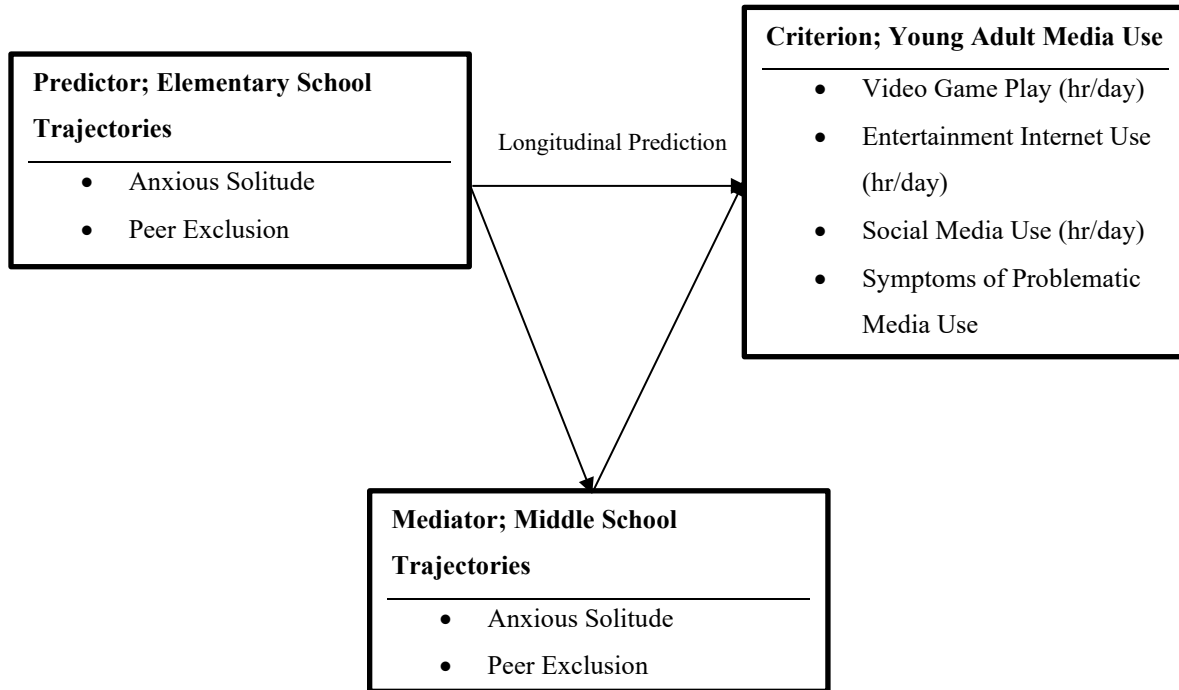
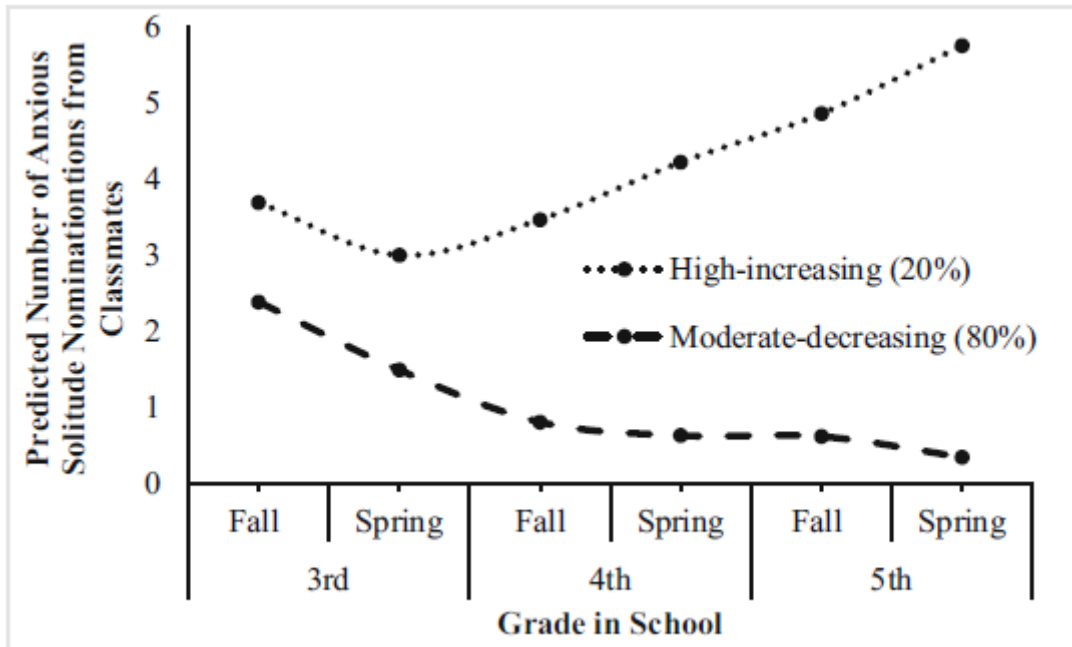


Figure 1. Conceptual model proposing that the links from increasing elementary school trajectories of anxious solitude/peer exclusion to elevated young adult media use are mediated by increasing middle school trajectories of anxious solitude and peer exclusion.

(A)



(B)

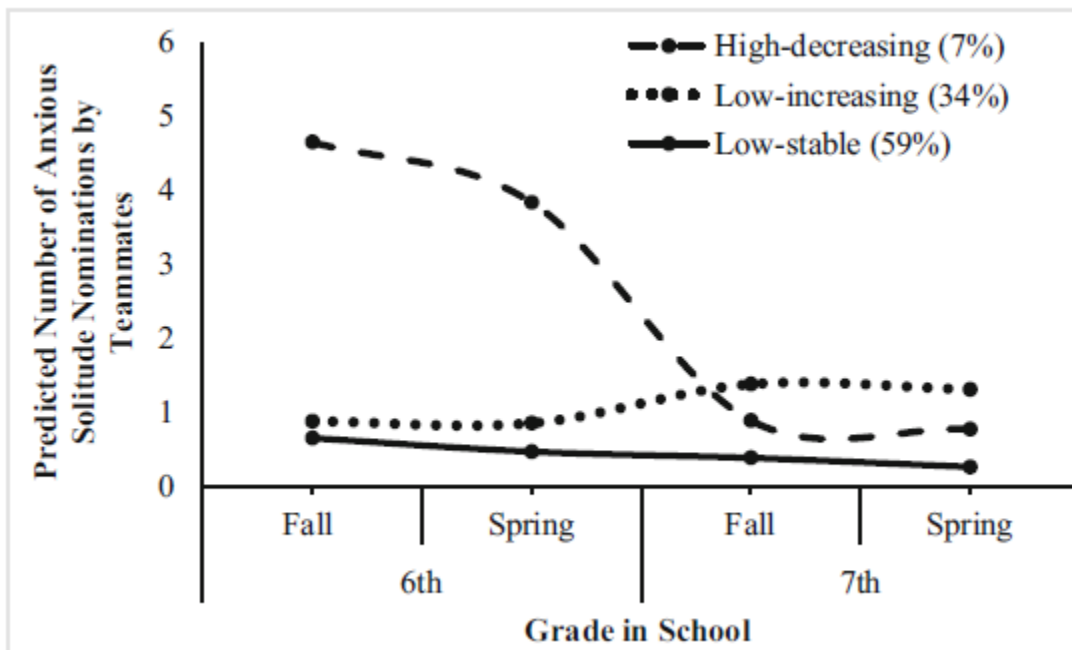
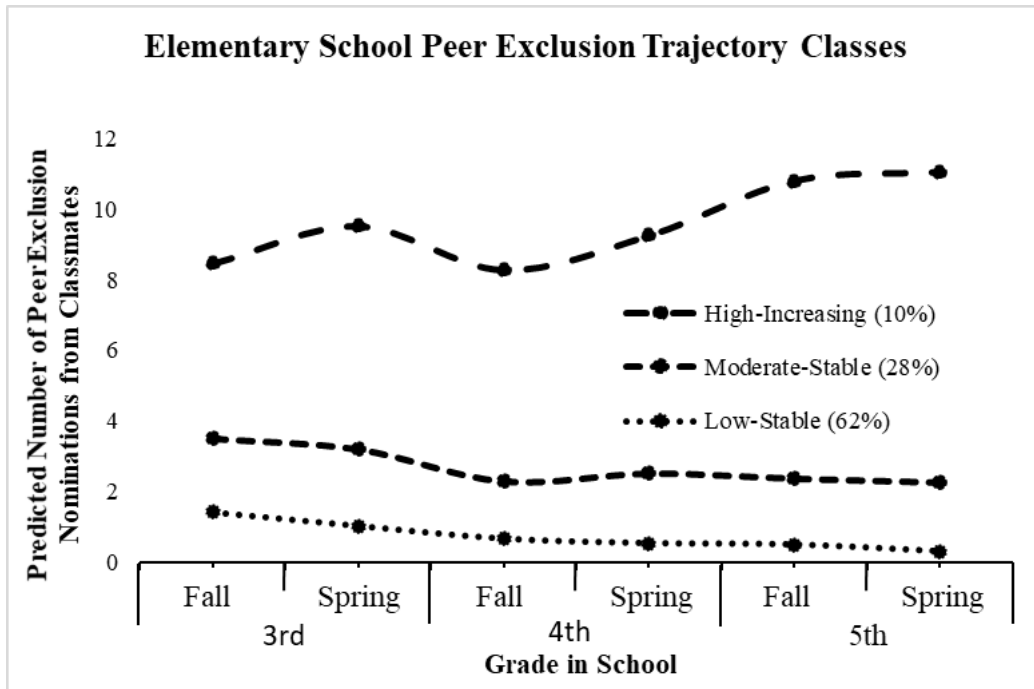


Figure 2. Peer-reported anxious solitude latent trajectory classes from (A) the fall of 3rd grade to the end of elementary school in the spring in 5th grade and (B) from the start of middle school in the fall of 6th grade to the end of 7th grade.

Note. Anxious solitude trajectory classes were identified in Gazelle & Faldowski, 2019 using the same data as the current study.

(A)



(B)

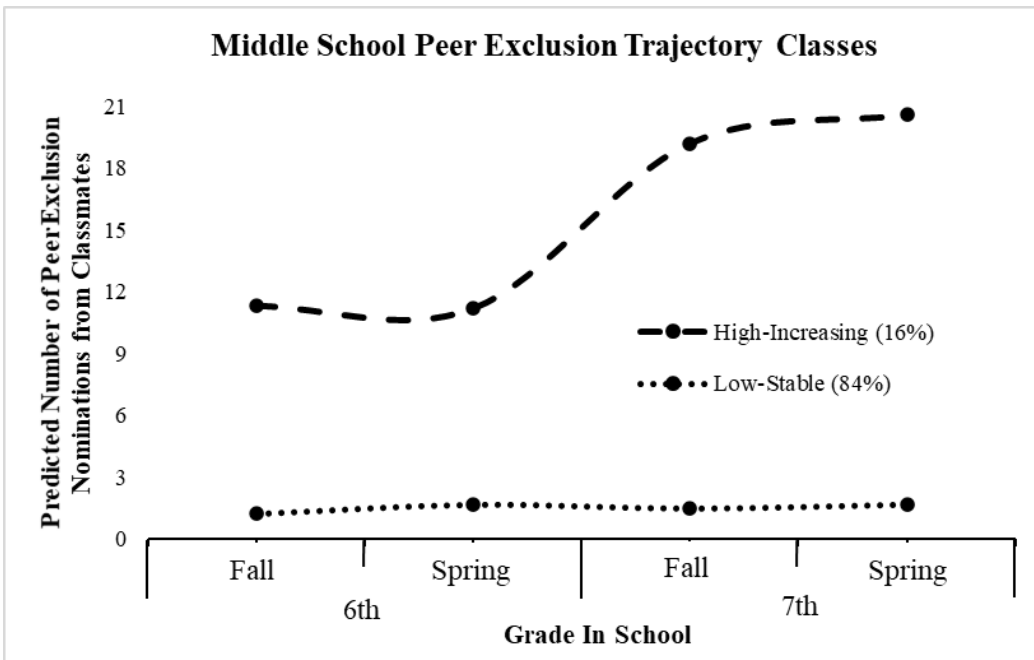
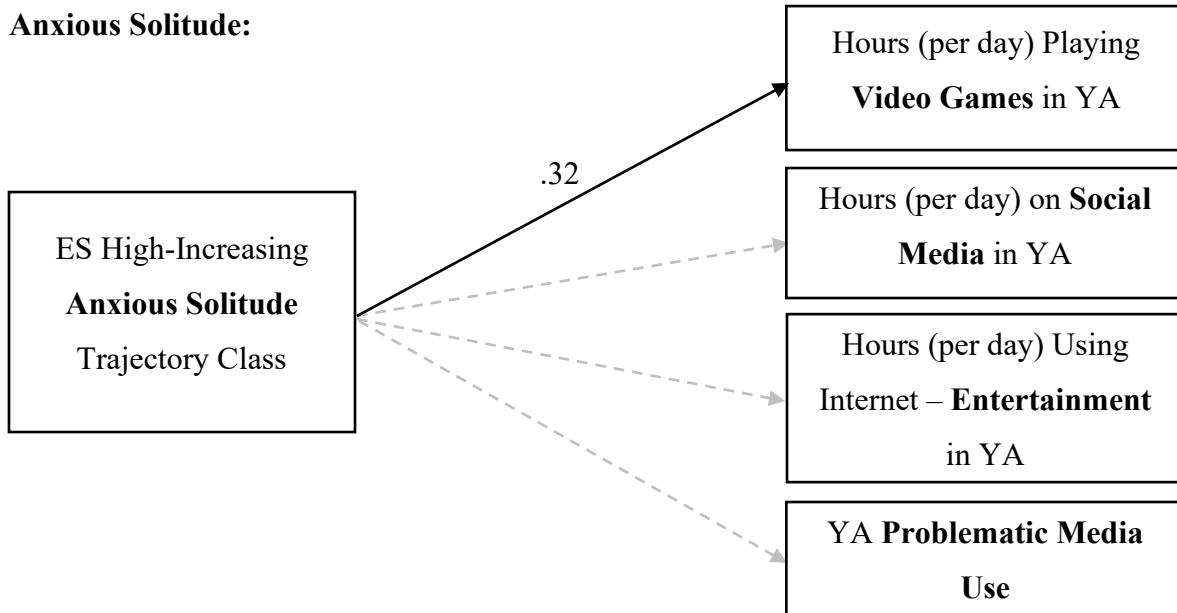


Figure 3. Peer-reported peer exclusion latent trajectory classes from (A) the fall of 3rd grade to the end of elementary school in the spring in 5th grade and (B) from the start of middle school in the fall of 6th grade to the end of 7th grade.

Anxious Solitude:



Peer Exclusion:

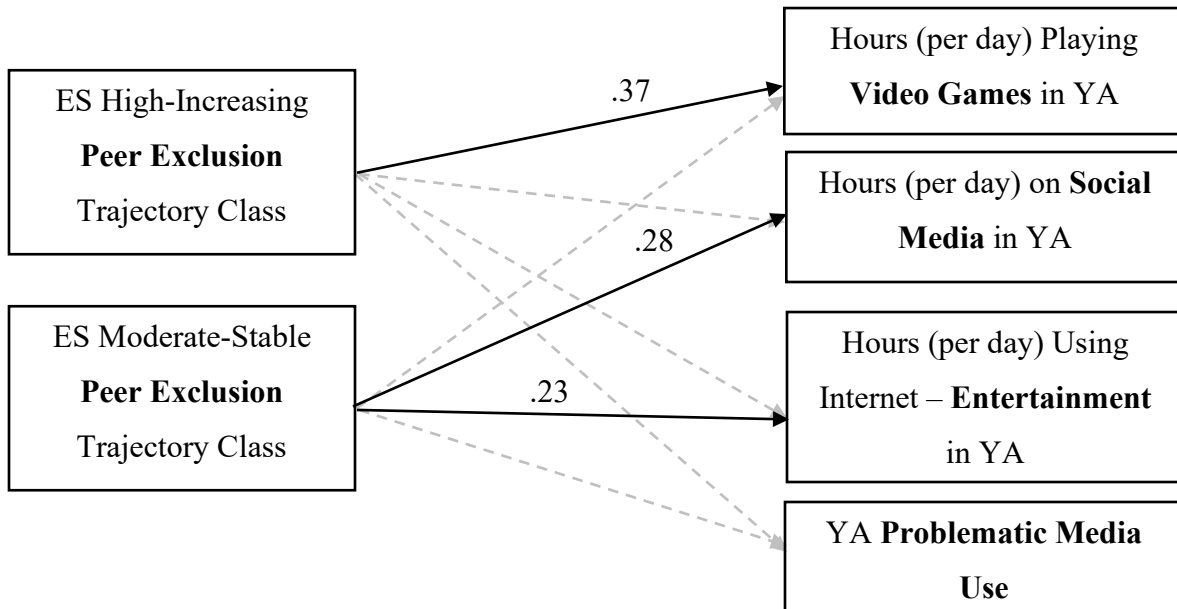


Figure 4. Direct effect models: Path analysis model of elementary school (3rd – 5th grade) trajectory class membership and young adult (age 21-25) excessive and problematic media use for anxious solitude and peer exclusion.

Note. Solid arrows indicate significant paths. Dashed arrows indicate non-significant paths. A significant main effect of male gender on video game play (AS: $\beta = .31, p < .001$; PE: $\beta = .23, p < .01$) was included in both the anxious solitude and peer exclusion model; and a main effect of older age in YA on entertainment media use (AS: $\beta = .17, p < .05$) was included in the anxious solitude model (control variables, error terms, and correlated error terms are not depicted to simplify the visual presentation). Path coefficients are standardized. ES = elementary school; YA = young adult/adulthood.

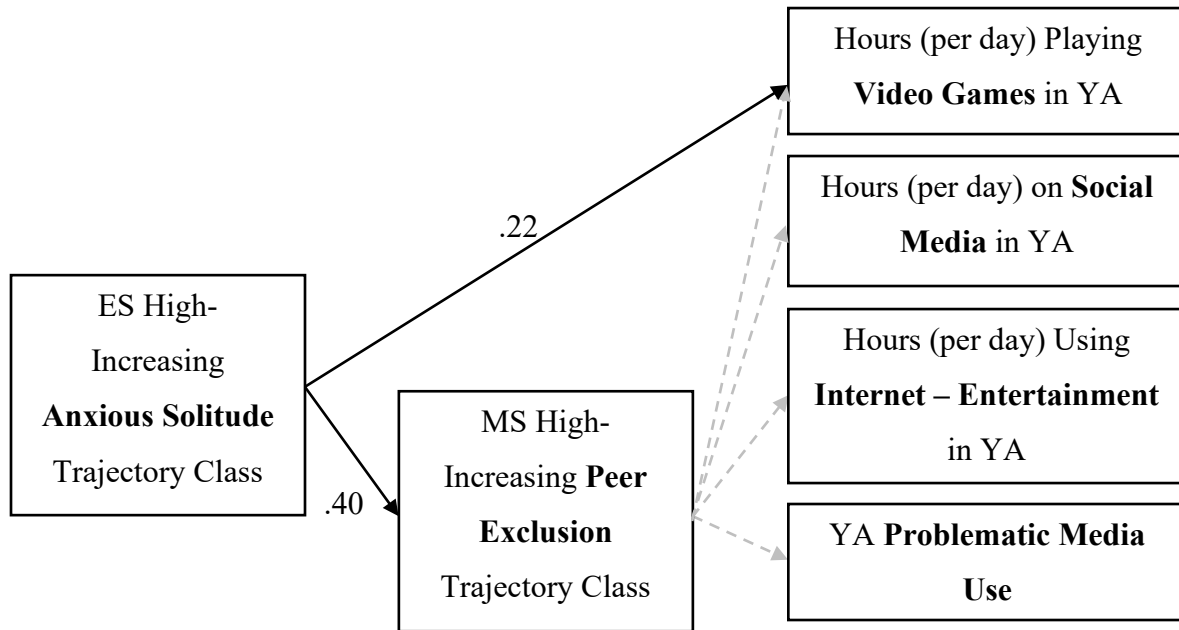


Figure 5. Hypothesized mediation model: Path analysis mediation model of elementary school (3rd – 5th grade) anxious solitude trajectory class membership (predictor), middle school (6th – 7th grade) peer exclusion trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).

Note. Solid arrows indicate significant paths. Dashed arrows indicate non-significant paths. Significant main effects of male gender on video game play ($\beta = .29, p < .01$) and older age in YA on entertainment media use ($\beta = .17, p < .05$) were included in the model but not depicted to simplify the visual presentation. Error terms and correlated error terms are omitted for clarity. Path coefficients are standardized. ES = elementary school; MS = middle school; YA = young adult/adulthood.

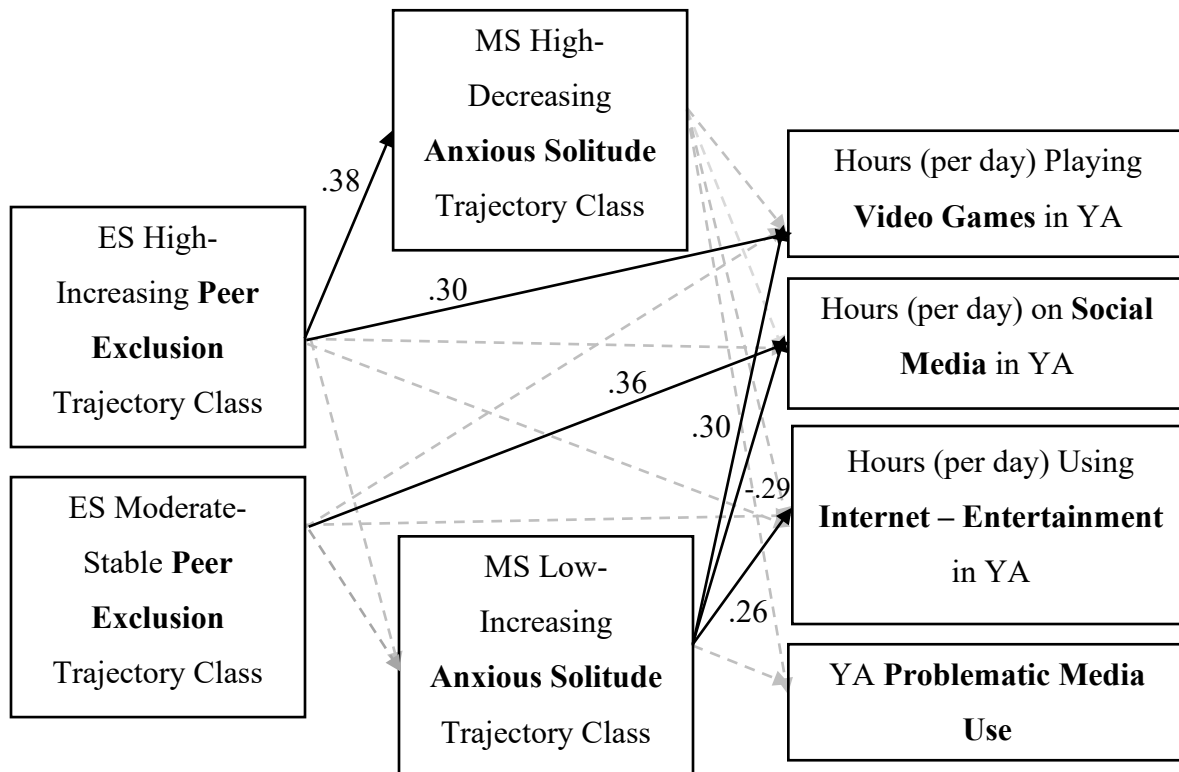


Figure 6. First alternative mediation model: Path analysis mediation model of elementary school (3rd – 5th grade) peer exclusion trajectory class membership (predictor), middle school (6th – 7th grade) anxious solitude trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).

Note. Solid arrows indicate significant paths. Dashed arrows indicate non-significant paths. Significant main effects of male gender on video game play ($\beta = .22, p < .01$) and older age in YA on entertainment media use ($\beta = .17, p < .05$) were included in the model but not depicted to simplify the visual presentation. Error terms and correlated error terms are omitted for clarity. Path coefficients are standardized. ES = elementary school; MS = middle school; YA = young adult/adulthood.

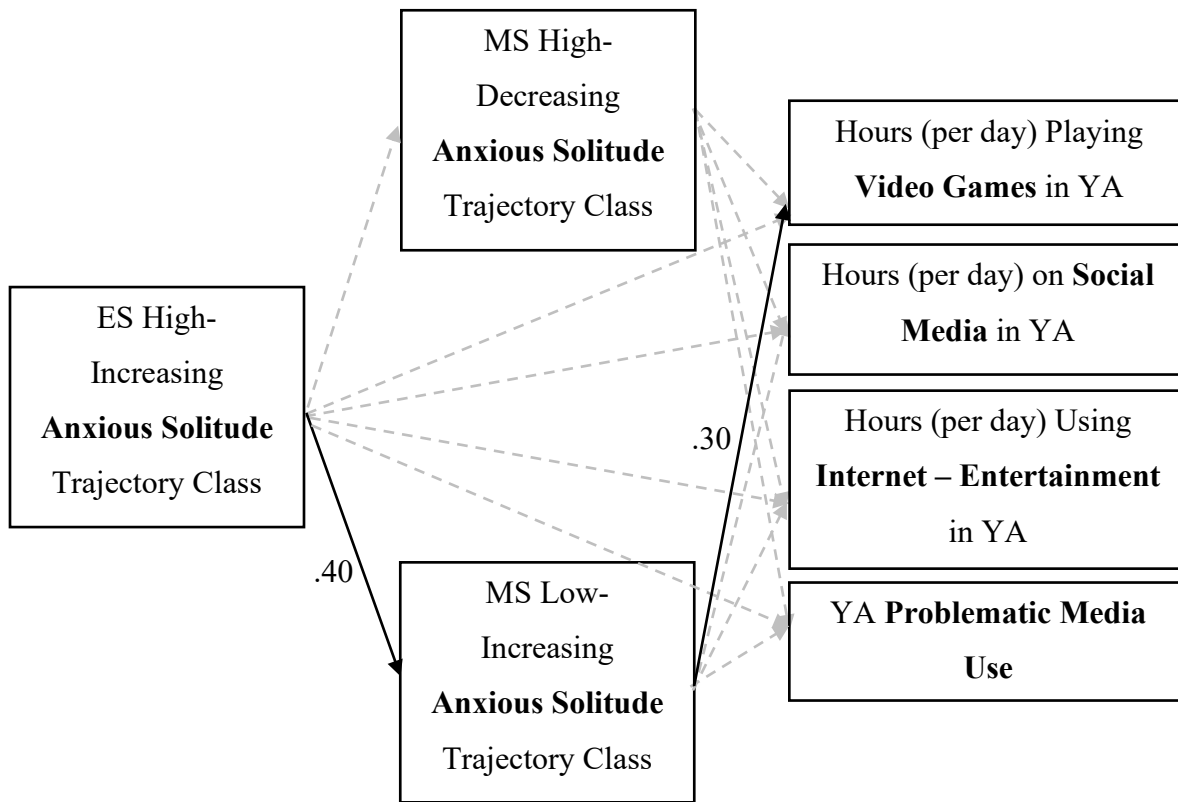


Figure 7. Second alternative mediation model: Path analysis mediation model of elementary school (3rd – 5th grade) anxious solitude trajectory class membership (predictor), middle school (6th – 7th grade) anxious solitude trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).

Note. Solid arrows indicate significant paths. Dashed arrows indicate non-significant paths. Significant main effects of male gender on video game play ($\beta = .30, p < .01$) and older age in YA on entertainment media use ($\beta = .18, p < .05$) were included in the model but not depicted to simplify the visual presentation. Error terms and correlated error terms are omitted for clarity. Path coefficients are standardized. ES = elementary school; MS = middle school; YA = young adult/adulthood.

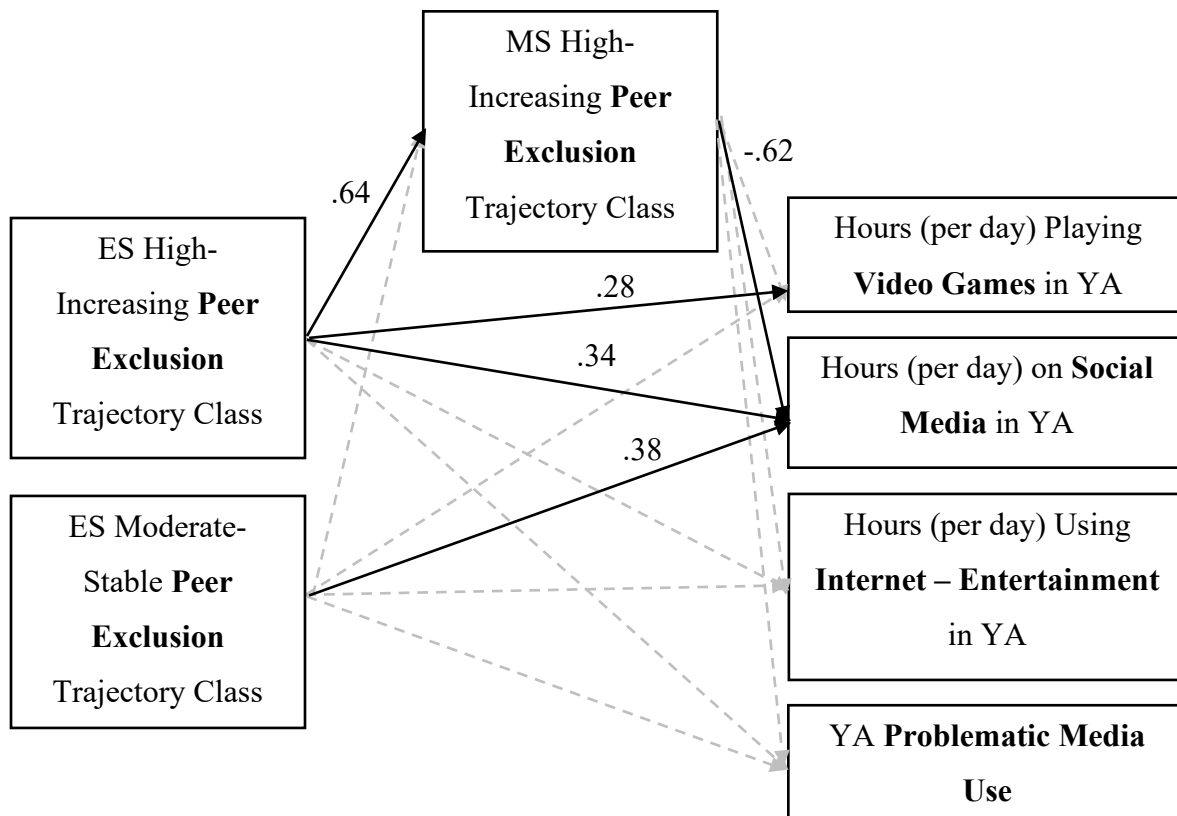


Figure 8. Third alternative mediation model: Path analysis mediation model of elementary school (3rd – 5th grade) peer exclusion trajectory class membership (predictor), middle school (6th – 7th grade) peer exclusion trajectory class membership (mediator), and young adult (age 21-25) excessive and problematic media use (criterion).

Note. Solid arrows indicate significant paths. Dashed arrows indicate non-significant paths. A significant main effect of male gender on video game play ($\beta = .26, p < .01$) and a non-significant effect of older age in YA on entertainment media use ($\beta = .15, p = .09$) were included in the model but not depicted to simplify the visual presentation. Error terms and correlated error terms are omitted for clarity. Path coefficients are standardized. ES = elementary school; MS = middle school; YA = young adult/adulthood.

APPENDIX C

IRB APPROVAL

FLORIDA STATE UNIVERSITY
OFFICE *of the* VICE PRESIDENT *for* RESEARCH



APPROVAL

July 30, 2021

Heidi Gazelle
850-644-5260
hgazelle@fsu.edu

Dear Heidi Gazelle:

On 7/30/2021, the IRB reviewed the following submission:

Type of Review:	Expedited (8)(a) Long-term follow-up
Title:	Anxious Solitary Youth Come of Age: Interpersonal Processes Link Youth Trajectories to Adjustment in Emerging Adulthood and Beyond
Investigator:	Heidi Gazelle
Submission ID:	MOD00001435
Study ID:	STUDY00000293
Funding:	Name: National Institute of Child He, Grant Office ID: FP00001331, Funding Source ID: 1 R03 HD104881-01A1
IND, IDE, or HDE:	None

Documents Reviewed:	<ul style="list-style-type: none"> • HRP-212 - FORM - Continuing Review 20191209-1.docx, Category: Continuing Review Form; • Friend consent & survey, Category: Consent Form; • Parent consent & survey, Category: Consent Form; • Protocol, Category: IRB Protocol; • Romantic partner consent & survey, Category: Consent Form; • YA Friend Phone Script 2021 Spanish (with accent marks).pdf, Category: Recruitment Materials; • YA Friend Phone Script 2021.pdf, Category: Recruitment Materials; • YA Parent Phone Script 2021.pdf, Category: Recruitment Materials;
---------------------	---

	<ul style="list-style-type: none"> • YA Parent Phone Script, 2021 Spanish (with accent marks).pdf, Category: Recruitment Materials; • YA Romantic Partner Phone Script 2021 Spanish (with accent marks).pdf, Category: Recruitment Materials; • YA Romantic Partner Phone Script 2021.pdf, Category: Recruitment Materials; • YA Romantic Partner Phone Script 2021.pdf, Category: Recruitment Materials; • Young Adult Qualtrics Consent & Survey, Category: Consent Form;
--	--

The IRB approved the protocol, effective from 7/30/2021 to 7/29/2022 inclusive. Before 7/29/2022 or within 30 days of study close, whichever is earlier, you are to submit a completed continuing review and required attachments to request continuing approval or closure.

If continuing review approval is not granted before the expiration date of 7/29/2022, approval of this protocol expires on that date.

Your study conforms to FSU policy on COVID-19-related requirements and restrictions related to research activities that involve in-person interventions or interactions with human research participants.

Note that once the COVID-19-related requirements and restrictions are lifted and due to which you plan to replace remote interactions or interventions involving study participants (subjects) with in-person alternatives, be sure to submit a modification to the IRB for review of these substitutions; if however you only plan to discontinue other COVID-19-specific risk mitigation (e.g., screening; use of masks and personal protective equipment; social distancing) then no study modification request need be submitted to the IRB for review before your discontinuing these mitigations. For all other study modifications, see notes below.

You are advised that any modification(s) to the protocol for this project must be reviewed and approved by the IRB prior to implementation of the proposed modification(s).

Federal regulations require that the Principal Investigator promptly report any new information related to this protocol (see Investigator Manual (HRP-103)).

You are required to submit a Continuing Review at least 60 days before the protocol expiration date of 7/29/2022 to request continuing approval or closure. If the continuing review approval is not granted before the expiration date, approval of this protocol expires on that date.

In conducting this protocol, you are required to follow the requirements listed in the Investigator Manual (HRP-103), which can be found by navigating to the IRB Library within the IRB system.

Sincerely,

Human Subjects Research Office
humansubjects@fsu.edu

STUDY00000293 Local Study Team Members

Local Study Team Members

1. Identify each additional person involved in the design, conduct, or reporting of the research:

Name	Roles	Involved in Consent	E-mail	Phone
Rachel Chandler	Research Assistant	yes	[REDACTED]	
Ming Cui	Associate Investigator	no	[REDACTED]	
Shanti Epps	Research Assistant	yes	[REDACTED]	
Alexis Hughes	Research Assistant	yes	[REDACTED]	
Hayden Lapinskie	Research Assistant	yes	[REDACTED]	
Christine Ohannessian	Associate Investigator	no	[REDACTED]	
Sally Saigueiro	Research Assistant	yes	[REDACTED]	
Jessie Shafer	Associate Investigator Research Assistant	yes	jshafer2@fsu.edu	217-413-6151
Kristen Turner	Research Assistant	yes	[REDACTED]	
Jacob Williams	Associate Investigator Research Assistant	yes	[REDACTED]	

2. External team member information:

Name	Description
------	-------------

[Back To Top](#)

Note. Screenshot indicates doctoral student Jessie Shafer is an associate investigator of the study approved by the IRB.

APPENDIX D

STUDY CONSENT FORM

Youth Wellness Project: Young Adult Follow-up

CONSENT TO PARTICIPATE IN RESEARCH

Study Title: **Youth Wellness Project: Young Adult Follow-up**

Principal Investigator: Dr. Heidi Gazelle, Associate Professor,
Family and Child Sciences, Florida State University (FSU,
formerly of the University of North Carolina at Greensboro)

Dear $\{m://FirstName\}$,

Do you remember participating in the **Youth Wellness Project** when you were in the third through seventh grades in Kernersville, North Carolina? (Even if you moved away from Kernersville, we would have continued to keep in touch with you through 7th grade).

The same researchers who conducted the **Youth Wellness Project** (Drs. Heidi Gazelle, Ken Rubin, and Madelynn Druhen Shell) are conducting this follow-up to that study.

Why is this study being done?

We are conducting this research to understand how who you and your classmates in elementary school were as children relates to who you are today as young adults.

Why are you being asked to take part in this study?

All children who participated in the original **Youth Wellness Project** are being asked to participate in this follow-up to that study.

How many people are expected to take part in this study?

We expect 230 young adults to participate in this follow-up research.

Study procedures

We would like to know how you are doing now that you are a young adult, including whether you're attending college or working, how satisfied you are with your personal relationships and your life in general, and how you think and feel about your life. In order to ask you these questions, you will click on a web link that will allow you to answer questions about these topics online.

How long will I be in this study?

It should take about 30-40 minutes to fill out these questionnaires. We may also contact you again in the future to find out how who you were as a child relates to who you become later in adulthood.

Risks of study participation

You might consider some questions we ask to be personal, but you are free to skip any question that you feel is too personal, to stop participating at any time, or to choose not to participate. Because this is a research study, there may be additional risks that we cannot identify at this time.

Benefits of study participation

The information we gather will help us to understand how to help children grow up to be healthy and happy adults.

Alternatives to study participation

You may choose not to participate in this study.

Ending participation in the study

Please call (850) 644-5722 or email chs-youthwellness@fsu.edu if you want to withdraw from the study.

Study compensation

Amazon will send you a **\$30 e-gift card** to thank you for your time and help.

Who can profit from study results?

No financial conflicts or gains have been identified for this research. FSU reviews its researchers for conflicts of interest.

How will my samples and data be used?

We will use your survey responses for research and training. If you withdraw from the study before completion, the data collected up to that point will still be used.

Confidentiality

We will keep your information confidential to the extent allowed by law. We protect confidentiality by using an id number to identify you in our data set, and this id will only be linked to your contact information in a separate file. Only members of the research team who need to contact you about participation will have access to your contact details. Data are published in aggregate (as a group) so no individual is identifiable.

What will happen to the information collected about me after data collection is over?

We will keep your data while we continue to use it for research and training. We may share your research data with our collaborators without asking for your consent again, but it will not contain information that could directly identify you. Data will be destroyed when no longer needed.

Voluntary nature of the study

Your choice about participation is entirely voluntary and will not result in any penalty.

Contacts and questions for the research team about the research

If you have questions about this study, please call (850) 644-5722 or email chs-youthwellness@fsu.edu.

Contact information for questions about your rights as a research participant

If you have any questions or concerns about your rights as a research participant, or regarding the study and would like to talk to someone other than the researcher(s), please contact the FSU IRB by calling 850-644-7900, emailing humansubjects@fsu.edu, or by writing or in person at 2010 Levy Street, Research Building B, Suite 276, FSU Human Subjects Committee, Tallahassee, FL 32306-2742.

If you would like to download a copy of the informed consent, click here: [Download Consent Form](#).

Statement of Consent

I have read the above information. I asked any questions I had and received answers.

- Yes**, I agree to complete the questionnaires.
 - No**, I do not agree to complete the questionnaires.
-

APPENDIX E

YOUNG ADULT QUESTIONNAIRE

My Internet and Video Game Use

In the following questionnaire, you will read statements about your Internet use and/or time spent playing video games. Please indicate on a scale from "Never" to "Always" how often these statements characterize your internet use or video game play.

On a typical day, how many hours do you spend:

1.1 Using the Internet for entertainment purposes (excluding internet based/online games and social media)?

1.2 On social media (including sites such as Instagram, Snapchat, and Facebook)?

1.3 Playing video games (including internet based or online games such as Fortnite and League of Legends)?

1. How often do you spend time online and/or playing video games when you'd rather sleep?

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

2. How often does it happen to you that you wish to decrease the amount of time spent online and/or playing video games but you do not succeed?

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

3. How often do you feel tense, irritated, or stressed if you cannot use the Internet and/or play video games for as long as you want to?

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

4. How often do you try to conceal the amount of time you spend online and/or playing video games?

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

5. How often does it happen that you feel depressed, moody, or nervous when you are not on the Internet and/or playing video games and these feelings stop once you are back online?

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

6. How often do people in your life complain about spending too much time online and/or playing video games?

1. Never
2. Sometimes
3. About half the time
4. Most of the time
5. Always

REFERENCES

- Anderson, J., & Rainie, L. (2018, April 17). *The future of well-being in a tech-saturated world*. Pew Research Center: Internet, Science & Tech. Retrieved December 23, 2021, from <https://www.pewresearch.org/internet/2018/04/17/the-future-of-well-being-in-a-tech-saturated-world/>
- Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E., & Pallesen, S. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of Addictive Behaviors, 30*(2), 252.
- Antheunis, M. L., Valkenburg, P. M., & Peter, J. (2007). Computer-mediated communication and interpersonal attraction: An experimental test of two explanatory hypotheses. *CyberPsychology & Behavior, 10*(6), 831-836.
- Arnett, J. J. (2014). *Emerging adulthood: The winding road from the late teens through the twenties*. Oxford University Press.
- Bagir, A., Emre, O., Birgul, C. H., & Ulutas, A. (2020). The relationship between social exclusion (ostracism) and Internet addiction of adolescent girls. *Research in Pedagogy, 10*(1), 50-65.
- Bjornsen, C. A. (2018). Social media use and emerging adulthood. In M. Zupančič and Puklek Levpušček, M. (Eds.), *Prehod v odraslost: sodobni trendi in raziskave [Emerging adulthood: Current trends and research]* (pp. 223-261). Ljubljana: Znanstvena založba Filozofske fakultete.
- Brown, A. (2017, August 7). *Who plays video games? Younger men, but many others too*. Pew Research Center. Retrieved October 23, 2021, from <https://www.pewresearch.org/fact-tank/2017/09/11/younger-men-play-video-games-but-so-do-a-diverse-group-of-other-americans/>.
- Burgess, S. R., Stermer, S. P., & Burgess, M. C. (2012). Video game playing and academic performance in college students. *College Student Journal, 46*(2), 376-388.
- Casale, S., & Fioravanti, G. (2015). Satisfying needs through Social Networking Sites: A pathway towards problematic Internet use for socially anxious people? *Addictive Behaviors Reports, 1*, 34-39.
- Caspi, A., Elder, G. H., & Bem, D. J. (1988). Moving away from the world: Life-course patterns of shy children. *Developmental Psychology, 24*(6), 824-831. <https://doi.org/http://dx.doi.org/10.1037/0012-1649.24.6.824>

- Chak, K., & Leung, L. (2004). Shyness and locus of control as predictors of internet addiction and internet use. *CyberPsychology & Behavior*, 7(5), 559-570.
- Clement, J. (2021a, September 30). *U.S. daily time spent playing games/computer use by age 2019*. Statista. Retrieved October 23, 2021, from <https://www.statista.com/statistics/502149/average-daily-time-playing-games-and-using-computer-us-by-age/>.
- Clement, J. (2021b, September 30). *U.S. daily time spent playing games/computer use by gender 2019*. Statista. Retrieved October 23, 2021, from <https://www.statista.com/statistics/502144/average-daily-time-playing-games-and-using-computer-us-by-gender/>.
- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.
- Cole, H., & Griffiths, M. D. (2007). Social interactions in massively multiplayer online role-playing gamers. *Cyberpsychology & Behavior*, 10(4), 575-583.
- Coplan, R. J., Gavinski-Molina, M. H., Lagace-Seguin, D. G., & Wichmann, C. (2001). When girls versus boys play alone: Nonsocial play and adjustment in kindergarten. *Developmental Psychology*, 37(4), 464.
- Coplan, R. J., Rose-Krasnor, L., Weeks, M., Kingsbury, A., Kingsbury, M., & Bullock, A. (2013). Alone is a crowd: Social motivations, social withdrawal, and socioemotional functioning in later childhood. *Developmental Psychology*, 49(5), 861.
- De Leo, J. A., & Wulfert, E. (2013). Problematic Internet use and other risky behaviors in college students: An application of problem-behavior theory. *Psychology of Addictive Behaviors*, 27(1), 133.
- Demetrovics, Z., Király, O., Koronczai, B., Griffiths, M. D., Nagygyörgy, K., Elekes, Z., ... & Urbán, R. (2016). Psychometric properties of the Problematic Internet Use Questionnaire Short-Form (PIUQ-SF-6) in a nationally representative sample of adolescents. *PLoS One*, 11(8), e0159409.
- DeWall, C. N., & Richman, S. B. (2011). Social exclusion and the desire to reconnect. *Social and Personality Psychology Compass*, 5(11), 919-932.
- Engelbrecht, J., Llinares, S., & Borba, M. C. (2020). Transformation of the mathematics classroom with the internet. *Zdm*, 1-17.
- Ergun, G., & Alkan, A. (2020). The Social Media Disorder and Ostracism in Adolescents: (OSTRACA-SM Study). *The Eurasian Journal of Medicine*, 52(2), 139.
- Felmlee, D., Sweet, E., & Sinclair, H. C. (2012). Gender rules: Same-and cross-gender friendships norms. *Sex Roles*, 66(7), 518-529.

- Gazelle, H. (2008). Behavioral profiles of anxious solitary children and heterogeneity in peer relations. *Developmental psychology*, 44(6), 1604.
- Gazelle, H. (2013). Is Social Anxiety in the Child or in the Anxiety-Provoking Nature of the Child's Interpersonal Environment?. *Child Development Perspectives*, 7(4), 221-226.
- Gazelle, H., & Cui, M. (2020). Relations Among Anxious Solitude, Peer Exclusion, and Maternal Overcontrol from 3rd Through 7th Grade: Peer Effects on Youth, Youth Evocative Effects on Mothering, and the Indirect Effect of Peers on Mothering via Youth. *Journal of Abnormal Child Psychology*, 1-14.
- Gazelle, H., Cui, M., & Ohannessian, C. M. (2022). Anxious Solitary Youth Come of Age: Interpersonal Processes Link Youth Trajectories to Adjustment in Young Adulthood. In FSU: NICHD Grant 1 R03 HD104881-01A1
- Gazelle, H., & Faldowski, R. A. (2019). Multiple trajectories in anxious solitary youths: The middle school transition as a turning point in development. *Journal of Abnormal Child Psychology*, 47(7), 1135-1152.
- Gazelle, H., & Ladd, G. W. (2003). Anxious solitude and peer exclusion: A diathesis–stress model of internalizing trajectories in childhood. *Child Development*, 74(1), 257-278.
- Gazelle, H., & Rubin, K. H. (2019). Social withdrawal and anxiety in childhood and adolescence: Interaction between individual tendencies and interpersonal learning mechanisms in development. *Journal of Abnormal Child Psychology*, 47(7), 1101-1106.
- Gazelle, H., & Shell, M. D. (2017). Behavioral profiles of anxious solitary children: predicting peer relations trajectories from third through fifth grades. *Merrill-Palmer Quarterly*, 63(2), 237-281.
- Gentile, D. A., Choo, H., Liau, A., Sim, T., Li, D., Fung, D., & Khoo, A. (2011). Pathological video game use among youths: a two-year longitudinal study. *Pediatrics*, 127(2), e319-e329.
- Göktaş, S., Aygar, H., Zencirci, S. A., Önsüz, M. F., Alaiye, M., & Metintaş, S. (2018). Problematic internet use questionnaire-short form-6 (PIUQ-SF 6): a validity and reliability study in Turkey. *International Journal of Research in Medical Sciences*, 6(7), 2354.
- Greenfield, D. N. (1999). Psychological characteristics of compulsive Internet use: A preliminary analysis. *Cyberpsychology & Behavior*, 2(5), 403-412.
- Grütter, J., & Buchmann, M. (2021). Developmental antecedents of young adults' solidarity during the Covid-19 pandemic: The role of sympathy, social trust, and peer exclusion from early to late adolescence. *Child Development*, 92(5), 832-850.

- Hanson, M. (2021, December 3). *College graduation statistics [2021]: Total graduates per year*. Education Data Initiative. Retrieved December 19, 2021, from <https://educationdata.org/number-of-college-graduates>
- Hayes, A. F., & Rockwood, N. J. (2017). Regression-based statistical mediation and moderation analysis in clinical research: Observations, recommendations, and implementation. *Behaviour Research and Therapy, 98*, 39-57.
- Hong, W., Liu, R. D., Oei, T. P., Zhen, R., Jiang, S., & Sheng, X. (2019). The mediating and moderating roles of social anxiety and relatedness need satisfaction on the relationship between shyness and problematic mobile phone use among adolescents. *Computers in Human Behavior, 93*, 301-308.
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal, 6*(1), 1-55
- Huan, V. S., Ang, R. P., Chong, W. H., & Chye, S. (2014). The impact of shyness on problematic internet use: the role of loneliness. *The Journal of Psychology, 148*(6), 699-715.
- Igartua, J. J., & Hayes, A. F. (2021). Mediation, moderation, and conditional process analysis: Concepts, computations, and some common confusions. *The Spanish Journal of Psychology, 24*.
- Jung, T., & Wickrama, K. A. (2008). An introduction to latent class growth analysis and growth mixture modeling. *Social and Personality Psychology Compass, 2*(1), 302-317.
- Kardefelt-Winther, D. (2014). A conceptual and methodological critique of internet addiction research: Towards a model of compensatory internet use. *Computers in Human Behavior, 31*, 351-354.
- Király, O., Urbán, R., Griffiths, M. D., Ágoston, C., Nagygyörgy, K., Kökönyei, G., & Demetrovics, Z. (2015). The mediating effect of gaming motivation between psychiatric symptoms and problematic online gaming: An online survey. *Journal of Medical Internet Research, 17*(4), 88.
- Ko, C. H., Yen, J. Y., Chen, C. S., Yeh, Y. C., & Yen, C. F. (2009). Predictive values of psychiatric symptoms for internet addiction in adolescents: a 2-year prospective study. *Archives of Pediatrics & Adolescent Medicine, 163*(10), 937-943.
- Kowert, R., Vogelgesang, J., Festl, R., & Quandt, T. (2015). Psychosocial causes and consequences of online video game play. *Computers in Human Behavior, 45*, 51-58.

- Lay, J. C., Pauly, T., Graf, P., Biesanz, J. C., & Hoppmann, C. A. (2019). By myself and liking it? Predictors of distinct types of solitude experiences in daily life. *Journal of Personality, 87*(3), 633-647.
- Lee, B. W., & Leeson, P. R. (2015). Online gaming in the context of social anxiety. *Psychology of Addictive Behaviors, 29*(2), 473.
- Lee, B. W., & Stapinski, L. A. (2012). Seeking safety on the internet: Relationship between social anxiety and problematic internet use. *Journal of Anxiety Disorders, 26*(1), 197-205.
- Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010, February 3). *Social media & mobile internet use among teens and young adults*. Pew Research Center: Internet, Science & Tech. Retrieved December 23, 2021, from <https://www.pewresearch.org/internet/2010/02/03/social-media-and-young-adults/>
- Lim, M. (2019). Social exclusion, surveillance use, and facebook addiction: The moderating role of narcissistic grandiosity. *International Journal of Environmental Research and Public Health, 16*(20), 3813.
- MacKenzie, D. I., Nichols, J. D., Royle, J. A., Pollock, K. H., Bailey, L. L., & Hines, J. E. (2018). Chapter 3 – fundamental principals of statistical inference. In D. I. MacKenzie, J. D. Nichols, J. A. Royle, K. H. Pollock, L. L. Bailey & J. E. Hines (Eds.), *Occupancy estimation and modeling (second edition)* (pp. 71-111). Boston: Academic Press. Doi: <https://doi.org/10.1016/B978-0-12-407197-1.00004-1> Retrieved from <https://www.sciencedirect.com/science/article/pii/B9780124071971000041>
- MacKinnon, D. P., Krull, J. L., & Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science, 1*(4), 173-181.
- Michikyan, M., & Suarez-Orozco, C. (2016). Adolescent media and social media use: Implications for Development. *Journal of Adolescent Research, 31*(4), 411-414.
- Monacis, L., De Palo, V., Griffiths, M. D., & Sinatra, M. (2017). Social networking addiction, attachment style, and validation of the Italian version of the Bergen Social Media Addiction Scale. *Journal of Behavioral Addictions, 6*(2), 178-186.
- Muthén, L. K., & Muthén, B. (1998-2018). Mplus. *The comprehensive modelling program for applied researchers: user's guide, 5*.
- Nelson, L. J., Coyne, S. M., Howard, E., & Clifford, B. N. (2016). Withdrawing to a virtual world: Associations between subtypes of withdrawal, media use, and maladjustment in emerging adults. *Developmental Psychology, 52*(6), 933.

- Odacı, H., & Çelik, Ç. B. (2013). Who are problematic internet users? An investigation of the correlations between problematic internet use and shyness, loneliness, narcissism, aggression and self-perception. *Computers in Human Behavior*, 29(6), 2382-2387.
- Oh, W., Rubin, K. H., Bowker, J. C., Booth-LaForce, C., Rose-Krasnor, L., & Laursen, B. (2008). Trajectories of social withdrawal from middle childhood to early adolescence. *Journal of Abnormal Child Psychology*, 36(4), 553-566.
- Pallavicini, F., Ferrari, A., & Mantovani, F. (2018). Video games for well-being: A systematic review on the application of computer games for cognitive and emotional training in the adult population. *Frontiers in Psychology*, 9, 2127.
- Perrin, A., & Atske, S. (2021a, March 26). *About three-in-ten U.S. adults say they are 'almost constantly' online*. Pew Research Center: Internet, Science & Tech. Retrieved December 23, 2021, from <https://www.pewresearch.org/fact-tank/2021/03/26/about-three-in-ten-u-s-adults-say-they-are-almost-constantly-online/>
- Perrin, A., & Atske, S. (2021b, April 2). *7% of Americans don't use the internet. Who are they?* Pew Research Center: Internet, Science & Tech. Retrieved December 23, 2021, from <https://www.pewresearch.org/fact-tank/2021/04/02/7-of-americans-dont-use-the-internet-who-are-they/>
- Prizant-Passal, S., Shechner, T., & Aderka, I. M. (2016). Social anxiety and internet use—A meta-analysis: What do we know? What are we missing?. *Computers in Human Behavior*, 62, 221-229.
- Rideout, V., Roberts, D., & Foehr, U. (2005). *Generation M: Media in the Lives of 8-18 Year olds*. Menlo Park, CA: Kaiser Family Foundation.
- Rucker, D. D., Preacher, K. J., Tormala, Z. L., & Petty, R. E. (2011). Mediation analysis in social psychology: Current practices and new recommendations. *Social and Personality Psychology Compass*, 5(6), 359-371.
- Rubin, K. H., Bowker, J. C., & Gazelle, H. (2010). Social withdrawal in childhood and adolescence. *The development of shyness and social withdrawal*, 131-156.
- Rubin, K. H., Bukowski, W., & Parker J. G. (2006). Peers, relationships, and interactions. In Damon W & Lerner R (Eds.). *Handbook of Child Psychology* (pp. 141–180). New York: Wiley.
- Schmidt, L. A., Tang, A., Day, K. L., Lahat, A., Boyle, M. H., Saigal, S., & Van Lieshout, R. J. (2017). Personality development within a generational context: Life course outcomes of shy children. *Child Psychiatry and Human Development*, 48(4), 632-641. doi:<http://dx.doi.org/10.1007/s10578-016-0691-y>

- Serbin, L. A., Cooperman, J. M., Peters, P. L., Lehoux, P. M., Stack, D. M., & Schwartzman, A. E. (1998). Intergenerational transfer of psychosocial risk in women with childhood histories of aggression, withdrawal, or aggression and withdrawal. *Developmental Psychology, 34*(6), 1246-1262. <https://doi.org/http://dx.doi.org/10.1037/0012-1649.34.6.1246>
- Shell, M. D., Gazelle, H., & Faldowski, R. A. (2014). Anxious solitude and the middle school transition: A diathesis× stress model of peer exclusion and victimization trajectories. *Developmental Psychology, 50*(5), 1569.
- Simsek, A., Elciyar, K., & Kizilhan, T. (2019). A Comparative Study on Social Media Addiction of High School and University Students. *Contemporary Educational Technology, 10*(2), 106-119.
- Smith, A., Rainie, L., & Zickuhr, K. (2011). College students and technology. *Pew Research Center*. Retrieved from <https://www.pewresearch.org/internet/2011/07/19/college-students-and-technology/>
- Spangler, T., & Gazelle, H. (2009). Anxious solitude, unsociability, and peer exclusion in middle childhood: A multitrait–multimethod matrix. *Social Development, 18*(4), 833-856.
- Sussman, S. (2013). A lifespan developmental-stage approach to tobacco and other drug abuse prevention. *International Scholarly Research Notices, 2013*.
- Sussman, S., & Arnett, J. J. (2014). Emerging adulthood: developmental period facilitative of the addictions. *Evaluation & the health professions, 37*(2), 147-155.
- Tang, A., Van Lieshout, R. J., Lahat, A., Duku, E., Boyle, M. H., Saigal, S., & Schmidt, L. A. (2017). Shyness trajectories across the first four decades predict mental health outcomes. *Journal of Abnormal Child Psychology, 45*(8), 1621-1633. <https://doi.org/http://dx.doi.org/10.1007/s10802-017-0265-x>
- Teachman, B. A., & Allen, J. P. (2007). Development of social anxiety: Social interaction predictors of implicit and explicit fear of negative evaluation. *Journal of Abnormal Child Psychology, 35*(1), 63.
- Terry, R., & Coie, J. D. (1991). A comparison of methods for defining sociometric status among children. *Developmental Psychology, 27*(5), 867.
- Tian, Y., Bian, Y., Han, P., Gao, F., & Wang, P. (2017). Associations between psychosocial factors and generalized pathological internet use in Chinese university students: A longitudinal cross-lagged analysis. *Computers in Human Behavior, 72*, 178-188.

- Tian, Y., Si, Y., Meng, W., Bian, Y., Han, P., Hu, J., ... & Gao, F. (2019). Mediating factors of the association between shyness and generalized pathological internet use in Chinese university students. *International Journal of Mental Health and Addiction*, 17(3), 555-572.
- Tian, Y., Chen, P., Meng, W., Zhan, X., Wang, J., Wang, P., & Gao, F. (2019b). Associations among shyness, interpersonal relationships, and loneliness in college freshmen: A longitudinal cross-lagged analysis. *Scandinavian Journal of Psychology*, 60(6), 637-645.
- Vansteenkiste, M., & Ryan, R. M. (2013). On psychological growth and vulnerability: basic psychological need satisfaction and need frustration as a unifying principle. *Journal of Psychotherapy Integration*, 23(3), 263.
- Vayre, E., & Vonthron, A. M. (2019). Identifying work-related Internet's uses-at work and outside usual workplaces and hours-and their relationships with work-home interface, work engagement and problematic Internet behavior. *Frontiers in Psychology*, 10, 2118.
- Villani, D., Carissoli, C., Triberti, S., Marchetti, A., Gilli, G., & Riva, G. (2018). Videogames for emotion regulation: a systematic review. *Games for health journal*, 7(2), 85-99.
- Wang, P., Yan, Y., Gao, F., Zhang, R., Wang, J., Zhan, X., & Tian, Y. (2020). The Effect of Shyness on Adolescent Network Problem Behavior: The Role of Gender and Loneliness. *Frontiers in Psychology*, 11, 803.
- Ward, M. R. (2018). Cutting class to play video games. *Information Economics and Policy*, 42, 11-19.
- Watson, A. (2020, February). Daily time spent with selected media and the United States in 1st quarter 2019, by age group (in minutes) [Chart]. In *Statista*. Retrieved from <https://www.statista.com/statistics/233386/average-daily-media-use-of-us-adult-population-by-medium/>
- Weiser, E. B. (2000). Gender differences in Internet use patterns and Internet application preferences: A two-sample comparison. *Cyberpsychology and behavior*, 3(2), 167-178.
- Witteck, C. T., Finserås, T. R., Pallesen, S., Mentzoni, R. A., Hanss, D., Griffiths, M. D., & Molde, H. (2016). Prevalence and predictors of video game addiction: A study based on a national representative sample of gamers. *International Journal of Mental Health and Addiction*, 14(5), 672-686.
- Yau, J. C., & Reich, S. M. (2020). Buddies, friends, and followers: The evolution of online friendships. In *Online Peer Engagement in Adolescence* (pp. 18-34). Routledge.
- Young, K. S. (1998). Internet addiction: The emergence of a new clinical disorder. *Cyberpsychology & Behavior*, 1(3), 237-244.

- Yücens, B., & Üzer, A. (2018). The relationship between internet addiction, social anxiety, impulsivity, self-esteem, and depression in a sample of Turkish undergraduate medical students. *Psychiatry Research*, *267*, 313-318.
- Zach, S., & Lissitsa, S. (2016). Internet use and leisure time physical activity of adults—A nationwide survey. *Computers in Human Behavior*, *60*, 483-491.
- Zhang, H., Li, D., & Li, X. (2015). Temperament and problematic Internet use in adolescents: A moderated mediation model of maladaptive cognition and parenting styles. *Journal of child and Family Studies*, *24*(7), 1886-1897.
- Zhao, J., Kong, F., & Wang, Y. (2012). Self-esteem and humor style as mediators of the effects of shyness on loneliness among Chinese college students. *Personality and Individual Differences*, *52*(6), 686-690.

BIOGRAPHICAL SKETCH

Jessie Shafer M.S. is a doctoral candidate in the Human Development and Family Science department at Florida State University. Her research is focused on new media (e.g., Internet, social media, video games) and technology (e.g., smartphones, computers, tablets) as contexts of human development. Specifically, she is interested in understanding how these media and devices impact interpersonal relationships, identity development, and maladaptive behaviors. She received her Master of Science degree in Developmental Psychology at Illinois State University.