MISSION: OPTIMIZE VIDEO GAMES FOR TEEN DEVELOPMENT

UNLOCKING GREATER POTENTIAL FOR THRIVING

Susan E. Rivers, PhD
Executive Director & Chief Scientist

Michelle Bertoli
Director of Content &
Lead Science Writer

Isaac Handley-Miner
Senior Research Associate

Independent Consultants

Lori Nathanson, PhD

Robert Sherman, PhD

March 11, 2017

TABLE OF CONTENTS

ABOUT ITHRIVE

iThrive's mission is to empower teens to thrive using great games. We define teen thriving as accumulating intrapersonal and interpersonal assets while moving forward through the successes, setbacks, and struggles of adolescence on the path to adulthood. Thriving teens become adults poised to shape society in positive ways, paying incalculable dividends on our early investments. We are committed to a strengths-based approach to teen development, focusing on identifying and leveraging teens' strengths in the service of positive youth development and thriving, as opposed to detecting and pointing out their problems, ills, or that which needs fixing (although these are necessary to consider and attend to in the process).

Teens develop as a function of their experiences in both the physical and virtual world. There has been a seismic shift in how teens inhabit settings, with more time spent in virtual settings than ever before. The impacts of that shift on teen behavior and development have yet to be measured or understood. It is clear that teens are interacting and relating in different ways because of their richly digital lives. Those experiences have the potential to add to or detract from teen development in meaningful ways. iThrive's approach is to harness the opportunities presented by virtual settings, and to integrate best knowledge of adolescent development so that we capitalize on the intentional design of meaningful experiences to optimize development and thriving.

iThrive seeks to understand the impacts of gameplay—and video gameplay in particular—on teen development. To do this, we engage with scientists in developmental psychology, neuroscience, learning science, and social psychology (amongst other fields) and consult with game developers to understand the complexities of creating meaningful player experiences and facilitate the creation of transformative games.

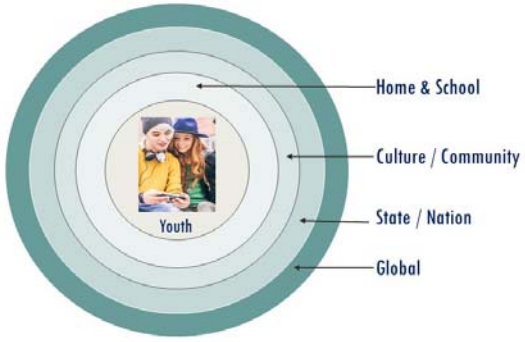
The purpose of this paper is to bring to light existing influential developmental frameworks and leading evidence on teen growth to guide our exploration of how video games and teen development interact. We argue that video games have the potential to offer meaningful developmental experiences for teens across their development.

INTRODUCTION

As teens transition from childhood to adulthood, they encounter dramatic transformation in their bodies, brains, and relationships. The physical, cognitive, and social changes of adolescence are interdependent and non-linear. Progress is purposeful and forward moving, but does not preclude

stumbles and setbacks.[1] For teens, thriving means actively working through developmental tasks vis-a-vis experiences, accumulating skills, and progressing towards achieving their full potential in later developmental stages (e.g., early adulthood, midlife, and so on). In other words, development and thriving are a journey, not a destination.

As a society, our increased understanding of adolescent development, coupled with the ubiquity of technology in everyday life, provides us new opportunities to meet teens where they are to support their growth and progress. Children and subsequently adolescents are situated in systems, which include settings like home (the primary setting for young children), school, and community. These settings are located within a neighborhood or larger community, within a state and a nation, and then at its furthest reaches, the global setting. Developmentalist Uri Bronfenbrenner posited that these settings—and in particular the interactions the developing child has within them—form the ecosystem of development, wherein the settings and interactions work to impact the developing child.[2] This ecosystem has been rendered as concentric circles. Research on adolescent development in these physical settings abounds, and has been the focus of numerous national reports and frameworks for how to promote optimal development.[3] Physical settings are punctuated increasingly by virtual ones, with teens engaging in social media, video games, and online exploration while at home, at school, and in their communities. The opportunities to impact development, offered by virtual settings, have yet to be given extensive attention in this literature.

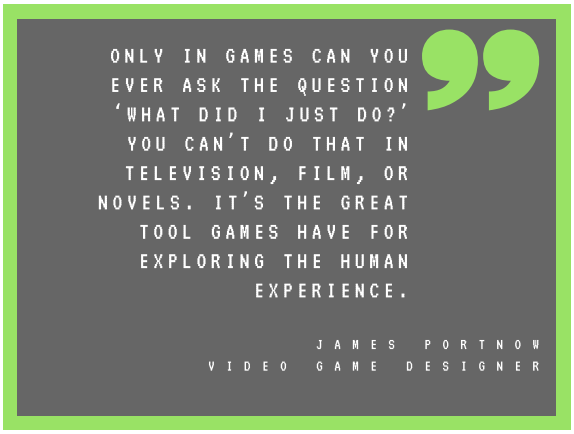


Bronfenbrenner (1979). *The ecology of human development.*

Like physical settings, iThrive posits that virtual settings, and video games specifically, hold promise to provide meaningful experiences and, for teens, a safe context for working through the tasks of development. Video games are worth exploring both for their ubiquity and for their unique characteristics in the world of media. Playing games is nearly a universal experience among teens: 97% of teens report playing video games, with, on average, teens devoting over an hour daily to gameplay.[4] Video games are accessible almost anywhere—on computers and game consoles, as well as on mobile devices like handhelds, smartphones, and tablets—making them an important setting within the developmental ecosystem. Video games vary a great deal but share some commonalities including agreed-upon rules, clear goals, timely feedback, and the centrality of the player's role in moving the action forward. Video games are unique compared to

> AT THEIR HEART, GAMES DIFFER FROM OTHER MEDIA IN ONE FUNDAMENTAL WAY: THEY OFFER PLAYERS THE CHANCE TO INFLUENCE OUTCOMES THROUGH THEIR OWN EFFORTS. WITH RARE EXCEPTION, THIS IS NOT TRUE OF FILM, NOVELS, OR TELEVISION.
>
> KATHERINE ISBISTER
> VIDEO GAME SCHOLAR

other types of media in that they are “interreactive”[5]—players react to the game, and in turn the game reacts to players’ actions and choices, providing feedback and consequences that may again shape players’ behavior. Movies, television, and books (by and large) do not require this same level of engagement to move the story forward. Video games provide a safe space for exploring, taking risks, building skills, experiencing failure, and receiving feedback.[6] They facilitate flow states, which are “the state[s] you enter when you are experiencing absolute concentration on a task. When you’re in absolute control, the challenges that come at you are met precisely by your skills.”[7] Video games also provide opportunities for embodied learning, learning that integrates movement with thinking, which many consider the most impactful kind of learning.[8]



The aim of this paper is to inform approaches to designing and using video games in ways that are meaningful for teens’ positive development. To do this, we examine the systems and processes of teen development and elaborate on the potential for video games to offer meaningful experiences for teens in light of the developmental tasks they are undertaking. Section 1 presents iThrive’s framework for optimizing games for teen thriving. This section introduces the context of adolescent development and presents the foundational research on which the framework is built. Section 2 focuses on the measurable effects of video games, exploring the evidence and promise of games for providing teens with rich and varied experiences that contribute to thriving. Finally, Section 3 identifies a pathway forward. We propose a preliminary set of design principles that, given the current evidence, have the potential to guide the creation of games to offer meaningful developmental experiences for teens. We also articulate gaps in the research that, when addressed, will provide additional foundation for creating meaningful games for teen development.

1. FRAMEWORK FOR OPTIMIZING GAMES FOR TEEN THRIVING

1A. CONTEXT FOR TEEN THRIVING

Exploring development during adolescence—a period marked by dramatic changes to individuals’ bodies, brains, relationships, and identity—means exploring possibility. Mid-20th century investigations of human development zeroed in on a perfect storm of productive challenges (or tasks) on the heels of childhood, the successful navigation of which prepares teens for adulthood.[9] A strong foundational understanding of adolescence was laid down in the 1940s-1960s and, in subsequent decades, an orientation to the challenges of adolescence shaped theory building, research, and practice. A focus of this era was articulating adolescent pitfalls (pregnancy, addiction, risky behavior, school failure, criminal behavior, and the like) that schools, youth programs, and child-rearing approaches should attempt to prevent. In the 1970s and 80s, society viewed young people primarily as problems to be fixed; public language in the United

States, promoted by the government, even referred to some young people as “super-predators.”[10] More current views, in contrast, regard teens as essential to society’s future, and need to be nurtured and developed. This *positive youth development approach,* which emerged formally in the early 1990s, focuses on promoting positive and prosocial outcomes of development, including skill acquisition, positive identity, academic attainment, strong social and emotional skills, and civic engagement, to name a few.[11]

This sea change of perspective—from problem focused to strengths focused—has held firm, giving rise to a steady stream of contemporary theories and research on adolescent thriving.[12] While newer theories vary in their specifics, they converge on structural components surrounding and affecting human development. More specifically, physiology (genes, temperament, innate abilities, and challenges) interacts with physical environment (home, neighborhood, food/water/air quality) and closest people (parents, caregivers, teachers, friends), nested within a community (school, afterschool, playground, neighborhood), which itself nests inside a wider culture (arts, politics, finance, culture, global influences).[13] At varying levels of intensity, each of these factors and their interaction influences the developing person.

Growth through adolescence varies dramatically across and within individuals. Physiology, temperament, environments, and experiences combine to forge individual paths and outcomes. This significant period of growth and plasticity (second only to early childhood) is marked by substantial changes in all domains of development. Adolescent plasticity heralds both great vulnerability and great potential for growth. A remarkably consistent picture of progression in core areas of adolescent growth, instantiated distinctly and uniquely by each individual on his/her personal path, is documented in the literature.[14] Early adolescent years (for many, ages 12-14) are marked by physical growth spurts and the emerging prominence of peers in social life. Being accepted, and not different, are core social goals of this age, also marked by leaps forward in abstract thinking capacities, intense emotions, and some risky behavior. Physical studies of the brain show evidence of dramatic development and plasticity occurring during the teenage years. For instance, middle adolescence (for many, ages 15-17) brings cognitive advances in abstract thinking, whereas the focus up to this point likely was on surface, tangible ideas and facts. With growing abstract thinking abilities, teens can ponder concepts beyond the physical, such as metaphor and symbolism. This transition accompanies access to a wider intellectual and moral world than was available previously. Establishing independence from parents becomes paramount, and a sense of right and wrong comes forward powerfully, although it often is not yet fully integrated into a coherent values system. Late adolescence (for many, ages 18 and 19, but often stretching beyond) brings greater coherence to the cognitive, interpersonal, social, and vocational aspects of the self. Desperate needs for peer approval diminish, family attachments endure (although in new forms), and personal identity further consolidates.[15] These changes inform and mesh into an integrated identity by the end of adolescence, albeit with individual differences between teens.

Adolescence is a time of great meaning making, including developing necessary self-awareness and self-management, sorting the self out from the constant barrage of possibilities and influences, building a sense of how the world works and one’s place within it, and clarifying life objectives for the short-, mid-, and long-term.[16] It is during adolescence that teens start to develop

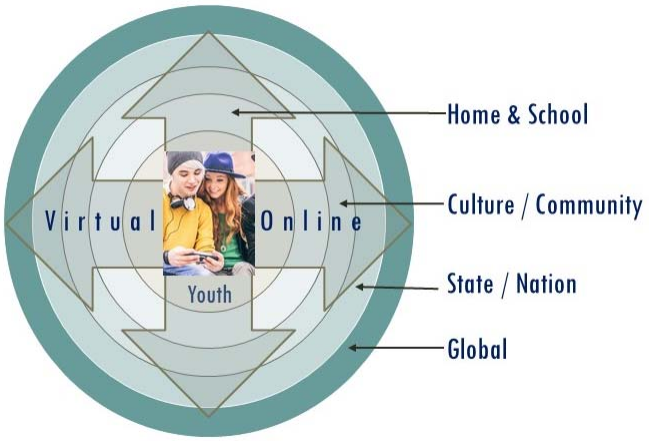
a sense of purpose, creating meaning for themselves in ways that align with or, at times, contradict what adults tell them. While teens are very much rooted in the moment, they begin to imagine multiple possible futures. They begin to make adult decisions about college, career, and significant relationships that have long-lasting implications. They learn to balance immediate and longer-term demands to thrive in the moment and in later years. For example, teens may select courses at their challenge level to stretch their skills or even earn college credits while in high school by excelling in AP courses. They may begin to weigh friends' choices against their own values and determine whether present popularity is worth sacrificing their own standards. They might begin to explore deeper romantic relationships and manage the tension between maintaining relationships they have built and their desire to explore their own path in the wider world.

The stakes are high during adolescence. It is no exaggeration to say that teens face life and death challenges. Recent statistics from national surveys show that as many as 1 in 12 teens has made a suicide attempt within the previous 12 months. Teens experience high rates of depression; 12.5% of teens have experienced a major depressive episode in the last year, compared to 6.7% of adults who have in the same time frame. In contrast to teens growing up four decades ago, teens today also report more physical symptoms of depression like difficulties sleeping, concentrating, and remembering. Moreover, more than a quarter of teens take prescription psychotherapeutic drugs to treat depression, ADHD, and other conditions.[17] Many teens first encounter tobacco, alcohol, and illicit drugs during adolescence. Approximately 1 in 10 teens reported using one or more of these substances within the previous 30 days. Adolescence, for many, also marks the beginning of sexual activity. As of 2015, more than half of high school seniors reported having had sexual intercourse, and sexually active high schoolers do not always use birth control. While high school graduation rates have reached an all-time high, nowadays a high school diploma alone is usually insufficient preparation for adapting to the demands of adulthood.[18]

The proliferation of screens requires teens to navigate new contexts and content, and consequently new risks. Teens spend an average of 9 hours daily consuming media of any kind, more than 6 hours of which is consumed via screens. These estimates do not include any media consumed while at school or doing homework. Teens may devote an average of more than 3 hours a day to digital activities—video games, social media, texting, and other activities on computers and mobile devices—that most members of previous generations did not even have regular access to. There is growing evidence of a positive relationship between amount of screen time and depression.[19] And beyond the amount of time teens spend in virtual settings, the behaviors they exhibit in virtual worlds may have far-reaching consequences. An act caught on video can go viral in seconds, impacting a teen's reputation far beyond the school community and the teen years. Stories of public shaming for online acts are becoming commonplace. Take Lindsay Stone, whose sophomoric prank posted to Facebook went viral, leading to death threats, unemployment, and depression.[20]

Teens are creating norms around what can and should be posted online to protect reputations and relationships, a form of peer policing which may prevent potentially disastrous missteps.[21] And the creation and enforcement of norms emerge in online games as well. Players in massively

multiplayer online games (MMOs) are vulnerable to abusive comments by anyone they encounter in these social games due to open and largely anonymous chat functionality. Game developers like Riot Games have worked to build tribunals of peer judges and algorithms that provide timely and specific feedback to those who engage in verbally abusive behavior, which have shown great success in reducing toxic chats.[22] In addition to game developer actions, players learn they can "mute" those who are verbally abusive, essentially tuning them out to stay engaged in gameplay. Players also have suggested such actions as forgoing some amount of anonymity in order to foster kinder behaviors, and creating points systems that reward kindness and cooperation and are tied to real, game-relevant achievements.[23]



At present, teens concurrently inhabit physical settings and virtual ones, like video games, social media, and the internet. It is in these settings that development unfolds. Developmental frameworks should fully account for the impact of young people's digital lives—played out via video games, social media, and the internet—as they are widespread and influential. We argue that virtual settings, including games, have become an important element within the ecosystem of development, and update Bronfenbrenner's classic image (above) to show how new virtual settings cut across these systems.

We propose the *Thriving Through Development* framework as a blueprint for examining how and under what circumstances video games can impact development in meaningful ways, providing the assets teens need to thrive through adolescence and into adulthood.

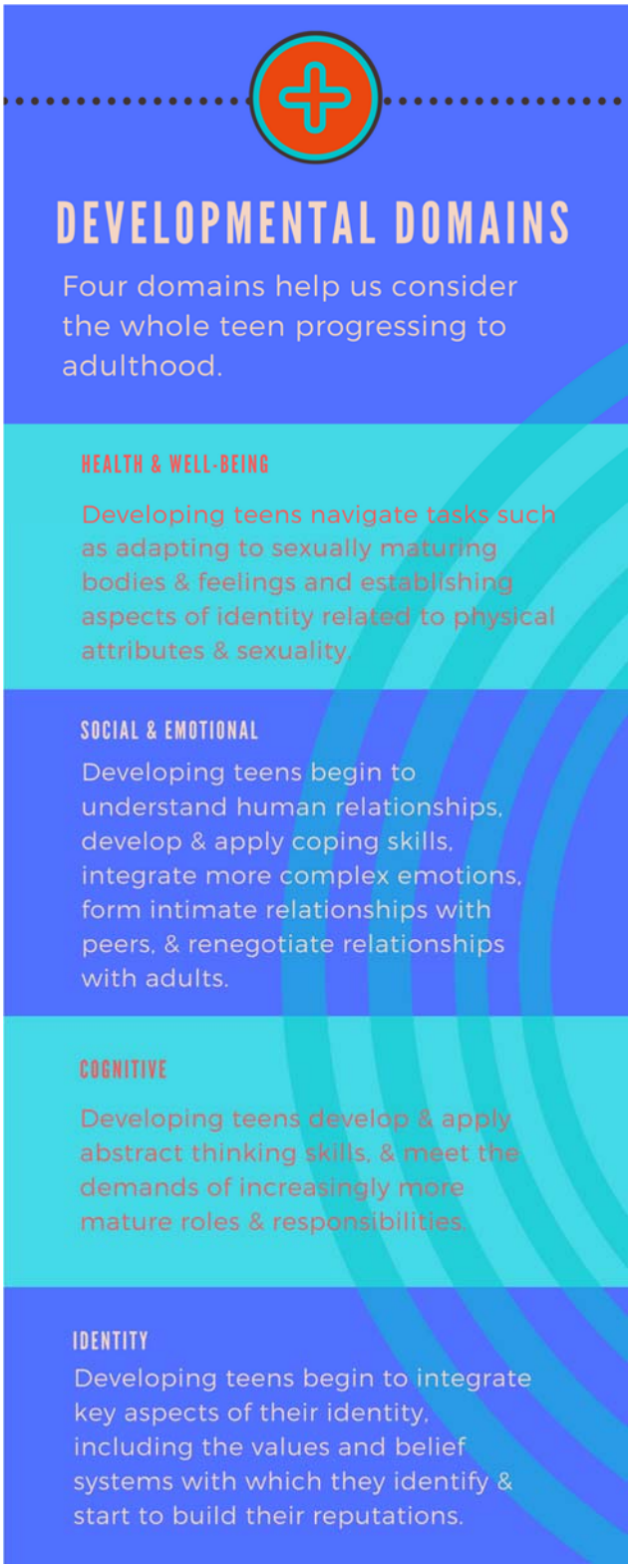
1B. THRIVING THROUGH DEVELOPMENT FRAMEWORK

iThrive's *Thriving Through Development* framework articulates a context for exploring how video games, as a virtual setting, influence teens' development. This framework adopts a holistic perspective of the developing teen, integrating four overlapping and interconnected ***domains*** of development: physical, social and emotional, cognitive, and identity. Development unfolds as teens take on a set of core ***developmental tasks*** that extend across and between these domains. Through their daily ***experiences***—especially meaningful ones which prompt reflection, new understandings, relationships, and increased competency—teens make progress towards these tasks, acquiring ***assets*** along the way that prepare them for the transition to adulthood.

Here we present the *Thriving Through Development* framework and provide a deeper description of its foundational theories and evidence. We unpack the framework's core components as a foundation for considering how video games impact development.

DEVELOPMENTAL DOMAINS

A holistic approach to teen development requires a focus on the intersecting and overlapping ***developmental domains*** in which teens are changing: physical, social and emotional, cognitive, and identity (Figure 1, Panel 1). ***Physically,*** developing teens are adapting to sexually maturing bodies and feelings; establishing aspects of identity related to their changing physical attributes, hormonal shifts, and sexuality; and learning to take care of their bodies with nutrition, sleep, and exercise. ***Socially and emotionally,*** developing teens begin to understand more complex human relationships, acquiring and applying more advanced coping skills, integrating more complicated emotions, forming intimate relationships with peers, and renegotiating relationships with adults (including separating from parents while also remaining anchored to them). ***Cognitively***, developing teens build and apply abstract thinking skills, and engage in more complex decision making and other executive functions required of their increasingly mature roles and responsibilities. Teens' brains are changing how they experience risk and structurally integrating not only cognitive, but social and emotional infrastructure. Specifically, changes in the limbic regions and prefrontal cortex are staggered; across cultures, teens experience heightened sensation-seeking that peaks in late adolescence and then declines, while prefrontal regions tasked with executive functions, including regulation of emotions and behavior, do not reach full maturity until the mid-twenties.[24] In forming their ***identity***, developing teens begin integrating key aspects of their identity (gender, civic, social, academic, extracurricular), including the values and belief systems with which they relate. Identity also becomes outwardly facing as teens begin to build their reputations.[25]



DEVELOPMENTAL TASKS

The ultimate task of development is to transition from childhood to adulthood, prepared to be independent from one's caregivers, able to take care of one's needs and be fulfilled, and able to contribute to society. Across the course of adolescence, teens work through a set of developmental tasks across all four developmental domains in support of the transition to adulthood. Findings in both neuroscience and the learning and motivation sciences bear out the existence of a core set of developmental tasks (Figure 1, Panel 2).[26]

Although there is diversity in developmental trajectories across individual adolescents, developmental theorists generally agree on the core life tasks to be accomplished during the teen years. These tasks exist in each of the four developmental domains—physical, social and emotional, cognitive, and identity—and when undertaken successfully, they build personal stability and consistency, and yield assets that prepare teens for the demands of adult life.

Core developmental tasks of adolescence include adapting to changes occurring in the body (physical maturation, neurochemical/hormonal shifts), the mind (changes in perception, language, learning, memory, problem-solving, mental processes/abstract thinking, self-regulation, executive function, mindsets) and the psychosocial self (self-knowledge and management, interpersonal and relationships skills, moving beyond parental primacy/closer to peers, responsible decision-making). These tasks co-occur as ongoing processes. For example, understanding and expressing more complex emotions (Task 6) and forming mutually close and supportive friendships (Task 7) have crossover. Teens explore friendships built on trust and understanding of their more complex emotional lives. These friendships take on a more important role in teens' lives as they renegotiate roles with their parents (Task 10) for greater independence.[27]

MEANINGFUL DEVELOPMENTAL EXPERIENCES

Teens work through their developmental tasks implicitly and over time via *meaningful developmental experiences* within and across the settings they inhabit—home, school, community, culture, state, nation, and global and virtual settings (Figure 1, Panel 3).

Teens have experiences every moment of every day. iThrive is keenly interested in *meaningful experiences*, which we consider to be those that contribute to young people's attainment of intrapersonal and interpersonal assets such as community connection and purpose that set them up for thriving across the four developmental domains.[28] Action and reflection are essential to making experiences developmentally meaningful, allowing teens to progress and to understand barriers and setbacks.[29] Meaningful experiences are those that make outsized and specific impacts for adolescents, allowing them to experiment and explore activities and identities safely and to stretch and be challenged, all within the context of consistent support and approval. Reflecting on experience—sometimes called meta-cognition—helps to consolidate gains in both intrapersonal and interpersonal realms. Reflecting is about understanding that one is on a path of self-discovery and growth. Understanding how one learns and grows, the triggers that fire strong emotion, and conditions for recovery and perseverance, are all important aspects of evolving during adolescence. Thriving, to some extent, depends on the ability to become reflective, an aspect of both cognitive and affective development made possible by the increasingly connected and efficient brain. The presence of supportive and caring relationships—newly formed or growing and sustaining—also are essential for experiences to be meaningful. Not every relationship provides support, approval, and encouragement. Particularly important ones, however, bolster development, and may, during the teen years, be increasingly found outside the family.

Proponents of positive youth development programs argue that exposure to a variety of experiences is critical for optimal development.[30] Teens' experiences facilitate their accumulation of a number of personal and social assets they need to progress physically, socially and emotionally, cognitively, and in forming their identity.[31, 32]

DEVELOPMENTAL ASSETS

The developmental assets teens acquire from meaningful developmental experiences indicate thriving and are the final component of the *Thriving Through Development* framework. The many assets teens accumulate during adolescence may be protective against the risks encountered during these years, making teens able to be resourceful, adaptive, and resilient. Teens who acquire these assets—some of which include connection to a supportive community, multicultural understanding, self-control, school engagement, and the development of self-efficacy and purpose—will be more likely to experience well-being and to function in a healthy and constructive way in the present, and be better able to transition successfully to adult roles.[33]

Our thinking about assets is informed by the Foundations of Young Adult Success Framework, developed by the Chicago Consortium of School Research (CCSR), which identifies competencies, agency, and integrated identity as key factors for success. *Competencies* are at the foundation of assets and include the ability to acquire and integrate new knowledge (facts and how things work), critical thinking, self-awareness, self-management, relationship skills, responsible decision-making, the ability to collaborate, and other positive practices such as growth mindset, curiosity, forgiveness, gratitude, and empathy. Teens who have *agency* may be better equipped to use and rely on their competencies. Teens have agency when they believe they have the ability to influence their world and life path deliberately and with skill. Identity also matters. One marker of successful development is the formation of an integrated identity, which is the developed sense of internal consistency across multiple social and personal roles including, but not limited to, gender, race, culture, and profession.[34] An *integrated*

identity incorporates mindsets (beliefs about the self that govern motivation) and values (morals and conduct codes, beliefs about what is right/wrong). As teens forge their identity however, there may be inconsistency in roles, mindsets, and values which may or may not align with deployment of competencies and feeling agentic. So although teens may acquire competencies, they may refrain from using them if there is a perceived conflict with their identity.

More research is needed to determine exactly how teens accumulate and apply the assets they develop through exposure to environments, experiences, and relationships. It is possible (and probable) that teens are not always aware of the assets they have built through engagement with their surroundings, and it may be over time and through direct assessment and use of their skills—and feedback from others—that they reflect on and discover their unique set of assets and strengths.

Ideally, settings and close individuals will model for teens that competencies and strengths are malleable and that they can improve with practice and effort. For instance, teens should come to understand that gratitude is not simply a strength or trait that one has or does not have, but that it is a practice that can be honed over time and turned into a habit. Practices like gratitude and kindness produce benefits for self-reported well-being among teens as well as adults.[35] Teens can complete assessments (like the one available at www.viacharacter.org) to gain awareness of the character strengths they are most inclined to use regularly. In tandem with those reflective efforts, it is important that teens receive feedback that aligns with, and learn to practice, a growth mindset, whereby all strengths are understood as buildable at least to some degree. Within the framework of growth mindset, praise is given for effort and the intentional use of good learning strategies, not for "being smart" or "being kind."[36] When teens learn about their strengths and believe that they can grow their abilities through effort and the careful use of strategies, they may be laying the foundation to gain more specific assets. If they find, for instance, that they are inclined to practice curiosity, they might find it easier to capitalize on opportunities to learn about other cultures, an asset that is proposed to have implications for thriving.[37]

It has been proposed that teens' acquisition of assets happens through "continued exposure to positive experiences, settings, and people as well as abundant opportunities to gain and refine their life skills."[38] Specific features of settings which teens inhabit (e.g., levels of safety, structure, and supervision) may facilitate the accumulation of strengths and skills. Further, the way that teens engage with the settings they inhabit is as critical as the features of those settings. If teens are not engaged in an agentic and reflective way with the settings they inhabit, positive features available within them may be less impactful than they otherwise could be.[39] While the features of settings referenced here have been proposed for community youth programs, they also may apply (perhaps with adjustments) to features of video games and the supports that surround them. For instance, video games that provide exposure to positive social norms may help teens to integrate those positive norms and values, especially when teens encounter those same norms in other settings they inhabit.[40] Other features of settings that may impact asset accumulation are safety, and especially protection from violence; supportive relationships; and opportunities to belong to a group, develop a sense of agency and efficacy, and build life skills like planning and execution of tasks. Further, there should be communication and a synergy of efforts across the settings teens inhabit, so that assets are reinforced for greater integration.[41]

1C. MAPPING VIRTUAL EXPERIENCES ONTO DEVELOPMENT

Understanding the impact of the countless experiences teens have across adolescence is made more complex by the ubiquity of virtual settings. Consider the developmental task of forming and maintaining friendships that are mutually close and supportive. Are the ways in which this unfolds similar for teens today compared to teens in prior generations, regardless of the advent of Facebook, Instagram, Snapchat, and multiplayer online games? Does the public sharing of experiences promote more and better friendships, or lead to greater superficiality? Does having explicit means by which to control privacy online (e.g., Facebook's privacy settings) make teens more cognizant of and deliberate in how and with whom they share personal information? Does ready access to the social lives of their peers on handheld devices skew decisions about who to spend time with and how? Does the ability to hang out online in a social game with another teen who lives across the country (or world) support stronger friendships outside of immediate friend circles? Does the greater inhabitancy of virtual settings accelerate development or stymy it? Are teens' experiences fundamentally different because of their digital lives? And are the developmental tasks of teens qualitatively different as a result? Will new tasks need to be added?

Amidst this uncertainty, iThrive sees the potential for video games to be a setting for meaningful experiences that contribute to adolescent development. As a society, we unlock greater potential for teen thriving when we meet teens where they are—developmentally as whole human beings; physically in homes, schools, and communities; and virtually in video games, social media, and the internet.

2. MEASURABLE EFFECTS OF VIDEO GAMES ON ADOLESCENT DEVELOPMENT

Here, we examine extant research on games, mining for evidence that they impact adolescent development and more specifically outcomes relevant to teen thriving in the four developmental domains—physical, social and emotional, cognitive, and identity. Most of the empirical investigations on video games center on aggression,[42] which we locate in the social and emotional domain, or spatial reasoning abilities[43] and knowledge acquisition,[44] which we locate in the cognitive domain. While these outcomes give us insight into some specific effects video gameplay may have on adolescent development, this research is not yet comprehensive (or deliberate) enough to paint a holistic picture of games' impact. We know little about outcomes of video games within the domains of physical development or identity formation, and only a limited amount within the social and emotional and cognitive domains. Small-scale research studies have engaged teens in identity exploration within the context of digital games, so there is some emerging work here. However, the studies have focused on exploring teens' choices about identity expression (e.g., how often players choose an avatar of a different gender, and their motivation for playing with that identity), rather than the process of identity formation and integration.

This section presents a brief summary of the major topics of research in this field focused on two developmental domains—social and emotional, and cognitive. We narrowed in on findings of meta-analyses, which statistically aggregate effects across all studies that examine a particular

topic and set of outcomes. Meta-analyses provide a more robust and evenhanded overview of an area of research than any single study. Since few studies use the same games in their analysis, and given the sheer number of variables embedded in any sophisticated video game, other game elements may confound the results of a study. Furthermore, a recent attempt to replicate 100 published psychological studies raised concerns in the discipline when only 38% of the results noted in the original studies were successfully replicated. With this in mind, and especially within a field that has little empirically verified theory and few replicated studies, meta-analyses give us more confidence in the validity of specific outcomes of playing video games.[45]

2A. SOCIAL AND EMOTIONAL DEVELOPMENT: AGGRESSION AND PROSOCIAL OUTCOMES

The debate over violence and aggression has monopolized much of the video game research space. Though violence pervades many video game genres, it is perhaps most explicitly embodied by first-person shooter games. In first-person shooters, like Call of Duty: Black Ops III (the top selling video game of 2015), players wield and fire weapons from a first-person perspective, as if the player is seeing through the character's eyes.[46] The objective is often to kill as many opponents as possible, and it is common for first-person shooters to include realistic weaponry, human enemies, and blood and gore.

A handful of meta-analyses have summarized the research on video game violence. Most of the studies included in these analyses employed experimental designs in which participants fill out questionnaires to measure their baseline aggression levels, play a violent video game for a short time (e.g. 30 minutes), and then complete another questionnaire or task to measure potential changes in aggression levels. Few experimental studies follow up with participants at later dates to assess residual changes, but there have been many cross-sectional and longitudinal studies aimed at evaluating long-term effects of violent video game content on aggression.[47]

The results of the available meta-analyses are inconsistent. Two recent ones find that exposure to violence in video games promotes aggressive affect (e.g., anger, hostility), aggressive cognition (e.g., positive attitudes towards violence), and aggressive behavior (e.g., choosing to subject others to loud noise blasts), and also reduces prosocial behavior (e.g., donating money). These effects were present immediately after playing violent games (assessed via experimental designs) and also after repeated exposure to violent games over a period of weeks or months (assessed via longitudinal and cross-sectional designs).[48] However, other meta-analyses assert that there is very little or no measurable effect of video game violence on aggression or prosocial behavior.[49] Furthermore, it has been argued that publication bias might be overstating the link between video game violence and aggression found in previous meta-analyses, which calls into question how strong the aggression effects of video game violence might be, if indeed there is a relationship between the two.[50]

While most research appears to confirm at least a small positive association between video game violence and aggression, the contention on this issue may reflect a larger challenge confronting video game research. As noted above, popular video games are very complex systems. They have numerous variables that could be impacting outcomes and thereby obscuring the true effects

of a particular game element. For example, there is emerging evidence that cooperatively playing violent video games—playing on the same team as a friend to complete a mission, for example––may mitigate increases in aggression due to violent content.[51]

Tandem to the research on violence in video games is the investigation of the effects of prosocial gameplay. Prosocial elements in games are those where the player's primary goal is to help another character through nonviolent means. A set of three cross-cultural studies on prosocial content in video games—one correlational, one longitudinal, and one experimental—reported a significant and positive link between prosocial video game content and prosocial behavior.[52] These results are buoyed by a meta-analysis that concludes that prosocial video games increase prosocial behavior and decrease aggression.[53] Similar to the findings that cooperative play moderates aggression effects, cooperative play may also contribute to prosocial behavior, regardless of the content of the video game.[54]

The study of the prosocial effects of digital games is nascent. As this research matures, close investigations of the relational aspects of digital games (e.g., how the player relates to other characters and situations in digital, interactive spaces) will allow for a more even-handed assessment of both the positive and negative social and emotional effects of playing video games.

2B. COGNITIVE OUTCOMES

As with video game research in the social-emotional domain, the literature on the cognitive outcomes of playing video games is not without serious debate. While most researchers agree that video gameplay is associated with increases in cognitive skills, some question how transferrable this learning is to tasks beyond the realm of video games.[55] Part of the contention stems from the fact that the majority of studies assessing cognitive outcomes of playing video games employ correlational designs, using various tests to evaluate the cognitive abilities of regular gamers versus non-gamers, thus they cannot determine adequately the direction of causality (do video games lead to increases in cognitive abilities, or are those with stronger cognitive abilities more likely to play video games, or is there a third factor affecting both?). However, a sizable number of studies have employed stricter experimental designs to address these concerns. In a typical experiment assessing cognitive effects of video games, participants take a variety of tests to measure a range of cognitive skills, play a designated video game over the course of several sessions that span multiple weeks, and then retake the cognitive tests to measure any improvements. Their results are then compared to a control group who either participated in no video game sessions or played a game that requires less cognitive engagement.[56]

Recent meta-analyses report that video games are an effective means of increasing some spatial and information processing skills.[57] An analysis of 118 studies—which included participants ranging from young children to older adults—found positive effects of video gameplay on motor skills (e.g. hand-eye coordination), auditory processing (e.g. distinguishing between sounds), visual processing (e.g. peripheral vision), and spatial imagery skills (e.g. interpreting maps). However, this meta-analysis found no evidence that video games improve executive functions such as multi-tasking and performance on intelligence tests.[58]

Another well-developed research area on cognitive outcomes examines learning and comprehension through video games. Studies in this realm tend to test games whose primary purpose is educational. This is not the objective of most commercial video games that teens play; however, these studies are still worth reviewing since both educational games and commercial games employ many of the same mechanics, such as difficulty scaffolding and achievement systems. One meta-analysis found that participants who were taught via video games, compared to alternative means of instruction, displayed better recall of the facts presented in the instruction and retained this information longer. They also showed better knowledge about how to perform tasks discussed in the instruction and had higher levels of confidence in their ability to perform those tasks. [59] Other meta-analyses reported that students who received instruction through games—instead of through traditional methods like lecture or drill and practice—performed higher on cognitive learning measures.[60]

2C. LIMITATIONS AND POTENTIAL FOR GAMES RESEARCH

This review of the literature leads to three preliminary conclusions. First, video games with a high degree of violence may in fact contribute to aggressive behavior, affect, or attitudes, although the effects may be quite small. Second, games incorporating opportunities for prosocial gameplay may in fact contribute to prosocial behavior, affect, or attitudes. Third, video games demanding high levels of cognitive engagement (auditory processing, visual processing, motor skills, spatial imagery skills) may lead to cognitive improvements, although the degree of transfer to other tasks is up for debate. Many of the games tested within these studies were not deliberately designed to affect these sets of outcomes, yet some impacts have been found nonetheless. What is promising about this research is that if we deliberately design games to promote a set of outcomes, we may well succeed in doing so.

This is by no means a comprehensive overview of all the research on video games. The field is broad, with research areas extending into areas ranging from the dimensions of engagement employed during gameplay[61] to video games as interventions for depression,[62] areas we did not review here. As stated, the field of games research is emerging and, to date, with the exception of the areas reviewed above, meta-analytic research on these other areas (and countless others) has yet to be completed.

Of particular importance for iThrive is research on the impacts of video games on adolescent development. Given the high degree of neural plasticity characteristic of adolescents,[63] it would stand to reason that the effects of video games would be more impactful in this population. Unfortunately, there is not enough research on this topic yet to comment on that hypothesis. Few studies recruit a wide age range of participants and specifically look for age effects. Far more common are studies that recruit only one age group (children or adolescents or adults), which makes direct comparison of adolescents to other age groups difficult. This forces us to rely on meta-analyses that employ age as a moderator variable to hint at possible differences between age groups. Of the analyses reported on above, most found either no moderator effect of age[64] or small moderator effects that suggest that younger individuals are more likely to demonstrate the measured outcome of video games.[65] However, the meta-analyses did not report on non-

linear age effects, and it is therefore difficult to determine the degree to which (if at all) adolescents are more susceptible to the effects of video gameplay than either adults or children.[66]

Nevertheless, the above research is enlightening insofar as it demonstrates games' potential to influence social and cognitive processes. In effect, what concerns iThrive is whether or not video games can provide the meaningful experiences for teens to progress towards the successful completion of developmental tasks and the accumulation of assets. Unfortunately, existing research does not directly answer this question. However, given that games provide experiences that are significant enough to impact outcomes related to cognition and social behavior, it is feasible that games could offer meaningful experiences for development if designed intentionally to do so. This is the work of iThrive.

3. APPLYING ITHRIVE'S THRIVING THROUGH DEVELOPMENT FRAMEWORK TO GAMES

iThrive's framework, grounded in the developmental literature, specifies that across developmental domains (physical, social and emotional, cognitive, and identity), teens have meaningful experiences wherein they accumulate assets allowing them to make progress towards the tasks of development. We argue that virtual settings, and video games in particular, hold promise for offering meaningful experiences. Not all games can or will provide meaningful experiences, but iThrive aims to guide and inspire (1) game developers to create games that elicit meaningful experiences for players, ones in which players acquire developmental assets and make progress on developmental tasks; and (2) players to choose games that provide meaningful experiences.

To achieve these goals, iThrive will build an evidence base for video games that positively impact teen development. This evidence base will specify (1) a set of game titles that contribute to development in meaningful ways across domains and tasks vis-à-vis the accumulation of developmental assets; (2) a set of game features that contribute to the accumulation of developmental assets; and (3) principles of game design that guide the construction of games that provide meaningful experiences for teens on their developmental journey.

We propose to focus on the acquisition and accumulation of *developmental assets* within games as the lever for impacting adolescent development because the acquisition of assets allows for measures of learning most proximal to gameplay. More distal outcomes, such as making progress on developmental tasks within or across domains, may be more accumulative, requiring time and additional meaningful experiences, and may be more challenging to assess. That said, examining outcomes at different levels (asset acquisition, progression on tasks, development within domains) remains the ultimate goal.

In the following sections, we hone in on a set of activities, currently underway and continuing to emerge, that set iThrive on the course to build an evidence base for video games that positively impact teen development.

GAME CURATION

To identify games that contribute to development, iThrive will examine commercially available, off-the-shelf games to determine the extent to which they show promise for contributing to teen thriving. That is, in what ways might existing games provide for meaningful developmental experiences, promoting asset acquisition and progression on developmental tasks? We will undertake two primary activities for game curation. In the first, we use as a starting point the scientific literature to articulate how developmental assets are accumulated and best practices for cultivating those assets in teens. We then will apply these practices to analyze games for those qualities. Concurrently, we use games as the starting point, asking players and game developers to identify games they believe provide for meaningful developmental experiences. Both activities will yield groups of games that show promise for developmental asset acquisition, and those that do not. Using an iterative process, games identified using the literature as the starting point will be put in front of players and designers to further verify on which list they belong; and games identified by players and game developers will be subjected to the evidence-based list of practices to further verify their categorization as promising or not for development. The ultimate test will be to subject the games to efficacy testing to assess their impact on development.

Appendix A presents a sample list of practices found in the literature, and Appendix B presents the initial list of games that emerged from our first round of curation.

GAME FEATURES

The game curation process will yield a set of game features, or mechanics, that contribute to meaningful developmental experiences for players. Game features—including the rules of the game, what the player interacts with in the game, the content of the game (who the characters are, what the world is like, the narrative)—are the game's building blocks. They are integrated into a dynamic system that draws in the player and creates gameplay experience for players. The gameplay experience includes the sensations the player has while playing: feelings of empathy, challenge, awe, and flow, among countless other feelings.[67] Examining the mechanics of the games in both categories, gleaned from the game curation activities, will yield insights into which mechanics might contribute to meaningful experiences and which might not. Appendix C presents an initial set of game features that may contribute to meaningful developmental experiences in video games. This list emerged from interviews and focus groups with expert game developers and from close examination of games that have been identified in our initial game curation activities.

Identifying features of existing games is important, but this alone is insufficient to appreciate what elements are necessary to support asset acquisition. The assets within iThrive's developmental framework are acquired through learning. Integrating the science of learning into game design also is critical.

GAME-BASED LEARNING

In this area of iThrive's work, we will draw from the learning science literature to articulate how to optimize games for learning. And further, we will use the evidence base to identify which in-game

features and out-of-game activities and supports are necessary for in-game learning to transfer to out-of-game learning.

Learning during the adolescent years presents opportunities especially relevant to video games. The brain development that happens during adolescence is the final significant advancement, whereby learning is rapid and hormonal and brain changes ignite teenagers to be more impulsive and risk seeking than they were in childhood or will be in adulthood.[68] The cognitive integration that is a hallmark of adolescent neural developmental involves the strengthening of specific neural connections used most frequently and trimming away those that are used less frequently. This means that asking teens to engage in learning activities that require them to think and process information in specific ways may have lasting impacts.[69]

IN-GAME LEARNING. Focusing first on in-game learning, evidence from learning sciences suggests that learning is optimized when the learner is challenged appropriately. The term *productive struggle* refers to the learner working through a task that relies on but requires a reach just beyond current knowledge and skills, current knowledge and skills. If there is no challenge, the learner becomes bored. If the challenge is too great, the learner becomes frustrated and quits trying. Games already rely on players experiencing productive struggle; each game level is slightly harder than the previous and requires players to apply skills acquired in earlier levels in new ways as they advance.

Research by neuroscientist Dan Siegel suggests an additional set of essential ingredients that optimize learning during adolescence. These include sparking the interests of teens by presenting learning opportunities through the lens of that which is personally and emotionally meaningful and relevant; engaging teens socially through cultivating mutually supportive and encouraging relationships with others, including elders (e.g., parents, teachers, mentors) and peers; initiating novel and exciting experiences including risk-taking which is heightened in adolescence; and providing opportunities for creative expression, allowing for teens to co-create experiences and give voice to their perspectives and views on the world.[70]

Ingredients of optimal learning experiences culled from the evidence base should inform the creation of meaningful developmental experiences offered in video games. Fortunately, from our initial review of this literature, they translate well into principles of great game design.

OUT-OF-GAME LEARNING. Games are played within a physical context, which may be the teen's home, friends' homes, school, or afterschool programs, amongst other contexts. Considering the context in which teens are playing games will better allow us to encourage the transfer of meaningful experiences within the game to the world outside of the game. And this is the overarching goal—creating meaningful experiences that both support teens in their navigation of the tasks of adolescence and set them up for transitioning successfully to adulthood.

The relationships that teens have within those contexts are one lever on which to focus for the transfer of learning that happens within the game to outside of the game. An evidence base exists that provides guidelines focusing on relationships for the transfer and extension of learning in ways that promote development. Catalogued by the Search Institute, relationships which promote learning and growth are those that express care (offering steady support, authentic empathy, and

caring); challenge growth (helping teens stretch, reframing challenge as positive, not as a stressor); provide support (scaffolding when necessary and promoting autonomy when possible); share power (developing agency, which is critical to feeling effective and finding purpose); and expand possibilities (acting as a guide to a bigger, richer world).[71]

The out-of-game learning opportunities are critical to consider and design for in order to create meaningful experiences.

GAME DESIGN PRINCIPLES

Identifying game features present in promising games alongside the ingredients of optimal learning experiences (pairing in-game experiences with out-of-game supports) will drive a set of design principles that guide the development of games designed to deliberately provide meaningful developmental experiences.

In this final section we sketch out some exciting possibilities for games that leverage game design principles to support the accumulation of developmental assets and progression on developmental tasks. While video gameplay may support progress on all ten developmental tasks of adolescence, here we focus on a sample of three: identity exploration, honing abstract thinking skills, and identifying values and moral standards.

IDENTITY EXPLORATION. Establishing key aspects of identity, the eighth developmental task in the framework, occurs through the active exploration of different social roles and personalities.[72] There is tremendous potential for games to provide a rich setting in which teens can (and already do!) try on different identities in a space safer than home and school provide, where social repercussions of trying out identities may lead to ridicule, condemnation, or abuse. Games offer a rich and immersive opportunity for teens to try on different identities through customizable avatars, joining game-based communities, and playing multiplayer games. Actively trying on different identities—such as by gender bending or exploring different group affiliations (e.g., athletes, musicians, coders)—comprise rich learning experiences for teens, experiences that may be afforded through gameplay. Via inhabiting avatars, players can transition from one character to another and rapidly take on complete transformations that would be much more difficult or impossible in real life. For example, a 14-year-old girl may play a multiplayer, online social game like *World of Warcraft* as a male and reflect on how other players react to and interact with "him," safely exploring complex social scenarios, free from some of the risks of ridicule or violence that gender exploration may have in real life. In a game like *The Sims*, players fully customize their character's appearance (including gender, weight, skin and hair color, piercings and tattoos), personality quirks, and even life ambitions. Players then guide their sim through daily life, fulfilling their wishes, helping them to learn skills, and growing their sim into the artist, scientist, or explorer the teens themselves might believe they'd like to be. Importantly, sims also can share romantic relationships with other sims of either gender, allowing for teens to safely explore their burgeoning sexual identity in a risk-free environment.

HONING ABSTRACT THINKING SKILLS. Developing and applying abstract thinking skills is the second developmental task in the framework. Video games in multiple genres, including puzzle games and simulations, may provide such opportunities for advancing abstract thinking skills with

the emphasis they provide on trial-and-error experimentation. Tasks in video games may recruit teens' budding abilities to plan ahead, develop and test a hypothesis, and examine their failures for information that makes success more likely next time. Puzzle-platformer games like *Portal 2* play with physics and gravity and require teens to learn the rules of an otherworldly environment in order to get from point A to point B or unlock rooms or levels. In *Portal 2* teens must estimate the velocity and angle from which they'll need to approach a portal in order to land in the right place on the other side, and doing so successfully often takes multiple attempts. The *Kerbal Space Program* is an example of a game that recruits higher-order thinking skills in the service of exploring an alien universe. Players must use the resources at hand to build rockets and consider factors like torque, trajectory, and thrust to successfully land their craft on a faraway moon or planet. Games like these provide a safe space in which to try (and fail by using) a range of hypotheses divorced from the risk inherent in graded academic assignments. Additionally, games' mix of curiosity-provoking alien worlds, the promise of exciting rewards, and immersive narratives and relatable characters, may motivate teens to put forth the focused and effortful critical thinking required of them.

IDENTIFYING VALUES AND MORAL STANDARDS. Identifying one's moral standards and values is the fifth developmental task of the framework. Video games can be powerful spaces in which to face ambiguous ethical and moral choices and to become aware of injustices and the plight of others, including "enemies." Games where choices are not facile—and the impact of those choices on the player and other characters is unclear—may prompt players to reflect on their personal values and to act in alignment with the type of person they aspire to be. In the game *Papers, Please*, teens take on the role of an immigration officer whose job it is to permit or deny the entry of individuals from other countries. Some cases are cut and dry, but grayer situations also emerge that force players to decide whether to follow the rules blindly or to bend them at personal risk for the benefit of an immigrant looking for a better life. Some games, like *Star Wars: Knights of the Old Republic* offer their own morality systems that give players the choice to follow the path of benevolence on one hand, or exploitive power on the other. There are benefits, in terms of in-game abilities and achievements, to both paths. It is not dictated that one is better than the other, necessarily, but teens who play such games are afforded a powerful opportunity to explore the emotions and consequences that each path yields. With their chat functionality and cooperative or competitive gameplay possibilities, multiplayer online social games like *World of Warcraft* offer a riskier, but truer-to-life, playground in which to explore morals and values related to the treatment of others. Teens have the opportunity in such games to reflect on how they are welcomed, or not, as newcomers to the online game community, the consequences of selfish behaviors like stealing loot, and the meaningful connections that are possible when teens share a passion for a game and work cooperatively to overcome challenges. Such games also may bolster coping strategies (the fourth developmental task) by exposing teens to bullying or other antisocial behaviors in a space where teens are physically safe, but may need to learn to mute and ignore menacing players in order to stay engaged. Finally, video games can challenge the societal "us versus them" scripts that teens often absorb through osmosis during active conflicts with foreign countries. *This War of Mine* is a game about war that removes the player from the traditional soldier/shooter role so prevalent in war-centered video games like *Call of Duty*. Instead, in *This War of Mine*, teens play average civilians enduring a fictional war, trying to survive by

making heart-wrenching choices. Games like this can prompt critical thinking and moral reflection on the consequences of painting a whole culture as an enemy or outgroup. Instead, such games bring to the fore the universality of human suffering and the fight to survive.

SUMMARY / CONCLUSIONS

The adolescent years are ripe with possibility. Teens are primed for learning and hungry for a wide range of meaningful experiences that will shape who they become. While each teen progresses in a unique way on the path to adulthood, evidence suggests that all teens undertake ten key developmental tasks in four domains. Teens thrive when they move through these tasks while accumulating assets—the competencies, agency, and integrated identity—that bolster well-being and, eventually, the successful adoption of adult roles and responsibilities. The settings teens inhabit influence their developmental trajectories and either facilitate or hinder their accumulation of assets, and virtual spaces including video games are one such setting. iThrive sees the potential for video games, with their far reach and broad appeal, to influence development by providing teens with meaningful experiences in a low-risk environment that invites and supports learning and experimentation.

At this point in time, there are significant gaps in our knowledge of how the virtual settings teens inhabit impact their development. iThrive's *Thriving Through Development* framework and accompanying research agenda seeks to address those gaps as they relate to the potential for video games to deliver meaningful developmental experiences for teen players. iThrive is embarking on an investigation of video games, game mechanics, and gameplay contexts (e.g., physical settings and relationships within them) that might support teens' accumulation of assets during development. We also urge continued and expanded research on the impact of video gameplay on outcomes in all domains of adolescent development—physical, social and emotional, cognitive, and identity—to further elucidate how video games can both support and impede teen thriving and the successful transition from adolescence to adulthood.

APPENDICES

APPENDIX A. EXAMINING VIDEO GAMES FOR STRENGTHS CONTENT

Below is a sample of questions iThrive posed to game design students to allow them to assess a set of video games for content related to strengths and practices that support teen thriving.

Curiosity

Seeking out new knowledge and experiences for their own sake; embracing uncertainty.

(Check any that apply.) Does this game:

- ☐ Invite players to explore fantastical settings or use mundane objects in novel ways?
- ☐ Encourage players to ask NPCs questions about themselves and the world of the game?
- ☐ Prompt players to think about what new information they need to solve a problem, and to
1. venture out into the game world to find it?
   - ☐ Keep certain areas, objects, characters, or tasks/quests visible but grayed out when players start to spark their curiosity about what is yet to be discovered?
   - ☐ Use sandbox elements that encourage exploration and creation or combination of found
2. objects and resources?
   - ☐ Reward new approaches to challenges to encourage players to experiment beyond the
3. same “tried-and-true” methods?
   - ☐ Offer lore objects that can be explored (books, songs, statue plaques, etc.) and reward such optional exploration with experience points or other achievements?
   - ☐ Include crafting systems with invisible recipes that can only be discovered by trying out
4. random combinations of ingredients?
   - ☐ Allow players to create creatures and watch them interact independently through AI?
   - ☐ Provide optional hints to reduce anxiety or frustration if players get stuck?
   - ☐ Integrate storylines based on real historical events, social issues, the natural world, or the lives of people in various cultures and circumstances, sparking players’ interest in aspects of the world and society they may not have known or cared about before?
5.

Empathy

Feeling what others feel, imagining how they view and think about situations, and wanting to do something with that knowledge.

(Check any that apply.) Does this game let players:

- ☐ Learn about other players/NPCs through narrative, dialogue, and other means?
- ☐ Encounter characters that defy stereotypes?
- ☐ Help other characters and/or take responsibility for the welfare of another character?
- ☐ Practice asking about feelings and identifying realistic emotions in NPCs/other players?
- ☐ Try many approaches to a challenge to see the value of different perspectives?
- ☐ Discover the circumstances that motivate a character’s behavior?
- ☐ View the same scene or situation from many perspectives?
- ☐ Encounter NPCs with universal goals and values?
- ☐ Avoid jumping to conclusions by having tools to override automatic, biased thinking about others?

Gratitude

Recognizing the good in life and acknowledging its source as outside ourselves.

(Check any that apply.) Does this game:

- ☐ Model and provide ways to express thanks via text, emotes, gestures, or other means?
- ☐ Foster interdependence among players, such as through coordinated action?
- ☐ Allow players to repay the kindness of other players and non-player characters by performing side quests for them or gifting them collectibles or resources?
- ☐ In social games, allow players to publicly call out the generosity of those who have helped them?
- ☐ Prompt players to record good things that happen to them in a game journal or by some other means such as taking “pictures” with an in-game camera?
- ☐ Use narrative that highlights the role NPC’s, or a greater force for good, have played in players’ successes?
- ☐ Strategically make some abilities unavailable for a time to boost players’ gratitude for the tools and powers they have learned or received throughout the game?
- ☐ Depict in the narrative struggles that people face in the real world to boost players’ gratitude for the gifts and opportunities they have?

Growth Mindset

Believing that personal attributes can improve as a result of hard work. People who practice growth mindset see difficult tasks as opportunities to grow instead of evidence that they are incapable.

(Check any that apply.) Does this game:

- ☐ Use a narrative and visuals (such as skill meters) that affirm the ability to improve with effort?
- ☐ Reward effort, learning, and persistence, not just winning?
- ☐ Affirm the value of mistakes for teaching players new approaches?
- ☐ Design multiple ways to win and encourage new approaches instead of “safe bets”?
- ☐ Allow players to “level up” skills and retry difficult challenges?
- ☐ Provide rewards for attempting more challenging tasks when easier tasks are available?
- ☐ Include a specification track that allows players to see what skills or powers they will earn as they level up in their chosen character progression?
- ☐ Depict a character's eventual form in some way (a silhouette, for example) before it has been achieved, so that the player can aspire to it and see how effort will pay off?
- ☐ Display players’ improvements in accuracy or efficiency as they progress in the game?
- ☐ Use text or narrative to indicate that an upcoming difficult task is an opportunity to learn and improve?
- ☐ Use character descriptions that acknowledge the capacity for change—for example, instead of labeling someone “dim-witted,” he or she “needs opportunities to learn”?

APPENDIX B. VIDEO GAMES WITH POTENTIAL GROWTH OPPORTUNITIES FOR TEENS

The video games listed here appear to provide opportunities for teens to practice skills and mindsets that may support the accumulation of strengths and assets during development. The lists were compiled with consultation from professional game developers, scholars, and students of game design. Age ratings—primarily from www.commonsensemedia.org—are included after the name of each title.

Curiosity
Video games might support the practice of curiosity when they provide opportunities for players to explore and create in intriguing worlds, experiment with combining found objects to make new and useful things, solve mysteries or discover meaning gradually through deep exploration, and try out different identities and interactions just to see what happens.

- Her Story (16+ years): More an interactive film than a game, players use a police computer to solve a murder mystery via video clips and searchable transcripts.
- Kentucky Route Zero (10+ years): A point-and-click adventure game/interactive novel "about a secret highway in the caves beneath Kentucky, and the mysterious folks who travel it." - http://kentuckyroutezero.com/
- Nancy Drew series (10+ years): A series of point-and-click mystery adventure games. Players interview characters and search for clues to solve the mystery at hand. Bonus: Depending on which game from the series players choose, they might learn about topics like physics and electricity or become more familiar with other cultures as they play.
- Myst (13+ years): Players explore and examine objects on a mysterious island to reveal secrets about an injustice that they can then help to right.
- Broken Age (13+ years): Players switch between two teenage characters living in very different worlds. They experiment with combining objects and explore the world to ultimately discover how the characters' destinies intertwine.
- Portal 2 (10+ years): In this spatial puzzle-platformer, players help their robot companion to "find the portal gun, rescue other test subjects, and rebuild the dilapidated facility...Players have to figure out where to shoot portals, how to jump through them, and at what velocity and angle." - www.commonsensemedia.org
- Monument Valley (7+ years): Players experiment with physics and gravity to move a silent princess through a beautiful world of MC Escher-inspired architecture.
- This Is The Only Level series (6+ years): A set of online games where the level stays the same, but the mechanics constantly change. Guide the elephant to the exit...once you figure out the rules!
- Spore (11+ years): An evolution simulation where players create their very own species and guide creatures through 5 stages mirroring real-world evolution: Cell, Creature, Tribe, Civilization, and Space.
- Little Alchemy (8+ years): A simple but delightful online game where players start with just four elements (air, earth, fire, water) and combine them to create over 500 different elements. What do you combine to make a vacuum cleaner in Little Alchemy?
- Minecraft (8+ years): Players move through a virtual "sandbox" with nearly endless possibilities for what they can create from the resources they gather.

- The Legend of Zelda franchise (8+-12+ years): A classic action-adventure role-playing game with a series of clever puzzles to solve and massive dungeons to explore on the way to banishing villains.
- Dreamfall (18+ years): An “epic adventure across continents” that takes place in a future world where the ability to dream is in jeopardy. Players “visit exotic locations in an action-packed and emotional storyline.” - www.dreamfall.com
- Dragon Age: Inquisition (18+ years): An open-world fantasy role-playing game that offers opportunities to explore a massive world and complete quests that interest the player.
- The Elder Scrolls V: Skyrim (18+ years): A fantasy role-playing game with a vast, beautiful world to explore, and countless quests players can opt to take on or ignore. Choices shape who the player becomes.
- 80 Days (13+ years): Players race to make it around the world in 80 days, meeting fellow explorers and learning about 19th-century cities along the way.
- Kerbal Space Program (8+ years): A rocket-building sim that lets players launch missions to “the Mun” and other destinations in the Kerbal universe using real rocket science principles.
- Abzu (10+ years): Players dive below the ocean’s surface, exploring underwater ruins and observing deep sea creatures as they work to restore neglected areas.
- Pokémon Go (13+ years): An augmented reality game where players explore the real world to catch virtual Pokémon and train them to be strong fighters. The game intrigues players by showing the shadows of mysterious creatures they haven’t yet caught.
- The Sims 4 (12+ years): This life simulation game lets players fully customize the look and personality of their sim and then experiment with interacting with other sims in a variety of kind, mean, and romantic ways.

Empathy

Video games might support the practice of empathy when they allow players to see the same situation from many perspectives; appreciate diversity of personalities, backgrounds, and skills; inhabit difficult circumstances to understand what it might be like to face those particular challenges; be immersed in a historical event from an unexpected point of view; discover another culture; and make choices that impact other characters or real players.

- 1979 Revolution: Black Friday (15+ years): A game about the Iranian Revolution of 1979, where players explore “politics, empathy, and tough decisions amid some very high stakes.” – www.commonsensemedia.org
- Never Alone (13+ years): Players are immersed in an Inupiaq legend as a young heroine and her fox companion, setting out to discover the cause of an endless blizzard. Documentary-style video clips and authentic language give players a peek into Inupiaq culture.
- Papers, Please (15+ years): Players deal with difficult ethical decisions as they simulate “working as an immigration inspector on the border of a fictitious communist nation. Players analyze people's immigration documents, look for potential problems, interrogate applicants, and decide whether to let them in the country or keep them out of it.” – www.commonsensemedia.org
- Passage (15+ years): Players observe the universalities of a human life in this 5-minute game that takes the protagonist from youth to old age amid obstacles and rewards.
- Star Wars: Knights of the Old Republic (13+ years): A game set in the Star Wars universe where players’ choices to align with good or evil yield very different rewards.

- That Dragon, Cancer (16+ years): This interactive narrative explores the heart-wrenching circumstances around caring for a child with a terminal illness.
- This War of Mine (14+ years): Entering a fictional warzone, “players control a group of ordinary citizens attempting to survive through the conflict that's destroying their town.” – www.commonsensemedia.org
- Undertale (9+ years): A beginner-friendly role-playing game where players must test their assumptions about the “enemy,” and explore other ways of resolving conflict besides fighting.
- Gone Home (15+ years): An interactive narrative where “players take on the role of a young woman who explores her family's empty house after a year abroad, piecing together details of her family's activities during her time away.”
- Brothers: A Tale of Two Sons (13+ years): Players control a pair of brothers simultaneously to solve puzzles and help others in this emotional fantasy tale.
- Papo & Yo (11+ years): This puzzle-platformer game “chronicles an abused child's escape into a fantasy world,” broaching topics of addiction and difficult parent-child relationships. – www.commonsensemedia.com
- The Walking Dead (Telltale) (18+ years): In this zombie adventure game, the player takes on the role of Everett, a man trying to survive the zombie apocalypse while making tough choices that might lead to the death of innocents.
- Life is Strange (18+ years): Players assume the role of Max Caulfield, a teen who finds she has the mysterious power to reverse time and do things differently.
- Thomas Was Alone (10+ years): A 2-D platformer/puzzler that celebrates diversity by relying on the unique abilities of each “character” to bypass obstacles.

Growth Mindset
Video games might support the practice of growth mindset when they reward small actions and give immediate feedback that helps players to learn and improve performance. Video games also may allow players to level up and to grow kingdoms, armies, or empires through sustained effort; visualize the growth they are headed for through progress maps and ability trees; train and evolve characters into more masterful beings; and gamify real-life progress towards goals of emotional, cognitive, and mental health.

- Fitbit (no objectionable content): A wearable tracker that charts progress towards healthy habits like exercise.
- Lumosity (no objectionable content): Online brain training that hones players’ mental speed, flexibility, memory, attention, and problem-solving skills.
- Happify (no objectionable content): Online “games” that help build habits like gratitude that boost happiness.
- The Sims series (12-16+ years): Players create and customize characters, then guide them through the ups and downs of life, befriending other Sims and building a range of interesting skills from charisma to alchemy.
- Pokémon series (6-13+ years): Gotta catch ‘em all! Players explore their surroundings to catch Pokémon, then train and evolve them into powerful battlers.
- Spelunky (10+ years): A platformer set underground where levels are randomized, challenging players in new ways every time.
- Super Mario Bros. series (6-10+ years): A classic platformer with many variations and lots of chances to hone timing skills.

- Dominion (13+ years): A card game where players are ambitious monarchs, challenging one another to build the largest, most civilized kingdom.
- Castles of Mad King Ludwig (13+ years): A tile-laying board game with the goal of building an extravagant castle room by room.
- Civilization series (11-13+ years): A turn-based strategy game centered on building an empire.
- Clash of Clans (13+ years): A strategy game where players train raiders to fill their coffers.
- RPG's: Role-playing games like Final Fantasy XV (13+ years) and World of Warcraft (16+ years) let players aim to achieve a set of skills in areas that interest them, and see their persistence pay off one level at a time.

APPENDIX C. GAME MECHANICS THAT REINFORCE STRENGTHS RELATED TO TEEN THRIVING

The table below provides examples of how specific video games and game mechanics might support teens' practice of strengths related to thriving.

Strength	**Video Game**	**Mechanics that May Support the Practice of the Strength**
Curiosity	*Kerbal Space Program*	• Players have a novel and intriguing universe to explore • Players experiment with scientific concepts to create a rocket that will fly to their desired destination
Empathy	*Never Alone*	• Players learn about an indigenous culture through video interviews and language • Players switch between the heroine and her fox companion to explore multiple perspectives and abilities
Forgiveness	*Valiant Hearts: The Great War*	• An emotional narrative requires players to forgive themselves as the player character for something the character (or their race) has done, or to forgive another character who has wronged them in order to move on.
Gratitude	*Farmville*	• For players to build their virtual farms, they need some resources they can only get from fellow players. Gifting systems promote gratitude and "pay-it-forward" reactions.
Growth Mindset	*The Sims*	• Players choose and meet daily goals for their sims • Sims put hours into practicing to get better at life skills like cooking
Kindness	*Super Mario Sunshine*	• Players set out to restore order and beauty to a polluted island
Optimism	*Undertale*	• Players learn over time that they can avoid fighting and deal with "enemies" in more peaceful ways.
Purpose	*Halo 3*	• Players work cooperatively to take out evil forces and "save the world" • Players create and reach community milestone goals, like 10 billion successful hits on the enemy
Zest	*Dance Dance Revolution*	• Game mechanics require players to be up and moving energetically, inspiring zestful emotion

REFERENCES

WORK IN PROGRESS!!!!

---

[1] Our definition of teen thriving is informed by: Susan Crown Exchange; Thrive Foundation; NRC's report…. [Insert thriving resources in a sidebar: See Thrive Foundation for Youth website for more about thriving. Susan Crowne Foundation Thrive publication...

[2] cite Bronfennbrenner's original work and anything more recent on it (Pam Morris did a retrospective I think within the last 10 years)

[3] Recent examples include: Institute of Medicine and National Research Council (2002). Community Programs to Promote Youth Development. Washington, DC: The National Academies Press. doi:https://doi.org/10.17226/10022.; National Research Council (2003). Engaging Schools: Fostering High School Students' Motivation to Learn. Washington, DC: The National Academies Press. doi:https://doi.org/10.17226/10421. CCSR framework; Turnaround school; WT Grant Foundation reports…

[4] These are the most recent stats available from Lenhart et al. (2008) and Rideout (2015). We didn't find anything published in 2016. Other prominent scholars such as Granic (2014) and Przybylski (2014) use Lenhart et al. (2008) as well; it appears to be the most recent source with nationally representative data on the percentage of teens who play video games. ~~[Isaac double check my framing of this]~~

[5] Smethurst, T., & Craps, S. (2015). Playing with Trauma: Interreactivity, Empathy, and Complicity in The Walking Dead Video Game. *Games and Culture*, *10*(3), 269-290.

[6] Citation for (Kinzie & Joseph, 2008) quote. Raph Koster's book, James Paul Gee's book. [michelle confirm]

[7] Koster, Raph. Theory of Fun for Game Design (p. 99). O'Reilly Distribution. Kindle Edition.

[8] need some refs on embodied learning

[9] by Havighurst, Bronfenbrenner, Erikson, Vygotsky and Piaget (among others), Developmental tasks and education.,Havighurst, Robert J., Chicago, IL, US: University of Chicago Press Developmental tasks and education.(1948). iii 86 pp. We can reference others here too to look more scholarly and complete: Vygotsky, Erikson and Piaget.

[10] https://www.sutori.com/story/the-super-predator-myth-timeline There are non internet references also, but this one might stand, and would lead a reader to a comprehensive review of our turn from the 1990s to now. [ISAAC: Can you find original sources for this? We could use this too but need to pair it with a more reputable source I think]

[11] Pittman, Cahill, get references

[12] CCSR, Thrive Fdtn for youth, Blythe, Pittman, etc -- the bibliographical note can go here --

[13] Bronfenbrenner's ecological systems framework remains influential in guiding theory building and practice. List and cite the frameworks we reviewed that lead to this conclusion (universal frames) [ROBERT]—CCSR, what else?.

[14] The End of Average, Todd Rose. This point can be built into its own paragraph if we have space.

[15] http://www.actforyouth.net/resources/rf/rf_stages_0504.cfm -- can this stand as reference for this delineation of stages? [from Robert]

[17] Data on suicide come from Kann and colleauges (2016) and their analysis for the Youth Behavior Surveillance data 2015; depression rates are from Bose and colleague's (2016) analysis of the National Survey on Drug Use and Health data, 2015. Cross-generatioal comparisons of depression symptoms are from Twenge (2015), and XXX come from YRBS, 2016. <<ISAAC – DOUBLE CHECK REFERENCES FOR THESE STATS>>

[18] For **substance use**, recent reports show that 11.5% of teens drink alcohol, 9.4% use illicit drugs, and 7% use tobacco products (NCES ref). For **sexual activity**, as of 2015 58.1% of high school seniors reported having had sexual intercourse, and among those who are sexually active 13.8% did not use any birth control during their most recent sexual intercourse (YRBS, 2016). **High school graduation** rates are reported to be 82 percent according to most recent statistics (addd NCES). <<ISAAC – DOUBLE CHECK REFERENCES FOR THESE STATS>>

[19] Data on screen time comes from Rideout (2015). <<ISAAC – ANY PLACE ELSE?>> Twenge Journal of College and Character, 2013

[20] Isaac – provide link to a summary story of Lindsay Stone. One of the items we used in the UDL retreat maybe. Maybe write 1-2 sentences describing the case here.

[21] On January 15, 2017, the New York Times published piece about the "unspoken rules" teens (not their parents) are developing to monitor behavior on social media. Rule violators (those who publish many photos of their "fancy" vacations or "too sexy" photos of themselves wearing bikinis) risk being shunned by peers. https://www.nytimes.com/2017/01/05/well/family/the-unspoken-rules-kids-create-for-instagram.html?_r=0 The focus of this paper remains on video games, not all online behavior on Facebook, Instagram, and the like. Gameplay does need to be considered in context of all online behavior, however this paper will not delineate all the impacts (good/bad) of being online. Resources that address online behavior more generally include: Terkle; …. [susan has books about this to add, but add what you know too]

[22] http://www.nature.com/news/can-a-video-game-company-tame-toxic-behaviour-1.19647

[23] By Jorge Albor. Self-policing gamer culture. http://www.experiencepoints.net/2008/10/self-policing-gamer-community.html

[24] Steinberg, L., Icenogle, G., Shulman, E. P., Breiner, K., Chein, J., Bacchini, D., ... & Fanti, K. A. (2017). Around the world, adolescence is a time of heightened sensation seeking and immature self-regulation. Developmental Science. doi: 10.1111/desc.12532.

[25] Include endnote citing the sources we consulted to identify these four domains. CCSR, NRC, Building Blocks... +lbnathanson@gmail.com - what else? Classic like Erikson and Bronfenbrenner. Nod to Robert's more comprehensive section.

[26] A 10 item list of tasks developed by the Center for Health Communication at the Harvard School of Public Health amplifies this summary well and can be found here --

[27] Simpson (2001). *Raising Teens: A Synthesis of Research and a Foundation for Action* is a comprehensive review of the research on topics related to adolescence and parenting, drawn from hundreds of articles, reports, and books. The report outlines ten core tasks of adolescence, which were distilled from key findings in the adolescent development literature.

[28] ISAAC: specify that this understanding of meaningful experiences is greatly informed by

Search's framework for "developmental relationships" and include reference/link to their work.

[29] CCSR informs this thinking here re: action and reflection; cite in endnote and add some context re: action and reflection

[30] National Research Council and Institute of Medicine (2002) Community Programs to Promote Youth Development. Committee on Community-Level Programs for Youth. Jacquelynne Eccles and Jennifer A. Gootman, eds. Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education. Washington,DC: National Academy Press.

[31] Community Programs to Promote Youth Development: National Research Council and Institute of Medicine (2002) Community Programs to Promote Youth Development. Committee on Community-Level Programs for Youth. Jacquelynne Eccles and Jennifer A. Gootman, eds. Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education. Washington,DC: National Academy Press.

[32] The Search Institute. 40 Developmental Assets for Adolescents: http://www.search-institute.org/content/40-developmental-assets-adolescents-ages-12-18

[33] Add endnote, reference NRC's book—community programs to promote youth development

[34] Cite CCSR report here

[35] Cite lyubomirsky

[36] Cite dweck article(s) about praise

[37] Cite community programs for positive youth development.

[38] Community Programs to Promote Youth Development: National Research Council and Institute of Medicine (2002) Community Programs to Promote Youth Development. Committee on Community-Level Programs for Youth. Jacquelynne Eccles and Jennifer A. Gootman, eds. Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education. Washington,DC: National Academy Press. p. 85. **ISAAC – add Susan Crown Exchange Report here; double check that it's relevant

[39] Community Programs to Promote Youth Development: National Research Council and Institute of Medicine (2002) Community Programs to Promote Youth Development. Committee on Community-Level Programs for Youth. Jacquelynne Eccles and Jennifer A. Gootman, eds. Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education. Washington,DC: National Academy Press.

[40] Community Programs to Promote Youth Development: National Research Council and Institute of Medicine (2002) Community Programs to Promote Youth Development. Committee on Community-Level Programs for Youth. Jacquelynne Eccles and Jennifer A. Gootman, eds. Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education. Washington,DC: National Academy Press.

[41] Community Programs to Promote Youth Development: National Research Council and Institute of Medicine (2002) Community Programs to Promote Youth Development. Committee on Community-Level Programs for Youth. Jacquelynne Eccles and Jennifer A. Gootman, eds. Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education. Washington,DC: National Academy Press.

[42] Ferguson, 2015; Anderson et al., 2010

[43] Uttal et al., 2013
[44] Sitzmann, 2011
[45] Open Science Collaboration, 2015. This finding has sparked a large debate in the field over the reproducibility of findings. See Gilbert et al. (2016) for a response to the original paper published in *Science*. The Open Science Collaboration's subsequent response can be found in Anderson et al. (2016).
[46] ESA Essential Facts 2016 (http://essentialfacts.theesa.com/Essential-Facts-2016.pdf)
[47] Anderson et al., 2010; Anderson et al., 2004; Ferguson, 2015; Ferguson & Kilburn, 2009; Greitemeyer & Mugge, 2014;
[48] Anderson et al., 2010; Greitemeyer & Mugge, 2014
[49] (e.g., Ferguson, 2015)
[50] Ferguson, 2015. For more on the debate over the effects of video game violence on aggression, see Boxer et al. (2015), Bushman et al. (2010), Ferguson and Kilburn (2010), Furuya-Kanamori and Doi (2016), Markey (2015)].
[51] (Greitemeyer, 2013; Ewoldson et al., 2012).

[52] Gentile et al., 2009
[53] Greitemeyer and Mugge's (2014)
[54] (Greitemeyer, 2013).
[55] See Boot et al. (2011) and Green & Bavelier (2012) for a sample of the debate over the transferability of cognitive skills attained through video gameplay
[56] Powers et al., 2013; Uttal et al., 2013
[57] (Powers et al., 2013; Uttal et al., 2013).
[58] Powers et al., 2013. Powers et al. (2013) conducted two meta-analyses: one analyzing quasi-experimental (correlational) studies and one analyzing true experimental studies. While the analysis of quasi-experiments found a significant relationship between playing video games and increased cognitive functions, the analysis of true experiments did not confirm this result.
[59] Sitzmann, 2011
[60] Vogel et al., 2006; Wouters et al., 2013
[61] (Boyle et al., 2012)
[62] (Li et al., 2014).
[63] Steinberg (2013)
[64] Ferguson, 2015; Uttal et al., 2013; Vogel et al., 2006
[65] Anderson et al., 2010; Wouters et al., 2013
[66] Anderson et al., 2010; Clark et al. (2016); Ferguson, 2015; Greitemeyer & Mugge, 2014; Powers et al., 2013; Sitzmann, 2011; Uttal et al., 2013; Vogel et al., 2006
[67] Hunicke, R., LeBlanc, M., & Zubek, R. (2004, July). MDA: A Formal Approach to Game Design and Game Research. Paper presented at Challenges in Game AI Workshop, Nineteenth National Conference on Artificial Intelligence, San Jose, CA.
[68] Siegal, D, (2015), Brainstorm: *The Power and Purpose of the Teenage Brain*. PUBLISHER…,. Robert also mentions: Steinberg, Cozzalino, Immordino-Yang, Ito, others
[69] Add productive struggle reference – one of Gabbie's papers?
[70] Siegal, D, (2015), Brainstorm: *The Power and Purpose of the Teenage Brain*

[71] Search Institute, http://www.search-institute.org/sites/default/files/a/Dev-Relationships-Framework.pdf. Downloaded on XXXX.

[72] Can cite Steinberg's "Adolescence" – "During the psychosocial moratorium, the adolescent can experiment with different roles and identities in a context that permits and encourages exploration. The experimentation involves trying on different postures, personalities, and ways of behaving…" Steinberg, Laurence. Adolescence (Pages 220-221). McGraw-Hill Higher Education. Kindle Edition.