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**Curiosity and Video Gaming: How Curiosity Relates to Video Gaming Preferences,  
Engagement, and Addiction**

A Thesis Submitted to  
The School of Social and Health Sciences of James Cook University

By

Yow Yong Jie (Mr)  
BSc. Psychology (Hons)

In Partial Fulfilment of the Requirements for the Degree of  
Doctor of Philosophy (Health)

November 2024

### **Acknowledgements**

I would like to express my gratitude to my supervisory panel, Associate Professor Jonathan Ramsay, Dr Patrick Lin, and Professor Nigel Marsh, for their guidance, insight, and encouragement. Their patient and easy-going personalities have also contributed greatly to my PhD journey being a smooth one. I have thoroughly enjoyed all the discussions and meetings we had, and the chit-chat sessions even more.

To my fellow HDRs, Elsie, Alif, Marc, Arushi, Da Xuan, Kitty, Ratna, Hina, and Aliff, thank you for your friendship and for making this experience a less lonely one. I would also like to thank the students whom I have had the pleasure of meeting and teaching, for pushing me to be a better educator.

I am incredibly grateful towards my parents for their unwavering support in me pursuing a PhD. Their love and care has been an invaluable source of strength. To Yong Hui, Hui Qi, and Jun Wei, thank you for keeping me going, and constantly buying me meals.

Last but not least, I would like to thank Li Xuan. She has been a huge pillar of moral and emotional support throughout this journey, and has never doubted my ability to succeed. Through celebrating the highs and simply being there during the lows, her presence is deeply appreciated. Her name deserves to go on this thesis just as much as mine.

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**Statement of Contribution of Others**

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|                      | Intellectual support     | Dr Patrick Lin (James Cook University, Singapore)   |
| Financial support    |                          | Prof Nigel Marsh (James Cook University, Singapore) |
|                      | Tuition fee waiver       | James Cook University, Australia                    |
|                      | Scholarship stipend      | James Cook University, Australia                    |
| Research support     | Minimum resource funding | James Cook University, Australia                    |
|                      | Administrative support   | Ms Belinda Lee, James Cook University, Singapore    |

**Publications Associated with Thesis****Published*****Chapter 3***

Yow, Y. J., Ramsay, J. E., Lin, P. K. F., & Marsh, N. V. (2022). Dimensions, measures, and contexts in psychological investigations of curiosity: A scoping review. *Behavioral Sciences*, 12(12), 493. <https://doi.org/10.3390/bs12120493>

***Chapter 5***

Yow, Y. J., Ramsay, J. E., Lin, P. K. F., & Marsh, N. V. (2024). From thrill seekers to social creatures: dimensions of curiosity differentially predict video game preferences and behaviours. *Behaviour & Information Technology*, 1–13.  
<https://doi.org/10.1080/0144929X.2024.2376869>

**In Preparation**

Yow, Y. J., Ramsay, J. E., Lin, P. K. F., & Marsh, N. V. Validation of the Five-dimensional Curiosity Scale Revised: A Southeast Asian perspective.

Yow, Y. J., Ramsay, J. E., Lin, P. K. F., & Marsh, N. V. Curiosity killed the cat—dimensions of curiosity differentially relate to video gaming addiction and engagement.

## Table of Contents

|                                                                                            |             |
|--------------------------------------------------------------------------------------------|-------------|
| <b>Acknowledgements .....</b>                                                              | <b>ii</b>   |
| <b>Access Declaration .....</b>                                                            | <b>iii</b>  |
| <b>Ownership Declaration.....</b>                                                          | <b>iv</b>   |
| <b>Declaration of the use of Generative AI.....</b>                                        | <b>v</b>    |
| <b>Statement of Contribution of Others .....</b>                                           | <b>vi</b>   |
| <b>Publications Associated with Thesis .....</b>                                           | <b>vii</b>  |
| <b>Table of Contents .....</b>                                                             | <b>viii</b> |
| <b>List of Tables.....</b>                                                                 | <b>xiii</b> |
| <b>List of Figures.....</b>                                                                | <b>xiv</b>  |
| <b>Abstract.....</b>                                                                       | <b>xv</b>   |
| <b>Chapter 1: Introduction .....</b>                                                       | <b>1</b>    |
| The Origins of Video Gaming.....                                                           | 2           |
| The Study of Video Games—Game Genres .....                                                 | 3           |
| The Study of Video Games—Separating Addiction From Engagement.....                         | 5           |
| Curiosity as an Antecedent to Video Gaming .....                                           | 7           |
| From Being Curious to Playing Video Games.....                                             | 8           |
| Objectives and Structure of Thesis .....                                                   | 10          |
| <b>Chapter 2: Literature Review .....</b>                                                  | <b>13</b>   |
| Classifying Video Games: The Use of Genres.....                                            | 13          |
| Classifying Video Games: Structural Characteristics of a Video Game .....                  | 15          |
| Disordered Video Gaming .....                                                              | 21          |
| Distinguishing Between Disordered Video Gaming and Engagement .....                        | 25          |
| An Antecedent to Video Gaming Engagement and Addiction: Curiosity.....                     | 28          |
| Curiosity as a Sub-dimension of a More General Construct .....                             | 32          |
| Contexts of Curiosity .....                                                                | 38          |
| The Links Between Curiosity and Video Gaming Preferences, Motivation, and Behaviours ..... | 40          |
| <b>Conclusion .....</b>                                                                    | <b>44</b>   |
| <b>Chapter 3: Dimensions, Measures, and Contexts of Curiosity—A Scoping Review .....</b>   | <b>47</b>   |
| Rationale and Aims .....                                                                   | 48          |
| Method .....                                                                               | 48          |

|                                                                                                                  |           |
|------------------------------------------------------------------------------------------------------------------|-----------|
| Framework .....                                                                                                  | 48        |
| Inclusionary Criteria .....                                                                                      | 49        |
| Search Strategy .....                                                                                            | 49        |
| Article Screening .....                                                                                          | 50        |
| Data Extraction .....                                                                                            | 53        |
| Results.....                                                                                                     | 53        |
| Demographics and General Characteristics .....                                                                   | 53        |
| Dimensionality of Curiosity.....                                                                                 | 54        |
| Measures of Curiosity .....                                                                                      | 57        |
| Contexts of Curiosity .....                                                                                      | 59        |
| Discussion .....                                                                                                 | 60        |
| Geographical Location.....                                                                                       | 60        |
| Dimensionality and Measurement of Curiosity .....                                                                | 62        |
| Context of Curiosity Research .....                                                                              | 65        |
| Limitations and Future Research .....                                                                            | 68        |
| Conclusion .....                                                                                                 | 70        |
| <b>Chapter 4: Validation of the Five-Dimensional Curiosity Scale Revised—A Southeast Asian Perspective .....</b> | <b>73</b> |
| Curiosity in Non-Western Contexts .....                                                                          | 73        |
| The Present Study .....                                                                                          | 75        |
| Method .....                                                                                                     | 75        |
| Participants.....                                                                                                | 75        |
| Design and Analysis.....                                                                                         | 76        |
| Measures .....                                                                                                   | 77        |
| Five-Dimensional Curiosity Scale Revised (5DCR) .....                                                            | 77        |
| Mini-International Personality Item Pool (IPIP).....                                                             | 77        |
| Twenty Item Values Inventory (TwIVI).....                                                                        | 78        |
| Depression, Anxiety, and Stress Scales (DASS-21) .....                                                           | 78        |
| Subjective Happiness Scale .....                                                                                 | 78        |
| Situating Wise Reasoning Scale (SWIS).....                                                                       | 79        |
| Short Warwick Edinburgh Mental Wellbeing Scale (SWEMWBS) .....                                                   | 79        |
| Procedure .....                                                                                                  | 81        |
| Results.....                                                                                                     | 82        |

|                                                                                             |            |
|---------------------------------------------------------------------------------------------|------------|
| Confirmatory Factor Analysis (CFA).....                                                     | 82         |
| Reliability and Descriptive Statistics .....                                                | 86         |
| Construct Validity .....                                                                    | 86         |
| Measurement Invariance .....                                                                | 89         |
| Supplementary Analysis.....                                                                 | 92         |
| Discussion .....                                                                            | 93         |
| <b>Chapter 5: From Thrill-seekers to Social Creatures: Dimensions of Curiosity</b>          |            |
| <b>Differentially Predict Video Game Preferences and Behaviours .....</b>                   | <b>96</b>  |
| Multidimensional Curiosity, Playtime, and Video Game Structural Characteristics .....       | 96         |
| The Present Study .....                                                                     | 102        |
| Method .....                                                                                | 102        |
| Participants.....                                                                           | 102        |
| Measures .....                                                                              | 103        |
| Five-Dimensional Curiosity Scale Revised (5DCR) .....                                       | 103        |
| Gaming Behaviour Survey.....                                                                | 104        |
| Video Game Structural Characteristics Survey (VGSC) .....                                   | 104        |
| Procedure .....                                                                             | 105        |
| Design and Analysis.....                                                                    | 105        |
| Results.....                                                                                | 105        |
| Descriptive Statistics.....                                                                 | 106        |
| Confirmatory Analyses .....                                                                 | 106        |
| Association Between Curiosity and Gaming Hours .....                                        | 106        |
| Association Between Curiosity and Gaming Behaviours .....                                   | 107        |
| Exploratory Analyses .....                                                                  | 108        |
| Discussion .....                                                                            | 110        |
| <b>Chapter 6: Curiosity Killed the Cat—Dimensions of Curiosity Differentially Relate to</b> |            |
| <b>Video Gaming Addiction and Engagement .....</b>                                          | <b>114</b> |
| The Present Study .....                                                                     | 114        |
| Dimensions of Curiosity Predicting Addiction Toward Video Gaming.....                       | 115        |
| Method .....                                                                                | 117        |
| Design .....                                                                                | 117        |
| Measures .....                                                                              | 117        |
| Gaming Addiction Scale (GAS-7) .....                                                        | 117        |
| Procedure .....                                                                             | 118        |

|                                                                                 |            |
|---------------------------------------------------------------------------------|------------|
| Results.....                                                                    | 119        |
| Discussion .....                                                                | 122        |
| <b>Chapter 7: General Discussion .....</b>                                      | <b>125</b> |
| Summary of Chapters .....                                                       | 125        |
| Validating the 5DCR in a Southeast Asian Setting .....                          | 127        |
| Factor Structure and Reliability of the 5DCR.....                               | 127        |
| Construct Validity of the 5DCR.....                                             | 128        |
| Measurement Invariance Between Malaysia, the Philippines, and Singapore .....   | 130        |
| Supplementary Analysis: Inter-country Differences in Curiosity.....             | 131        |
| Associations Between Curiosity and Video Gaming Behaviours.....                 | 133        |
| Predicting Time Spent Video Gaming .....                                        | 133        |
| Joyous Exploration Predicting Enjoyment of Rewarding/Punishing Features .....   | 135        |
| Covert and Overt Social Curiosity Predicting Enjoyment of Social Features ..... | 135        |
| Supplementary Findings .....                                                    | 137        |
| Relationships Between Curiosity and Video Gaming Addiction and Engagement ..... | 139        |
| Stress Tolerance Predicting Video Gaming Addiction.....                         | 139        |
| Social Curiosity Predicting Video Gaming Addiction .....                        | 141        |
| Implications.....                                                               | 142        |
| Literature and Research .....                                                   | 142        |
| For Mental Health Professionals.....                                            | 144        |
| For Industry: Game Designers, Developers, and Advertisers.....                  | 146        |
| Limitations and Future Directions .....                                         | 148        |
| Conclusion .....                                                                | 152        |
| References.....                                                                 | 153        |
| Appendix A .....                                                                | 199        |
| Appendix B .....                                                                | 200        |
| Appendix C .....                                                                | 201        |
| Appendix D.....                                                                 | 202        |
| Appendix E .....                                                                | 203        |
| Appendix F.....                                                                 | 204        |
| Appendix G.....                                                                 | 205        |
| Appendix H.....                                                                 | 206        |
| Appendix I .....                                                                | 207        |

|                  |     |
|------------------|-----|
| Appendix J ..... | 208 |
| Appendix K ..... | 209 |
| Appendix L ..... | 210 |
| Appendix M ..... | 211 |
| Appendix N ..... | 212 |
| Appendix O ..... | 213 |

### List of Tables

|                                                                                                                                    |     |
|------------------------------------------------------------------------------------------------------------------------------------|-----|
| Table 2.1: The Video Game Structural Characteristics Taxonomy (King et al., 2010).....                                             | 18  |
| Table 4.1: Measures, Subscales, and Sample Items of Administered Scales.....                                                       | 80  |
| Table 4.2: Factor Loadings for Items in the Six-factor Structure of the 5DCR.....                                                  | 84  |
| Table 4.3: Means, Standard Deviations, Omega, and Test-retest Coefficients of the<br>5DCR.....                                     | 86  |
| Table 4.4: Construct Validity of the 5DCR.....                                                                                     | 88  |
| Table 4.5: Coefficients for Tests of Measurement Invariance.....                                                                   | 91  |
| Table 4.6: Means and Standard Deviations for Thrill-seeking and Covert Social Curiosity by<br>Country.....                         | 92  |
| Table 5.1: Bivariate Correlations and Predictive Relationship Between Dimensions of<br>Curiosity and Hours Spent Gaming Daily..... | 107 |
| Table 5.2: Bivariate Correlations Between Dimensions of Curiosity and Structural<br>Characteristics of Video Games.....            | 108 |
| Table 5.3: Parameter Estimates of Associations Between Structural Characteristics and<br>Dimensions of Curiosity.....              | 109 |
| Table 6.1: Parameter Estimates of Associations Between the Engagement / Addiction<br>Subscales of the GAS-7 and the 5DCR.....      | 120 |
| Table 6.2: Parameter Estimates of Associations Between Addiction Facets of the GAS-7 and<br>the 5DCR.....                          | 121 |

**List of Figures**

|                                                                              |    |
|------------------------------------------------------------------------------|----|
| Figure 1.1: Flowchart of Thesis.....                                         | 12 |
| Figure 3.1: Flowchart for Selecting Articles Included in Scoping Review..... | 52 |
| Figure 3.2: Dimensionality of Curiosity.....                                 | 55 |
| Figure 3.3: Common Dimensions of Curiosity Examined.....                     | 57 |
| Figure 3.4: Commonly Used Validated Curiosity Measures.....                  | 58 |

### **Abstract**

The psychological construct of curiosity is a basic yet important human trait, which bestows benefits such as improved academic and work performance. However, there have been many different conceptualisations of curiosity, resulting in a plethora of curiosity scales. Moreover, it appears that curiosity is understudied in the context of leisure activities. As such, the first goal of the project was to scope the literature on curiosity to better understand how it has been studied, specifically with regards to its dimensions, measures, and contexts. Results from the scoping review provided the foundation for three more empirical studies, which ultimately aimed to better understand the relationships between curiosity and a massively popular leisure activity—video gaming. The first empirical study validated the most contemporary and comprehensive framework of curiosity—The Five Dimensional Curiosity Scale-Revised (5DCR) in a Southeast Asian context. The second empirical study investigated how dimensions of curiosity predicted video gaming behaviours, including play time and features of games that players enjoy. The third empirical study examined the associations between curiosity and a potential negative consequence of curiosity—video gaming addiction. Overall, results showed that dimensions of curiosity differentially predicted video game preferences and behaviours, as well as gaming addiction. Our findings provide insights into how game developers and advertisers can leverage curiosity to respectively create more engaging video games and advertise more effectively, and how a deeper understanding of the pathways between curiosity and video gaming addiction can present opportunities to lower the prevalence of addiction.

*Keywords:* Curiosity, video gaming behaviours, video gaming addiction

## Chapter 1: Introduction

Time is a limited resource. We allocate this finite resource across many activities, including sleep, paid and unpaid work, school, personal care, and leisure. According to a Time Use survey by the Organisation for Economic Co-operation and Development (OECD), people between the ages of 15 and 64 spent a comparable amount of time between working and leisure activities (Ortiz-Ospina et al., 2020), indicating that leisure activities represent a major domain of human activity. One such recreational activity is video gaming. Playing video games is a hugely popular activity; over the last decade, there has been a steady growing interest in video games (Marston & Azadvar, 2020). In the USA, there were an estimated 214 million video gamers in 2020, and this number has continued to rise since (Entertainment Software Association, 2022). Besides video games simply being fun and engaging, circumstances such as lockdowns and work from home conditions due to COVID-19 could have contributed to this surge in video gamers, by freeing up time to play games. For example, in Singapore, marketing research firm YouGov reported that almost 60% of Singaporean gamers aged 18-24 reported playing more video games post-COVID-19 (Ho, 2020). Beyond the pandemic, the upward trend of video gamers worldwide is projected to increase by a further 400 million users between 2023 and 2027 (Clement, 2023).

Given that video gaming is an increasingly ubiquitous activity that many people partake in, there is also a possibility for players to be addicted. Thus, researchers have also been interested in antecedents of video gaming behaviours. This raises the question of whether individual differences can not only influence the types of games that people enjoy, but also potentially play a role in problematic video gaming. The research described in this thesis examines curiosity as a potential contributing factor. Curiosity is defined as the hunger for knowledge and novel experiences (Wagstaff et al., 2020), and has been implicated as a motivating factor as to why people play games (e.g., Sedano, 2007). Specifically, research

has suggested that the psychological construct of curiosity may be a precursor to both video game enjoyment (e.g., Dahabiyeh et al., 2021) and addiction (e.g., Hsu et al., 2009), although these links have not been thoroughly studied. The present thesis seeks to expand upon the literature on curiosity and video games across four studies (a review and three subsequent empirical studies), with the former two studies focusing on curiosity, while the latter two tackle the relationships between curiosity and video gaming. A better understanding of curiosity as well as how curiosity functions in the video gaming space benefits multiple parties, including game designers, developers, and advertisers, in shaping the design choices that they make to engage players. Also, knowing the associations between curiosity and video gaming addiction can also help to inform clinical practice and provide insights into curiosity-related interventions. The remainder of this chapter will briefly introduce the topic of video games, followed by the psychological construct of curiosity, before concluding with the overall objectives and structure of the thesis.

### **The Origins of Video Gaming**

The first video game can be traced back to 1958. It was created by William Higinbotham, a physicist who worked on the first atomic bomb at Los Alamos Research Laboratory (Kowert & Quandt, 2015). To entertain attendees at an annual visitor's day event, Higinbotham programmed a basic tennis simulation called *Tennis for Two*<sup>1</sup> (Higinbotham & Dvorak, 1958), which accidentally ended up being the first ever video game ever developed. A few years later in 1962, the video game *Spacewar!* was released (Monnens & Goldberg, 2015). *Spacewar!* placed two players in spaceships where the goal was to shoot each other down with torpedoes. While the game was a hit, its popularity was restricted to research labs across the United States since computers at the time were too expensive for the public.

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<sup>1</sup> We went with the stylistic choice to italicise all names of video games and video game companies, as well as the first time that key variables of the project are mentioned.

Regardless, while its original release could not be commercialised, the first coin-operated arcade machines were adaptations of *Spacewar!*. Even in the early days of video gaming, it was evident that there was a focus on competition, and games were often based on simulations of sport or combat.

One example of an arcade game inspired by *Spacewar!* was *Computer Space* (Nutting Associates, 1971). Continuing the trend of a focus on combat, *Computer Space* placed players in control of a rocket while shooting down enemies and avoiding fire. Unfortunately, the game turned out to be a commercial flop as the controls were hard to master, which proved too steep a learning curve for novice players. Learning from this mistake, the follow-up game—*Pong*, arguably kickstarted the video game industry (Egenfeldt-Nielsen et al., 2019). In *Pong*, simple paddles replaced the complex controls of space battles, and instructions for playing could be explained in a single line: “Avoid missing ball for high score” (Lowood, 2009). These changes propelled its developing company, *Atari*, to unprecedented heights. *Atari* made approximately three million dollars in 1973, by 1975 that figure rose to roughly 70 million dollars (Egenfeldt-Nielsen et al., 2019). Since then, revenue from the video gaming industry as a whole has increased rapidly and exponentially. Richter (2022) reported that in 2021, this figure added up to an estimated \$192.7 billion, and eclipsed other popular media industries such as film entertainment, and music.

### **The Study of Video Games—Game Genres**

We now shift focus onto an important and common way that video games have been studied, its limitations, and an alternative that could provide additional insights. As the gaming industry grew and evolved, many games outside the realm of competition, sports, and combat were developed. Companies then needed a way to differentiate games from one another, which could also help with commercial marketing and therefore business success. One method of classifying games is through the use of genres. Genre classification is popular

and has been used across different forms of media. For instance, genre was listed as the second most common reason why people buy books (the first being the author); genre was also reported as the most important factor when people were deciding whether to watch a movie (Clarke et al., 2015). Similarly, using video game genres served as a good marketing tool, allowing consumers to easily narrow down the list of video games that they might purchase (Lee et al., 2015). Common genres include action adventure, board or card games, casual, education, fighting, flight, massively multiplayer online role-playing games (MMORPG), music, party, platformer, puzzle, racing, real-time strategy, role-playing (RPG), shooters, simulation, sports, text adventure, and turn based strategy (Peever et al., 2012). These genres can also sometimes be further broken down into sub-genres. For instance, a shooter game can be divided into either a first-, or third- person shooter.

As technology has progressed and digital marketing has evolved, publishers have sought to find ever more targeted ways of characterising individual preferences, and linking game genres to dimensions of personality (including curiosity; further discussed in the subsequent sections) represents one promising avenue. For example, a study by Qiu et al. (2012) reported that online user-generated content can be used to extract information about an individual's personality. Knowing one's personality might then allow advertisers to engage in targeted marketing. Such an approach has proven to be successful—Hirsh et al. (2012) found that advertisements were rated more positively when they were tailored to an individual's personality. In the same vein, being able to link personality to genres of games that players prefer can also enhance sales. Accordingly, research has been conducted involving the use of video game genres, such as the relationships between personality and gaming genres (Peever et al., 2012). For example, Graham and Gosling (2013) found that players of an MMORPG—*World of Warcraft* (Blizzard Entertainment, 2004)—displayed higher levels of extraversion and neuroticism compared to agreeableness and

conscientiousness. Another study conducted by Lesmana et al. (2021) revealed that first-person shooter players possessed very low extraversion, agreeableness, conscientiousness, and openness, but have high neuroticism, compared to non-first-person shooter game players. However, findings from the above studies could be distorted by the fact that often times, a video game does not fit into a single genre. In the case of *Cyberpunk 2077* (CD Projekt RED, 2020), it was primarily marketed as a role-playing game, but in fact the game contains elements of an action game, a simulation game, a role-playing game, and a first-person shooter. As such, pegging modern games to a single genre could be somewhat reductive. This points to a need for alternative ways to capture the nuances of video gaming, which would provide additional insights into specific elements of games that players enjoy.

### **The Study of Video Games—Separating Addiction From Engagement**

Another area of focus in video gaming research pertains to the consequences of playing video games. Given the rising popularity of video gaming, concerns of problematic gaming have also increased (Kim et al., 2022). Gaming disorder has officially been recognised in the International Classification of Diseases (ICD) 11<sup>th</sup> revision (WHO, 2019), as well as given a provisional status that warranted further research in the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition (DSM-5; American Psychiatric Association, 2013). Problematic gaming is characterised by persistent gaming behaviour, a loss of control over gaming, and marked by the negative impact gaming has on an individual's functioning (Saunders et al., 2017). The negative effects of disordered gaming are well documented, including poorer quality of life (Lim et al., 2016), lapses in decision making (Nuyens et al., 2017), low self-esteem (Király et al., 2014), and psychopathology including anxiety and depression (Brand et al., 2014; Van Rooij et al., 2014). While it is evident that playing video games excessively is harmful, recent studies have pointed out that this may not always be the case.

As outlined in the previous paragraph, individuals suffering from problematic video gaming often face negative consequences. However, it is important to separate the concept of addiction from the intense but ultimately benign notion of engagement, where highly involved gamers do not experience the adverse ramifications (Deleuze et al., 2018). Conflating addiction and engagement, or mistaking one for the other is likely to lead to overestimating the prevalence of gaming addiction (Charlton & Danforth, 2007). Previous research has supported the view that video game engagement may not always lead to impairment in one's life. For instance, Lehenbauer-Baum and Fohringer (2015) found that depression was significantly linked to addiction, rather than engagement. Lehenbauer-Baum and Fohringer (2015) also found that engaged gamers were physically and psychologically healthier compared to addicted gamers, further illustrating the differences between video gaming addiction and engagement when concerning mental health outcomes.

The need to distinguish between addiction and engagement has been an area of contention in the psychometric measurement of video game addiction. One of the more popular scales—the shortened version of the Gaming Addiction Scale (GAS-7; Lemmens et al., 2009)—was originally developed to measure game addiction, based on the DSM criteria for pathological gambling (salience, tolerance, mood modification, withdrawal, relapse, conflict, and problems). While the GAS-7, based on multiple reviews, has been found to be psychometrically sound and has garnered greater empirical support compared to other gaming addiction scales (King et al., 2020; Yoon et al., 2021), there were critiques that some of the seven subscales did not measure addiction. Specifically, researchers have pointed out that the subscales of salience, tolerance, and mood modification, instead measure engagement with video games, rather than addiction (e.g., Ferguson et al., 2011). This calls into question whether it is appropriate to examine problematic gaming by subsuming both the addiction

and engagement subscales into one; more research focusing specifically on the addiction facets is needed to better understand the negative effects of disordered gaming.

### **Curiosity as an Antecedent to Video Gaming**

As alluded to in the earlier sections, individual differences in personality have been investigated for the role that they play in shaping preferences for playing certain types of video games. Research has also uncovered factors that drive individuals toward video gaming in general. One such important motivating factor of gaming that has been implicated is curiosity. Curiosity has a positive relationship with time spent engaging with any subject matter of interest. For instance, when individuals are curious about something, they assign more attention toward it, and spend more time engaging in activities surrounding it (Yang et al., 2020). In the context of video games, this interest and the desire to find out and explore more about a game then leads to immersion in the virtual world, narrative, or even just novel stimuli. For a video game to be popular and successful, it must be able to pique gamers' curiosity and maintain it. Thus, curiosity is a concept frequently used by game designers because it drives player engagement and keeps people deeply involved with a game (Schaekermann et al., 2017).

In the short term, curiosity prompts one to engage in new experiences. Doing so consistently over time drives knowledge acquisition and the development of competencies (Kashdan et al., 2018). From being captivated by global issues to being interested in what other people think, individuals exhibit varying levels of curiosity across a multitude of settings and contexts. Research has shown that being curious comes with many benefits, including academic success, better job performance, and improved well-being (Lydon-Staley et al., 2019; Musell, 2013; Tang & Salmela-Aro, 2021). For example, in the education sector, curiosity has been linked with better academic performance through improved memory and academic persistence (Kang et al., 2009; Smalls et al., 2007). At the workplace, being curious

associates with better acceptance of feedback (Harrison & Dossinger, 2017) and greater creativity (Chang & Shih, 2019), both of which are common correlates of job performance.

Given the boons of curiosity, it is not surprising that researchers have conducted thorough examinations of its structure, dimensionality, and measures. However, the contemporary study of curiosity as a psychological construct remains fragmented. Firstly, the current literature conceptualises curiosity in different ways. For example, curiosity has been studied as a facet-level personality construct under the broad trait of openness to experience, such as in the revised NEO Personality Inventory (NEO-PI-R; Costa & McCrae, 2008). Scholars who focused specifically on curiosity have also variously conceptualised it as being unidimensional (e.g., Marvin & Shohamy, 2016) or as multidimensional (e.g., Kashdan et al., 2009), with the latter conceptualisation having many different possible structures and domains, ranging from two (e.g., Litman, 2008) to six factors (Kashdan et al., 2020). Secondly, to add on to the confusion, some researchers investigated specific dimensions of curiosity (e.g., social curiosity; Amorim Neto et al., 2022), while others ultimately ignore the inherent multidimensionality and used aggregated total scores in their research (e.g., Halamish et al., 2019). Thirdly, the disjointed conceptualisation of curiosity has resulted in a plethora of curiosity measures. According to Wagstaff et al. (2020), over 30 measures of curiosity exist in the literature. As a result, it can be difficult to select a “best” measure to administer when seeking to examine the antecedents, correlates, and consequences of curiosity.

### **From Being Curious to Playing Video Games**

Studies have hinted at the importance of curiosity for understanding both benign and problematic video gaming. Sedano et al. (2007) identified curiosity as one of the critical elements in prolonged engagement with mobile games, and found that curiosity was the main driving factor behind participants’ motivation to complete a game. Dahabiyeh et al., (2021)

also found that higher levels of curiosity led to lowered perceived risk (e.g., compromising privacy) in playing an online game, but increased intention to play it, demonstrating how curiosity can affect video gaming preferences. Similarly, Gómez-Maureira and Kniestedt (2019) reported that exploration and social simulation games were more effective in piquing the curiosity of video gamers, compared to other genres such as strategy games. However, the authors noted that certain nuances could be missed out on when using genre labels, and recommended for future research to examine design features of games instead. Nevertheless, it appears that curiosity does influence the types of games that players enjoy.

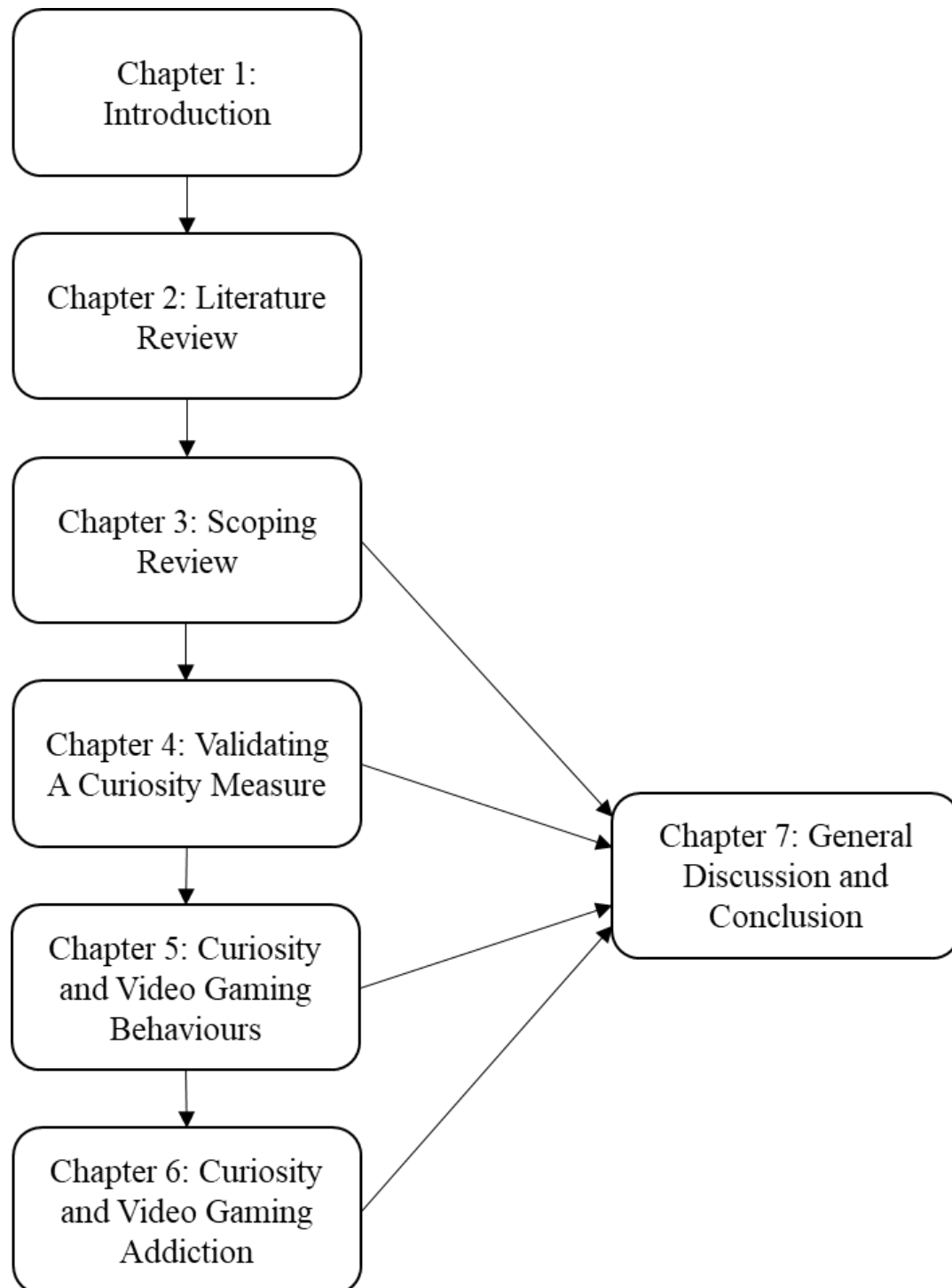
Another study also found that flow (the enjoyable experience that people feel when they act with total involvement) predicted online gaming addiction. While flow is typically positive in nature, it may not be beneficial if it leads to being overly engrossed in games. Incidentally, curiosity was also put forward as both a component and prerequisite of flow (Trevino & Webster, 1992; Yilmaz & Tunca, 2024). While the exact role of curiosity is unclear, these findings are suggestive of elevated risk among more curious individuals. In another study, Hsu et al. (2009) sought to better understand video game addiction (specifically online role-playing games) from a user experience perspective. They hypothesised that individuals who were curious would be motivated to play, resulting in a higher probability of becoming addicted. In line with expectations, results found that curiosity positively predicted online role-playing game addiction (Hsu et al., 2009).

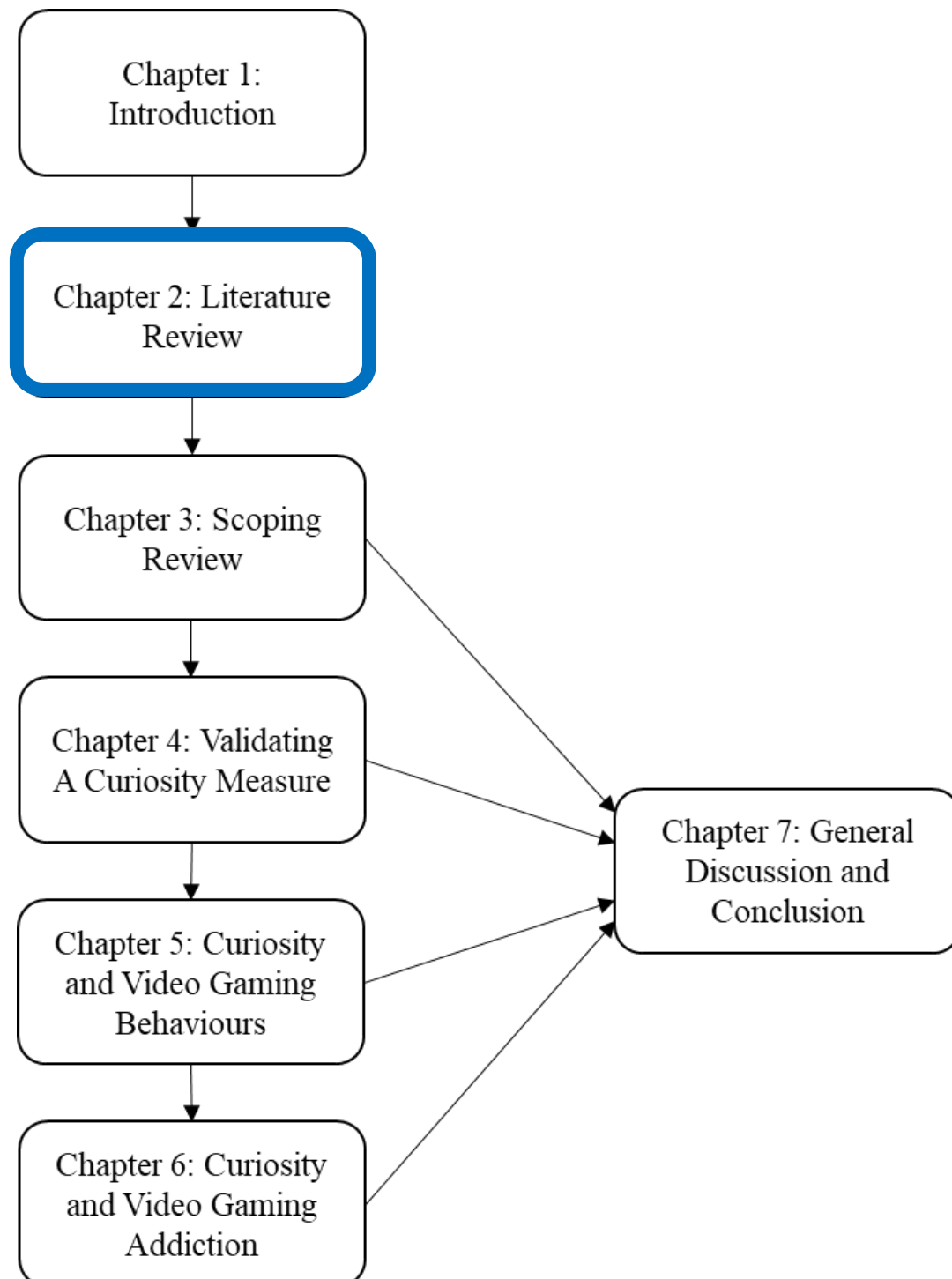
While making significant contributions to the literature, these studies do suffer from some significant limitations. Firstly, they all conceptualised and measured curiosity differently, which might confuse researchers on the best way to capture curiosity. Furthermore, this makes it difficult to compare and integrate findings across studies. This underscores the need to identify the most common, contemporary, and appropriate conceptualisation and measure of curiosity in the literature. Secondly, the labels given to

video games (e.g., mobile phone games, online games, online role-playing games) share certain commonalities with one another, but are less telling of the specific characteristics and elements that appeal to gamers. Thirdly, studies often conflate problematic video gaming and simply video gaming engagement, thus raising questions on the robustness of their results. It is these gaps in the curiosity and video gaming literature that the present research seeks to address.

### **Objectives and Structure of Thesis**

The overall goal of the current project is to provide a detailed and nuanced account of the relationships between curiosity and video gaming preferences and problematic video gaming. This chapter (Chapter 1) introduces the key variables of the project, highlighting the central issues regarding research on video gaming behaviours, the psychological construct of curiosity, as well as the interplay between them. Chapter 2 provides a review of the literature on video gaming and curiosity. Chapter 3 presents a scoping review that summarises the existing literature on the dimensionality, measures, and contexts of curiosity. In chapter 4, we validate a comprehensive and contemporary framework of curiosity in Southeast Asia. This is necessary as the majority of curiosity research has been conducted in Western contexts (Yow et al., 2022), which speaks to the need for curiosity to be examined more thoroughly in non-Western contexts. In Chapter 5, given that curiosity serves as an important motivational factor to play games, we further examine the relationships between these two constructs, by accounting for the multidimensionality of curiosity, as well as focusing on structural characteristics of video games, instead of genres. This particular study also addresses the lack of research investigating how curiosity functions in more informal activities (Yow et al., 2022). Chapter 6 investigates how curiosity relates to video gaming addiction. Chapter 7 consolidates the key findings from Chapters 3 to 6 and discusses their implications for future research. Figure 1.1 depicts a conceptual diagram of the overall thesis.

**Figure 1.1***Flowchart of Thesis*



## Chapter 2: Literature Review

This chapter is divided into three sections. The first provides a review of video games, particularly of how video games have been categorised via the use of genres, its limitations, and an alternative to them. We then examine how the use of structural characteristics of a video game, and players' enjoyment of these characteristics can potentially circumvent the challenges presented by genre labels. We also propose that one of the most important motivations and antecedents for playing games may be the psychological construct of curiosity. Accordingly, the second part of this chapter reviews the literature on the psychological construct of curiosity, specifically on its dimensionality, measures, and contexts. The third section discusses existing literature on the relationship between curiosity and video gaming motivations, preferences, and behaviours.

### Classifying Video Games: The Use of Genres

Genre classification is a common framework used to categorise creative works. From the gaming industry's point of view, it is critical to tag genres to video games as it facilitates marketing, allowing consumers to easily narrow down the games that interest them (Lee et al., 2015). As a result, gamers learned to identify as fans of a certain genre over another, and publishers created product plans based entirely on them (Adams, 2009). Likewise, physical retailers followed the trend and organised their shelves based on genres (Cășvean, 2016). Even to this day, with the decline of physical video game stores and rise of online video game stores such as *Steam* (Valve, 2003) and *Epic Games Store* (Epic Games, 2016), genre remains the foremost method of classifying video games.

Since the inception of gaming genres, there has been no consensus on how many genres exist in the video gaming sphere. For example, an early attempt by Crawford (1982) differentiated games into "skill-and-action", and "strategy" games. Skill-and-action games included racing and combat games, and strategy games encompassed role-playing and

adventure games. While not explicitly stated, this classification also hinted at the presence of sub-genres of games. In 2001, Wolf sought to cover the whole video game genre spectrum and proposed 42 categories of video games (2001). Even so, it came under criticism for an overreliance on older games to label genres, thus missing out on newer and more contemporary genres, such as MMORPGs and First-person Shooters (Clearwater, 2011). This highlighted a further challenge in using video game genres, in that existing genres could not keep pace with the release of more sophisticated and advanced video games, suggesting that genres need to be constantly updated, or a different system should be used to categorise video games.

Other researchers used differing numbers of genres, including 3 (Whalen, 2004), 4 (Apperly, 2006), 5 (Choi et al., 2020), 14 (Lenhart et al., 2008), up to 42 (Wolf, 2001). Of note, Aasaeth et al. (2003) attempted to develop a taxonomy of genres that tried to cater to game developers, journalists, scholars, and players. They proposed five categories: space, time, player structure, control, and rules. However, these genres were seen as being too abstract, and the terminology used were unfamiliar to gamers, developers, and publishers alike. Thus, contrary to bridging the disconnect between different stakeholders, it instead widened the gap. Overall, this further cemented the fact that there is little to no consensus on the conceptualisation of genres. It also suggested that different stakeholders in the gaming industry have different ideas of what game genres should encompass.

A secondary problem can be seen by the fact that modern games often do not fit into a single genre. Gros (2007) identified seven genres, namely action, adventure, fighting, role-playing, simulations, sports, and strategy. However, it was acknowledged that the seven-genre typology could be difficult to apply, as games sometimes fall into multiple genres. For example, most sports games also contain elements and information on managing a sports team, and trying to win tournaments or leagues. Thus, it is arguable that on top of being a

sports game, it could also be categorised as a simulation, and/or strategy game (Gros, 2007). Another example can be seen from the ever popular *Minecraft* (Mojang 2009), which is concurrently tagged with many different genres, depending on the source. On Wikipedia, it is listed as a sandbox and survival game; on popular gaming websites such as Gamespot it is classified as a 3D, Adventure, and First-person game; on Google it is categorised as a third-person shooter, fighting, indie, action-adventure, and nonlinear gameplay game. Another recent popular video game released was *Cyberpunk 2077*, which was marketed as a role-playing game, but could simultaneously be an action game, a driving game, and a first-person shooter (CD Projekt RED, 2020).

Overall, the use of video game genres has been beneficial for game developers, game retailers, and gamers alike. However, as the video gaming industry continues to innovate and improve, the use of genres has somewhat stagnated and could potentially be a hindrance instead. Applying multiple genre labels to a single game confuses the game's identity and consumers looking to purchase games such as *Minecraft* (or similar titles) do not know which genre to look under (Clark et al., 2015). Moreover, this could present an issue for scholarly research as different researchers make use of different conceptualisations of genres (both in numbers and genre labels), potentially distorting results and making findings difficult to compare across studies.

### **Classifying Video Games: Structural Characteristics of a Video Game**

With the rise of multiple-genre video games and “hybrid” video games (Dale & Green, 2017), there may be better ways to understand player preferences in video games. (Hartanto et al., 2021). Rather than looking at genres, another approach may be to look at specific features of a game, and the characteristics of a game which appeal to players. Early findings from Griffiths and Hunt (1995) indicated that adolescents' main reasons for playing video games included graphics, sound effects, and number of levels, suggesting that further

investigation of the structural characteristics of video games was warranted. Despite growing anecdotal evidence on the importance of structural characteristics, there remained a lack of empirical research in this area.

Interestingly, some research has shown significant overlap between video gaming and gambling, particularly in their structural characteristics (King & Delfabbro, 2018; Prasad et al., 2020). For instance, Wood et al. (2004) drew inspiration from the well-established literature on structural characteristics in gambling and found that both activities provide visual and auditory rewards for winning via reinforcement schedules. With a sample of 382 self-selected video gamers, findings from Wood et al. (2004) revealed that a high degree of realism (realistic sound, graphics, and setting), character development, the ability to customise the game, and multiplayer features were the most essential features that appeal to gamers.

Building on Wood et al.'s (2004) work, King et al., (2010) proposed a five-factor taxonomy of video game structural characteristics (social features, manipulation and control features, narrative and identity features, reward and punishment features, presentation features) that players enjoy within a video game. *Social features* refer to how players communicate with one another in video games, and the factors that create both a cooperative and competitive community. *Manipulation and control features* pertain to how a gamer interacts and controls in-game functions. Additionally, this feature also relates to feelings of mastery and control, such as being able to reload saved games to retry levels. *Narrative and identity features* allow players to adopt the identity of a fictional character or a creation of a self-made one, and how storytelling elements serve to engage the player. In *reward and punishment features*, players' behaviours are reinforced (i.e., players kept immersed in a game by rewarding wins and punishing losses. Finally, *presentation features* refer to the aesthetics of a video game, including graphics, audio, and in-game advertisements. Each of

these features included sub-features, which further demonstrated specific characteristics of video games that appeal to players (Table 2.1).

**Table 2.1***The Video Game Structural Characteristics Taxonomy (King et al., 2010)*

| Feature                           | Sub-features                   | Example                                         |
|-----------------------------------|--------------------------------|-------------------------------------------------|
| Social features                   | Social utility                 | In-game voice and chat via text                 |
|                                   | Social formation/institutional | Guilds/clans                                    |
|                                   | Leaderboard                    | “Hall of fame” high score list                  |
|                                   | Support network                | Internet forums                                 |
| Manipulation and control features | User input                     | “Combos”, “hot keys”                            |
|                                   | Game saving                    | Checkpoints, quick-saving                       |
|                                   | Player management              | Managing various in-game currency and resources |
|                                   | Non-controllable               | Scripted events, loading screens                |
| Narrative and identity features   | Avatar creation                | Choice of sex, attribute points                 |
|                                   | Storytelling device            | Cutscenes, mission briefing                     |
|                                   | Theme and genre                | “Role-playing”, “shooting”                      |

| Feature                        | Sub-features                 | Example                                       |
|--------------------------------|------------------------------|-----------------------------------------------|
| Reward and punishment features | General reward               | Experience points                             |
|                                | Punishment                   | Losing a life, restarting levels              |
|                                | Meta-game reward             | Achievement points, trophies                  |
|                                | Intermittent reward          | Increasing difficulty of levels               |
|                                | Negative reward              | Repairing equipment and items                 |
|                                | Near miss                    | Difficult boss at end of level                |
|                                | Event frequency and duration | Unlimited replayability of level              |
| Presentation features          | Payout interval              | Instant rewards for playing/logging into game |
|                                | Graphics and sound           | Realistic graphics, high tempo music          |
|                                | Franchise                    | Trademarked names, such as Mario              |
|                                | Explicit content             | Violence, drug use, nudity                    |
|                                | In-game advertising          | Real-life brands, sponsor logos               |

Subsequently, an empirical study utilising the above framework was carried out (King et al., 2011), with 421 gamers. Findings revealed that reward and punishment features were the most enjoyable. Simultaneously, gamers also enjoyed interacting with narrative elements in the games that they play, managing in-game sources, and overall obtaining a mastery over a video game. Multiple regression analyses also showed that the structural characteristics were better predictors of certain video gaming behaviours (problematic gaming in this case) above and beyond factors such as age, gender, and time spent playing.

Other taxonomies that instead focused on players have also been developed as alternatives to the structural characteristics as proposed by King et al. (2010). Westwood and Griffiths (2010) funnelled 40 gamers' responses on a Q-sort task into six unique types of gamers, each with differing preferences. The types include (a) casual gamers, who prefer less lengthy mission based games with good graphical fidelity; (b) social gamers, whose preferences lean toward gaming with others; (c) solo limited gamers, who in contrast to the social gamers, like to play on their own; (d) solo control/identity gamers, who have a particular inclination towards role-playing games, with an emphasis on character choice and development; (e) story-driven solo gamers, who enjoy narratives in games; and (f) hardcore online gamers, who are characterised by their preference for online games, and duration of games played (18 hours a week on average, as opposed to 12 hours a week on average for social gamers).

Yee (2006) focused on the motivations of MMORPG players and developed a three-factor taxonomy, comprising of achievement (desire to advance one's status in-game), social (building relationships and cooperation with others), and immersion (discovering new things, and customising one's character). Quick et al. (2012) sought to expand the literature by incorporating elements of personality into their research on structural characteristics. These authors argued that previous research overly focused on more devoted gamers, and only on

specific types of games (e.g., MMORPGs; Yee, 2006). Their taxonomy that sought to encompass and represent a wider range of gamers and their associated preferences included six factors (fantasy, exploration, fidelity, companionship, challenge, and competition). Consistent with past findings, Quick et al. (2012) reported that their six factors theoretically overlapped with the three from Yee (2006), where competition and challenge pertains to achievement, companionship matches the social aspect, and fantasy and exploration relates to immersion. This adds credence to the construct validity of video gamers' motivations, and what they enjoy in games.

In sum, evidence suggests that the use of structural characteristics of video games can at least partially compensate for the shortcomings of using genre labels, by focusing on specific aspects of a video game that players enjoy, thus leading to more meaningful and comparable findings. Through this lens, there have been numerous taxonomies of how structural characteristics and features can be studied. It is worth noting that of the taxonomies presented above, it appears that the one developed by King et al. (2010) might be the most robust. Westwood and Griffith's (2010) taxonomy derived from Q-sort methodology has not been further examined empirically, while three-factor taxonomy by Yee (2006) only focused on MMORPG players. The taxonomy by Quick et al. (2012) suffered from a relatively small sample size, and participants were mainly infrequent gamers (Griffiths & Nuyens, 2017). It was also pointed out that Quick et al. failed to identify manipulation and control factors, which evidence points to as an important factor for video game enjoyment (Griffiths & Nuyens, 2017). This calls into question the generalisability of their results, especially in terms of the gamers who play more and for longer durations.

### **Disordered Video Gaming**

There is good reason why researchers often focus on the more "hardcore" (i.e., individuals who are persistent towards gaming and duration of gaming sessions) gamers.

These video gamers are more likely to suffer from problematic video gaming and thus, a host of negative consequences (Saunders et al., 2017). As outlined in Chapter 1, these maladaptive effects include poorer quality of life (Lim et al., 2016), lapses in decision making (Nuyens et al., 2017), low self-esteem (Király et al., 2014), and psychopathology including anxiety and depression (Brand et al., 2014; Van Rooij et al., 2014). Gaming disorder has officially been recognised in the International Classification of Diseases 11<sup>th</sup> revision (ICD-11; WHO, 2019), as well as given a provisional status that warrants further research in the Diagnostic and Statistical Manual of Mental Disorders, 5<sup>th</sup> edition (DSM-5; American Psychiatric Association, 2013). The ICD-11 provides three guidelines for meeting the criteria of gaming disorder, namely impaired control, increasing the priority of gaming in daily life, and continued use despite harm. The DSM-5 criteria included nine factors (preoccupation, withdrawal, tolerance, unsuccessful attempts to stop/limit, loss of interests due to gaming, continued use despite harm, deception, escape, and harm). According to King et al. (2020), there are a total of 32 measures of gaming disorder, but these tools provide inconsistent coverage of all the symptoms as proposed by both the ICD-11 and DSM-5, raising questions on which is the optimal measure of gaming disorder.

King et al. (2020) evaluated all 32 tools used to measure gaming disorder. Their systematic review included 320 empirical research articles, and the authors scored each of the 32 measures on the following criteria: DSM-5 and ICD-11 coverage, whether there were cut-off scores to determine disordered gaming, examinations of dimensionality, validation samples, longitudinal and prevalence data, evidence of reliability (internal consistency) and validity (test-retest, criterion), test refinement, impairment, and structured interview. Based on the results, there were five gaming disorder tools that fulfilled more of the scoring criteria compared to others (see King et al., 2020, for a review of the remaining 28 measures). The five were the (a) Gaming Addiction Scale – 7 items (GAS-7; Lemmens et al., 2009); (b)

Internet Gaming Disorder Scale-9 Short Form (IGDS9-SF; Pontes & Griffiths, 2015); (c) Internet Gaming Disorder Test-10 items (IGDT10; Király et al., 2017); (d) Young Diagnostic Questionnaire (YDQ; Young, 1998),; and (e) Internet Gaming Disorder – 9 items (IGD-9; Lemmens et al., 2015).

The GAS-7 (Lemmens et al., 2009) comprises seven items, one each for the criteria of *salience* (“Did you think about playing a game all day long”), *tolerance* (“Did you spend increasing amounts of time on games”), *mood modification* (“Did you play games to forget about real life”), *relapse* (“Have others unsuccessfully tried to reduce your game use”), *withdrawal* (“How you felt bad when you were unable to play”), *conflict* (“Did you have fights with others over your time spent on games”), and *problems* (“Have you neglected other important activities to play games”). Items are rated on a 5-point Likert scale ranging from 1 (*never*) to 5 (*very often*), with higher scores indicating higher levels of each of the subscales. An individual is said to have gaming disorder if they indicate at least a 3 (i.e., *sometimes*) on at least four of the seven items.

The IGDS9-SF (Pontes & Griffiths, 2015) is a nine-item measure (e.g., “Do you systematically fail when trying to control or cease your gaming activity”) that adopted the nine criteria of gaming disorder as set out by the DSM-5 (preoccupation, tolerance, withdrawal, persistence, escape, problems, deception, displacement, and conflict; APA, 2013). It is scored on a 5-point Likert scale (1 = *never* to 5 = *very often*). A global score is obtained by summing the scores of each item, with higher scores reflecting higher degrees of gaming disorder. Scores of 25 and above are indicative of gaming disorder.

The IGDT-10 (Király et al., 2017) includes 10 items (e.g., “when you were not playing, how often have you fantasised about gaming, thought of previous gaming sessions, and/or anticipated the next game”), with one item measuring each of the nine criteria of the DSM-5 (APA, 2013). The only exception was the criterion of “jeopardy or losing a

significant relationship, job, or educational or career opportunity because of participation in Internet games”, which was split into two separate items due to concerns over being a double-barreled item. Items are rated on a 3-point Likert scale (*never, sometimes, often*). Following the dichotomous structure of internet gaming disorder in the DSM-5 (i.e., yes or no), responses of *never* and *sometimes* are recoded as 0 (no), and *often* as 1 (yes). Individuals who score five or more are considered to have gaming disorder.

The YDQ (Young, 1998) comprises eight items (e.g., “Do you feel restless, moody, depressed, or irritable when attempting to cut down or stop Internet use”) across seven factors (preoccupation, tolerance, loss of control, withdrawal, deception, escape, and conflict). Responses are binary (yes/no). An endorsement of at least five “yes” would classify one as being gaming disordered. The IGD-9 (Lemmens et al., 2015) is a nine-item scale, with a single item for each of the DSM-5 criteria (e.g., “have you experienced serious conflicts with family, friends, or partner because of gaming”). Scoring is similar to the YDQ (binary scale of yes/no, with at least five “yes” indicative of gaming disorder).

Though the abovementioned five measures of gaming disorder stood out compared to the remaining 28 due to having greater empirical support, there is no single optimal choice with a distinct practical or psychometric advantage (King et al., 2020). The IGD-9 (Lemmens et al., 2015) shares similar strengths to the GAS-7 (Lemmens et al., 2009) as both scales had a comparable evaluation profile. Bearing this in mind, the GAS-7 possesses the largest evidence base, and holds an additional advantage in being the shortest scale amongst the five tools. However, it has not been used clinically, and has incomplete coverage of both the DSM-5 and ICD-11 criteria (though it is arguable that full coverage is not required when screening for gaming disorder; King et al., 2020). Conversely, the IGDS9-SF (Pontes & Griffiths, 2015) and IGDT-10 (Király et al., 2017) provide complete coverage of the DSM-5 and ICD-11 criteria, but the evidence base comprised of mostly convenience samples. The

YDQ (Young, 1998) was primarily used in Eastern countries, and researchers in Western countries seldom utilised the YDQ. In the short term, it appears that using any of the five instruments would provide sufficiently robust results. However, in the long run, a unified approach to measuring gaming disorder is important, which calls for the development of a gold standard instrument (King et al., 2020).

### **Distinguishing Between Disordered Video Gaming and Engagement**

Besides the development of scales used to measure gaming disorder, a separate line of research has sought to distinguish between being addicted to games from simply being engaged with them (e.g., André et al., 2020; Deleuze et al., 2018). As per the definition of disordered video gaming outlined in the earlier sections, addicted individuals often suffer from negative consequences. However, it is important to separate the concept of addiction from the intense but ultimately benign notion of engagement, where highly involved gamers do not experience the adverse ramifications (Deleuze et al., 2018). Some scholars have also criticised the conceptualisation of gaming disorder by the WHO (2019), arguing that it pathologises healthy gamers and creates moral panic (Bean et al., 2017). A primary concern revolving around this panic is the potential for the formalisation of gaming disorder to negate the perceived benefits of video gaming, which include higher levels of well-being (Jin & Li, 2017), increased prosocial behaviours (Harrington & O'Connell, 2016), and improved learning (Shute et al., 2015). Conflating addiction and engagement, or mistaking one for the other is also likely to lead to overestimating the prevalence of gaming addiction (Bilginer et al., 2021; Charlton & Danforth, 2007).

The initial conceptualisation of gaming disorder drew much inspiration from the perspective that all behavioural addictions comprise a set of common components (Griffiths, 2005). Griffiths developed a model of addiction based on a biopsychosocial framework, consisting of six components: salience, mood modification, tolerance, withdrawal, conflict

and relapse. Subsequently, researchers who sought to conceptualise various types of addictions, such as substance and internet addiction, often took reference from Griffith's model (e.g., Muñoz-Rivas et al., 2010; Tullett-Prado et al., 2023). Another example can be seen in problematic pornography consumption, where scholars have utilised the core components from Griffith to develop measures of pornography addiction (e.g., Böthe et al., 2018). Similarly, scholars have commonly transposed criteria for pathologising addiction to video gaming addiction, rather than developing new and disorder-specific ones (Billieux et al., 2019). While it is widely accepted that the core components play an important role, it is plausible that diagnostic criteria for behavioural addiction may not necessarily fully apply to video gaming, again highlighting the importance of distinguishing between addiction and engagement.

Previous research has supported the view that video game engagement may not always lead to impairment in one's life. For instance, a longitudinal study reported that engagement (e.g., in-game advancement and social motivations) predicted rapid progression in a video game, but highly engaged players presented with no symptoms of video game addiction (Billieux et al., 2013). In another study, Pontes et al. (2022) found that engaged gamers who played approximately 20 hours of games (equivalent to a part-time job) on average per week did not meet the diagnostic criteria for gaming addiction. Yet another study found that addiction was negatively associated with poor scholastic achievement, but engagement with video games was not (Skoric et al., 2009). On top of academic performance, a similar trend was found for clinical factors. Lehenbauer-Baum and Fohringer (2015) found that depression was significantly linked to addiction, rather than engagement. They also found that engaged gamers were physically and psychologically healthier compared to addicted gamers, further cementing the differences between addiction and engagement.

Charlton and Danforth (2007) further acknowledged that some of the addiction and engagement criteria could overlap, and high engagement was usually a stepping stone towards problematic video gaming. This interaction should be accounted for, such as by assigning weightings to the different criteria (Charlton & Danforth, 2007). Nevertheless, this view has been met with conflicting findings from other studies. For example, Yildiz Durak et al. (2023) reported that video game engagement was not significantly related to video gaming addiction. However, when conducting multi-group analyses, the authors found a significant relationship between aspects of engagement (e.g., entering a narrative world) and addiction, but only for expert gamers (compared to novice players). While whether engagement is a critical factor in the lead up to addiction is still a matter of debate, literature suggests that player characteristics can play an important role in the nomological network between engagement and addiction.

The need to distinguish between addiction and engagement has also been an area of contention in the psychometric measurement of video game addiction. The GAS-7 (Lemmens et al., 2009) was originally developed to measure game addiction, based on the DSM criteria for pathological gambling (salience, tolerance, mood modification, withdrawal, relapse, conflict, and problems). While the GAS-7, based on multiple reviews, has been found to be psychometrically sound and has garnered greater empirical support compared to other gaming addiction scales (King et al., 2020; Yoon et al., 2021), there were critiques that some of the seven subscales did not measure addiction. Specifically, researchers have pointed out that the sub-factors of salience, tolerance, and mood modification, instead measure engagement with video games, rather than addiction (e.g., Ferguson et al., 2011). Importantly, it is possible to be extremely engaged, yet not addicted to video games (Brunborg et al., 2013). Indeed, a psychometric study conducted by Brunborg et al., (2015) suggested that the separated two-factor structure of engagement and addiction yielded a better fit, and advocated

the use of the four core criteria—withdrawal, relapse, conflict, and problems—to properly examine video game addiction, while the remaining three factors were termed the peripheral criteria. Taken together, be it behavioural outcomes or the measures used to measure problematic video gaming, it is clear that there is a difference between addiction and engagement.

Regardless of whether one is addicted to or simply engaged with video games, there are many reasons why an individual initially starts playing games, and continues playing them. Under more general circumstances, when there are novel experiences and knowledge to be attained, individuals might be drawn towards them (Yang et al., 2020). In other words, interest in a certain activity would prompt one to engage with it. Pertaining to games, participants in a qualitative study commonly reported interest in tabletop role playing games as a reason for playing them (Coe, 2017). The importance of interest holds true across other mediums and types of games as well—a study by Rasche et al. (2017) found that curiosity was the most important reason that individuals started playing an augmented reality game (*Pokémon GO*; Niantic, 2016). Similarly, curiosity is a concept frequently used by video game designers because it drives player engagement and keeps people deeply involved with a game (Schaekermann et al., 2017). Evidently, a major factor in why people play video games is due to interest in them, or curiosity about them.

### **An Antecedent to Video Gaming Engagement and Addiction: Curiosity**

Virtual worlds are ideal sandboxes for the investigation of human behaviour. How or why people play video games can reveal things about their personal attitudes and motivations. Lazzaro (2004) identified curiosity as one of the main motivational factors of gaming. This sense of curiosity and the “want” to find out and explore more about a game then leads to immersion in the virtual world, narrative, or even just novel stimuli. Curiosity, defined as the hunger for knowledge and novel experiences, is a fundamental and important

human trait (Wagstaff et al., 2020). In the short term, curiosity prompts one to engage in new experiences. Doing so consistently over time drives knowledge acquisition and competencies (Kashdan et al., 2018). From being captivated by global issues to being interested in what makes a person tick, individuals exhibit varying levels of curiosity across a multitude of settings and contexts. The idea of curiosity being an antecedent to video gaming was introduced approximately four decades ago, where Malone (1981) purported that curiosity formed one of three pillars (the other two being challenge and fantasy) of intrinsic motivation leading to playing video games. At the time, curiosity was viewed as having two components: sensory (desire for new sensations) and cognitive (desire for new information). Given the shift in perspectives over the years when conceptualising curiosity (e.g., Kashdan et al., 2020; Litman, 2008; Lowenstein, 1994), there is a need to update and consolidate the literature.

The significance of curiosity is underpinned by its benefits. Research has shown that being curious can lead to positive outcomes across a wide spectrum of settings, including better job performance, academic success, and improved clinical outcomes. Confirmatory research by Mussel (2013) suggested that curiosity has high predictive validity with respect to job performance. Moreover, assessing curiosity provides incremental validity above and beyond other predictors such as the Big Five personality traits, integrity, and social competence, when predicting job success. Being curious at the workplace can also lead to better acceptance of feedback (Harrison & Dossinger, 2017) and greater creativity (Chang & Shih, 2019), which are themselves common correlates of better job performance. Reio and Callahan (2004) found that anger and anxiety reduce curiosity, and that this negatively impacts performance, indicating the importance of fostering curiosity in the workplace. This not only benefits employees via job satisfaction, but also helps organisations in human resource management. For example, Celik et al. (2016) suggested that curiosity is an

important predictor of job fit, and that this should factor into hiring decisions and personnel upskilling.

In an educational setting, curiosity has tangible benefits too. Curiosity has been linked to improved memory and learning, where functional brain imaging showed that curiosity increased activity in caudate regions of the brain (the area that is implicated in memory; Kang et al., 2009). This was substantiated by a post-test which found that higher levels of curiosity was correlated with better recall of answers one to two weeks after the pre-test (Kang et al., 2009). Halamish et al. (2019) later corroborated this view—they found that participants better recalled answers to questions that they were more curious about in a one week post-test. According to Tang and Salmela-Aro (2021), curiosity was positively correlated to academic achievement, though the pattern of results did somewhat differ depending on the type of curiosity, and the subject-specific (mother tongue and math) performance. This implied that effects of curiosity on outcomes are nuanced, and there is a need to account for its different dimensions and contexts. Similarly, von Stumm et al. (2011) identified curiosity as an important third pillar of academic performance, on top of the well-established constructs of intelligence and effort. They advocated for schools to encourage cultivating a “hungry mind”, and not solely rely on rewarding intelligence and effort. Curiosity not only improves academic achievement directly, but also indirectly, through better work ethic (Anderson et al., 2020), and engagement (Vracheva et al., 2020).

In clinical and medical research, curiosity has also been shown to be related with enhanced coping. For example, curiosity was inversely related with suicidal ideation severity among highly distressed veterans. Moreover, veterans with higher levels of curiosity showed better gains in coping efficacy to stop negative thoughts compared to their lower-curiosity counterparts (Denneson et al., 2017). Among myocardial infarction patients, curiosity was positively associated with coping strategies such as reframing, problem solving, the use of

humour, and played a role in improving the emotional and physical aspects in individuals' quality of life (Włodarczyk, 2017). According to Kalka and Pawłowska's (2015) research on individuals with type-2 diabetes, those with higher levels of curiosity displayed more satisfaction with life, and this positive relationship was attributed to the fact that curious individuals often used proactive strategies to cope with stress. In sum, it appears that being curious can be beneficial across different settings and environments, from employment to education, and even improving clinical outcomes.

However, possessing, or satiating one's curiosity may not always bring about positive consequences (Hsee & Ruan, 2016). For instance, people may seek out potentially distressing information, such as their partners' sexual history, or results of medical tests (Kruger & Evens, 2009). While the information may be negative, one might argue that attaining such knowledge provides long-term benefits, such as how to improve marital life, or make informed medical decisions. Unfortunately, that is not always the case. Hsee and Ruan (2016) used the example where a person would choose to "open Pandora's box" simply to satisfy one's curiosity, even if the contents of the box were aversive. They demonstrated this effect in an experimental study where they found that participants would click pens tagged with an uncertain outcome (either containing a mild shock or no shock) more, compared to pens tagged with a certain outcome (confirmed to either shock or not shock). It appears that curiosity resolution may not always be beneficial.

Research has also found that curiosity can lead to a variety of addictive behaviours. Gjeruldsen et al. (2003) reported that curiosity was a critical factor that led to narcotics addiction. Individuals with higher levels of curiosity were also linked to alcohol and tobacco misuse (Khail et al., 2018). Lindgren et al. (2010) reported similar results, albeit with a caveat. They found that the tendency to become deeply involved in a certain activity (termed absorption, conceptualised as an aspect of curiosity) was related to more alcohol-related

problems, but the desire to seek out novel experiences (termed exploration, another factor of curiosity) was associated with fewer issues. This not only illustrates that curiosity can impact behaviour, but also the nature of behaviour involved, calling for further research into how different aspects of curiosity can potentially alter behaviours, both adaptive and maladaptive. In essence, to truly understand the relations between curiosity, engagement, and addiction, other than accounting for the nuances in conceptualising curiosity, there is also a need to consider the various ways that addiction (and engagement) have been conceptualised and operationalised.

### **Curiosity as a Sub-dimension of a More General Construct**

One way that curiosity has been examined by contemporary researchers in psychology is as a component of a more general construct, such as personality. In Chapter 1, we highlighted that scholars have viewed curiosity in numerous ways, one of which is curiosity being nested under the higher-order trait of openness to experience. These manifestations occur in different ways. While some models and measures of personality plainly list curiosity as one of the facets, others are more tacit.

For example, in the Big Five Model, curiosity is termed intellectual curiosity, and describes individuals having wide interests and a desire to attain knowledge across different intellectual topics (Soto & John, 2017). In Woo et al.'s (2014) scale that specifically measures openness to experience, curiosity is one of the six-facet structure. In another measure of personality, Tse et al. (2020) placed curiosity as one of the constellations of individual characteristics that facilitate engagement in daily activities (i.e., autotelic personality). Conversely, in the Big Five Aspects Model (DeYoung et al., 2007), curiosity is instead hinted at through the aspect of intellect capturing intellectual engagement, but not directly captured (Silvia & Christensen, 2020). In the honesty-humility (H), emotionality (E), extraversion (X), agreeableness (A), conscientiousness (C), and openness to experience (O)

scale (HEXACO), curiosity is supposedly captured by the inquisitiveness facet, which is defined as the tendency to seek information and experiences with the natural and human world, where high scorers are curious about politics, and low scorers have little interest in reading encyclopaedias (Ashton & Lee, 2009). Overall, the majority of personality models do include curiosity in some shape or form, but they differ on whether it is made explicit or subtle. It is also worth noting that curiosity is sometimes conceptualised in a general manner (i.e., no context), but other times referred to as more of an intellectual pursuit. This indicates that settings and contexts may play a role in the elicitation of curiosity.

Curiosity has also been examined as part of character strengths. In the Values in Action Inventory of Strengths (VIA-IS; Ng et al., 2017), four of the five curiosity items loaded strongly on a general factor described as having a positive disposition. At the workplace, curiosity has also been named as a sub-dimension in the construct of career adaptability (indicating an individual's resources and ability for coping with current and anticipated tasks in their respective job roles; Savickas & Porfeli, 2012). Consistent with the model that career adaptability comprises four dimensions, Savickas and Porfeli (2012) confirmed that curiosity formed one of the dimensions too (the others being concern, control, and confidence). Despite insights driven by studying curiosity as part of wider and more general traits, curiosity is unique, distinct, and deserves to be studied as its own construct (Lievens et al., 2022).

### **Dimensions and Measures of Curiosity**

Moving beyond conceptualisations of curiosity as a component of broader traits and characteristics, researchers have also examined curiosity more directly, some seeking to characterise it as a singular trait while others seek to delineate various forms of curiosity. In this vein, some researchers have examined curiosity as a unidimensional trait. This could be due to researchers adopting the view that curiosity is simply an overall interest or inclination

to find out about something in general, such as in Galli et al. (2018), where the researchers examined participants' trait-level curiosity. Participants reported ratings of how curious they were at wanting to know the answers to trivial questions. Such single item measures to capture curiosity in a general and overall manner are common in the literature. Just like Galli et al. (2018), Marvin and Shohamy (2016) also utilised a single item to measure participants' curiosity in the context of trivia questions. Yau et al. (2012) acknowledged that curiosity comprises multiple dimensions, but analysed the construct as unidimensional using a five-item scale. Similarly, Thomas and Vinuales (2017) measured curiosity as a unidimensional construct with a three-item measure. In the aforementioned studies, non-validated measures of curiosity were used, potentially raising questions as to how appropriately or accurately the construct of curiosity was captured.

In contrast to the unidimensional approach, other researchers have conceptualised curiosity as a multidimensional construct with distinct components, seeking to identify different forms of curiosity that may to some extent vary independently. However, there are varying views on the number of dimensions of curiosity, as well as how they should be defined and described. For example, a dimension that commonly appears is an intrinsic motivation to seek knowledge, where gaining knowledge yields positive emotions such as joy. Kashdan et al. (2004) proposed that this approach type curiosity comprised two sub-dimensions: exploration (the propensity to seek out novel experiences, knowledge, and information) and absorption (the inclination to become immersed in these new experiences). This led to the creation of the Curiosity and Exploration Inventory (CEI-I; Kashdan et al., 2004), comprising of the two aforementioned factors.

A few years later, Kashdan et al. (2009) refined their views on curiosity by acknowledging that the original CEI-I failed to account for the fact that individuals may manage, or even embrace the tension that arises when faced with novelty and ambiguity. As a

result, they put forward that this willingness to tolerate uncertainty formed a dimension of curiosity (termed embracing) in their updated scale, the Curiosity and Exploration Inventory (CEI-II). Consistent with the conceptualisation of approach type curiosity, the other dimension in the CEI-II was named stretching: a general fascination with new information that leads to positive emotions. Yet another similar conceptualisation can be seen from the works of Litman and Spielberg (2003) where curiosity refers to “a desire for acquiring new knowledge and new sensory experience that motivates exploratory behaviour” (p. 75). However, their take on this approach type curiosity was that there were two further sub-dimensions: diversive (seeking stimulation regardless of origin or content), and specific (investigating novel stimuli to obtain new information). This paved the way for the development of the Epistemic Curiosity Inventory (Litman & Spielberg, 2003), encompassing two domains of curiosity as a feeling of interest.

More recently, Kashdan et al. (2018) referred to the concept of exhibiting curiosity via exploratory behaviour for pleasure as *joyous exploration*, and named it as one of the five dimensions of curiosity in their Five-Dimensional Curiosity Scale (5DC). This instrument was later improved in the development of the 5DCR (Kashdan et al., 2020), by including a sixth dimension of curiosity, but maintained the dimension of joyous exploration. The dimension of joyous exploration is perhaps the textbook definition of curiosity, capturing the tendency for novel experiences and knowledge (Kashdan et al., 2018). Evidently, the notion of feeling joy when engaging in exploratory behaviour often manifests as different names, yet seemingly referring to the same dimension (e.g., joyous exploration in the 5DCR and stretching in the CEI-II). While the nomenclature differs, it appears that this facet points to an approach type curiosity, or more specifically, an interest type curiosity. Individuals exhibiting this interest type curiosity would seek knowledge out of their own volition, and subsequently gain pleasure from learning new information.

While it might be intuitive to think of curiosity as a positive and approach oriented construct, an individual can in fact be curious not because it brings pleasure, but instead because it reduces anxiety. Making this distinction is important as many measures of curiosity previously incorrectly assumed that feeling curious is always pleasurable (Kashdan et al., 2004; Kashdan et al., 2009). This is also supported by research showing that even if acting on one's curiosity would lead to instant punishment with no likely reward in the future, individuals do so willingly, indicating that the satisfaction of curiosity in itself is a powerful motivator, and having a joyful experience is not mandatory (Hsee & Ruan, 2016). This avoidance oriented, or deprivation type curiosity was proposed by Loewenstein (1994), who purported that an individual could be curious not due to an interest in acquiring new knowledge, but rather more of a desire to learn what one does not know, or to close an information gap. Loewenstein's conceptualisation suggested that information gaps cause anxiety and pique curiosity in a bid to resolve the gap in knowledge. Aligning with this view, Litman and Jimerson (2004) focused on curiosity as a feeling of deprivation (CFD) in their curiosity measure, with three dimensions: intolerance (intolerance experienced when information is unattainable), competence (the need to feel competent), and problem solving (urgency to resolve issues).

Given the dichotomy of the approach and avoidance oriented nature of curiosity, any measure of curiosity should account for these seemingly opposite sides of the same coin. Appreciating that there are both interest and deprivation types of curiosity, Litman's (2008) measure of curiosity, the Epistemic Curiosity Scale, incorporated both approaches of exhibiting curiosity by including both interest and deprivation subscales. Kashdan et al.'s (2018) 5DC scale, and later the 5DCR (Kashdan et al., 2020), also included subscales for both types of curiosity, with the avoidance oriented subscale being named *deprivation sensitivity*.

Moving beyond interest and deprivation type curiosity, researchers have also reported other conceptualisations, such as interpersonal curiosity, where individuals desire information about other people (Litman & Pezzo, 2007). This is not unlike the social curiosity facet as part of the 5DC (Kashdan et al., 2018). Past research has shown that being curious about other people is a distinct dimension of curiosity, indicating that any holistic and comprehensive measure of curiosity should include this social element (Renner, 2006). This dimension also held the biggest change from the original 5DC to the 5DCR. Kashdan et al. (2020) reported a distinction between being curious about others, and trying to discretely gather new information about others. As a result, the dimension of *social curiosity* was further classified as *overt*, where individuals are interested in gathering information through socialising, and *covert*, where knowledge regarding others is obtained indirectly and secretly (e.g., spying). A further improvement was made in the transition from the 5DC to the 5DCR, by removing the psychometrically weakest item on each of the five original subscales.

Research has also uncovered another dimension of curiosity named *stress tolerance*. Prior to exhibiting curiosity, a person has to make two judgement calls. Firstly, an individual needs to acknowledge that an event is novel and interesting enough to warrant their attention. Secondly, the individual has to appraise if they can adequately manage potential distress that could surface when exploring a new situation (Silvia, 2008). For curiosity to be initiated and sustained, both conditions should be met. Conversely, if the novel situation causes unnecessary stress and an individual deems themselves unable to cope, then curiosity would likely not be displayed. This dimension of stress tolerance was found to be an antecedent to experiencing curiosity (Silvia, 2008).

Inspired by the work of Zuckerman (1994) on sensation-seeking, the dimension of *thrill-seeking* was included as an aspect of curiosity in Kashdan et al. (2018, 2020). Besides tolerating stress, some may embrace it; willingly taking reputational, financial, legal, and

health-related risks in order to gain unique experiences. Thus, in thrill-seeking, arousal is sought after, rather than avoided. This can potentially explain the actions of adventurous individuals, which can sometimes devolve into maladaptive inclinations, such as disregard for safety or addiction (e.g., Lindgren et al., 2010).

With multiple dimensions of curiosity being uncovered in the literature, this raises a potential issue: it is difficult to know how best to measure and investigate curiosity given the variety of conceptualisations and accompanying measures that are available. Over 30 measures of curiosity exist in the literature, some thoroughly validated, others created for use in an isolated study (Wagstaff et al., 2020). As a result, it can be difficult to select a “best” measure to administer when seeking to examine the antecedents, correlates, and consequences of curiosity. These measures of curiosity vary in terms of their dimensionality, some being unidimensional while others are multidimensional, while researchers adopting a multidimensional measure also vary in terms of analytic strategy, with some examining specific sub-dimensions of curiosity while others are happy to aggregate to an overall score. Though the optimal measure to administer will vary depending on the research question, it would nevertheless be useful to comprehensively survey the various conceptualisations and measures of curiosity in the extant literature, with a view to enabling researchers to make more informed choices when planning their investigations of curiosity.

### **Contexts of Curiosity**

Other than dimensions and measures of curiosity, the context or setting can play a role in its elicitation and expression. Research has found that context specificity is important when assessing various psychological constructs, and has also advocated for the use of frames-of-reference to achieve a more holistic understanding of the construct in question (Lievens et al., 2008). In their study using academic GPA as a criterion, Lievens et al. (2008) instructed participants to utilise different frames-of-reference (at-school versus at-work). They found

that using an incorrect frame-of-reference (i.e., at-work) decreased validity substantially compared to using a correct frame-of-reference (i.e., at-school). In the case of risk-taking, Weber et al. (2002) argued that attitudes toward risk-taking behaviours should be treated as domain-specific, as individuals could display very different risk appetites across domains, ranging from lower (i.e., recreational) to higher stakes (i.e., gambling). Importantly, people vary in terms of subjective values on outcomes when considering the perceived risks and benefits of each scenario, thus accounting for these scenarios appears to be critical. Taken together, it appears that conceptualisations that are domain-specific (and by extension having the appropriate frame-of-references) do have advantages over domain-general examinations, including improved psychometric properties.

Based on the above, a similar argument can be made about the study of curiosity. A person who is curious about their colleague at the workplace may not be curious about their teacher at school. The same person may be curious about the discipline of geography but not mathematics. Consistent with this idea, it has been argued that curiosity is context-specific (Peterson & Cohen, 2019). Although it has been found that individuals differ in the degree of context-general curiosity, it is somewhat limiting to only examine overall curiosity, as individuals carry both context-general and context-specific individual differences across multiple settings (Cromley et al., 2017).

Investigating specific contexts of curiosity has been shown to bring about additional benefits. For example, empirical evidence from research utilising a workplace-specific curiosity scale indicates that work curiosity predicts job performance above and beyond more general predictors such as personality traits, cognitive ability, and integrity (Mussel et al., 2012). Also, Park et al. (2014) described that curiosity in a sporting context is different from general curiosity, and contexts outside of sports, and made one of the first attempts to determine if a facility can induce curiosity. They found that curiosity about a sports facility

(e.g., “I enjoy exploring brand new sport stadiums or facilities”) was a facet of curiosity in their sports curiosity measure. Research has pointed out that compared to other industries, one critical and unique feature of the sporting industry is facilities such as stadiums (Park et al., 2010). Accordingly, measuring sports curiosity specifically can provide a more apt representation of sports fans, compared to using a general curiosity scale. Likewise, a curiosity measure situated in the context of nature and its potentially dangerous elements (e.g., volcanic eruptions, hurricanes, and snowstorms) was created and purported to help explain motivation and behaviour specifically when nature is a factor (Prochniak, 2017).

On the other hand, curiosity is often studied as a trait, which is more concerned with a general disposition of curiosity rather than domain specificity. Having trait level and domain general measures allowed researchers to make “broad stroke” conclusions on individual differences. It also allows for easier accumulation of knowledge by having a more general scale, which in turn is more likely to add to construct validity, instead of multiple scales each measuring different domains. While there are pros and cons to the domain-general and specific debate, perhaps the more important factor to consider would be the value of using one over the other. This is also reflected in Pekrun (2019), who argued that a complementary viewpoint would be to conceptualise curiosity as domain-general, while also being aware that there are variances across domains. As such, researchers should be careful when conceptualising and choosing an appropriate measure of curiosity.

### **The Links Between Curiosity and Video Gaming Preferences, Motivation, and Behaviours**

While curiosity has been positioned as an important motivator to playing games, there appears to be a lack of empirical research, especially on the links between the psychological construct of curiosity and video gaming behaviours and preferences. In the limited literature on this front, Sedano et al. (2007) identified curiosity as one of the critical elements in

prolonged engagement with mobile games, and found that curiosity was the main driving factor behind participants' motivation to complete a game. Simultaneously, Sedano et al. (2007) also reported that curiosity was separate from the other two factors of challenge and fantasy. However, the lack of parametric statistical analyses to examine the claims do present a drawback when interpreting the findings. Nonetheless, the results do hint at the importance of curiosity toward gaming tendencies.

More recent research has also sought to further clarify the relationships between curiosity and video gaming behaviours. For example, Dahabiyeh et al., (2021) found that higher levels of curiosity led to lowered perceived risk, such as compromising privacy, in playing an online game, but increased intention to play it. When faced with scenarios that offer enabling conditions for curiosity (e.g., partial information), players tend to not evaluate the risks involved, which covers a wide spectrum, ranging from information risk (e.g., privacy), to financial or even physical risks. Even if individuals engage in risk assessment, they often underplay it, preferring to indulge their curiosity regardless of outcome, highlighting the power of curiosity (Dahabiyeh et al., 2021). Also in the study, curiosity was conceptualised as a unidimensional construct, specifically as an information gap that individuals want to close (i.e., deprivation factor of Litman, 2008). Given that curiosity has been established as a multidimensional construct (e.g., Kashdan et al., 2020), it is unclear how different facets of curiosity relate to video gaming intentions. Additionally, the curiosity scale used was adapted from the state-trait curiosity inventory (Naylor, 1981), which conceptualised curiosity as both a disposition (trait) and a response to external circumstances (state). Importantly, the items in the scale do not strictly measure curiosity arising from an information gap, but rather assess elements of approach-related curiosity (e.g., "my interest has been captured by the game"). Given the inconsistency between how curiosity was conceptualised and measured, these findings should be interpreted with caution. This

limitation again highlights the importance of using an appropriate measure to examine the multidimensional structure of curiosity.

In another study, Kim and Lee (2017) investigated how interest and deprivation types of curiosity were related to future play intentions in mobile games. Participants were categorised into different groups, based on their interest and deprivation curiosity scores (dichotomised into high/low scores, resulting in a combination of four groups). Statistically, there was a significant difference between the four groups, but there was no post-hoc test conducted to evaluate where the difference lay. Hence, it is premature to conclude if there is an “ideal” group that would be more likely to continue playing mobile games. Also, the study used intention to play, as opposed to actual gaming behaviour. Studies have shown that intentions do not necessarily lead to behaviour (Webb & Sheeran, 2006), which underscores the advantage of examining exhibited behaviour, or at least retrospective recall of gaming behaviour, as opposed to intentions toward behaviour.

Gómez-Maureira and Kniestedt (2019) examined how different types of games can pique curiosity. Based on their survey findings, the authors found that games which emphasise exploration was an ideal way to evoke curiosity in players. It was proposed that having elements such as out of place objects (e.g., three identical looking trees where one has an extra apple hanging from a branch), which would arouse curiosity and act as a cue to further exploration. Another key finding from Gómez-Maureira and Kniestedt (2019) was that the genre of social simulation was ranked the highest (compared to 10 other genres) in terms of ability to invoke curiosity. Specifically, social curiosity can be piqued by bridging the gap between what players know about the relationships between in-game characters and the possibility to deepen these relationships. However, it should be noted that the study investigated simulation of social actions (implying single-player games where players carry

out social actions), instead of actual social interactions between real people (suggestive of multiplayer games). Whether this difference is meaningful would require further research.

Schaekermann et al. (2015) contributed to the curiosity-video gaming literature by investigating the extent to which different dimensions of curiosity affected gamers' behaviours by pooling data from 1,745 players in the popular online first-person shooter video game *Destiny* (Bungie, 2014). The authors found that social curiosity showed the highest positive correlations with measures of player versus player (PvP) combat such as win/loss ratio and team scores, and negative correlations with every player versus environment (PvE) metric (e.g., activities that are completed individually). Schaekermann et al. (2015) also reported that individuals with higher levels of explorative curiosity spent more time in PvE game modes, which was in line with the fact that PvE modes were often driven by exploration. While the authors acknowledged the lack of generalisability since only a single game was examined, their findings suggested that it was possible to infer player motivations and preferences from observing player behaviour and objective metrics in-game.

In the associations between curiosity and gamer preferences and behaviours, some researchers have instead focused on how curiosity can lead to gaming addiction. In today's highly digitised world where electronic media permeates many aspects of everyday life, it is no surprise that curiosity has been implicated in addiction towards such media, particularly social media and video gaming. For example, Brailovskaia et al., (2018) found that curiosity (in this case conceptualised as the desire to know what happens on Facebook) was a significant predictor of Facebook addiction. In a qualitative study conducted by Aksoy (2018), they observed that self-declared social media addicts would often list the curiosity to make new friends (i.e., social curiosity) as a primary motivator to using social networking sites.

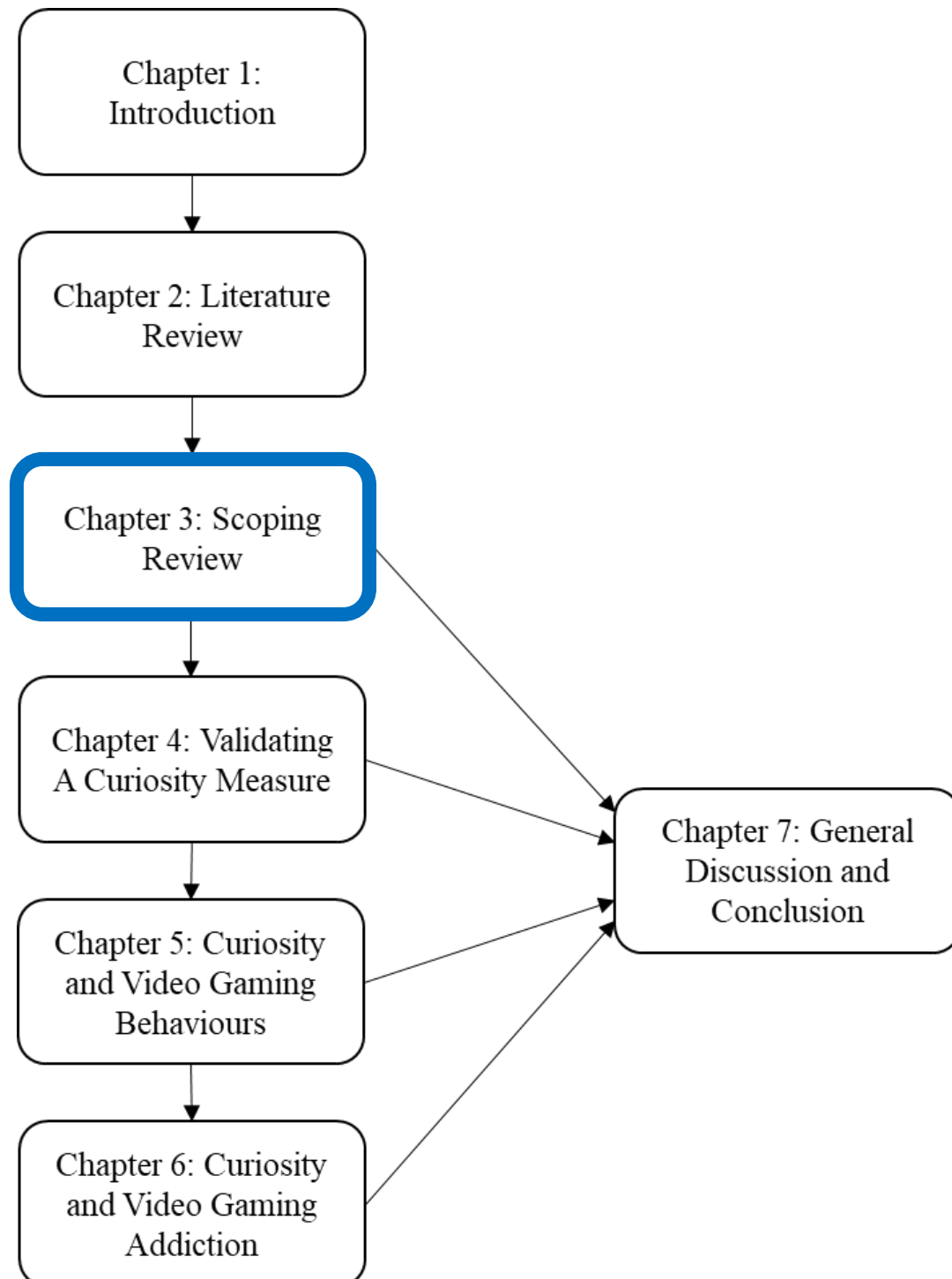
From the literature on curiosity and problematic video gaming, Park and Huang (2009) used the concept of flow (the enjoyable experience that people feel when they are fully immersed in an experience) to predict online gaming addiction. They found that flow was predicted online gaming addiction. While flow is often conceptualised as a positive construct, it may not be beneficial if it leads to players being unable to control the urge to play games. Indeed, Park and Huang (2009) found that flow mediated the relationship between presence and gaming addiction. Incidentally, curiosity was also put forward as both a component and prerequisite of flow (Trevino & Webster, 1992; Yilmaz & Tunca, 2024). While the exact role of curiosity is unclear, it suggests that more research needs to be conducted. In another study, Hsu et al., (2009) sought to better understand video game addiction (specifically online role-playing games) from a user experience perspective. They hypothesised that individuals who were curious would be motivated to play, resulting in a higher probability of getting addicted. In line with expectations, results found that curiosity positively predicted online role-playing game addiction (Hsu et al., 2009).

Overall, research has elucidated links between curiosity and video gaming motivations, preferences, and behaviours. However, these links have also highlighted some gaps in the literature. Firstly, there is a need to use an appropriate measure of curiosity to provide more robust findings. In particular, using a multidimensional scale of curiosity would help to capture the full breadth and depth of the construct. Secondly, it is important to also further examine the role of curiosity in the lead up to disordered video gaming, while being mindful of the distinction between engagement and addiction.

### **Conclusion**

This chapter first reviewed two important ways in which video games can be categorised and differentiated from one another. While the use of game genres is useful and widely understood, it does present with limitations with respect to both scholarly research,

such as the lack of consensus on number of genres, as well as practical use cases, where the difficulty in categorising games according to these genres can be confusing for consumers. A way to work around these limitations could be to examine the structural characteristics of video games instead. We next introduced a critical antecedent to playing video games—curiosity, particularly on its dimensionality, instruments, and contexts. We ended the chapter by highlighting the literature on the associations between curiosity and video gaming motivations, preferences, and behaviours. The following chapter (Chapter 3) presents a scoping review on how curiosity has been studied, specifically on the three abovementioned axes of dimensionality, measures, and contexts.



### **Chapter 3: Dimensions, Measures, and Contexts of Curiosity—A Scoping Review**

Chapter 2 illustrated that the extant literature conceptualises curiosity in many ways. For example, researchers have commonly viewed curiosity as part of the personality trait of openness, while others have focused on curiosity as an important individual difference in its own right. Research that examined curiosity as a standalone construct can also be further delineated into whether curiosity is seen as unidimensional or multidimensional. When treating curiosity as a multidimensional construct, some researchers focus on specific dimensions of curiosity, while others ultimately ignore the inherent multidimensionality and used aggregated total scores in their research. Moreover, some conceptualisations are seemingly similar, but yet are termed differently (e.g., interest type curiosity versus joyous exploration). While some facets are clearly delineated from one another (e.g., joy of learning new information versus anxiety from not knowing), the distinction is less clear in others and could be referring to the same underlying dimension (e.g., social curiosity versus interpersonal curiosity, intrapersonal curiosity versus self-curiosity). The presence (or absence) of contexts is also telling of the many ways that curiosity has been studied (Peterson & Cohen, 2019).

Given the number of ways that curiosity has been conceptualised, the research described in this chapter sought to formally survey the various forms of curiosity and provide a functional overview of their prevalence and the various ways in which they have been employed in psychological research. This was done to guide decision-making on the operationalisation and measurement of curiosity in the overall programme of research, as well as to provide a resource for other scholars working in the area. Furthermore, as stated in Chapter 2, we anticipated that the links between curiosity and video gaming behaviours and preferences have not been thoroughly studied. Another aim of the research described in this chapter was therefore to seek corroboration of this and enhance the justification for the

subsequent studies.

### **Rationale and Aims**

In light of the disjointed ways curiosity has been conceptualised and operationalised, a key goal of the project was to consolidate how the construct has been studied, particularly in its dimensionality, instruments, and contexts. Knowing the extent of how curiosity has been studied also uncovers gaps in the literature, facilitating future research (i.e., the program of research in this thesis; this is further elaborated in the discussion section of this chapter). To this end, we decided to conduct a scoping review. Scoping reviews are an increasingly popular method to synthesise evidence and can be used to identify knowledge gaps and set research agendas (Munn et al., 2018; Tricco et al., 2016). In recent years, reviews of the curiosity literature have tended to focus on specific contexts like human resource development in organisations and education (Grossnickle, 2016; Wagstaff et al., 2020). The current scoping review intended to cast a wider net to obtain a broader overview of research conducted thus far. Specifically, we sought to answer the following questions:

1. To what extent is curiosity seen as being unidimensional or multidimensional?
2. If curiosity is seen as being multidimensional, what are the dimensions that make up curiosity?
3. How is curiosity measured?
4. Is curiosity characterised as being context-general or specific?
5. If curiosity is seen as being more specific, in which contexts has curiosity typically been studied?

### **Method**

#### **Framework**

The framework for this scoping review was developed according to the Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA). The Joanna Briggs

Institute (JBI) approach to scoping reviews was also used as an additional resource when developing this scoping review (Peters et al., 2020). A scoping review protocol documented the objectives, inclusion criteria, and methods of extraction, and was preregistered via deposit on the Open Science Framework

([https://osf.io/dj7xg/?view\\_only=1ea474dc90ec4de586a774941d624cee](https://osf.io/dj7xg/?view_only=1ea474dc90ec4de586a774941d624cee))

### **Inclusionary Criteria**

The PCC framework (Population, Concept, and Context) was used to develop the inclusion criteria, as recommended by JBI (Peters et al., 2020). Firstly, participants of all types were included in the scoping review. Regarding the concepts to be included, studies were required to focus on the psychological construct of curiosity, and to have explicitly measured and analysed it as a variable of interest. Studies that measured only specific dimensions of curiosity were included as well (e.g., social curiosity dimension of the 5DCR). In the curiosity literature, self-report questionnaires are the most common approach to measuring curiosity (Grossnickle, 2016). Thus, we chose to include only quantitative research, focusing on empirical papers using self-report surveys, while being open to all types of study designs (e.g., experimental, quasi-experimental, correlational). All contexts (e.g., workplace, education) and article types (e.g., journal articles, theses, conference papers) were qualified for inclusion, and no exclusion criteria was imposed on the timeframe of records. The multidisciplinary databases of Scopus, Web of Science, and ProQuest platform were used to conduct the scoping review. Lastly, only records in the English language were included.

### **Search Strategy**

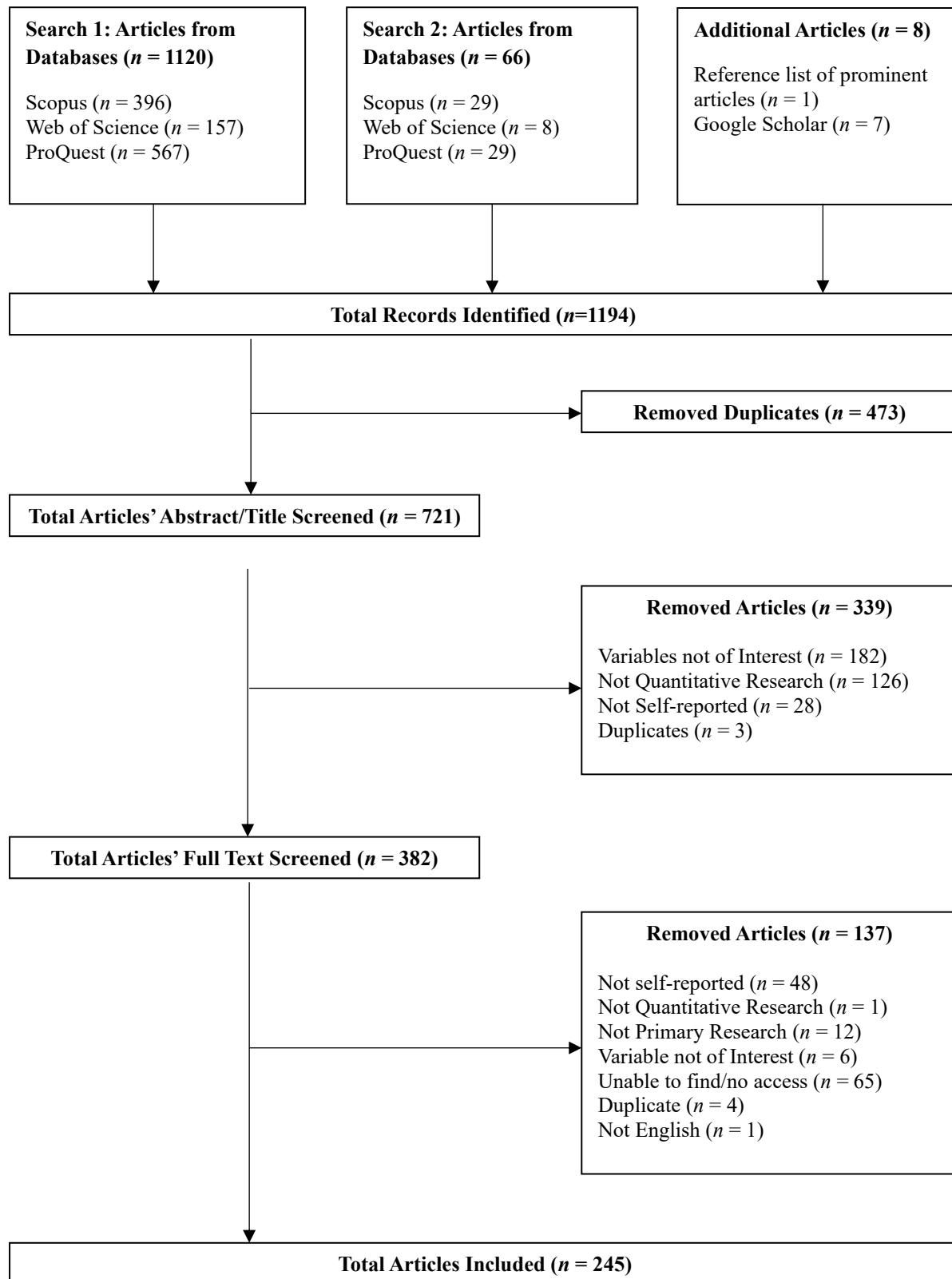
To begin, an initial search was conducted on Scopus using the keywords: (Curiosity) AND (facet OR dimension). From the results, relevant articles were identified and analysed for further keywords to refine the search. A keyword analysis tool was also used to aid the

process (SEOscout, 2021). Following an iterative process, we decided that the word ‘curiosity’ had to be specified in the article title in order to yield articles where curiosity was a specific, measured variable of interest. As second level keywords, we searched for the terms ‘facet’ OR ‘\*dimension\*’ OR ‘aspect’ OR ‘factor’ OR ‘construct’ OR ‘individual differences’ OR ‘predict\*’ OR ‘empirical’ across titles, abstracts, and keywords. This level was included to focus on retrieving quantitative research that examined curiosity by including synonyms of ‘dimensions’ in the search string. Finally, we searched for ‘scale’ OR ‘measure’ across full texts as third level keywords to narrow results to articles that include measures of curiosity. Each level of keyword(s) was connected by the Boolean AND. The finalised search terms were then used to gather records from the three selected databases (Scopus, Web of Science, and ProQuest). Searches across all three databases were also filtered to display only English language items. A total of 1120 articles were identified. A second search using the same keyword string was conducted in February 2022, yielding an additional 66 articles. To capture the grey literature, relevant review articles were chosen and their reference lists examined to identify possibly relevant records not captured by the database search (Grossnickle, 2016; Wagstaff et al., 2020). A Google Scholar search was also conducted to source for additional grey literature. These two methods resulted in an additional eight articles, for a total of 1194 records.

### **Article Screening**

To decide on the full list of articles to be used in the scoping review, two levels of screening were implemented: title and abstract screening, followed by full text screening. EndNote 20 was first used to remove 473 duplicate entries. Rayyan (Ouzzani et al., 2016) was then used for screening the remaining entries. Rayyan is a web application that assists users in article screening, and is commonly used for reviews. Two reviewers (the author and another psychology graduate) assessed all records at each given stage (barring articles that

had already been excluded), and disagreements were resolved via discussion and consensus. Pilot testing on 10 articles was carried out before each level of screening to ensure inter-rater reliability, and on both occasions over 90% inter-rater reliability was achieved. At the abstract/title screening stage, 339 articles were excluded. A further 137 articles were omitted after screening the full texts, resulting in 245 articles that were included in the final scoping review. A flowchart of the article selection process is shown in Figure 3.1.

**Figure 3.1***Flowchart for Selecting Articles Included in Scoping Review*

### **Data Extraction**

A data extraction form was created and preregistered as part of the scoping review protocol. The variables of interest were: article title, year of publication, author(s), sample size, sample profile, age, gender, country, curiosity measure adopted, dimensionality of adopted measure, number of dimensions and items used, response format of measure, design of study, context in which curiosity was studied, key findings, and areas for future research. Data was extracted and tabulated using Microsoft Excel.

### **Results**

#### **Demographics and General Characteristics**

All 245 included articles were published between 1965 and 2022. Twenty articles (8%) were published before 2000, 34 (14%) from 2000-2009, 127 (52%) from 2010-2019, and 64 (26%) from January 2020 to February 2022, when the second search was conducted. There was a strong upward trend of studies meeting the inclusion criteria, especially in the period 2010-2019, reflecting the rapidly increasing volume of many scientific literatures (Landhuis, 2016).

With regards to the geographical origin of each record, we took the location of data collection as the primary method of determining origin. If it was not explicitly stated where the study took place, we then used the corresponding author's institutional affiliation (or first author if no information on corresponding author was provided). Given the large number of included articles, we grouped them by continental region: North America represented 108 articles (44%), Europe contributed 52 (21%) articles, followed by Asia with 52 (22%), and Australia (11; 4%). Lastly, there were 22 articles (9%) that used mixed samples across multiple regions. In terms of specific countries, the USA contributed by far the greatest number of included articles with 103, followed by Taiwan with 11, and Australia with 10.

The most common sample type was students, who were participants in the research

described in 152 articles (62%), with the majority (110 articles) comprising of students who were at least at the undergraduate level. Forty-five articles (18%) used general public/community samples. Forty-six articles (18%) used more targeted samples, such as video gamers, entrepreneurs, and physicians, and 12 articles (5%) did not specify a sample profile.

### **Dimensionality of Curiosity**

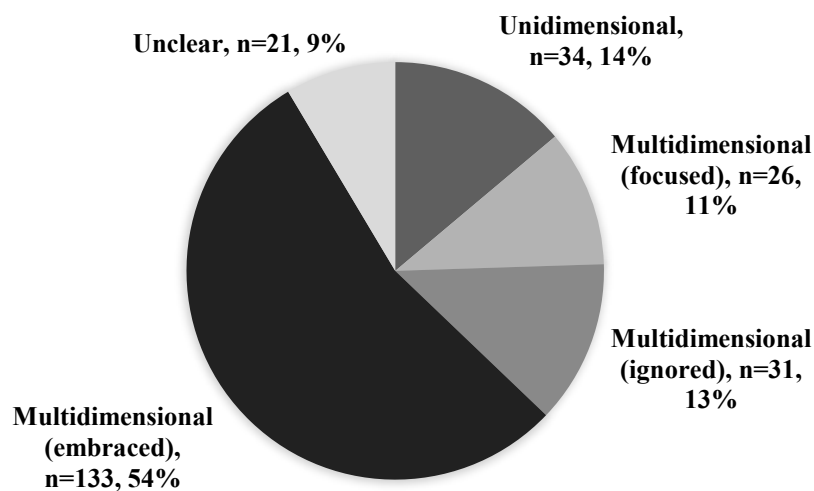
We classified dimensionality of curiosity into five categorisations. Firstly, articles that viewed curiosity as a unitary construct and employed a single curiosity score in their analyses were labelled as “unidimensional”. Secondly, articles that acknowledged the multifaceted nature of curiosity but chose to focus on one facet either by using a facet-specific measure or a subscale of a multidimensional measure were termed “multidimensional (focused)”. Thirdly, articles with a multidimensional perspective but used an aggregate score to represent curiosity would be termed “multidimensional (ignored)”. Fourth, articles that adopted the multidimensional view, measured various facets, and then employed analyses involving different scores for different facets were classified as “multidimensional (embraced)”. Lastly, articles that were ambiguous in their position on dimensionality were categorised as “unclear”.

Of the included articles, 34 articles (14%) treated curiosity as a unidimensional construct. For example, an article reported that a one-factor structure of curiosity (i.e., unidimensional) fitted better compared to a two-factor one (Celik et al., 2016). Similarly, Marvin and Shohamy (2016) also reported curiosity as a single-factor construct. Twenty-six articles (11%) viewed curiosity as a multidimensional construct, but investigated it in a focused manner (i.e., focusing only on one facet). For instance, articles of this nature homed in on a specific dimension, such as a want to acquire new knowledge and experiences (i.e., “stretching”) by only measuring and analysing that specific facet, or focused only on social

curiosity (Anorim Neto et al., 2022; Denneson et al., 2017). An additional 31 articles (13%), while recognising that curiosity is multidimensional, chose to use a global score, or a single item measure. For example, Kaczmarek et al. (2014) utilised a multidimensional measure of curiosity (Curiosity and Exploration Inventory-II; Kashdan et al., 2009) but only reported an aggregate score; Halamish et al. (2019) acknowledged that curiosity is multidimensional, but used a single-item curiosity measure (i.e., curiosity to learn the answer of trivia questions). One hundred and thirty-three articles (54%) acknowledged the multidimensionality of curiosity and studied multiple facets of it, such as in Kashdan et al. (2020), where a total of six dimensions were investigated and analysed separately, or in Litman's (2008) work, where two dimensions of curiosity were examined. The remaining 21 articles (9%) were categorised as unclear, since it was not clear whether the researchers considered curiosity to be uni- or multi-dimensional (Aluja-Fabregat, 2000; Khalil et al., 2018). Figure 3.2 shows the breakdown of curiosity dimensions.

**Figure 3.2**

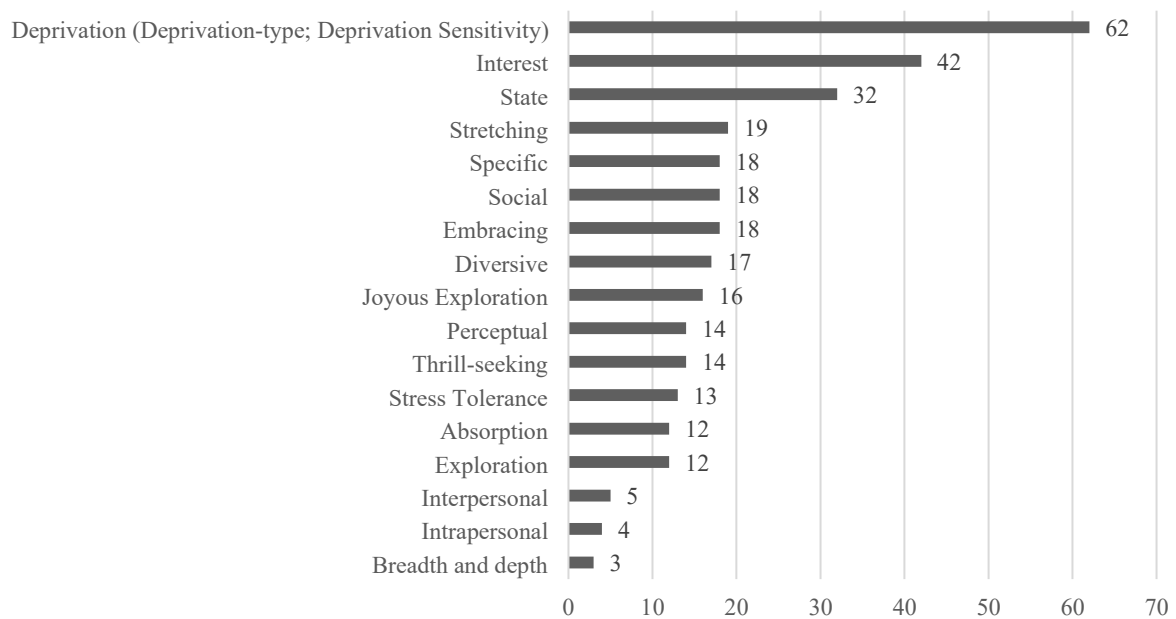
*Dimensionality of Curiosity*



Across the included articles (see Figure 3.3), 62 articles conceptualised curiosity as having a deprivation aspect, where an individual displays curiosity to lower anxiety and frustration, such as from not knowing the answer to a puzzle. Forty-two articles

conceptualised curiosity as the pleasure to discover new knowledge, and gave this factor a general name called interest-based curiosity. From a more temporal point of view, 32 articles viewed state curiosity (as opposed to trait) as a dimension of curiosity. Nineteen articles conceptualised curiosity as having a dimension of stretching (seeking new information and experiences), and 18 articles conceptualised curiosity as the willingness to accept the anxiety-provoking and unpredictable nature of life (also called embracing).

Other dimensions of curiosity picked up by the scoping review included the social aspect of curiosity, commonly called social curiosity, with 18 articles. Eighteen articles included specific curiosity as a dimension (solving particular and singular problems), while 17 articles viewed curiosity as having a diversive element (broad spectrum information seeking). Sixteen articles reported on a dimension called joyous exploration, where an individual finds joy and interest in acquiring new information. Fifteen articles investigated thrill-seeking propensity as part of curiosity, while 14 articles contained the investigation of perceptual curiosity, which generally assessed individuals' interest in sensory stimuli. Stress tolerance was also reported as a dimension of curiosity, with 13 articles. Twelve articles investigated the dimensions of exploration (tendency to pursue new information), and absorption (ability to focus full attention to tasks). Akin to social curiosity, interpersonal curiosity was reported as a dimension of curiosity in five articles, while on the flip side, intrapersonal curiosity, or curiosity about the self, was studied as part of four articles. Three articles investigated curiosity in terms of its breadth and depth (curiosity about many topics vs sustained interest toward a single topic). The remaining records examined highly specific dimensions of curiosity (e.g., recollection of curiosity during childhood) and as this only appeared in a low number of articles, will not be highlighted here.

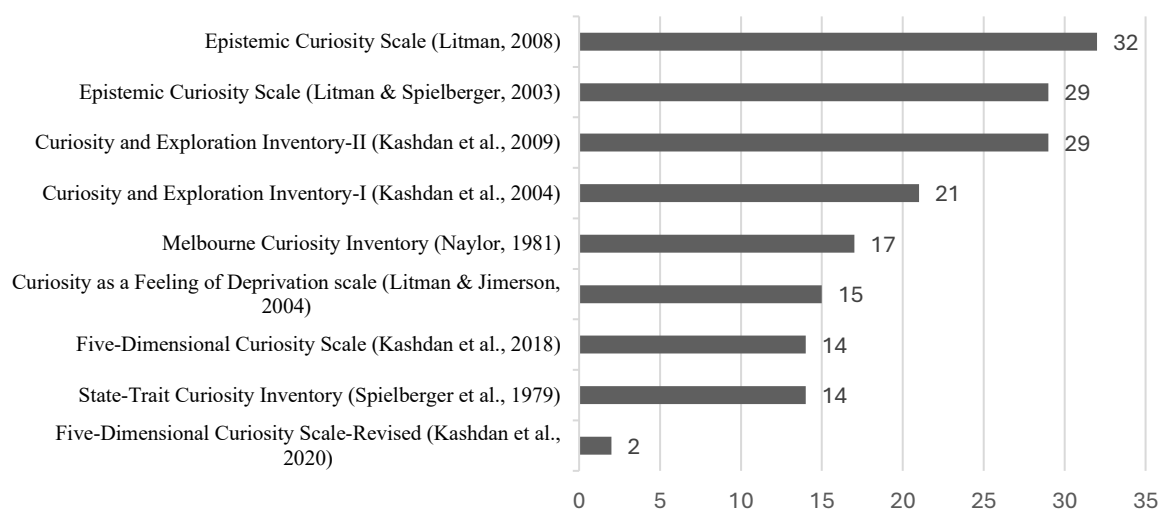
**Figure 3.3***Common Dimensions of Curiosity Examined***Measures of Curiosity**

Of the psychometrically validated curiosity measures used, the most widely used survey was the Epistemic Curiosity Scale (ECS; Litman, 2008) which was administered in the research described by 32 articles. The next two commonly used measures were the Curiosity and Exploration Inventory-II (CEI-II; Kashdan et al., 2009) and the Epistemic Curiosity Scale (Litman & Spielberger, 2003), which appeared in 29 articles each. The original version of the CEI-II, the CEI-I, was used in 21 articles (Kashdan et al., 2004). Naylor's (1981) Melbourne Curiosity Inventory was used in 17 records, while Curiosity as a Feeling of Deprivation scale (CFD; Litman & Jimerson, 2004) was used on 15 occasions. The curiosity scales (also called the State-Trait Curiosity Inventory) in the State-Trait Personality Inventory came up in 14 articles (Spielberger et al., 1979). Of the two most recently developed measures, Kashdan et al.'s (2018) Five-Dimensional Curiosity Scale (5DC) was administered in 14 papers, while its updated version – the Five-Dimensional Curiosity Scale Revised (5DCR; Kashdan et al., 2020) was employed in two articles. The remaining

measures were utilised less than 10 times each (e.g., Interpersonal Curiosity Scale; Work-related Curiosity Scale), and will receive no further mention here (Litman & Pezzo, 2007, Mussel et al., 2012). With regards to non-validated measures of curiosity, a total of 23 articles used ad-hoc single-item scales to measure curiosity. Figure 3.4 depicts the commonly used validated measures of curiosity.

**Figure 3.4**

*Commonly Used Validated Curiosity Measures*



Of all the curiosity measures used, 226 (92%) articles relied solely on a Likert scale response format. Twelve articles (5%) investigated curiosity using only binary questions (e.g., Curiosity about Sexual Events scale using a True/False response format; single-item curiosity measure using Yes/No; Ho et al., 2021; Zuckerman & Little, 1986). Four articles (2%) used a mix of Likert scales and binary outcomes, such as in the work of Reio et al. (2006). One article (0.4%) used a visual analogue scale to assess curiosity (Stone et al., 2022) and one article (0.4%) used a mix of Likert and visual analogue scales (Tanaś, 2021). Lastly, one article (0.4%) did not specify the response format for measuring curiosity (Sujati & Akhyar, 2020).

### **Contexts of Curiosity**

Beyond seeking verification of our belief that video gaming and other leisure pursuits were understudied in curiosity research, we were also more broadly interested in whether curiosity was characterised as being context-general or studied in specific domains. Articles that were not explicit in the context, or were ambiguous, were categorised as context-general. The data extracted showed that 108 (44%) articles studied the construct of curiosity as context-general, meaning no specific context or domain was examined. Of the remaining, 69 (28%) articles focused on the workplace, such as entrepreneurship (e.g., Jeraj & Antoncic, 2013), and job performance (e.g., Reio & Callahan, 2004). Twenty-nine (12%) articles revolved around education, and included articles on academic performance and success (e.g., Powell & Nettebeck, 2017), student development (e.g., Vranceva et al., 2020), and student learning (e.g., Wade and Kidd, 2019).

Investigating curiosity in the context of leisure activities accounted for 26 (11%) articles. Contexts such as travelling, backpacking, and tourism (e.g., Chen & Hsu, 2021; Jani, 2014; Totsune et al., 2021), gaming (e.g., Huck et al., 2020; Kim & Lee, 2017), and social networking (e.g., Fang, 2014; Thomas & Vinuales, 2017) fell under this umbrella term. In particular, gaming accounted for 3% of included articles. Other leisure-based contexts that were less studied (compared to travelling, gaming, and social networking) included curiosity in music (Omigie & Ricci, 2021), virtual reality (Schutte, 2020), nature (Prochniak, 2017), smoking (Pierce et al., 2005), alcohol consumption (Lindgren et al., 2010), sports (Park et al., 2010; 2014), visual arts (Fayn et al., 2018), and noctcaelador (an attachment to the night sky; Kelly & Daughtry, 2016).

Five (2%) articles studied curiosity as correlates of both mental and physical debilitations in clinical settings. Denneson et al (2017) measured curiosity in their study of suicide ideation among military veterans. Other articles set in the clinical domain include

therapy (e.g., Lefevre, 2012), myocardial infarction (Włodarczyk, 2017), and schizotypy (Gross et al., 2019). Lastly, eight (3%) articles focused on curiosity and health, primarily on well-being (Jovanovic & Brdaric, 2012; Jovanovic & Gavrilov-Jerkovia, 2014; Kaczmarek et al., 2014, Kashdan & Steger, 2007; Lydon-Staley et al., 2019; Öztekin & Bayraktar, 2019), personal growth (Mohanty et al., 2015), and quality of life (Kalka & Pawlowska, 2015).

### **Discussion**

The first objective of this scoping review was to map the literature on curiosity, in terms of dimensionality, how it was measured, and the context that it was studied in. The second objective was to take a broader perspective and uncover gaps that could inform future research (i.e., the following chapters). Before discussing the main findings, we first detailed the relevance of curiosity research based on geographical location.

#### **Geographical Location**

Of the identified articles, approximately 70% of articles were conducted in Western countries (North America, followed by Europe, and Australia). Conversely, Asian countries only accounted for an estimated 22%. This suggests an imbalance of literature that skews towards Western cultures. Research has found that culture plays a role in shaping personality traits (Schmitt et al., 2007). Given that curiosity has been studied as part of the web of personality traits in personality inventories such as the NEO-PI-R (Costa & McCrae, 2008) and the HEXACO (Ashton & Lee, 2009), it is possible that curiosity differs across cultures.

In a psychometric study examining the factor structure of curiosity, Ye et al. (2015) found that the CEI-II (developed and validated in the USA; Kashdan et al., 2009) did not conform to a two-factor structure as per the original scale, in a sample of Chinese students in Hong Kong. The researchers reported that a single factor curiosity construct fitted the data better. Moreover, the Hong Kong students showed higher levels of curiosity compared to the USA sample, which could be due to living in a culture that emphasises innovation and

creativity, which are common correlates of curiosity (Karwowski, 2012). Of the 22 articles that used mixed country samples, only six articles mentioned cultural impact when interpreting their findings. Importantly, of these six articles, only one involved an Asian territory (i.e., Hong Kong). This again reflects an underrepresentation of non-Western countries in the curiosity literature. Accordingly, more research should be done in Eastern cultures to obtain parity with their Western counterparts.

From the perspective of an individualistic-collectivistic continuum based on the cultural dimensions theory by Hofstede (2011), research often points to Western countries as being more individualistic, and Asian countries as more collectivistic (e.g., Sivadas et al., 2008), and it is often the case that openness to experience (a personality factor that curiosity is nested under) is higher in Western cultures compared to Eastern cultures (Church, 2016). However, by using this distinction, nuances can be missed. For example, Singapore, located in Southeast Asia, often blends both individualistic and collectivistic principles, and is aligned with Western modernity while retaining its Asian values, such as prioritising harmony and conformity (Yeo & Pang, 2017). It could be insightful to investigate how curiosity works not only in an underrepresented region (Asia), but also in multicultural or blended countries. In our scoping review, there were no studies involving Singapore, and only four originating from the region of Southeast Asia (three from Malaysia, one from Indonesia).

Secondly, again drawing upon the cultural dimensions by Hofstede (2010), a difference in power distance within cultures can affect levels of curiosity. Power distance is defined as the extent (usually high vs. low) to which the less powerful members of organisations and institutions accept that power is unevenly distributed, and tends to be higher in Asian countries, while lower in English-speaking Western countries (Hofstede, 2011). In relation to curiosity, Karandikar et al. (2021) conducted a cross-cultural study of

curiosity between Americans and Indians, and found that the Indian participants showed lower snooping (a covert social curiosity facet) than their American counterparts. They explained that the difference in said levels of curiosity could be due to a higher power distance between individuals in India, which then led to them maintaining distance from people perceived to have higher status, ultimately resulting in individuals stifling their curiosity.

Lastly, a cultural difference in levels of curiosity can also be characterised by the high vs. low uncertainty avoidance dimension, where people in a high uncertainty avoidance culture (e.g., Japan) display increased stress and anxiety when faced with ambiguity compared to those in low uncertainty avoidance cultures (e.g., the USA; Hofstede, 2010). Drawing links to curiosity, specifically the stress tolerance facet of curiosity, in order to elicit curiosity, one has to make a judgement that they are able to cope with the stress that accompanies uncertainty (Kashdan et al., 2018). Considering that research has shown that different cultures display varying degrees of uncertainty avoidance (e.g., high in East and Central European countries, low in Chinese culture countries; Hofstede et al., 2010), it is plausible that people from different cultures would also possess different levels of curiosity, especially on the stress tolerance facet.

### **Dimensionality and Measurement of Curiosity**

Since the dimensions of curiosity are inherent in the measure of curiosity used, they will be discussed in the same section. Results from the scoping review suggested that curiosity was more commonly conceptualised as a multidimensional construct (78%) as opposed to a unidimensional one (14%). This aligned with views that there are multiple facets and aspects to curiosity. This was also further highlighted with the majority of articles ( $n = 133$ , 54%) embracing this multidimensionality by analysing individual facets of curiosity. Curiously, research that viewed curiosity as unidimensional construct sometimes

used single-item task-specific measures, such as asking participants how curious they were when reading an academic text (Knoblock et al., 2004), rather than examining the nuances of curiosity as a psychological construct. While this may not affect the robustness of the studies, it does imply that there is much more to curiosity when viewed as a psychological construct rather than simply as a synonym of interest. There was also a small subset of articles ( $n = 31$ , 13%) that viewed curiosity as multidimensional, but used a global score in their analyses. While the appropriateness of using a global score is beyond the scope of this review, it is worth noting that given the multidimensionality of curiosity, using global scores could mask nuances as opposed to examining them as individual facets.

Findings from this scoping review showed that the most studied dimension of curiosity is a deprivation type of curiosity. This factor of curiosity stems from individuals trying to resolve information gaps, where they strive to seek answers to avoid unpleasant feelings of not possessing said information (Litman, 2008). This then manifests as curiosity. Likewise, Kashdan (2018) put forward the factor of deprivation sensitivity as one of the core dimensions of curiosity. Together, these two conceptualisations of a deprivation type curiosity made up a substantial number ( $n = 62$ ) of the articles that conceptualised curiosity as multidimensional.

Conversely, although the nomenclature differs, a sizable portion of included articles ( $n = 58$ ) conceptualised curiosity as the pleasure of obtaining information (joyous exploration and interest-based curiosity; Kashdan et al., 2018; Litman, 2008). Results from this scoping review also found that researchers studied curiosity along the dimensions of diversive ( $n = 17$ ), specific ( $n = 18$ ), and breadth/depth ( $n = 3$ ). This classification conceptualised an individual's curiosity being more spread out across a wide range of subjects or focused on a single one. The abovementioned categorisations do not refer to the topic of interest itself, but rather the 'how' are people curious. While investigating curiosity based on the different axes

of dimensionality can provide a more holistic picture, it does not discount the importance of the context-specific nature of curiosity.

Findings from the present scoping review suggest that the Epistemic Curiosity Scale (Litman, 2008) was the most common measure used, followed by the CEI-II (Kashdan et al., 2009). In the CEI-II, curiosity is split into two factors, one involving the motivation to consume new experiences (e.g., “I actively seek as much as I can in new situations”) and the other, the inclination to accept unpredictability (e.g., “I like to do things that are a little frightening”). Litman (2008), in the Epistemic Curiosity Scale, goes one step further by incorporating a failure-avoidance factor in deprivation type curiosity (e.g., “Spend hours on a problem because I can’t rest without an answer”). Kashdan et al. (2018; 2020) sought to combine isolated strands of research into a comprehensive curiosity measure, and developed the 5DC, which was later refined into the 5DCR. Although this has been less widely utilised than the Epistemic Curiosity Scale and the CEI-II, we believe that this is largely due to the measure having been developed only recently. The 5DC was the first to include a social curiosity factor among other existing factors. This was further expanded into overt and covert social curiosity factors in the 5DCR. Additionally, both the 5DC and its successor encompass an appraisal style factor called stress tolerance, where an individual must determine if they are able to cope with the stress that accompanies novel and unfamiliar situations, before any manifestation of curiosity. Also, Kashdan et al., (2018; 2020) synthesised a body of research that was largely ignored in the construct of curiosity: thrill-seeking, where individuals feel a rush of excitement whenever they have to take risks.

Taken together, it is apparent that the 5DCR represents the most recent measure of curiosity that captures the full bandwidth of curiosity. This has multiple implications, such as enabling researchers to better study the correlates of curiosity using a single multidimensional scale, and also to allow for investigating curiosity profiles, or ‘types’ of curious people

(Kashdan et al., 2018). However, to establish that the 5DCR is truly the most robust measure of curiosity, more research should be conducted.

### **Context of Curiosity Research**

Results from the present scoping review found that 108 (44%) of included articles were context-general in nature (i.e., not investigating curiosity in specific domains). While curiosity may be trait-like and generalise across all contexts, some researchers have also put forward a more nuanced distinction, arguing that individuals exhibit both domain-general and domain-specific forms of curiosity that vary across multiple contexts (Cromley et al., 2017). From the remaining 137 (56%) articles that specified a context, roughly half were situated in a workplace context (69), followed by education ( $n = 29$ , 21%). Intuitively, this is unsurprising, given the importance of schooling, and thereafter joining the workforce once an individual graduates from school. Moreover, curiosity has often been implicated in both education and at the workplace. For example, curiosity aids learning by promoting engagement and improving academic performance (Von Stumm et al., 2011), while curiosity is also positively linked with job performance and a sense of belonging to organisations (Mussel & Spengler, 2015).

Compared to curiosity in employment and education, much less research has been conducted on curiosity in leisure activities ( $n = 26$ , 11%). Video gaming in particular, was studied in 3% ( $n = 6$ ) of the articles. Based on longitudinal data, people spend a comparable amount of time between work and leisure activities (Ortiz-Ospina et al., 2020), indicating that leisure activities represent a major domain of human activity, but have somewhat escaped the attention of curiosity researchers. Of note, there is a sharp increase in the leisure activity of video gaming, and this could present an opportune time to delve deeper into this topic, given

the increased interest and curiosity to play video games ever since the COVID-19<sup>2</sup> pandemic started, where global lockdowns and quarantine conditions forced individuals to stay home (Perez, 2020). On a global scale, time spent video gaming during COVID-19 has increased by 39% (Clement, 2021). Six articles in the present scoping review were situated in the domain of video gaming. Given the growing number of video gamers and time spent gaming, more research can be devoted to studying curiosity in video gaming. This is perhaps made even more important, since research has pointed out that curiosity not only drives video gamers' engagement, but can also have a negative effect—video gaming addiction (Hsu et al., 2009; Schaekermann et al., 2017).

Of the six studies investigating curiosity in the video gaming space, four (Dahabiyeh et al., 2021; Gómez-Maureira & Kniestedt, 2019; Kim & Lee, 2017, Schaekermann et al., 2017) have been detailed in the other chapters of this thesis and will not be elaborated upon here. Of the two remaining articles, Gómez-Maureira et al. (2021) investigated if curiosity would be related to in-game behavioural metrics such as how the playable character moves (e.g., jumping, running, walking) and camera rotations. The authors reported that the thrill-seeking dimension of curiosity was positively correlated with camera rotation. A possible explanation was that individuals seeking thrills would manoeuvre the in-game camera more to identify locations or stimuli where they might be able to satisfy the need for thrills.

In the final study of the six captured by the scoping review, Huck et al. (2020) examined the role of curiosity as a predisposition for information seeking behaviours (interest-type) and tendency to resolve gaps in knowledge (deprivation-type) within a video game. Results revealed that interest-type curiosity, but not deprivation-type curiosity was critical in becoming proficient at a video game, at least in the early stages of picking up a

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<sup>2</sup> We acknowledge that COVID-19 is now viewed as endemic, but reports show that prevalence of video gaming has been rising even before COVID-19, and is projected to continue to increase post-COVID (Clement, 2023; Palvia et al., 2018).

new game. This signifies that enjoyment in acquiring expertise and knowledge is a better motivator compared to closing knowledge gaps.

Outside of playing games, people also spend increasing amounts of time on social media, which is further exacerbated by a transition from offline to online activities (remote working / learning; Samet, 2020). Despite its many advantages such as the ease of information exchange, longer usage of social media can lead to addiction. More importantly, curiosity has been implicated as a potential antecedent to addictive social media use (Zhao & Zhou, 2021). For example, Brailovskaia et al., (2018) found that curiosity (the desire to know what happens on Facebook) was a predictor of Facebook addiction. In our scoping review, only three included articles had a social networking context. Given the ubiquitous nature of social media sites nowadays, more research should be conducted on the links between curiosity and addiction to social media.

Based on findings from the present scoping review, only 13 (5%) of included articles were situated in the context of a clinical setting, and health, and were all conducted pre-COVID-19. Along with individuals potentially turning to different leisure activities due to COVID-19, the global pandemic may have also highlighted the importance of investigating how curiosity works in clinical settings, or is related to an individual's well-being. Research has found that possessing high levels of curiosity increases coping efficacy to stop negative thoughts in suicidal clients (Denneson et al., 2017). Not only is curiosity useful for clients, but also for therapists – Lefevre (2012) reported that therapists who endorsed higher levels of curiosity had less compassion fatigue, enabling them to better connect with patients. It is well documented that COVID-19 resulted in individuals experiencing worsening mental health (Patrick et al., 2020). As such, this can serve as a call to action that more curiosity research can be done not only in the context of mental health, but also on well-being and quality of life.

### **Limitations and Future Research**

A few limitations of this scoping review should be noted. Firstly, only English language records were included, thus non-English but relevant articles could have been missed. The smaller number of articles originating from Asia, compared to North America, could be due to this limitation, where English may not be the first language in countries from these regions. This could also represent a constraint for examining how curiosity differs across cultures. However, available resources necessitated the exclusion of non-English language records.

Also, in the present scoping review, methodological rigour and quality of articles were not investigated. Since the purpose of a scoping review is to map the literature, rather than assessing quality, we opted to include not only published articles, but conference papers and dissertations as well. This aligned with the main objective to obtain breadth of research being conducted on the construct of curiosity.

As part of the data extraction form, we looked at future directions that the included articles proposed. As previously mentioned, curiosity does possess an unhealthy downside, such as addiction (Schaekermann et al., 2017). A total of 10 (4%) articles made recommendations to investigate the negative aspects of curiosity, such as its maladaptive effects, and propensity to engage in risky and unhealthy behaviours. To bolster the literature, future research can seek to further examine how curiosity interacts with maladaptive behaviours. For example, Dahabiyeh et al., (2021) found that curiosity leads to individuals downplaying risks and driving intention to play online games, resulting in problematic gaming. In Lindgren et al., (2010), the researchers found that higher scores on the absorption factor of the CEI-I (Kashdan et al., 2004) were associated with more alcohol-related problems, but this was not found for the exploration factor. This suggests that perhaps only specific facets of curiosity are applicable to maladaptive behaviour, and can be studied as

such, as compared to using global scores of curiosity. Researchers can also go one step further by investigating curiosity in the nuances among contexts of addiction. Current views suggest that gaming addiction works in a similar fashion to substance and gambling addiction (Tejeriro Salguero & Moran, 2002), but the specific role of curiosity with respect to the different types of addiction is still inconclusive, and thus provides fertile ground for future research.

The current scoping review only included records that used quantitative and self-report surveys. While self-report questionnaires are by far the most common, other forms of data can enrich the literature. For instance, qualitative data can shed light on individuals' in-depth experience of curiosity, and their personal perspectives (Clark & Seider, 2017). Studying curiosity from a neuroscience perspective can also further the field. For example, Marvin et al., (2020) reported that curiosity and impulsivity share surprising overlaps in their neural substrates. An interesting takeaway from their research involves the notion that educational and cultural consensus trend towards trying to decrease impulsivity in individuals, which could then inadvertently attenuate curiosity as well, along with its benefits. Taken together, conducting curiosity research using measures other than self-report surveys can help researchers achieve a more holistic picture on how curiosity functions.

Lastly, the 5DCR, developed by Kashdan et al., (2020), is the latest contemporary measure of curiosity, and also purported to be the most comprehensive, capturing the full construct of curiosity, and providing greater predictive power. Given its recency, it is unsurprising that only two articles administered the 5DCR. Future research can continue to not only utilise the 5DCR, but also validate its applicability across different cultures and countries. There are currently no cross-validation studies involving the 5DCR. Considering the substantial role that culture can have in affecting curiosity, it is important to investigate the 5DCR in a non-Western culture.

The 5DCR may also be used in conjunction with other curiosity measures that focus on facets of curiosity not measured by it. For example, Litman et al., (2017) developed a curiosity scale focusing on an individual's curiosity about oneself – the Intrapersonal Curiosity scale. An introspective form of curiosity can be helpful in reaping benefits from activities such as meditation, where a major goal is the improvement of the self-concept and accepting oneself (Jimenez et al., 2010). Research has shown that curiosity is positively related to individuals practicing meditation (Ivtzan et al., 2011). Considering that meditation focuses on the self, it is possible that an inward-looking curiosity can be efficacious in promoting personal growth and reducing self-discrepancy beyond a generic conceptualisation of curiosity (i.e., curiosity as unidimensional and context-general), even if it is through indirect means (e.g., via meditation). Whether intrapersonal curiosity can be assimilated with the 5DCR remains to be seen, but investigating this factor of curiosity could be a worthwhile endeavor for future research.

### **Conclusion**

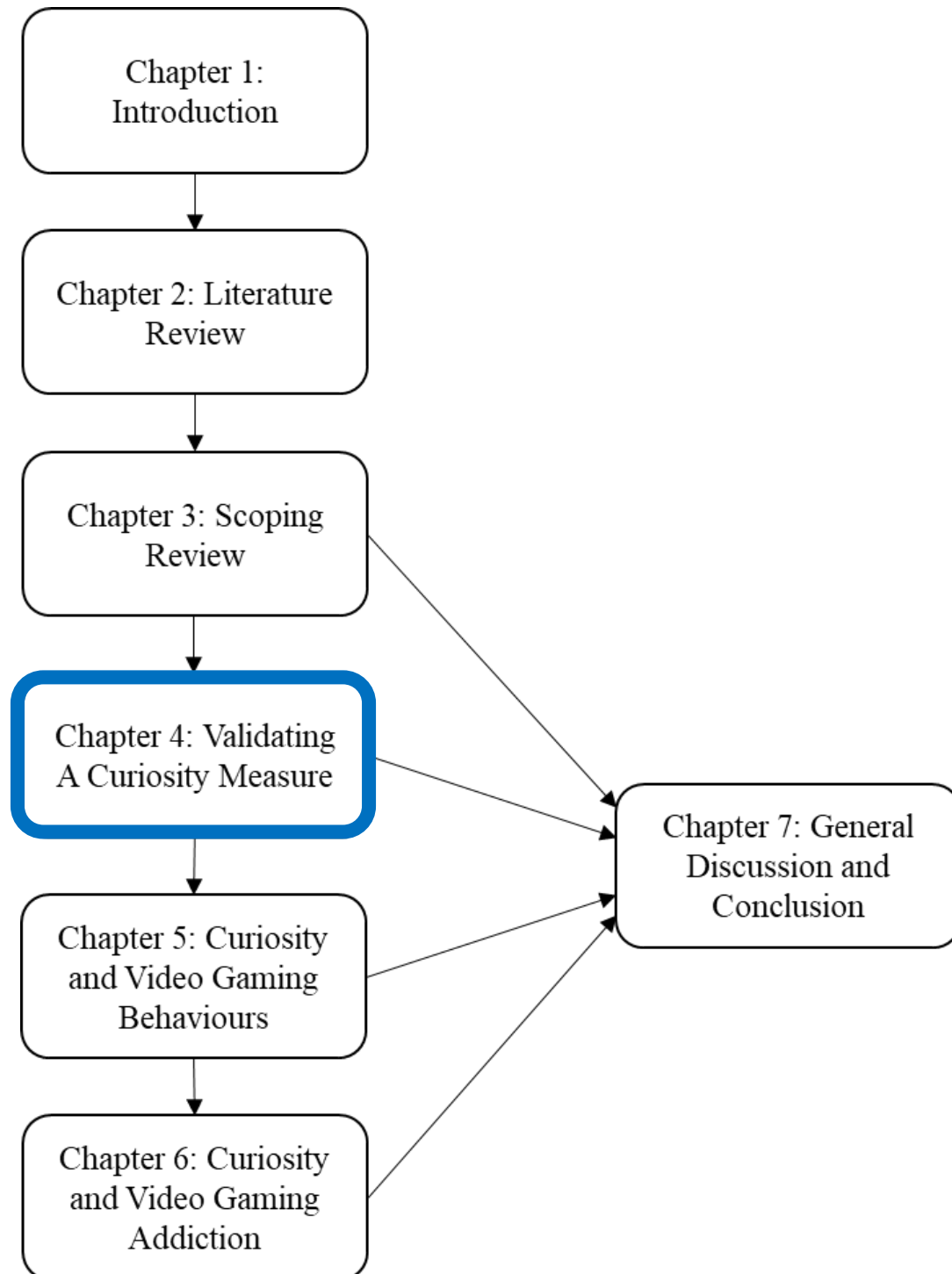
The study of curiosity has been fragmented in several ways, necessitating the conduct of a scoping review to synthesise and uncover gaps in the literature. This scoping review provided an overview on how curiosity research has been conducted over the past six decades, highlighting the ways curiosity has been conceptualised, the popular measures used, and the contexts in which curiosity research has taken place, with an overall emphasis on how the study of curiosity can be expanded upon. Essentially, the findings from the scoping review formed the foundation that led to the program of research in the current project.

Firstly, we found that the 5DCR (Kashdan et al., 2020) is the most recent measure of curiosity that captures the full bandwidth of curiosity, but has not been thoroughly cross validated. Coupled with the finding that the majority of curiosity research is skewed towards Western cultures, it is important to examine the applicability of the 5DCR in non-Western

settings. Chapter 4 addresses this need by validating the 5DCR in a sample of Southeast Asians.

Secondly, results from the scoping review revealed that there is a lack of curiosity research in leisure pursuits, despite people spending a comparable amount of time between formal and informal activities. As explained in Chapters 1 and 2, video gaming is one leisure activity that is growing rapidly in popularity. Literature has also put forth that curiosity plays an important role in why people immerse themselves in video games (e.g., Schackermann et al., 2017). Chapter 5 ties the concepts of curiosity and video gaming, investigating how the multidimensionality of curiosity can lead to different video gaming preferences.

Thirdly, as highlighted in the future directions section, possessing curiosity can potentially lead to addictive behaviours. Given that concerns over problematic gaming has risen alongside the popularity of games (Kim et al., 2022), it is timely to investigate the relationship between curiosity and video gaming addiction. Chapter 6 examines if dimensions of curiosity can predict video gaming addiction, while also being cognisant of the conceptual differences between video gaming engagement and addiction (see Chapter 2), to provide a deeper layer of insight.



## **Chapter 4: Validation of the Five-Dimensional Curiosity Scale Revised—A Southeast Asian Perspective**

As discussed in Chapter 3, the Five-Dimensional Curiosity Scale Revised (5DCR; Kashdan et al., 2020) represents the most updated and comprehensive framework of curiosity. It comprises six aspects of curiosity, including joyous exploration, deprivation sensitivity, stress tolerance, thrill-seeking, overt social curiosity, and covert social curiosity. The 5DCR was developed using samples primarily from the United States, with the majority identifying as white (Kashdan et al., 2020). Moreover, the scale was developed in 2020, thus it is unsurprising that there would be a lack of research examining the cross-cultural validity of the measure. To our knowledge, only one cross-cultural investigation has been conducted, where a German-language adaptation of the 5DCR was examined, in addition to the original English-language version in a UK sample (Grüning & Lechner, 2022). Exploratory and confirmatory factor analyses supported the six-factor structure in both samples. Furthermore, strict measurement invariance was found for the variables of sex and educational levels, and scalar invariance across age groups. Overall, findings from these studies showed support for the use of the 5DCR in both Germany and the UK. While this is promising, it is currently unclear how applicable the 5DCR is in non-Western contexts, such as Southeast Asia. Accordingly, validating the 5DCR is an important precursor to utilising it in the current project, which recruits samples from the Southeast Asian region.

### **Curiosity in Non-Western Contexts**

Cross-cultural research has found some evidence of differences in curiosity between cultures. In a cross-cultural validation of another curiosity measure (the Epistemic Curiosity Scale; Litman, 2008), Karandikar et al. (2021) found that an Indian sample had lower levels of gossip and snooping (both are parts of covert social curiosity) compared to an American sample. This was conceived as a difference in power distance between the two cultures,

where the Indian sample would keep their distance from those thought to possess a higher societal status, leading to suppression of curiosity. This is congruent with the power difference aspect in the theory of cultural dimensions by Hofstede (2011), where less powerful members of society accept that power is not equally distributed. He also found that individuals in Asian countries are more likely to endorse higher levels of power distance, compared to those in Western countries. Likewise, uncertainty avoidance is another dimension that could offer another perspective as to how curiosity might differ in Asia (Hofstede, 2011). For example, Japan is a country with high uncertainty avoidance, where stress and anxiety spikes substantially when encountering unpredictable situations, particularly when compared to responses from people living in the USA (Church, 2016). This could for example, affect the curiosity dimension of stress tolerance, where one judges if they are able to adequately deal with the stress that comes with unpredictability.

While studies examining differences in curiosity between cultures is relatively scarce, research conducted by Birenbaum and Nasser-Abu (2020), using the 5DC (Kashdan et al., 2018), investigated if Arabs and Jews differed in the dimensions of curiosity. They found that Arabs reported lower levels of social curiosity than Jews, perhaps due to their relatively more collectivistic culture, where respect for in-group norms and authority figures are emphasised. Also, Birenbaum and Nasser-Abu reported that Arab women scored far higher than their Jewish counterparts on the thrill-seeking curiosity subscale, which could be due to an extreme response tendency surrounding Arab culture (Batchelor & Miao, 2016). While differences between the Arab and Jewish groups clearly exist, whether they are meaningful cultural variations or more response-related inclinations is still a matter for debate. This not only underlines the need for more cross-cultural studies to be conducted, but also for shifting the focus to non-Western cultures and countries. Findings from Chapter 3 also indicate that curiosity research skews heavily towards Western cultures compared to Eastern ones (Yow et

al., 2022). Together, these findings speak to the need for curiosity to be examined more thoroughly in non-Western contexts such as various regions of Asia. However, before any cross-cultural comparisons can be carried out in future research, there is a need to first establish the validity and reliability of the 5DCR across different cultural settings.

### **The Present Study**

The aim of the current study was to evaluate the applicability of the 5DCR in Southeast Asia. Cross-cultural validity is an important consideration in the generalisability and utility of a measure (Arafat et al., 2016; Wang et al., 2016). It is paramount that the curiosity measure in question is suitable for use in a particular culture, such that scores and findings can be meaningfully compared with those derived in other cultural settings. The present study therefore aimed to provide a foundation for more research on curiosity in Southeast Asia by establishing the psychometric properties of the 5DCR in a Southeast Asian sample. The three primary objectives were as follows: (a) to assess the six-factor structure of the 5DCR in Southeast Asia, (b) to examine the internal consistency, test-retest reliability, and construct validity of the 5DCR, and (c) to assess the measurement invariance of the 5DCR across three Southeast Asian countries. Measurement invariance examines the psychometric equivalence of a construct (i.e., curiosity) across groups (i.e., three Southeast Asian countries) such that the construct can be meaningfully compared across these groups (Putnick & Bornstein, 2016). As a secondary objective, we assessed if there were differences in levels of curiosity among three Southeast Asian countries.

## **Method**

### **Participants**

Kyriazos (2018) recommended using the N:q guideline (number of cases to number of estimated parameters) of at least 10:1 for confirmatory factor analyses. Consequently, a sample size of 390 participants was targeted. Participants were recruited via multiple

avenues. First, the study was advertised on a university's research participation system. Snowball sampling using social media (Facebook, Instagram, Reddit) and messaging platforms (WhatsApp) were also used. Lastly, an external panel provider was engaged.

There were three inclusionary criteria for participation in the current study: participants must be (a) a citizen of a country in Southeast Asia, (b) at least 18 years old, and (c) proficient in the English language. After removing incomplete responses, a final sample of 434 participants (49.50% male, 49.10% female, 0.20% "others", and 1.20% preferred not to disclose) was obtained. Participants' mean age was 35.55 ( $SD = 13.04$ , range = 18 – 70 years), with 1 nonsensical value, which was treated as missing. Of the 434 participants, 35.50% were from Malaysia, 33.20% from the Philippines, 28.8% from Singapore, 0.90% from Indonesia, 0.70% each from Myanmar and Vietnam, and 0.20% from Thailand. Regarding relationship status, 43.30% were married, 53.20% were single, 2.50% were divorced/separated, and 0.90% reported "others". For occupational status, 1.84% were missing/nonsensical responses, 71.89% employed full time, 14.29% students, 3.22% freelancers, 3.00% stay-home parents, 2.76% retirees, 2.53% unemployed, and 0.46% part-timers. Average years of education was 14.77 ( $SD = 2.82$ , range = 1 – 26 years; barring one nonsensical value). To examine test-retest reliability, a follow-up study was conducted using  $N = 21$ .

### **Design and Analysis**

The study was hosted on Qualtrics (2020) and conducted online. Confirmatory Factor Analysis (CFA) was conducted using the AMOS software (Arbuckle, 2019) to assess factor structure. Model fit was assessed using Chi-square, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TFI), and Standardised Mean Square Residual (SRMR). Reliability was determined by internal consistency via McDonald's omega ( $\omega$ ) and test-retest correlations. Convergent and divergent

validity was assessed by correlations of the 5DCR subscales with other administered measures that assessed related constructs. We selected these measures based on the initial validation of the 5DCR, and the 5DC (the precursor to the 5DCR; Kashdan et al., 2018), to examine the patterns of correlations between the aforementioned studies and the present one.

## **Measures**

Demographic information including age, gender, nationality, number of years of education, occupational status, and relationship status were collected. For the primary analyses, a total of eight measures were administered. Example items for each measure and its subscales are presented in Table 4.1.

### ***Five-Dimensional Curiosity Scale Revised (5DCR)***

The 5DCR (Kashdan et al., 2020) is a 24-item measure consisting of six subscales: joyous exploration, deprivation sensitivity, stress tolerance, thrill-seeking, overt social curiosity, and covert social curiosity. Each subscale has four items, which are rated on a 7-point Likert scale, ranging from 1 (*does not describe me at all*) to 7 (*completely describes me*). All items in the stress tolerance subscale are reverse scored. Scores are averaged across each of the six subscales, with higher scores representing higher levels of curiosity on the respective dimension. The six-factor structure was confirmed in both a German, and UK sample (Grüning & Lechner, 2022). The 5DCR was shown to be internally reliable (cronbach's alpha for each subscale at least .8; Grüning & Lechner, 2022; Kashdan et al., 2020).

### ***Mini-International Personality Item Pool (IPIP)***

The IPIP (Donnellan et al., 2006) is a 20-item measure (11 items reverse coded) that encapsulates the big five factors of personality: extraversion, openness to experience, conscientiousness, agreeableness, and neuroticism. Items are rated on a 5-point Likert scale, from 1 (*very inaccurate*) to 5 (*very accurate*), and scores are averaged for each factor. Higher

scores indicate higher levels of each personality factor. Baldasaro et al. (2013) reported internal consistency for the IPIP to be  $\alpha = 0.62$  to  $0.70$ , and these results were consistent with results from other researchers (e.g., Cooper et al., 2010). Internal consistency coefficients ( $\alpha$ ) ranged from  $.44$  to  $.70$  in the present study.

#### ***Twenty Item Values Inventory (TwIVI)***

The TwIVI (Sandy et al., 2017) consists of 10 two-item subscales: conformity, tradition, benevolence, universalism, self-direction, stimulation, hedonism, achievement, power, and security. Items are rated on a 6-point Likert scale: 1 (*not at all like me*) to 6 (*very much like me*). Scores are averaged for each of the 10 values, with higher scores implying more identification with the respective value. Busque-carrier et al. (2023) reported Cronbach's alphas ranging from  $.53$  to  $.86$  for the TwIVI subscales. In the current study, Cronbach's alphas ranged between  $.50$  to  $.77$ .

#### ***Depression, Anxiety, and Stress Scales (DASS-21)***

The DASS-21 (Henry & Crawford, 2005) is a 21-item questionnaire with 3 scales. Only 14 items (the scales of depression and anxiety) were administered in the current study. Items are rated on a 4-point Likert scale, 1 (*did not apply to me at all*) to 4 (*applied to me very much or most of the time*). Averaged scores for each subscale are computed, with higher scores indicating more depression and anxiety respectively. Internal consistency was found to be at  $\alpha = .92$  for depression, and  $\alpha = .87$  for anxiety, in a Malaysian sample (Thiyagarajan et al., 2022). Cronbach's alphas were  $.93$  and  $.89$  for the depression and anxiety subscales respectively.

#### ***Subjective Happiness Scale***

The Subjective Happiness Scale (Lyubormirsky & Lepper, 1999) is a measure of happiness with four items, two of which are rated on a 7-point Likert scale asking for general happiness: 1 (*not a very happy person*) to 7 (*a very happy person*). The remaining two items

present a short depiction of a happy (“Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterisation describe you?”) and unhappy (“Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterisation describe you?”) person. Participants rate the extent to which they identify with each description on a 7-point Likert scale: 1 (*not at all*) to 7 (*a great deal*). Scores are averaged to achieve a global score, with higher scores suggesting higher subjective happiness. Swami et al. (2009) corroborated a single-factor structure, as well as adequate internal consistency ( $\alpha = .78$  in a Filipino sample). Cronbach’s alpha was .73 in the current study.

#### ***Situated Wise Reasoning Scale (SWIS)***

The SWIS (Brienza et al., 2018) consists of 19-items across five subscales: considering others’ perspectives (4 items), intellectual humility (4 items), compromise (3 items), adopting others’ perspective (3 items), and recognition of change (5 items). Participants rate the items based on how to they try to resolve personal conflicts. A 5-point Likert scale is used, ranging from 1 (*very useless*) to 5 (*very useful*). Scores are averaged for each subscale, with higher scores meaning higher levels of the subscale measured. Kashdan et al. (2020) reported good internal consistency within the subscales (ranging from  $\alpha = .82$  to .86). In the present study, Cronbach’s alphas ranged from .81 to .88.

#### ***Short Warwick Edinburgh Mental Wellbeing Scale (SWEMWBS)***

The SWEMWBS (Stewart-Brown et al., 2009) is a 7-item unidimensional scale capturing overall well-being. Items are rated on a 4-point Likert scale, from 1 (*none of the time*) to 4 (*all of the time*). Means of scores are tabulated, with higher scores suggesting better well-being. The SWEMWBS has been thoroughly validated, replicating a single-factor

structure, and found to have strong internal consistency values ( $\alpha = .88$  in Koushede et al., 2019;  $\alpha = .70$  in Ringdal et al., 2018). Cronbach's alpha was .89 in the current study.

**Table 4.1**

*Measures, Subscales, and Sample Items of Administered Scales*

| Scale/subscale Name                                         | Sample Item                                                                                                                         |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| <b>Five-Dimensional Curiosity Scale Revised</b>             |                                                                                                                                     |
| Joyous exploration                                          | I find it fascinating to learn new information                                                                                      |
| Deprivation sensitivity                                     | I work relentlessly at problems that I feel must be solved                                                                          |
| Stress tolerance                                            | The smallest doubt can stop me from seeking out new experiences                                                                     |
| Overt social curiosity                                      | I like finding out why people behave the way they do                                                                                |
| Covert social curiosity                                     | When around other people, I like listening to their conversations                                                                   |
| Thrill-seeking                                              | Risk-taking is exciting to me                                                                                                       |
| <b>Mini-International Personality Item Pool (Mini-IPIP)</b> |                                                                                                                                     |
| Openness to experience                                      | Have a vivid imagination                                                                                                            |
| Conscientiousness                                           | Get chores done right away                                                                                                          |
| Extraversion                                                | Am the life of the party                                                                                                            |
| Agreeableness                                               | Sympathise with others' feelings                                                                                                    |
| Neuroticism                                                 | Have frequent mood swings                                                                                                           |
| <b>Twenty Item Values Inventory (TwIVI)</b>                 |                                                                                                                                     |
| Conformity                                                  | It is important to him/her to always behave properly. S/he wants to avoid doing anything people would say is wrong.                 |
| Tradition                                                   | Religious belief is important to him/her. S/he tries hard to do what his religion requires.                                         |
| Benevolence                                                 | It's very important to him/her to help the people around him/her. S/he wants to care for their well-being.                          |
| Universalism                                                | S/he believes all the worlds' people should live in harmony. Promoting peace among all groups in the world is important to him/her. |
| Self-Direction                                              | Thinking up new ideas and being creative is important to him/her. S/he likes to do things in his/her own original way.              |

| Scale/subscale Name                                             | Sample Item                                                                                                   |
|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| Stimulation                                                     | S/he likes to take risks. S/he is always looking for adventures.                                              |
| Hedonism                                                        | S/he really wants to enjoy life. Having a good time is very important to him/her.                             |
| Achievement                                                     | Being very successful is important to him/her. S/he likes to impress other people.                            |
| Power                                                           | S/he always wants to be the one who makes the decisions. S/he likes to be the leader.                         |
| Security                                                        | It is important to him/her that things be organised and clean. S/he really does not like things to be a mess. |
| <b>Depression, Anxiety, and Stress Scales (DASS-21)</b>         |                                                                                                               |
| Anxiety                                                         | I was aware of dryness of my mouth                                                                            |
| Depression                                                      | I felt that I had nothing to look forward to                                                                  |
| <b>Situated Wise Reasoning Scale (SWIS)</b>                     |                                                                                                               |
| Consider other perspective                                      | Trying to put myself in the other person's shoes                                                              |
| Intellectual humility                                           | Considering whether others' opinions might be more correct than mine                                          |
| Search for compromise                                           | Trying to find a way to accommodate both perspectives                                                         |
| Adopting others' perspective                                    | Trying to see the situation from the point of view of an uninvolved person                                    |
| Recognition of change                                           | Looking for different solutions as the situation evolves                                                      |
| <b>Short Warwick Edinburgh Mental Wellbeing Scale (SWEMWBS)</b> | I've been feeling relaxed                                                                                     |

## Procedure

Approval for the study was obtained from the Human Research Ethics Committee (Approval code: H8712) of James Cook University prior to commencement. Taking part in the study was voluntary and participants could withdraw at any point in time without any prejudice. Participants were first presented with an information sheet explaining the

background and purpose of the study, followed by an informed consent form. Participants who provided consent then completed a demographics questionnaire asking for age, gender, nationality, number of years of education, occupation, and relationship status. The order of administration for the measures of interest was as follows: the 5DCR, IPIP, TwIVI, DASS-21, Subjective Happiness Scale, SWEMWBS, and finally the SWIS. The entire study took about 20 minutes to complete. Most participants that completed the study received course credit, some were from the external vendor's online panel and were paid approximately USD\$2.50 each, and the rest were recruited through the researcher's snowball sampling and were not remunerated for their participation. Participants from the research participation system (where extra credit points could be earned) and snowball recruitment (no remuneration) were invited to participate in a follow-up study conducted two months later (for the purpose of establishing test-retest reliability).

## **Results**

### **Confirmatory Factor Analysis (CFA)**

A CFA was conducted using AMOS v22, to assess the factor structure of the 5DCR. The final sample size was 434, which exceeded the required sample size of 390 as per guidelines from Kyriazos (2018). Based on findings from Kashdan et al. (2022), we expected a six-factor solution with four items per factor. To determine model fit, we used the indices of Chi-square, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardised Mean Square Residual (SRMR).

Results indicated that the model fit indices were:  $\chi^2 (237) = 556.21, p < .001$ ; RMSEA = .06 (90% CI: [.05, .06]); CFI = .94; TLI = .93; SRMR = .053. All indices suggested a good fit, with the exception of the significant Chi-square test. However, this is an overly stringent model fit criterion (Kline, 2011). Moreover, the Chi-square/df value was 2.35, which is less than 3, implying an acceptable fit (Kline, 1998).

The factor loadings for each item also showed support for the four items under each curiosity dimension: loadings for joyous exploration ranged from .73 to .83, deprivation sensitivity from .70 to .84, stress tolerance from .66 to .84, thrill-seeking from .68 to .83, overt social curiosity from .74 to .87, and covert social curiosity from .74 to .82. The individual items factor loadings are reported in Table 4.2.

**Table 4.2***Factor Loadings for Items in the Six-factor Structure of the 5DCR*

| <b>Dimension</b>        | <b>Item</b>                                                                                           | <b>Loading</b> |
|-------------------------|-------------------------------------------------------------------------------------------------------|----------------|
| Joyous exploration      | I view challenging situations as an opportunity to grow and learn.                                    | .77            |
|                         | I seek out situations where it is likely that I will have to think in depth about something.          | .83            |
|                         | I enjoy learning about subjects that are unfamiliar to me.                                            | .77            |
|                         | I find it fascinating to learn new information.                                                       | .73            |
| Deprivation sensitivity | Thinking about solutions to difficult conceptual problems can keep me awake at night.                 | .70            |
|                         | I can spend hours on a single problem because I just can't rest without knowing the answer.           | .84            |
|                         | I feel frustrated if I can't figure out the solution to a problem, so I work even harder to solve it. | .83            |
|                         | I work relentlessly at problems that I feel must be solved.                                           | .76            |
| Stress tolerance        | The smallest doubt can stop me from seeking out new experiences.                                      | .66            |
|                         | I cannot handle the stress that comes from entering uncertain situations.                             | .77            |
|                         | I find it hard to explore new places when I lack confidence in my abilities.                          | .84            |
|                         | It is difficult to concentrate when there is a possibility that I will be taken by surprise.          | .76            |

| Dimension               | Item                                                                             | Loading |
|-------------------------|----------------------------------------------------------------------------------|---------|
| Thrill-seeking          | Risk-taking is exciting to me.                                                   | .72     |
|                         | When I have free time, I want to do things that are a little scary.              | .68     |
|                         | Creating an adventure as I go is much more appealing than a planned adventure.   | .83     |
|                         | I prefer friends who are excitingly unpredictable.                               | .73     |
| Overt social curiosity  | I ask a lot of questions to figure out what interests other people.              | .74     |
|                         | When talking to someone who is excited, I am curious to find out why.            | .85     |
|                         | When talking to someone, I try to discover interesting details about them.       | .87     |
|                         | I like finding out why people behave the way they do.                            | .78     |
| Covert social curiosity | When other people are having a conversation, I like to find out what it's about. | .82     |
|                         | When around other people, I like listening to their conversations.               | .80     |
|                         | When people quarrel, I like to know what's going on.                             | .79     |
|                         | I seek out information about the private lives of people in my life.             | .74     |

### Reliability and Descriptive Statistics

Reliability statistics were computed using Cronbach's alpha ( $\alpha$ ). Results found that all items were highly reliable with respect to their individual factors, with coefficients ranging from .83 to .88. Test-retest correlations of two months assessed via Pearson's  $r$  also displayed acceptable to strong consistency over time, with values ranging from .62 to .96 (all  $p$ 's < .001, except thrill-seeking:  $p = .003$ ) Table 4.3 depicts the  $\alpha$  and  $r$  values, along with means and standard deviations for each dimension. However, it should be acknowledged that sample size was only  $n = 21$  for the follow-up study.

**Table 4.3**

*Means, Standard Deviations, Omega, and Test-retest Coefficients of the 5DCR*

| <b>Dimension</b>        | <b><i>M</i></b> | <b><i>SD</i></b> | <b><i><math>\alpha</math></i></b> | <b>Test-Retest <i>r</i></b> |
|-------------------------|-----------------|------------------|-----------------------------------|-----------------------------|
| Joyous Exploration      | 5.03            | 1.21             | .86                               | .96**                       |
| Deprivation Sensitivity | 4.74            | 1.33             | .86                               | .75**                       |
| Stress Tolerance        | 4.24            | 1.34             | .84                               | .80**                       |
| Thrill-seeking          | 4.19            | 1.32             | .83                               | .62*                        |
| Overt Social Curiosity  | 4.83            | 1.26             | .88                               | .86**                       |
| Covert Social Curiosity | 3.97            | 1.50             | .87                               | .84**                       |

\*  $p < .05$ ; \*\*  $p < .001$

### Construct Validity

Correlations of the six-factor structure of curiosity with the other scales of interest were examined. We interpreted correlational coefficients based on Gignac and Szodorai (2016), where  $r \geq .10$  reflects a small effect,  $r \geq .20$  suggests a medium effect, and  $r \geq .30$  for a large effect. In general, the dimensions of the 5DCR showed relevant associations with the five facets of personality traits, with Pearson's  $r$  values ranging from .01 to .37. The coefficients also generally highlighted the lack of collinearity, which indicated support for

discriminant validity of the 5DCR dimensions with facets of the IPIP. Except for covert social curiosity and deprivation sensitivity, each dimension of curiosity was significantly correlated with openness ( $r$  values ranging from .18 to .29). This indicated convergent validity via theoretical similarities in the approach based nature of curiosity (e.g., joyous exploration) and the tendency to be open-minded to new experiences (i.e., openness). In the same vein, overt social curiosity was also strongly correlated with extraversion ( $r = .30$ ) and agreeableness ( $r = .37$ ). This makes theoretical sense as these constructs pertain to an individual's interactions with other people. However, deprivation sensitivity did not correlate with any of the IPIP dimensions, which differed from the findings reported by Kashdan et al. (2020), and was contrary to expectations.

The relationships between dimensions of curiosity and the remaining constructs examined were consistent with those reported by Kashdan et al. (2020). With regards to the TwIVI, self-direction and stimulation showed the highest correlations with the dimensions of curiosity respectively, especially for joyous exploration ( $r = .48$  and  $r = .53$ ), deprivation sensitivity ( $r = .39$  and  $r = .35$ ), thrill-seeking ( $r = .43$  and  $r = .64$ ), and overt social curiosity ( $r = .48$  and  $r = .48$ ). On the other hand, the values of conformity and tradition generally showed weak correlations with the 5DCR facets ( $r$  values ranging from .01 to .19). These findings support the convergent and discriminant validity of the 5DCR respectively. Of all the curiosity dimensions, stress tolerance displayed strong correlations with both anxiety ( $r = -.43$ ) and depression ( $r = -.50$ ). Anxiety and depression were also significantly correlated with covert social curiosity ( $r = .22$  and  $r = .18$  respectively; indicative of convergent validity), but not overt social curiosity ( $r = .05$  and  $r = -.03$ ; highlighting discriminant validity).

Lastly, the facets of joyous exploration and overt social curiosity had the strongest correlations with wisdom: considering and adopting the perspectives of others, humility, seeking compromise, and recognising changes in situations ( $r$  coefficients ranging from .25 to

.36 for joyous exploration, and .22 to .36 for overt social curiosity). Conversely, stress tolerance displayed little to no relationship with the SWIS ( $r$  values from .05 to .11). This differential pattern of associations further corroborates both the convergent and discriminant validity of the 5DCR. The pattern of correlations between the facets of curiosity and other measures administered are reported in Table 4.4.

**Table 4.4**

*Construct Validity of the 5DCR*

|                   | Joyous<br>exploration | Deprivation<br>sensitivity | Stress<br>tolerance | Thrill-<br>seeking | Overt<br>social<br>curiosity | Covert<br>social<br>curiosity |
|-------------------|-----------------------|----------------------------|---------------------|--------------------|------------------------------|-------------------------------|
| <b>IPIP</b>       |                       |                            |                     |                    |                              |                               |
| Extraversion      | .22**                 | .05                        | .21**               | .30**              | .30**                        | .17**                         |
| Agreeableness     | .20**                 | .07                        | .16**               | .14**              | .37**                        | .19**                         |
| Conscientiousness | .14**                 | .05                        | .33**               | -.03               | .02                          | -.21**                        |
| Neuroticism       | -.19**                | -.01                       | -.37**              | .04                | .03                          | .05                           |
| Openness          | .28**                 | .09                        | .29**               | .18**              | .26**                        | -.03                          |
| <b>TwIV</b>       |                       |                            |                     |                    |                              |                               |
| Conformity        | .18**                 | .14**                      | .01                 | .10*               | .08                          | -.02                          |
| Tradition         | .12*                  | .14**                      | -.04                | .19**              | .02                          | -.002                         |
| Benevolence       | .29**                 | .27**                      | -.05                | .27**              | .35**                        | .18**                         |
| Universalism      | .33**                 | .22**                      | .05                 | .21**              | .27**                        | -.01                          |
| Self-Direction    | .48**                 | .39**                      | .01                 | .43**              | .48**                        | .23**                         |
| Stimulation       | .53**                 | .35**                      | .08                 | .64**              | .48**                        | .26**                         |
| Hedonism          | .36**                 | .23**                      | -.02                | .39**              | .40**                        | .28**                         |
| Power             | .28**                 | .23**                      | -.06                | .40**              | .22**                        | .30**                         |
| Security          | .24**                 | .21**                      | .08                 | .17**              | .22**                        | .04                           |

|                               | Joyous<br>exploration | Deprivation<br>sensitivity | Stress<br>tolerance | Thrill<br>seeking | Overt<br>social<br>curiosity | Covert<br>social<br>curiosity |
|-------------------------------|-----------------------|----------------------------|---------------------|-------------------|------------------------------|-------------------------------|
| <b>DASS</b>                   |                       |                            |                     |                   |                              |                               |
| Anxiety                       | -.09                  | .07                        | -.43**              | .22**             | .05                          | .22**                         |
| Depression                    | -.14**                | .01                        | -.50**              | .15**             | -.03                         | .18**                         |
| <b>SWIS</b>                   |                       |                            |                     |                   |                              |                               |
| Consider other<br>perspective | .32**                 | .19**                      | .10*                | .13**             | .36**                        | .19**                         |
| Intellectual<br>humility      | .33**                 | .24**                      | .11*                | .17**             | .31**                        | .17**                         |
| Search for<br>compromise      | .33**                 | .19**                      | .05                 | .14**             | .31**                        | .16**                         |
| Adopting other<br>Perspective | .25**                 | .18**                      | .05                 | .18**             | .22**                        | .17**                         |
| Recognition of<br>Change      | .36**                 | .25**                      | .06                 | .21**             | .36**                        | .20**                         |
| <b>Happiness</b>              | .24**                 | .11*                       | .32**               | .15**             | .13**                        | .03                           |
| <b>SWEMWBS</b>                | .34**                 | .18**                      | .26**               | .22**             | .21**                        | .06                           |

\*  $p < .05$ , \*\*  $p < .001$

### Measurement Invariance

We examined for configural, metric, and scalar invariance across three Southeast Asian countries. Participants from countries with low numbers ( $n = 3$  from Burma/Myanmar,  $n = 4$  from Indonesia,  $n = 1$  from Thailand,  $n = 3$  from Vietnam) were omitted from this analysis, leaving Singaporeans ( $n = 125$ ), Malaysians ( $n = 154$ ), and Filipinos ( $n = 144$ ), for a final sample of 423. We used alternative fit indices (AFIs;  $\Delta RMSEA$ ,  $\Delta CFI$ , and  $\Delta SRMR$ ) to determine invariance, as AFIs are less sensitive to sample sizes (Putnick & Bornstein, 2016). The model for configural invariance showed a satisfactory fit,  $\chi^2(711) = 1230.01$ ,  $p < .001$ ;

RMSEA = .042, CFI = .911; SRMR = .073. When factor loadings were constrained across the subgroups, evaluations of  $\Delta\chi^2(36) = 42.50, p = .21$ ,  $\Delta\text{RMSEA} = .001$ ,  $\Delta\text{CFI} = .001$ , and  $\Delta\text{SRMR} = .002$  indicated a negligible deterioration of the model, providing evidence of metric invariance (Chen, 2007)<sup>3</sup>. To assess for scalar invariance, item intercepts were constrained. Again, this model suggested scalar invariance across the three subgroups,  $\Delta\chi^2(36) = 88.10, p < .001$ ,  $\Delta\text{RMSEA} = .001$ ,  $\Delta\text{CFI} = .009$ , and  $\Delta\text{SRMR} < .001$ . Overall, the results imply that mean scores of the 5DCR can be meaningfully compared between Malaysia, the Philippines, and Singapore. Table 4.5 shows the full breakdown of the measurement invariance analyses.

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<sup>3</sup> Chen (2007) recommended the criteria of  $\Delta\text{RMSEA} \leq .015$ ,  $\Delta\text{CFI} \leq .010$ ,  $\Delta\text{SRMR} \leq .030$  (metric),  $< .010$  (scalar) to indicate invariance where  $N > 300$ .

**Table 4.5***Coefficients for Tests of Measurement Invariance*

| Model                     | $\chi^2$<br>(df)  | CFI  | RMSEA<br>(90% CI)    | SRMR | Model<br>comp | $\Delta \chi^2$ ( $\Delta$ df) | $\Delta$ CFI | $\Delta$ RMSEA | $\Delta$ SRMR | Decision |
|---------------------------|-------------------|------|----------------------|------|---------------|--------------------------------|--------------|----------------|---------------|----------|
| M1: Configural Invariance | 1230.01*<br>(711) | .911 | .042<br>[.038, .046] | .073 | -             | -                              | -            | -              | -             | Accept   |
| M2: Metric Invariance     | 1272.51*<br>(747) | .910 | .041<br>[.037, .045] | .071 | M1            | 42.50 (36)                     | .001         | .001           | .002          | Accept   |
| M3: Scalar Invariance     | 1360.61*<br>(783) | .901 | .042<br>[.038, .046] | .071 | M2            | 88.10* (36)                    | .009         | .001           | <.001         | Accept   |

\*&lt;.001

### Supplementary Analysis

As a secondary analysis, an exploratory MANOVA was conducted to investigate if there were differences between the Southeast Asian countries on the six factors of curiosity. The MANOVA was significant,  $F(12, 832) = 6.27, p < .001, \eta_p^2 = .08$ . Using a Bonferroni correction of .008, follow-up tests found that the three countries differed in terms of thrill-seeking,  $F(2, 420) = 9.07, p < .001, \eta_p^2 = .04$ , and covert social curiosity,  $F(2, 420) = 19.64, p < .001, \eta_p^2 = .04$ . The effects of countries on the other four dimensions of curiosity were non-significant.

Pairwise comparisons using Fisher's LSD found that for the facet of thrill-seeking, Singaporeans had lower levels of thrill-seeking compared to Malaysians and Filipinos (both  $p < .001$ ). There was no significant difference in thrill-seeking between Malaysians and Filipinos ( $p = .641$ ). For covert social curiosity, Filipinos displayed lower levels of covert social curiosity compared to Malaysians ( $p = .008$ ), and Singaporeans ( $p < .001$ ). The difference between Malaysians and Singaporeans was non-significant ( $p = .094$ ). Table 4.6 depicts the descriptive statistics of thrill-seeking and covert social curiosity by country.

**Table 4.6**

*Means and Standard Deviations for Thrill-seeking and Covert Social Curiosity by Country*

| Country     | Thrill-seeking |           | Covert social curiosity |           |
|-------------|----------------|-----------|-------------------------|-----------|
|             | <i>M</i>       | <i>SD</i> | <i>M</i>                | <i>SD</i> |
| Malaysia    | 4.30           | 1.25      | 4.03                    | 1.45      |
| Philippines | 4.37           | 1.22      | 3.58                    | 1.57      |
| Singapore   | 3.76           | 1.41      | 4.33                    | 1.41      |

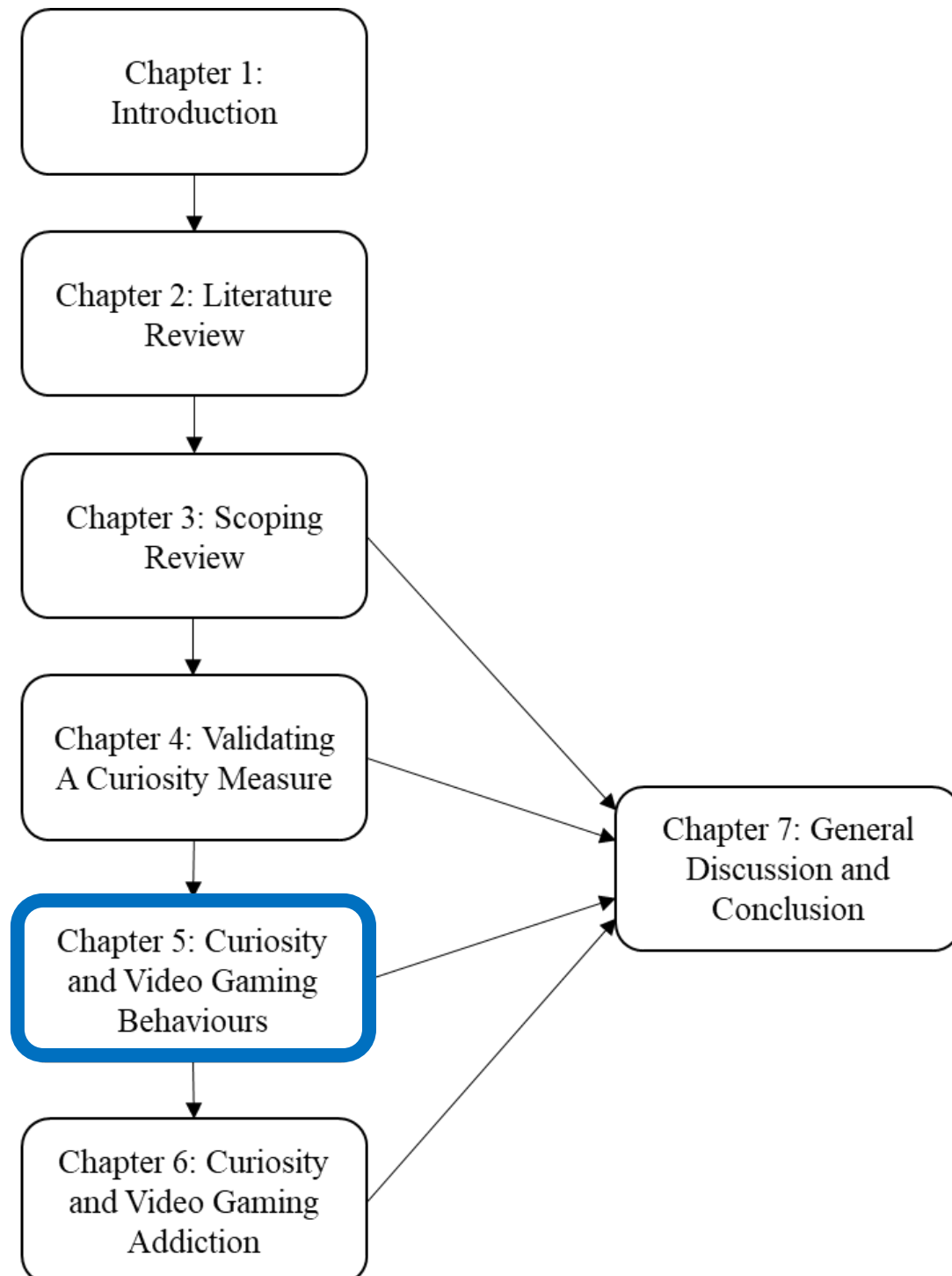
### Discussion

The present study sought to assess the applicability of the 5DCR in Southeast Asia. Overall, the results provided strong evidence that the 5DCR is meaningful and suitable for use in a Southeast Asian setting. Similar to findings from Kashdan et al. (2020) and Grüning and Lechner (2022), we confirmed a six-factor structure, and item loadings on their corresponding dimensions also closely replicated that in the original 24-item scale. Internal consistency coefficients were also excellent for each of the six dimensions. Although slightly less compelling, test-retest correlations from a two month follow up ranged from satisfactory to good. However, only 21 participants completed the follow-up study, thus findings should be interpreted with caution.

Regarding construct validity, the pattern of correlations in the current study replicated that of Kashdan et al. (2020), supporting the construct validity of the 5DCR. Significant correlations between the dimensions of curiosity and conceptually related constructs, such as factors of personality, happiness, and well-being, contributed evidence toward convergent validity. Indications of discriminant validity were also provided, through non-significant to small correlations between curiosity dimensions and unrelated constructs (e.g., tradition and conformity). However, some differences between past findings and those of the current study were also found, such as the non-significant correlation between deprivation sensitivity and the personality dimension of openness, which could be a product of a genuine cultural difference in how curiosity is elicited.

Additionally, our results suggested that measurement invariance in its configural, metric, and scalar forms can be assumed. This adds weight to claims that the 5DCR is valid across cultures. Coupled with the validation study by Grüning and Lechner (2022), this further emphasises that the 5DCR can be used globally. Supplementary findings also indicated some differences in curiosity between three Southeast Asian countries. Individuals

in Singapore displayed lower levels of thrill-seeking compared to both their Malaysian and Filipino counterparts, while those in the Philippines possessed lower covert social curiosity compared to Singapore and Malaysia. A full discussion of the results and their implications can be found in the Chapter 7 (general discussion).



**Chapter 5: From Thrill-seekers to Social Creatures: Dimensions of Curiosity****Differentially Predict Video Game Preferences and Behaviours**

One of the findings highlighted in the scoping review (Chapter 3) was that the majority of curiosity research has taken place in the context of school and work, suggesting that research on how curiosity promotes engagement with leisure activities, such as video gaming, is lacking. Given the rise in video gamers across the world (Clement, 2023), this represents a significant gap in the extant literature. The present study sought to fill this gap by investigating how dimensions of curiosity predict video game preferences and behaviours. We drew on Kashdan et al.'s (2020) Five-Dimensional Curiosity Scale Revised (5DCR) as our chosen framework and measure of multidimensional curiosity, having validated the measure for use in Southeast Asian populations in a preceding study (Chapter 4). Given the limitations of genres when examining video game preferences (see Chapter 2), we utilised King et al.'s (2010) taxonomy of Video Game Structural Characteristics (VGSC) to capture the specific features of games that players enjoy. Given that video gaming research often focuses on gaming genres, shifting the focus to structural characteristics of video games further contributes to research in this area. Moreover, knowing how individual dimensions of curiosity relate to characteristics of games can lend insight to game developers seeking to entice players by designing elements of games that cater to individuals and what piques their curiosity. The following section discusses how each dimension of curiosity based on the 5DCR (i.e., joyous exploration, deprivation sensitivity, stress tolerance, thrill-seeking, overt social curiosity, and covert social curiosity) potentially relates to video gaming playtimes, and the VGSC.

**Multidimensional Curiosity, Playtime, and Video Game Structural Characteristics**

There is reason to believe that adopting a multidimensional approach (i.e., examining individual dimensions of curiosity instead of unidimensional curiosity) will permit a fuller

and more nuanced understanding of the relationship between curiosity and video gaming playstyles and preferences (Tang & Kirman, 2024). For example, joyous exploration refers to revelling in new experiences. In a video gaming context, this could be exploring a virtual world and finding joy in what surprises the environment holds. In multiplayer online games, gamers explore the dynamic and large open worlds to satisfy their curiosity, and this motivation to make new discoveries keeps them playing (Chou & Ting, 2003). In a mixed methods study conducted by Acevedo et al. (2022), participants were asked to roam in a procedural generated game world for as long as they wanted. Based on the qualitative data collected, participants reported that exploring the digital world was initially interesting and fun, but became less so over time as the game lacked objectives. This suggested that at least initially, video gamers were motivated to explore solely for fun, but goals and objectives were required to sustain that exploratory behaviour. Given that completing objectives often provide players with some form of reward, it is plausible that the pleasurable feeling of exploring would be positively related to enjoyment of rewards in games as well.

The role of exploration for fun and uncovering new things in games has also been highlighted by Gómez-Maureira and Kniestedt (2019). The authors reported that games involving exploration are of particular interest to participants, and cited cues such as obstructions (e.g., a rock to block an object of curiosity) or out of place elements (e.g., three identical trees where one stands out by having an extra apple hanging from a branch; Gómez-Maureira & Kniestedt, 2019). Such cues usually come with the promise of rewards should gamers explore them further. This notion was also supported in research by Wang and Sun (2011), who reported that gamers who enjoy exploring do so because of a desire to earn unique rewards. Overall, this would suggest a positive relationship between joyous exploration and duration of gaming sessions, as well as a predictive relationship between the joy of exploration and reward features in video games.

The ubiquitous nature of the internet has led to people interacting with others through online mediums. In gaming, being able to socialise with others was reported to be the most important feature of online games (Griffiths et al., 2004). In that vein, the genre of MMORPGs was among the first to prioritise social elements. In the aforementioned study by Griffiths et al., participants reported that their top three favourite features of the multiplayer game *EverQuest* (Daybreak Game Company, 1999) were that (a) it was a social game, (b) players could form groups together, and (c) the possibility of guild membership. All three features hold elements of social interactions, and are aligned with the primary goal of MMORPGs, which functions as an omnipresent space for players to interact with one another (Stavropoulos et al., 2017). Accordingly, this indicates that curiosity in other players can be what draws gamers to the social aspects in video games.

While video gamers traditionally play multiplayer games on PCs and consoles, advances in mobile technology have led to mobile multiplayer games increasing in popularity (Li & Suh, 2021). Besides the advantage of portability, gaming on mobile devices continue to allow players to interact with one another in a shared online space (Gong et al., 2019). Li and Suh (2021) found that the desire to play with others was positively related to engagement with a mobile game's social features. Also, Bowman et al. (2015) reported that wanting to socialise was a key motivator for not only starting a game but continually playing it. In all, these findings suggest that taking an interest in others (i.e., social curiosity) can not only predict how long gamers play for, but also enjoyment of social features in video games.

From a theoretical perspective, self-determination theory can perhaps also explain social antecedents in video gaming. For instance, the need for relatedness (i.e., a sense of social connectedness) predicted video gaming enjoyment, and video gaming hours (Tamborini et al., 2010; Williams et al., 2008). Oliver et al. (2016) reported similar findings, claiming that the need for relatedness can be fulfilled via playing online games. Given that

trait curiosity is related to the needs established in self-determination theory (Kashdan, 2004; Silvia, 2006), it is plausible that social curiosity could be a driving factor behind enjoyment of games that heavily involve social features.

Regarding covert social curiosity behaviours such as gossip, research has also linked gossiping to aggressive behaviour, and aggression has been found to be associated with the playing of more violent video games (Moller & Krahe, 2009). Given the popularity of video games containing violence, it is possible that covert social curiosity would be predictive of gaming hours. Moreover, De Backer et al. (2007) reported that if players can create virtual avatars that are unrecognisable to others, they might be more prone to engage in eavesdropping and gossiping. Also, gossiping with, and about others, have been found to be a useful tool to establish a sharing understanding of social norms within a virtual world (Cherny, 1999). In sum, covert social curiosity might play an important predictive role in how players engage with social elements in video games.

The dimensions of social curiosity could be further exacerbated by COVID-19. Since the outbreak, research has also found that individuals reported playing more multiplayer games to make up for the lack of in-person communication (Barr & Copeland-Stewart, 2022). Even before COVID-19, interpersonal communication via the use of information technology has been rising (Palvia et al., 2018), thus this upward trend may not be directly caused by the pandemic, but simply accelerated. Nonetheless, it appears that social curiosity plays an even more important role now in increasing gaming playtime (suggestive of a predictive relationship), and influencing behaviour, especially pertaining to the social features in video games that allow players to connect with others.

With deprivation sensitivity, an individual may feel curious due to a discomfort that rises from a disparity between what one knows, and what one wants to know. This can drive the individual to resolve this mismatch in knowledge and information. In video games, the

crux appears to be inducing uncertainty in video gamers (Costikyan, 2013). By providing gamers with the challenge of solving a puzzle with limited resources, an information gap is created between the solution and what players currently know about the puzzle. As a result, players are motivated to solve the puzzle, and are likely to play for a longer period of time. Such elements are common in puzzle games such as *Portal* (Valve, 2007), where players manipulate space using a portal gun to reach the end of the level. Other more recent releases of puzzle games include *Inside* (Playdead, 2016), and *Little Nightmares II* (Supermassive Games, 2021), both of which retain a blueprint similar to *Portal*. There may only be one solution, and the gap in knowledge arises between the player's attempted solution and the right solution, which is closed as the player develops strategies to complete the level (Costikyan, 2013). Deprivation sensitivity in games can also be seen in in-game scenarios where stimuli are purposefully complex and ambiguous, which then creates an information gap, and results in the manifestation of curiosity (To et al., 2016). This can also be applied from a narrative standpoint. For example, the motives of a non-playable character in a video game can be made obscure, or incongruent with the character's actions, which create uncertainty in players' mind. In sum, this suggests a potential relationship between deprivation sensitivity and gaming hours—the need to resolve these gaps in knowledge would be associated with prolonged gaming sessions.

An important reason why individuals are attracted to video games is escapism. Escapism can be characterised as a stress relieving mechanism, where players engage in video games to distract themselves from real life stressors (Merhi, 2016; Warmelink et al., 2009). This suggests that facing high levels of stress may entice people to escape into the realm of video games. It could be because playing video games is a good way to reduce real life pressures—research has consistently shown that video games are efficacious in alleviating stress (Pallavicini et al., 2021; Russoniello et al., 2009). Accordingly, it appears

that individuals who are under stress might play more video games. Indeed, Canale et al., (2019) found that vulnerability to stress was positively correlated with weekly gameplay time. Also, a study found that video gamers who play more frequently were more likely to use games as an avenue to escape negative states (e.g., stress) compared to those who gamed less (Wood et al., 2004). Similarly, Yu et al., (2018) pointed out that individuals who are intolerant of negative affective states tend to cope with problems by using activities that provide a means of escape. Following this logic, it stands to reason that individuals with low stress tolerance should engage more in video gaming (i.e., spend more time playing video games).

Lastly, thrill-seeking is a facet of curiosity where arousal is coveted. For example, Petrova et al., (2017) reported that the reason why an individual watches gaming videos on YouTube is to get a thrill out of activities that one would not experience in the actual world, such as skydiving or bungee jumping. In research conducted by Gómez-Maureira and Kniestedt (2019), participants commonly mentioned *Grand Theft Auto* (Rockstar North, 2015) when thinking of games that invoke thrill-seeking curiosity. *Grand Theft Auto* is an action-adventure game series, where players play the role of a criminal who often partakes in larger-than-life activities, such as robbing banks and hijacking planes. It appears that playing games provides an avenue for individuals to satisfy their thrill-seeking curiosity by allowing them to partake in experiences that cannot be easily or safely realised in the real world. It is also worth noting that some of the most popular gaming franchises with the highest number of hours played such as *Call of Duty* (Treyarch, 2015) and *Battlefield* (DICE, 2021) revolve around violence and combat: a dangerous yet thrilling endeavour that people do not usually participate in in real-life. Thus, it is possible that thrill-seeking would predict hours spent playing video games.

### **The Present Study**

Using a comprehensive and holistic framework of curiosity, the present study sought to examine the links between dimensions of curiosity and gaming related behaviours. Moreover, given the potential concerns over using game genres as a framework, we instead took a different approach and examined the structural characteristics of games. Research has shown that curiosity has a positive relationship with time spent engaging with the subject matter of interest. We therefore hypothesised that all the facets of curiosity would predict video gaming playtime (H1). Other than time spent playing, we can also gain knowledge into the characteristics of games that players enjoy. Accordingly, we hypothesised that joyous exploration would predict enjoyment of rewarding features in a video game (H2). Lastly, we also hypothesised that covert (H3a) and overt (H3b) social curiosity would predict enjoyment of social aspects in a video game. Given the paucity of research surrounding the remaining dimensions of curiosity and structural characteristics of video games, we examined them in a more exploratory fashion.

### **Method**

#### **Participants**

We targeted participants who were from Southeast Asia, at least 18 years of age, proficient in the English language, and played video games for at least 1 hour per week (to be considered a video gamer). The “10-times rule” method was used (sample size greater than 10 times the number of relationships pointing to latent variables<sup>4</sup>; Hair et al., 2011), which resulted in a recommended sample of 300. After data cleaning, a final sample size of 398 was obtained, with 50.30% males, and 49.70% females. Participants’ age ranged from 18 – 75 years ( $M = 37.30$ ,  $SD = 12.05$ ). Participants were either from the Philippines (50.80%), or

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<sup>4</sup> Six dimensions of curiosity and five domains of structural characteristics would equate to 30 possible relationships between the latent variables.

Malaysia (49.20%). These two countries were selected due to budgetary considerations, but remain viable to answer our research questions as they have a substantial English speaking population and was suitable in terms of our geographical region of interest. Participants' average years of education was 14.22 ( $SD = 3.16$ , range = 2 – 26 years; 4 nonsensical values were omitted). With regards to relationship status, 53.50% were married, 42.00% were single, and 4.50% reported as “others”. Among the participants, 1.51% of the participants' information on occupation were missing or uninterpretable, 83.92% were working full time, 4.27% were unemployed, 4.52% were homemakers, 4.02% were students, 0.75% retirees, and 1.00% were employed part-time. Participants were recruited via a panel provider company, where they were remunerated with approximately USD\$3 each for participation.

### **Measures**

In the present study, a total of three scales were administered, along with a short demographic questionnaire asking for age, gender, nationality, number of years of education, occupational status, and relationship status. Two additional measures were administered, but they are only relevant to the analyses presented in Chapter 6, and will receive no further mention in this chapter.

#### ***Five-Dimensional Curiosity Scale Revised (5DCR)***

The 5DCR (Kashdan et al., 2020) is a 24-item measure consisting of six subscales: joyous exploration, deprivation sensitivity, stress tolerance, thrill-seeking, overt social curiosity, and covert social curiosity (refer to Table 4.1 for example items). Each subscale has four items, which are rated on a 7-point Likert scale, ranging from 1 (*does not describe me at all*) to 7 (*completely describes me*). All items in the stress tolerance subscale are reverse scored. Scores are averaged across each of the six subscales, with higher scores representing higher levels of curiosity on the respective dimension. The six-factor structure has previously been confirmed in both a German and a British sample (Grüning & Lechner, 2022), as well as

a Southeast Asian sample (see Chapter 4). The 5DCR was shown to be internally reliable (Cronbach's alpha for each subscale at least .80; Grüning & Lechner, 2022; Kashdan et al., 2020). Cronbach's alphas for the current study ranged from .82 to .90.

### ***Gaming Behaviour Survey***

The gaming behaviour survey was developed specifically for this study and consists of five items that measure several gaming behaviours, including (a) average time spent per day playing video games during the weekdays; and (b) weekends; (c) self-rating of video gamer engagement<sup>5</sup> on a 5-point Likert scale from “very casual” to “very hardcore”; (d) the gaming systems that respondents play video games on; and (e) the respondent's most commonly used system for playing video games.

### ***Video Game Structural Characteristics Survey (VGSC)***

The VGSC (King et al., 2011) comprises 37 items across five features of video gaming characteristics: social (seven items; e.g., “Making friends with other players in the game”), manipulation and control (eight items; e.g., “Needing good reflexes to advance in the game”), narrative and identity (seven items; e.g., “Taking on a new identity in the game”), reward and punishment (10 items; e.g., “Doing the same thing over and over, order to get a large reward”), and presentation (five items; e.g., “Sound, including music and audio effects). Participants rate each item on a 5-point Likert scale based on how much they enjoy each characteristic, ranging from 1 (*not enjoyable at all*) to 5 (*very enjoyable*). Scores are averaged for each of the five subscales; higher scores indicate higher levels of enjoyment. Cronbach's alpha ranged from .75 to .91 across the five subscales in the present study.

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<sup>5</sup> The terms casual and hardcore are commonly used within the video gaming space, and refer to persistence towards gaming and duration of gaming sessions (Poels et al., 2012).

## **Procedure**

Approval for the conduct of the study was obtained from the Human Research Ethics Committee of James Cook University (approval number: H8712) prior to commencement. Taking part in the study was voluntary and participants could withdraw at any point in time without any consequences. The study was administered online via Qualtrics (2020), where participants were first presented with an information sheet explaining the background and purpose of the study, before being asked whether they consented to participate. Participants who gave consent then completed the demographics questionnaire, followed by the 5DCR, gaming behaviour survey, and finally the VGSC. The study took approximately 20 minutes to complete.

## **Design and Analysis**

The design was correlational in nature. A multiple linear regression analysis using the stepwise method was used to examine if dimensions of curiosity could predict play times. A multivariate multiple regression analysis was used to identify associations between the six dimensions of curiosity, and the five structural characteristics of video games.

## **Results**

### **Assumptions Testing**

Prior to analysing the data, several assumptions were evaluated. First, maximum Cook's distance for all outcome variables were less than 1, suggesting no univariate outliers pertaining to regression analyses. Second, the maximum Mahalanobis distance was 28.90, which exceeded the critical chi-square value,  $\chi^2(8) = 26.12$ , at an alpha level of .001. This indicated the presence of 1 multivariate outlier. However, removing the outlier did not affect any results, thus we kept the existing dataset. Third, the assumption of normality was examined using Shapiro-Wilk tests, which were significant for all outcome variables. However, Shapiro-Wilk tests are known to be very sensitive and often signal departures from

normality that do not really matter (Bennett et al., 2022). Further visual inspection of the histograms indicated no severe violations of normality. Fourth, inspection of the normal probability plot of standardised residuals as well as the scatterplot of standardised residuals against standardised predicted values indicated that the assumptions of normality, linearity, and homoscedasticity of residuals were met. Last, inspection of the bivariate correlations between all the DVs indicated that none were overly highly correlated (i.e.,  $r > .90$ ) with each other. Also, tolerance and variance inflation factor (VIF) coefficients for all predictors were greater than .1 and lesser than 10 respectively. In sum, there was no evidence of multicollinearity.

### **Descriptive Statistics**

Regarding gaming platforms used, 18 nonsensical responses were omitted. Of the remainder, 71.13% ( $n = 271$ ) used one device to play video games, while the remaining 27.39% ( $n = 109$ ) gamed on multiple platforms. For single-platform gamers, 73.06% ( $n = 198$ ) gamed exclusively on mobile phones, 16.24% ( $n = 44$ ) played on a computer/laptop/tablet, and 10.70% ( $n = 29$ ) on a gaming console. The mean of the casual to hardcore item (i.e., self-rating of persistence in gaming and duration of gaming sessions) gamer continuum was 2.36 ( $SD = 0.96$ , range = 1 - 5). Participants reported that they played games for an average of 3.34 hours a day ( $SD = 2.67$ , range = 0.2 – 19.71)<sup>6</sup>.

### **Confirmatory Analyses**

#### ***Association Between Curiosity and Gaming Hours***

Bivariate correlations showed that stress tolerance, thrill-seeking, overt social curiosity, and covert social curiosity were significantly correlated with gaming hours. A multiple regression via the forward stepwise method was used to examine the dimensions of

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<sup>6</sup> Values of  $\geq 24$  were removed at the data cleaning stage. Applying a more stringent cutoff (i.e., 12 hours of gaming) did not affect findings regarding time spent video gaming, hence the existing dataset was kept.

curiosity as predictors of time spent playing video games. The model was significant,  $R^2 = .02$ ,  $F(1, 396) = 8.38$ ,  $p = .004$ . Using a Bonferroni correction of .008, thrill-seeking was a significant positive predictor of hours spent video gaming,  $b = 2.11$ ,  $SE = 0.73$ ,  $p = .004$ , but the other five predictors were non-significant, thus we concluded that H1 was only weakly supported. Table 5.1 shows the bivariate correlations between the dimensions of curiosity and the summary of the regression analysis.

**Table 5.1**

*Bivariate Correlations and Predictive Relationship Between Dimensions of Curiosity and Hours Spent Gaming Daily*

| Curiosity Dimension     | Hours Spent Gaming Daily |          |           |         |          |          |
|-------------------------|--------------------------|----------|-----------|---------|----------|----------|
|                         | <i>r</i>                 | <i>b</i> | <i>SE</i> | $\beta$ | <i>t</i> | <i>p</i> |
| Joyous exploration      | .058                     | -        | -         | -0.04   | -0.69    | .491     |
| Deprivation sensitivity | .059                     | -        | -         | -0.01   | -0.21    | .833     |
| Stress tolerance        | -.099*                   | -        | -         | -0.08   | -1.61    | .103     |
| Thrill-seeking          | .144**                   | 2.11     | 0.73      | 0.14    | 2.89     | .004*    |
| Overt social curiosity  | .112*                    | -        | -         | 0.02    | 2.07     | .675     |
| Covert social curiosity | .119*                    | -        | -         | 0.07    | 1.31     | .189     |

\*  $p < .05$ ; \*\*  $p < .001$

### ***Association Between Curiosity and Gaming Behaviours***

Table 5.2 shows the bivariate correlations between dimensions of curiosity and the structural characteristics of video games. A multivariate multiple regression was conducted to examine the relationships between the dimensions of curiosity and the structural characteristics of video games. The overall model was significant,  $F(30, 1955) = 6.38$ ,  $p < .001$ . Joyous exploration was significantly associated with reward and punishment features ( $b = 0.08$ ,  $SE = 0.04$ ,  $p = .034$ ), which supported H2. Overt social curiosity was linked with

social features ( $b = 0.10$ ,  $SE = 0.04$ ,  $p = .019$ ), but covert social curiosity was not significantly related to social features ( $b = 0.02$ ,  $SE = 0.03$ ,  $p = .439$ ). This provided support for H3a but not H3b. Table 5.3 shows the parameter estimates of relationships between the structural characteristics and dimensions of curiosity. We retained an alpha of .05 based on the advice of Rubin (2021), who argued that no adjustments should be made when individual hypotheses are assessed independently and not collectively (i.e., the null hypothesis that joyous exploration does not predict enjoyment of rewards is not contingent on all other associations being non-significant).

**Table 5.2**

*Bivariate Correlations Between Dimensions of Curiosity and Structural Characteristics of Video Games*

|                                | <b>Social features</b> | <b>Manipulation and control features</b> | <b>Narrative and identity features</b> | <b>Reward and punishment features</b> | <b>Presentation features</b> |
|--------------------------------|------------------------|------------------------------------------|----------------------------------------|---------------------------------------|------------------------------|
| <b>Joyous exploration</b>      | .440**                 | .353**                                   | .179**                                 | .384**                                | .361**                       |
| <b>Deprivation sensitivity</b> | .313**                 | .279**                                   | .134**                                 | .319**                                | .282**                       |
| <b>Stress tolerance</b>        | .136**                 | .002                                     | -.146**                                | .061                                  | .002                         |
| <b>Thrill seeking</b>          | .404**                 | .437**                                   | .305**                                 | .348**                                | .362**                       |
| <b>Overt social curiosity</b>  | .418**                 | .343**                                   | .291**                                 | .370**                                | .362**                       |
| <b>Covert social curiosity</b> | .190**                 | .228**                                   | .314**                                 | .188**                                | .198**                       |

\*  $p < .05$ ; \*\*  $p < .001$

### Exploratory Analyses

For the exploratory analyses, we also opted not to apply alpha adjustments given studies that argue against the use of such corrections in exploratory testing (e.g., Ranstam,

2016; Wason et al., 2014). Thrill-seeking significantly predicted social features ( $b = 0.10$ ,  $SE = 0.04$ ,  $p = .009$ ), manipulation and control features ( $b = 0.07$ ,  $SE = 0.03$ ,  $p = .027$ ), narrative and identity features ( $b = 0.11$ ,  $SE = 0.04$ ,  $p = .006$ ), and presentation features ( $b = 0.09$ ,  $SE = 0.04$ ,  $p = .015$ ). Joyous exploration predicted social features ( $b = 0.13$ ,  $SE = 0.04$ ,  $p = .003$ ), manipulation and control features ( $b = 0.08$ ,  $SE = 0.04$ ,  $p = .033$ ), and presentation features ( $b = 0.09$ ,  $SE = 0.04$ ,  $p = .037$ ). Stress tolerance was associated with reward and punishment features ( $b = 0.06$ ,  $SE = 0.02$ ,  $p = .010$ ). Covert social curiosity was associated with narrative and identity features ( $b = 0.09$ ,  $SE = 0.03$ ,  $p = .002$ ). All other associations were non-significant. Of note, deprivation sensitivity was not related to any of the structural characteristics.

**Table 5.3**

*Parameter Estimates of Associations Between Structural Characteristics and Dimensions of Curiosity*

| Structural Characteristic         | Dimension of curiosity  | <i>b</i> | <i>SE</i> | <i>t</i> | <i>Sig</i> |
|-----------------------------------|-------------------------|----------|-----------|----------|------------|
| Social Features                   | Joyous exploration      | 0.13     | 0.04      | 2.99     | .003*      |
|                                   | Deprivation sensitivity | 0.03     | 0.04      | 0.90     | .370       |
|                                   | Stress tolerance        | 0.11     | 0.03      | 4.20     | <.001*     |
|                                   | Thrill-seeking          | 0.10     | 0.04      | 2.61     | .009*      |
|                                   | Overt social curiosity  | 0.10     | 0.04      | 2.36     | .019*      |
|                                   | Covert social curiosity | 0.02     | 0.03      | 0.78     | .439       |
| Manipulation and control features | Joyous exploration      | 0.08     | 0.04      | 2.14     | .033*      |
|                                   | Deprivation sensitivity | 0.03     | 0.03      | 0.87     | .384       |
|                                   | Stress tolerance        | 0.04     | 0.02      | 1.50     | .134       |
|                                   | Thrill-seeking          | 0.07     | 0.03      | 2.22     | .027*      |
|                                   | Overt social curiosity  | 0.04     | 0.04      | 1.15     | .252       |

| Structural Characteristic       | Dimension of curiosity  | <i>b</i> | <i>SE</i> | <i>t</i> | <i>Sig</i> |
|---------------------------------|-------------------------|----------|-----------|----------|------------|
| Narrative and identity features | Covert social curiosity | 0.04     | 0.03      | 1.56     | .120       |
|                                 | Joyous exploration      | -0.01    | 0.04      | -0.20    | .984       |
|                                 | Deprivation sensitivity | -0.05    | 0.04      | -1.32    | .188       |
|                                 | Stress tolerance        | -0.03    | 0.03      | -1.07    | .286       |
|                                 | Thrill-seeking          | 0.11     | 0.04      | 2.77     | .006*      |
| Reward and punishment features  | Overt social curiosity  | 0.06     | 0.04      | 1.51     | .132       |
|                                 | Covert social curiosity | 0.09     | 0.03      | 3.17     | .002*      |
|                                 | Joyous exploration      | 0.08     | 0.04      | 2.12     | .034*      |
|                                 | Deprivation sensitivity | 0.06     | 0.03      | 1.78     | .076       |
|                                 | Stress tolerance        | 0.06     | 0.02      | 2.58     | .010*      |
| Presentation features           | Thrill-seeking          | 0.06     | 0.03      | 1.81     | .071       |
|                                 | Overt social curiosity  | 0.07     | 0.04      | 1.88     | .060       |
|                                 | Covert social curiosity | 0.02     | 0.03      | 0.72     | .475       |
|                                 | Joyous exploration      | 0.09     | 0.04      | 2.09     | .037*      |
|                                 | Deprivation sensitivity | 0.03     | 0.04      | 0.70     | .487       |
|                                 | Stress tolerance        | 0.03     | 0.03      | 1.14     | .253       |
|                                 | Thrill-seeking          | 0.09     | 0.04      | 2.44     | .015*      |
|                                 | Overt social curiosity  | 0.07     | 0.04      | 1.83     | .068       |
|                                 | Covert social curiosity | 0.01     | 0.03      | 0.48     | .629       |

\* $p < .05$ 

### Discussion

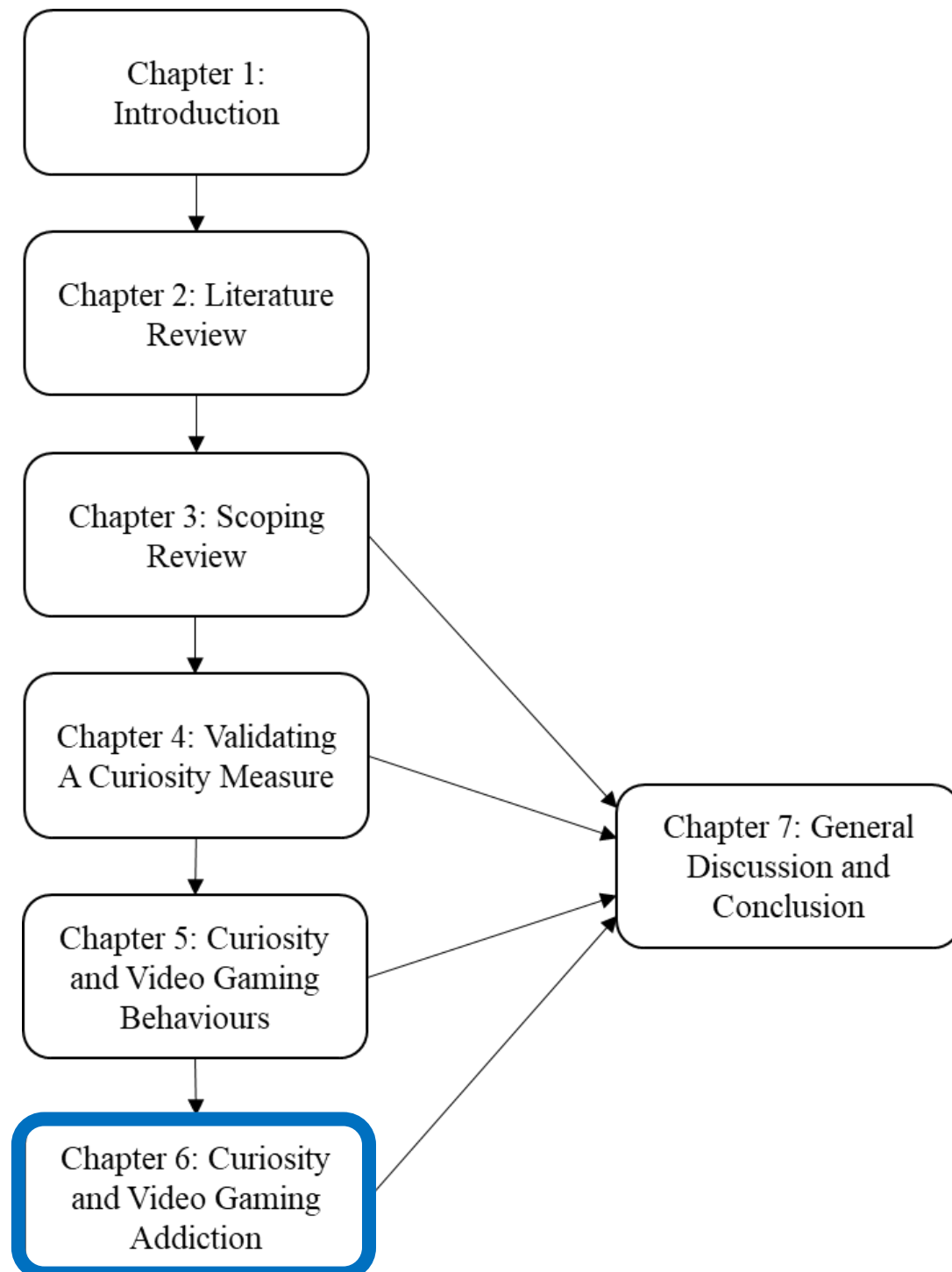
The hypothesis that dimensions of curiosity were significant predictors of hours spent playing video games was weakly supported (H1). Results of the regression analyses revealed that thrill-seeking was the only significant predictor of video game time, while the other five

dimensions were not. Despite significant bivariate correlations between four dimensions of curiosity (stress tolerance, thrill-seeking, both overt and covert social curiosity) and gaming hours, thrill-seeking emerged as the only significant predictor of gaming hours after all other dimensions of curiosity were taken into consideration. We found that the more interested an individual was in satisfying their craving for thrills (i.e., higher levels of thrill-seeking), the more time they spent playing video games. It appeared that the immersive and interactive qualities of video games serve as an ideal medium to stimulate engagement with thrill-seekers. The weak support for our hypothesis could have stemmed from overall number of hours played being an overly broad measure. Research has shown that people play differing number of hours across different times of day (Chen et al., 2019), which could have obscured results in the present study.

The hypothesis that joyous exploration would be linked to reward and punishment was supported (H2). Gamers who identify with the joy of exploring may be doing so because of a reward that awaits them. Accordingly, this implies that game developers should focus on rewarding explorers as a way of reinforcing further exploratory behaviour to keep players engaged. Hypothesis 3a was supported, but 3b was not. Overt (H3a), but not covert (H3b), social curiosity was positively associated with social features of video games. We expected that overt social curiosity, which emphasises interaction with others to gather information, would intuitively be linked to features that bring gamers together in a virtual space (e.g., joining a guild, working together to defeat a strong enemy), which was supported by the data in the current study. On the other hand, covert social curiosity was not associated with social features of video games, suggesting a mismatch in the mechanism in which overt or covert social curiosity are elicited. A possibility lies in the VGSC items for social features, where they are phrased in a manner more reminiscent of overt social curiosity (e.g., sharing tips and

strategies about the video game with others”; King et al., 2010), compared to its covert counterpart which relies more on gathering information in more discreet fashion.

Apart from the main hypotheses, we also examined other associations between curiosity and the structural characteristics of video games. Findings showed that thrill-seeking predicted four of the five structural characteristics, including preference for narrative and identity features, presentation features, social features, and manipulation and control features. However, thrill-seeking was not a significant predictor of preference for reward and punishment features. The non-significant links between thrill-seeking and rewards and punishment could be due to findings which show that thrill-seeking and risk-taking traits play a role in how an individual is enticed by rewards, but are not sensitive towards punishments (Lauriola et al., 2013). Results also showed that deprivation sensitivity was not a significant predictor of any structural characteristics in a video game. This could be because of a perceived mismatch between the valence of deprivation sensitivity (avoidant based) and the VGSC (based on enjoyment of features), which could have distorted the results. A full discussion of the findings can be found in Chapter 7.



## **Chapter 6: Curiosity Killed the Cat—Dimensions of Curiosity Differentially Relate to Video Gaming Addiction and Engagement**

The results described in Chapter 5 suggest that dimensions of curiosity can predict different features of video games that players enjoy. However, there is a risk of said enjoyment turning into problematic gaming (Hussain et al., 2015). With the sharp increase in number of video gamers worldwide (Clement, 2023), concerns over disordered gaming, or gaming addiction, have also risen (Kim et al., 2022). Accordingly, this chapter investigates if dimensions of curiosity can predict video gaming engagement and addiction. As outlined in Chapter 2, it is important to distinguish between video gaming engagement and disordered video gaming. For example, an individual who is heavily engaged with video gaming may not necessarily suffer from negative effects such as poor quality of life, anxiety, and depression (Brand et al., 2014; Lim et al., 2016). Failure to make this distinction between problematic gaming and the benign notion of video gaming engagement could result in an over-pathologising of gaming addiction (Charlton & Danforth, 2007). This view to separate the constructs has also been supported by empirical research, with studies demonstrating that a two-factor structure of engagement and addiction yielded a better fit, compared to a single factor (e.g., Brunborg et al., 2015).

### **The Present Study**

To answer our central research question of whether dimensions of curiosity could predict video gaming engagement and addiction, we continued the use of Kashdan et al.'s (2020) 5DCR to capture the construct of curiosity, and opted for the Gaming Addiction Scale-7 items (GAS-7; Lemmens et al., 2009) as our measure of video gaming addiction. We selected the GAS-7 due to its strong empirical support, large evidence base compared to its counterparts, and brevity (see Chapter 2). The following section details the rationale behind the two primary hypotheses in the current study.

*Dimensions of Curiosity Predicting Addiction Toward Video Gaming*

One reason why individuals could turn to playing video games with high frequency is to escape from real life issues, or in other words, to avoid the stress that arises in other areas of their lives (Pallavicini et al., 2021). Research has indicated that stress can lead to gaming addiction. For instance, Kardefelt-Winther (2014) reported that higher levels of stress were linked to negative consequences of video gaming, including losing sleep due to gaming, and conflict with partners/parents. These negative effects share substantial overlap with the conceptualisation of video gaming addiction (i.e., gaming to the point where it affects one's live negatively; Brunborg et al., 2015). In fact, after controlling for other psychological characteristics such as loneliness and social anxiety, stress remained a significant predictor of negative outcomes (Kardefelt-Winther, 2014), further highlighting the crucial role that stress plays in the pathway to video gaming addiction.

Fortunately, it appears that a tolerance towards stress can buffer against the adverse effects of addiction. According to the transactional theory of stress and coping (Lazarus & Folkman, 1984), individuals evaluate stressors and their ability to cope with said stressors. In the event that a stressor overwhelms the available resources to cope, an individual then experiences stress. Theoretically, this cognitive judgement also functions similarly to the stress tolerance dimension in the 5DCR, where a lack of stress tolerance lowers the likelihood of curiosity being exhibited (Kashdan et al., 2020). A potential way to combat the downsides of stress is to develop the ability to endure negative feelings or appraisals that accompany stressful situations (i.e., building stress tolerance; Yu et al., 2018). This tolerance toward stress has been noted to be negatively correlated with addiction (Ko et al., 2008; Rajab et al., 2020). Accordingly, we hypothesised that the stress tolerance dimension of curiosity would negatively predict video gaming addiction (H1).

Another factor that has received attention in its links to video gaming addiction is social motivation (Wang et al., 2021). This curiosity to know more about others (i.e., social curiosity) sparks motivation to form relationships with other individuals, chatting with them, and developing a sense of community (Kardefelt-Winther, 2014). The links between social curiosity and video gaming addiction can also be evidenced from the social networking literature. For example, Griffiths et al. (2016) explained that those who use social networking sites excessively are often poor at socialising in real life, thus they binge on social networking sites to replace real life interactions. This overreliance on virtual communications may then cause more problems, which in turn further exacerbate the use of social networking sites, resulting in addiction. Given that modern video games tend to have social networking elements, it is unsurprising that a curiosity to interact with others could be a risk factor for video gaming addiction. Indeed, both social interactions, and the need for social interactions, have been found to result in gaming addiction (Bhagat et al., 2020; Griffiths et al., 2011). Specifically in the context of video games, literature also suggests that social incompetence and social phobia play a role in video gaming addiction. Commonly, individuals who possess poor social competence tend to avoid social interactions (Lemmens et al., 2011). As a result, individuals who are uncomfortable with face-to-face contact may prefer to seek out online interactions, and turn to video games, which increases the likelihood of addiction (Sioni et al., 2017).

There are several advantages to online communication over in-person ones. For example, interactions online provide greater anonymity and less social risk (i.e., reduced reputational cost if interactions do not go well), and less social responsibility toward others (Bhagat et al., 2020). These perks provide a low-stakes approach to interactions and allow individuals to be more idealised and deceptive when presenting themselves (Cornwell & Lundgren, 2001). Compared to people who have no issues with interacting with others

directly, those who are socially less competent or have social phobia may prefer to interact or learn more about others via more indirect means. This distinction seems compatible with both the overt and covert social dimensions of curiosity in the 5DCR (Kashdan et al., 2020). Since addiction has been strongly linked to online interactions (e.g., Sioni et al., 2017), we proposed that curiosity to engage with others in a direct fashion (i.e., overt social curiosity) would predict video gaming addiction. Simultaneously, the interest in the lower stakes nature of online interactions which provide a safer and indirect way to communicate (i.e., covert social curiosity) would also predict video gaming addiction. In sum, we hypothesised that both covert (H2a) and overt social curiosity (H2b) would predict video gaming addiction.

### **Method**

The data for the present study was collected simultaneously as the previous one (i.e., the study described in Chapter 5), and the same dataset was used for analyses in both studies. Information that is unique to the present study (e.g., measures used specifically for analyses in this chapter) will be presented below, while information common to both studies will be omitted here (i.e., participants subsection, and description of the 5DCR; refer to Chapter 5).

### **Design**

The design was correlational in nature. A multivariate multiple regression analysis was used to identify associations between the dimensions of curiosity and gaming engagement and addiction. Each dimension of curiosity formed the independent variables (IVs), to predict each of the two domains of gaming addiction (DVs); there were a total of six IVs, and two DVs.

### **Measures**

#### ***Gaming Addiction Scale (GAS-7)***

The seven-item GAS (Lemmens et al., 2009) measures seven facets of gaming addiction, of which four form the core criteria of gaming addiction, while the remaining three

reflect the peripheral criteria (i.e., engagement in video games). All items begin with the prefix “How often during the last six months...” The four core criteria are relapse (“...have others unsuccessfully tried to reduce your game use?”), withdrawal (“...have you felt bad when you were unable to play?”), conflict (“...did you have fights with others such as family and friends, over your time spent on games?”), and problems (“...have you neglected other important activities such as school, work, sports, to play games?”). The three peripheral criteria are salience (“...did you think about playing a game all day long?”), tolerance (“...did you spend increasing amounts of time on games?”), and mood modification (“...did you play games to forget about real life?”). The GAS-7 items are rated on a 5-point Likert scale, ranging from 1 (*rarely*) to 5 (*very often*). Scores are averaged for each of the engagement and addiction subscales, with higher scores on each subscale representing higher levels on gaming engagement/addiction respectively. Research has found the GAS-7 to be psychometrically sound, with good internal consistency (e.g., Khazaal et al., 2016). Cronbach’s alphas for the engagement dimension in the present study was .72, and .80 for the addiction aspect.

### **Procedure**

Approval for the conduct of the study was obtained from the Human Research Ethics Committee of James Cook University (approval number: H8712) prior to commencement. Taking part in the study was voluntary and participants could withdraw at any point in time without any prejudice. The study was conducted online on Qualtrics (2020). Participants were first presented with an information sheet explaining the background and purpose of the study, followed by an informed consent question. Participants who gave consent then completed the demographics questionnaire, followed by the 5DCR, and the GAS-7 (in addition to the measures relevant to the study described in Chapter 5). The study took approximately 20 minutes to complete.

## Results

Given that the same dataset was used for both studies described in Chapters 5 and the present chapter, relevant assumptions were conducted and covered in Chapter 5. In the present study, a multivariate multiple regression was conducted to investigate if the six dimensions of curiosity predicted the subscales of engagement and addiction (see Table 6.1). The multivariate model was significant  $F(12, 776) = 8.83, p < .001$ . None of the curiosity dimensions predicted engagement. Similar to the results reported in Chapter 5, we retained an alpha of .05 based on advice from Rubin (2021). Conversely, stress tolerance ( $b = -0.11, SE = 0.03, p < .001$ ; supporting H1), and covert social curiosity ( $b = 0.17, SE = 0.04, p < .001$ ) predicted addiction, supporting H2a. Overt social curiosity did not predict addiction,  $b = -0.09, SE = 0.05, p = .087$ , thus H2b was not supported.

**Table 6.1**

*Parameter Estimates of Associations Between the Engagement / Addiction Subscales of the GAS-7 and the 5DCR*

| <b>Subscale</b> | <b>Dimension of curiosity</b> | <b><i>b</i></b> | <b><i>SE</i></b> | <b><i>t</i></b> | <b><i>Sig</i></b> |
|-----------------|-------------------------------|-----------------|------------------|-----------------|-------------------|
| Engagement      | Joyous exploration            | -0.03           | 0.05             | -0.57           | .568              |
|                 | Deprivation sensitivity       | 0.01            | 0.05             | 0.24            | .809              |
|                 | Stress tolerance              | -0.06           | 0.03             | -1.73           | .084              |
|                 | Thrill-seeking                | 0.08            | 0.05             | 1.67            | .096              |
|                 | Overt social curiosity        | 0.08            | 0.05             | 1.65            | .100              |
|                 | Covert social curiosity       | 0.02            | 0.04             | 0.61            | .543              |
| Addiction       | Joyous exploration            | -0.09           | 0.05             | -1.78           | .076              |
|                 | Deprivation sensitivity       | -0.01           | 0.05             | -0.21           | .837              |
|                 | Stress tolerance              | -0.11           | 0.03             | -3.25           | .001*             |
|                 | Thrill-seeking                | 0.14            | 0.05             | 3.06            | .002*             |
|                 | Overt social curiosity        | -0.09           | 0.05             | -1.72           | .087              |
|                 | Covert social curiosity       | 0.17            | 0.04             | 4.93            | <.001*            |

\* $p < .05$ . *Note.* GAS-7 = Gaming Addiction Scale. 5DCR = Five-Dimensional Curiosity

Scale Revised

To provide a deeper layer of insight, we conducted a facet-level analysis, where the four items of the addiction subscale in the GAS-7 were regressed on the six dimensions of curiosity. Other researchers have previously conducted facet-level analyses on the GAS-7, such as investigating the links between psychological wellbeing and the seven criteria of the GAS-7 independently (Lieberoth & Fiskaali, 2021). We excluded the three criteria in the engagement subscale since none of the dimensions of curiosity significantly predicted engagement. Stress tolerance negatively predicted two of the four aspects of addiction,

including conflict ( $b = -0.11$ ,  $SE = 0.04$ ,  $p = .015$ ), problems ( $b = -0.18$ ,  $SE = 0.04$ ,  $p < .001$ ), but not relapse ( $b = -0.08$ ,  $SE = 0.04$ ,  $p = .074$ ), and withdrawal ( $b = -0.08$ ,  $SE = 0.05$ ,  $p = .078$ ). Covert social curiosity predicted all four criteria of video gaming addiction, being positively associated with relapse ( $b = 0.16$ ,  $SE = 0.05$ ,  $p = .001$ ), withdrawal ( $b = 0.14$ ,  $SE = 0.05$ ,  $p = .003$ ), conflict ( $b = 0.19$ ,  $SE = 0.05$ ,  $p < .001$ ), and problems ( $b = 0.20$ ,  $SE = 0.04$ ,  $p < .001$ ). Table 1 depicts the parameter estimates of the relationships between the addiction items of the GAS-7 and the 5DCR.

**Table 6.2**

*Parameter Estimates of Associations Between Addiction Facets of the GAS-7 and the 5DCR*

| Addiction Facet | Dimension of curiosity  | <i>b</i> | <i>SE</i> | <i>t</i> | <i>Sig</i> |
|-----------------|-------------------------|----------|-----------|----------|------------|
| Relapse         | Joyous exploration      | 0.03     | 0.07      | 0.41     | .681       |
|                 | Deprivation sensitivity | -0.08    | 0.06      | -1.28    | .203       |
|                 | Stress tolerance        | -0.08    | 0.04      | -1.79    | .074       |
|                 | Thrill-seeking          | 0.10     | 0.06      | 1.72     | .086       |
|                 | Overt social curiosity  | -0.11    | 0.06      | -1.71    | .087       |
|                 | Covert social curiosity | 0.16     | 0.05      | 3.49     | .001*      |
| Withdrawal      | Joyous exploration      | -0.10    | 0.07      | -1.38    | .168       |
|                 | Deprivation sensitivity | 0.06     | 0.07      | 0.88     | .378       |
|                 | Stress tolerance        | -0.08    | 0.05      | -1.77    | .078       |
|                 | Thrill-seeking          | 0.07     | 0.06      | 1.13     | .261       |
|                 | Overt social curiosity  | 0.06     | 0.07      | 0.86     | .389       |
|                 | Covert social curiosity | 0.14     | 0.05      | 3.00     | .003*      |
| Conflict        | Joyous exploration      | -0.21    | 0.07      | -3.12    | .002*      |
|                 | Deprivation sensitivity | 0.03     | 0.06      | 0.51     | .613       |

| Addiction Facet | Dimension of curiosity  | <i>b</i> | <i>SE</i> | <i>t</i> | <i>Sig</i> |
|-----------------|-------------------------|----------|-----------|----------|------------|
| Problems        | Stress tolerance        | -0.11    | 0.04      | -2.44    | .015*      |
|                 | Thrill-seeking          | 0.26     | 0.06      | 4.41     | < .001*    |
|                 | Overt social curiosity  | -0.18    | 0.06      | -2.72    | .007*      |
|                 | Covert social curiosity | 0.19     | 0.05      | 4.30     | < .001*    |
|                 | Joyous exploration      | -0.09    | 0.07      | -1.41    | .159       |
|                 | Deprivation sensitivity | -0.05    | 0.06      | -0.81    | .416       |
|                 | Stress tolerance        | -0.18    | 0.04      | -4.10    | < .001*    |
|                 | Thrill-seeking          | 0.13     | 0.06      | 2.28     | .023*      |
|                 | Overt social curiosity  | -0.12    | 0.06      | -1.84    | .065       |
|                 | Covert social curiosity | 0.20     | 0.04      | 4.49     | < .001*    |

\* $p < .05$ .

*Note.* GAS-7 = Gaming Addiction Scale. 5DCR = Five-Dimensional Curiosity Scale Revised

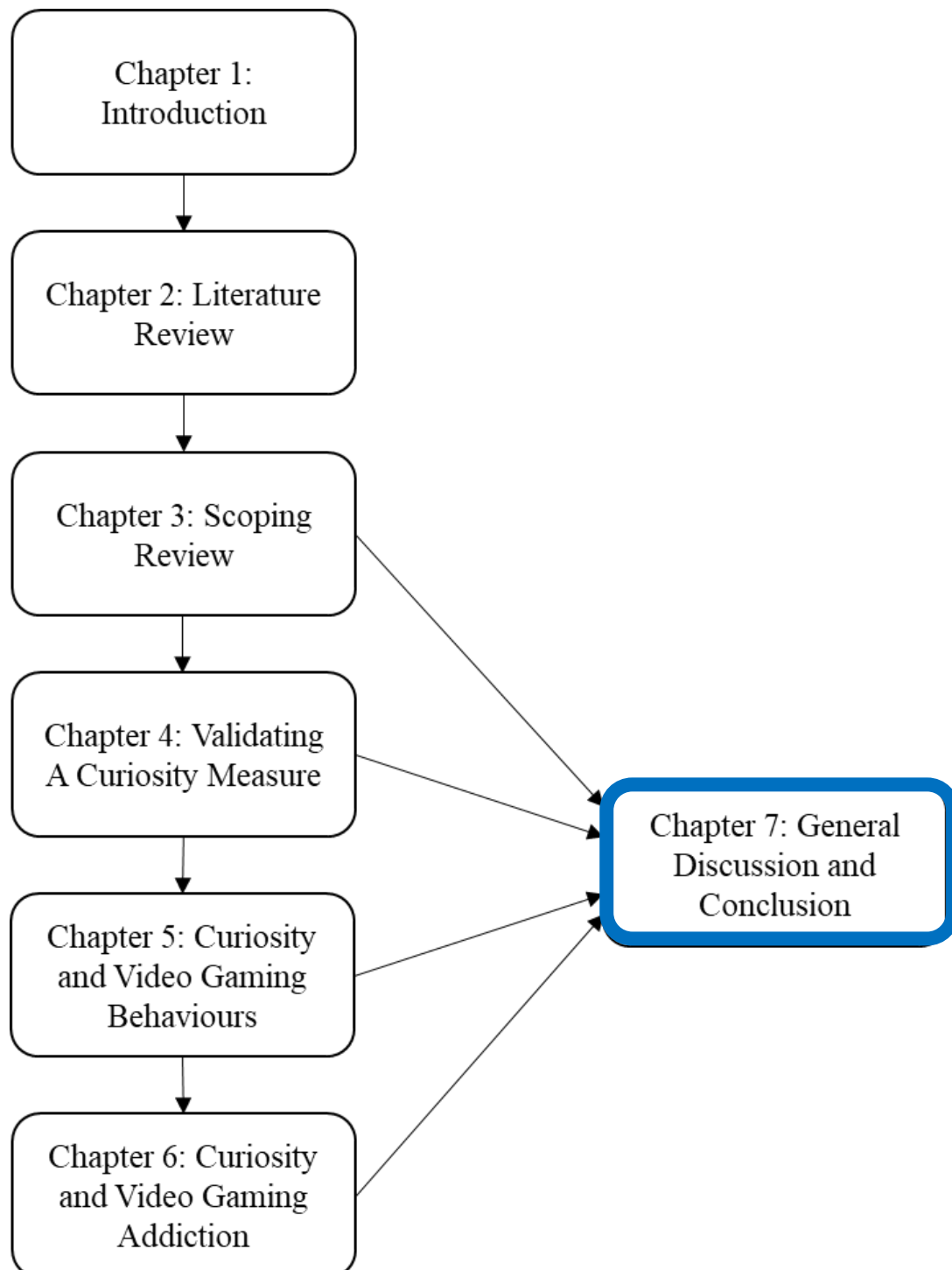
### Discussion

The hypothesis that stress tolerance would negatively predict video gaming addiction (H1) was supported. This finding was in line with past research indicating the negative relationship between tolerance toward stress and addiction (Ko et al., 2008; Rajab et al., 2020). Accordingly, this would also suggest that building stress tolerance can be an effective way of combating gaming addiction. To better examine how dimensions of curiosity predicted individual aspects of addiction, we also conducted an item-level analysis. Of the four criteria of video gaming addiction, conflict and problems were negatively predicted by stress tolerance, but relapse and withdrawal were not. This was partially aligned with past literature (e.g., Rajab et al., 2020), with a potential point of discrepancy stemming from the way addiction was conceptualised. Past studies (e.g., Ko et al., 2008) often classified

participants as either addicted or not addicted, while the present study conceptualised addiction as a continuum; this could have led to the difference in results. Additionally, our findings also indicated that stress tolerance may be more closely linked to the externalised consequences of addiction (i.e., conflict with family, and problems with work or school), rather than internalised ones (i.e., unable to stop playing video games, and feeling bad when an individual was unable to play video games).

The hypothesis that covert social curiosity would predict video gaming addiction (H2a) was supported. Further analysis indicated that covert social curiosity predicted all four criteria of addiction (i.e., relapse, withdrawal, conflict, and problems). On the other hand, overt social curiosity did not predict addiction, thus H2b was not supported. Our findings aligned with related literature documenting the safer, indirect ways, and lower stakes nature of online interactions (i.e., covert social curiosity) possibly predicting video gaming addiction (Bhagat et al., 2020; Cornwell & Lundgren, 2001). In all, this suggests that covert social curiosity is a better predictor of video gaming addiction compared to overt social curiosity. A full discussion of the results can be found in Chapter 7.

Overall, our findings suggested that different dimensions of curiosity can not only predict video gaming addiction, but also differentially predict different facets of video gaming addiction. Moreover, our results also supported the notion that additional insights can be obtained by examining the individual aspects of problematic gaming, rather than classifying an individual as either an addict or non-addict (i.e., using the polythetic format). This is useful because it highlights the specific domains of addiction that should be the focal point of interventions, which would then allow for targeted treatment (e.g., building stress tolerance to combat externalised behavioural issues).



## **Chapter 7: General Discussion**

The primary goal and central research question of the project was to empirically investigate the links between the multidimensional construct of curiosity and video gaming behaviours. The thesis is organised into a series of chapters that build progressively on one another, describing a series of studies undertaken to progressively answer the central research question. This chapter opens with a summary of the previous chapters, followed by a discussion of the findings for each of the primary studies that were conducted. The thesis concludes with a discussion of implications, limitations, and avenues for future research.

### **Summary of Chapters**

In Chapter 1, we argued that while leisure activities occupy a similar amount of time as more formal activities, researchers have tended to focus on the latter rather than former. In the realm of leisure activities, video gaming is one hobby that continues to increase in popularity. This has also prompted scholars to investigate antecedents of video gaming. Chapter 1 introduced the popular activity of video gaming, as well as curiosity as a potential antecedent to playing games. A brief overview of key concepts was provided, including how video games are commonly classified (i.e., game genres), and the importance of separating harmful gaming addiction from benign engagement. We then proposed the psychological construct of curiosity as a critical driving factor for playing video games.

Chapter 2 was split into three main sections. The first reviewed the literature on video gaming, starting from how video games have been classified, including the use of gaming genres, its limitations, and the structural characteristics of games. We also discussed an unhealthy outcome of video gaming—disordered video gaming. The second section discussed an important antecedent of video gaming, where we covered the psychological construct of curiosity, and how it has been studied in empirical research. The third section

formed the bridge between the first two sections by discussing the links between curiosity and video gaming.

Chapter 3 described a scoping review that focused on three aspects of curiosity—its dimensions, measures, and contexts. The findings were integral in informing the initial development of the program of research outlined in this thesis. In terms of dimensionality and measures, results indicated that curiosity is largely conceptualised as multidimensional, with Kashdan et al.'s (2020) 5DCR as the most contemporary measure that captures the full bandwidth of curiosity. The 5DCR comprises six dimensions of curiosity, including joyous exploration, deprivation sensitivity, stress tolerance, thrill-seeking, overt social curiosity, and covert social curiosity. With respect to contexts, we also noted the lack of research on curiosity in leisure pursuits, which substantiated the decision to focus on video games. Additionally, supplementary findings revealed that the majority of curiosity research is skewed towards Western countries, indicating the need to shift focus to non-Western cultures.

Chapter 4 described a validation study that examined the applicability of the 5DCR in a Southeast Asian sample. Our findings provided first evidence of the applicability of the 5DCR in a non-Western setting. We confirmed the six-factor structure, with each of the 24 items loading strongly on their respective factors. We also provided evidence of both convergent and discriminant validity via patterns of correlations with the constructs of personality, happiness, well-being, values, depression, anxiety, and wisdom. Lastly, we found measurement invariance of the 5DCR across three Southeast Asian countries—Singapore, Malaysia, and the Philippines. Essentially, Chapter 4 provided evidence of the validity of the measure of multidimensional curiosity that would be employed in the subsequent studies.

Chapter 5 investigated the links between the curiosity and video game preferences and behaviours. We expected that curiosity would predict number of hours that gamers played for, but found weak support for this hypothesis. We also proposed that the dimensions of curiosity

would differentially predict features of video games that players enjoy. In particular, we found that joyous exploration predicted enjoyment of rewards and punishments in video games, and that overt social curiosity predicted enjoyment of social features in a game. Contrary to expectations, covert social curiosity did not predict this enjoyment.

Chapter 6 explored the associations between curiosity and video gaming engagement and addiction. Results showed that the stress tolerance dimensions of curiosity negatively predicted video gaming addiction, thus supporting the first hypothesis. Covert social curiosity also predicted gaming addiction, but overt social curiosity did not. Coupled with facet-level analyses, our findings suggested that different dimensions of curiosity can not only predict video gaming addiction, but also differentially predict different facets of video gaming addiction. The following sections discuss the findings from the primary studies (i.e., Chapters 4, 5, and 6 respectively; a full discussion of the scoping review can be found in Chapter 3) in greater detail. For ease of readability, the key objective for each of Chapters 4, 5, and 6 are as follows:

1. Validating the 5DCR in a Southeast Asian setting
2. Associations between curiosity and video gaming behaviours
3. Relationships between curiosity and video gaming addiction and engagement

### **Validating the 5DCR in a Southeast Asian Setting**

#### ***Factor Structure and Reliability of the 5DCR***

In Chapter 4, we examined the model fit of a six-factor structure of the 5DCR. All parameters were in line with past studies (Grüning & Lechner, 2022; Kashdan et al., 2020) and suggested a good fit. Moreover, item loadings on their corresponding dimensions also closely replicated that in the original 24-item scale. This suggests that the 5DCR possesses six distinct aspects of curiosity, and supports the notion that it is the most comprehensive

curiosity measure to date. More importantly, this delineation of curiosity factors can also apply to Southeast Asia.

The results also implied that in a Southeast Asian sample, the 5DCR was very reliable, given the high internal consistency coefficients. Although slightly less compelling, test-retest correlations of two months ranged from satisfactory to good. However, the sample size at time two was small, thus results should be interpreted with caution. Nevertheless, this finding was in line with results from previous studies, which supported the temporal stability of the 5DCR across two weeks, two months, and eight months (Grüning & Lechner, 2022; Kashdan et al., 2020). Taken together, this provides evidence for the stable, trait-like nature of the constructs assessed by the 5DCR.

### ***Construct Validity of the 5DCR***

In general, the pattern of correlations in the current study replicated that of Kashdan et al. (2018, 2020), supporting the construct validity of the 5DCR. Joyous exploration, thrill-seeking, stress tolerance, and overt social curiosity were significantly related to the personality domain of openness. This was expected given the theoretical similarities between the approach based domains of curiosity and the propensity to be open to new and novel experiences. Also, overt social curiosity was strongly correlated with extraversion and agreeableness; this was again expected as these constructs commonly involve direct interactions between people. The only notable departure from the original work by Kashdan et al. was a non-significant correlation between deprivation sensitivity and openness. This could be due to the personality measure used. The present study used the mini-IPIP (Donnellan et al., 2006), while Kashdan et al. utilised the big five inventory-2 (BFI-2; Soto & John, 2017). Openness is often termed as one of the least understood personality traits, stemming from a lack of consensus on how to conceptualise the construct (Ng et al., 2021). The mini-IPIP appears to measure openness as a general factor, as compared to three lower

level facets of openness in the BFI-2. Furthermore, the shorter length of the mini-IPIP, though proven to be psychometrically sound, might not have captured the full spectrum of openness as a factor, especially the aspects that could be important in cultivating deprivation sensitivity.

We also administered the TwIVI (Sandy et al., 2017) to measure 10 basic human values (universalism, self-direction, stimulation, hedonism, achievement, power, security, conformity, tradition, and benevolence). Individuals high in joyous exploration, deprivation sensitivity, thrill-seeking, and overt social curiosity had the strongest relationships with self-direction and stimulation, implying people high in these curiosity dimensions prefer independence and pursuing excitement and challenge. On the other hand, conformity and tradition had a non-significant to weak correlation with the curiosity facets. Curiosity requires one to be open-minded, to seek out new information and experiences. This conflicts with conformity and tradition, which lean toward maintaining the status quo (Roccas et al., 2002). In sum, our pattern of results largely mirrored the findings from both Kashdan et al. (2020) and Grüning and Lechner (2022).

Anxiety and depression had the strongest links with stress tolerance and covert social curiosity. Both dimensions of curiosity possess a somewhat negative connotation: stress is known to correlate with anxiety and depression, and not being able to tolerate stress can lead to the aforementioned negative outcomes (Bland et al., 2012), while covert social curiosity refers to behaviours that are associated with spying and snooping (Kashdan et al., 2020). Snooping behaviour has been found to lead to anxiety and depression (Arikewuyo et al., 2021). Joyous exploration and stress tolerance showed the highest correlation coefficients with subjective happiness and overall well-being. Both curiosity dimensions appear critical in kickstarting the process to experience new things, while maintaining a healthy and positive mindset. Again, the findings closely replicate those of Kashdan et al. (2018).

Past research has reported moderate correlations between curiosity and wisdom (Neff et al., 2007). Our findings demonstrated that when examining the individual dimensions of curiosity, joyous exploration and overt social curiosity displayed the strongest associations with the four facets of wisdom, including appraising, and adopting the perspectives of others, being intellectually humble, and ability to notice change and uncertainty. Conversely, stress tolerance was not related to wisdom; this result was congruent with that reported in Kashdan et al. (2020).

### ***Measurement Invariance Between Malaysia, the Philippines, and Singapore***

To ensure that the 5DCR is psychometrically equivalent across the three Southeast Asian populations of Malaysia, the Philippines, and Singapore, we conducted a measurement invariance analysis. We found evidence of measurement invariance in its configural, metric, and scalar forms. This meant that individuals from Malaysia, the Philippines, and Singapore interpret the content in the 5DCR similarly. This substantiates the claim that the 5DCR is valid across cultures. To the best of our knowledge, there has been no attempts to examine the measurement invariance of curiosity between Eastern countries. However, studies have been conducted on the broader construct of personality. For example, Kajonius (2017) reported that Openness, which curiosity is often nested under, did not exhibit scalar invariance between their samples of Asian (e.g., Malaysia, Singapore) and European countries (e.g., France, Germany). This meant that participants between the Eastern and Western countries interpreted the construct of openness differently.

Conversely, another study by Woo et al. (2014) found evidence of measurement invariance in an openness scale, across USA and China undergraduate students. These authors also reported that undergraduates from China scored lower on the sub-facet of intellect compared to their USA counterparts, and the differences were driven by curiosity. Despite the discrepant findings, which are perhaps due to the lack of focus on curiosity by

instead focusing on the more general trait of openness, or differences in measures used, it suggests that more research can be done to better understand the nuances of curiosity across different countries. To this end, we provided evidence that the 5DCR scores can be meaningfully compared across Malaysia, the Philippines, and Singapore. Coupled with the validation study of the 5DCR by Grüning and Lechner (2022) across UK and Germany samples, this attests to the cross-cultural validity of the 5DCR and should help to stimulate more intercultural research in multidimensional curiosity.

***Supplementary Analysis: Inter-country Differences in Curiosity***

A follow-up exploratory MANOVA found that individuals in Singapore displayed lower levels of thrill-seeking compared to both their Malaysian and Filipino counterparts, while those in the Philippines possessed lower covert social curiosity compared to Singapore and Malaysia. The finding that Singaporeans possessed lower levels of thrill-seeking, which has roots in risk-taking and sensation-seeking behaviours, could be due to cultural factors. Much research has shown that multiculturalism increases creativity and promotes risk-taking (e.g., Leung & Chiu, 2010). However, in the case of Singapore, which is highly multicultural, the opposite appears to be true (Cheng & Hong, 2017).

Moreover, work by Li and Fang (2002) also found that Singaporeans display lower levels of risk-taking compared to other Asian samples, including Indians and Mainland Chinese. A possible reason cited for this phenomenon include an educational system that encourages academic performance over creativity; and a social culture that stigmatises failure (Bhasin, 2007). In the field of business, Cheng and Hong (2017) reported that Singapore companies are more risk averse in business strategies compared to other Asian countries. In sum, the aforementioned reasons could potentially explain why Singaporeans often “play it safe”, hence resulting in lower risk-taking and thrill-seeking behaviours compared to other countries in the region. By extension, Singapore’s culture could also influence, and be

influenced by having strict laws and policies (Ortmann, 2012). This could then potentially stifle the thrill-seeking dimension of curiosity. Thrill-seeking is often associated with reckless, or dangerous behaviours (Crone et al., 2016; Zuckerman, 1994). Having firm rules could reduce these negative behaviours, but simultaneously lower thrill-seeking inclinations.

The finding that Singaporeans and Malaysians displayed higher levels of covert social curiosity compared to Filipinos could be due to a cultural phenomenon known as kiasuism. Kiasuism is defined as the fear of losing out, often accompanied with an obsession to get ahead of others, and is a prominent cultural trait in Singapore (Bedford & Chua, 2018). Likewise, Lee (2007) also detailed how Malaysians were also prone to kiasu behaviour. A kiasu person is often selfish, calculative, greedy, and may suffer from low self-esteem, thus resulting in unhealthy coping mechanisms to get ahead of others (Nga, 2020). Given the need to “win” at all costs, one might expect kiasu individuals to resort to more surreptitious methods to gather social information, such as gossiping and prying, which is closely linked to covert social curiosity (Kashdan et al. 2020).

Alternatively, Filipinos might be less predisposed to covert social curiosity due to a culture that does not emphasise achievement motives. A study reported that in the Philippines, performance goals (needing to demonstrate competence to others) are not beneficial, as there are no competitive nation-wide exams, and university admission is relatively easy (King et al., 2014). As such, there could be less motivation to go out of one’s way to indirectly seek out information (i.e., covert social curiosity), to gain an advantage over others. Similarly, another study by Bernardo et al. (2014) also found that Filipino youths place less value on achievement, compared to a pan-cultural sample. In fact, Filipino students viewed Malaysian students who prioritise competence less favourably (Bernardo & Ismail, 2010). Taken together, it is possible that Filipinos are less competitive compared to

Malaysians and Singaporeans, which would potentially mitigate the need to rely on covert social behaviours.

### **Associations Between Curiosity and Video Gaming Behaviours**

#### ***Predicting Time Spent Video Gaming***

In Chapter 5, we examined the links between dimensions of curiosity and gaming-related behaviours, specifically hours spent playing games and features of video games that players enjoy. We hypothesised that dimensions of curiosity would be significant predictors of playtime. Bivariate correlations showed that thrill-seeking, stress tolerance, and both overt and covert social curiosity were significantly correlated with playtime, which provided partial support for our hypothesis. However, when placed in a regression model, results revealed that thrill-seeking was the only significant predictor of video game time, while the other five dimensions were not, ultimately providing weak support for our hypothesis.

We found that the higher a person's thrill-seeking, the more interested an individual was in satisfying their craving for thrills, the more time they spent playing video games. It appeared that the immersive and interactive qualities of video games serve as an ideal medium to stimulate engagement with thrill-seekers. Studies have found that this need for arousal draws thrill-seekers toward video games (Jensen et al., 2011). In particular, individuals with high levels of sensation-seeking tend to prefer playing video games that contain acts of violence (Bonnaire & Conan, 2024), which could also explain why some of the most famous video game franchises are violent in nature (e.g., Call of Duty; Treyarch, 2015).

Our non-significant findings could have been due to overall playtime being an overly broad measure. Chen et al. (2019) collected data on video game playtimes during different times of day, and found that hours spent gaming in the morning and afternoon affected school performance, but hours spent playing games in the evening had no effect on performance.

This could be explained by the displacement hypothesis, where playing games displaces time that would otherwise have been spent in school (Chen et al., 2019). Likewise in the present study, full-time workers and students would naturally have less time to spend on video games during the day given their “primary” commitments, and using overall playtime as a measure could have failed to capture certain nuances, leading to the non-significant results.

A potential explanation for the weak support of our hypothesis could be that curiosity does not influence time spent playing video games. Based on the concept of grinding (the repetitive execution of in-game tasks; Sgandurra, 2022), video gamers might be inclined to play for longer hours, regardless of curiosity levels. Grinding in games often offer rewards such as more experience points, and higher-level equipment. From this perspective, repeated engagement in the same task would result in players to not be curious about the game as there may not be new content to experience. Instead, the motivation to continue playing is rooted in other factors such as mastery over the game via the attainment of rewards, and not curiosity.

Another alternative explanation could be that the difficulty of video games suppressed curiosity in our sample. Past research has shown that an optimal level of difficulty is required to elicit curiosity (Baranes et al., 2014; Dubey et al., 2020) and it appears that the relationship between difficulty and curiosity follows an inverted U-shape function. The same could be true for video gaming—a game that is too difficult might cause players to no longer be curious and interested to play it as it causes frustration, while a game that is too easy would also not elicit curiosity as it does not provide satisfaction. This possibility should be further explored.

There could also be other factors that were not related to curiosity that affected video game playtime. For example, gaming to compensate for low self-esteem (King & Delfabbro, 2016) and experiences of competence, autonomy, and relatedness during gameplay (Johnson et al., 2016) have been shown to increase playtime. Subsequent research might look into

whether other psychological or trait variables play a role in the relationship between curiosity and video game playtime. Nevertheless, when examining the regression model in the present study, findings show that thrill-seeking appear to overshadow the other predictors when asking for retrospective recall of playtime.

### ***Joyous Exploration Predicting Enjoyment of Rewarding/Punishing Features***

The hypothesis that joyous exploration would be linked to reward and punishment was supported. This finding was in line with that in past research from Gómez-Maureira and Kniestedt (2019). These authors found that exploration games commonly ranked high in eliciting curiosity within gamers, and went on to suggest that the pleasant experience of exploring a game world was underscored by the promise of rewards. We provide empirical evidence that this is the case. It appears that gamers who identify with the joy of exploring may be doing so because of a reward that awaits them. Interestingly, it is unclear if gamers with high levels of joyous exploration would be aligned with only the punishing, but not the rewarding aspect. Perhaps the allure of exploring is not specifically about the promise of rewards per se, but about making progress and discovery within the game, regardless of whether an outcome is rewarding or punishing. Likewise, Gómez-Maureira and Kniestedt (2019) reported that players expect their exploratory behaviour to not only be rewarding, but instrumental in game progression. More research would be needed to shed light on these potential differences, particularly to examine if rewards and punishments function similarly, and if rewards and progress are mutually exclusive.

### ***Covert and Overt Social Curiosity Predicting Enjoyment of Social Features***

The hypothesis that overt social curiosity would be linked to social features was supported. Conversely, the hypothesis that covert social curiosity would predict enjoyment of social features was not supported. Overt, but not covert, social curiosity was positively associated with enjoyment of social features in video games. Overt social curiosity, which

emphasises interaction with others to gather information, would intuitively be linked to features that bring gamers together in a virtual space (e.g., joining a guild, working together to defeat a strong enemy). For example, in MMORPGs such as *World of Warcraft* (Blizzard Entertainment, 2004), players band together to defeat increasingly difficult enemy encounters, where interaction between members (i.e., communication and synergy) is key for overcoming these challenges (Williams et al., 2006).

The significant link between overt social curiosity and a video game's social features could also be due to factors such as using socialisation in multiplayer games as a replacement for face-to-face interactions. Williams et al. (2006) found that playing online games allowed for geographically distant friends and relatives to keep in touch. This would be even more apparent during COVID-19 lockdowns, allowing individuals to connect virtually in lieu of physical meetings. Given that the data for the present project was collected during the height of the pandemic, it is unsurprising that video gamers would be more willing to connect with others via multiplayer games, which typically offer an abundance of social features. For instance, the biggest change in gaming habits during the pandemic revolved around socialisation, with respondents reporting "playing more multiplayer games to make up for the lack of in-person communication", and "played more multiplayer games with friends to keep us in contact" (Barr & Copeland-Stewart, 2022). This could then account for why overt social curiosity predicted enjoyment of social features in a video game.

On the other hand, covert social curiosity was not associated with social features of video games. This could be due to a mismatch in the mechanism in which overt or covert social curiosity are elicited. In overt social curiosity, an individual is usually more upfront and direct in social interactions. Conversely, in covert social curiosity, individuals acquire information through more secretive and indirect ways (e.g., snooping; Kashdan et al., 2020). Based on the items under social features in the VGSC, they appear to be more aligned toward

overt social curiosity (e.g., “sharing tips and strategies about the video game with others”; King et al., 2010), compared to covert social curiosity, which could potentially explain the non-significant association.

However, it is plausible that covert social curiosity could be significantly linked to social features, but in a more competitive, rather than cooperative environment. In competitive play, if the goal is to win against other players, then gamers might be more inclined toward covert behaviours. For instance, the term “stream sniping” refers to secretly acquiring information about another player’s avatar by watching their live broadcast (such as on streaming platforms like YouTube, or Twitch), while simultaneously being in the same video game space (Felczak, 2023). Knowing another player’s in-game whereabouts can provide a huge advantage, especially in player-versus-player scenarios. To test the claim that covert social curiosity is associated with social features, albeit in a competitive context, more research should be conducted. Regardless, our results indicate that direct social interactions in games play a role in a player’s enjoyment. However, players should be mindful of enjoyment turning into addiction. Research has found that online games (where social features are abundant) in particular can lead to gaming addiction (Cole & Hooley, 2013).

### ***Supplementary Findings***

Findings showed that thrill-seeking predicted four of the five structural characteristics, including preference for narrative and identity features, presentation features, social features, and manipulation and control features. However, thrill-seeking was not a significant predictor of preference for reward and punishment features. The non-significant links between thrill-seeking and rewards and punishment could be due to how those with high levels of thrill-seeking respond to rewards and punishments. Research has found that thrill-seeking and risk-taking traits play a role in how an individual is enticed by rewards, but are not sensitive towards punishments (Lauriola et al., 2013). Based on reinforcement

sensitivity theory, the behavioural activation system (BAS) regulates sensitivity to rewards, while the opposing system – the behavioural inhibition system (BIS) affects responses to punishments (Scott-Parker & Weston, 2017). Both systems work in tandem to mediate a person's response to an event. In the present study, the reward and punishment items in the VGSC were collapsed into a single subscale, thus their scores could have been conflated (i.e., cancelling out one another), resulting in a non-significant link with thrill-seeking. Another way to further the literature is to possibly examine indirect relationships. Research has investigated how rewards and punishments act as mediators or moderators (e.g., Sauer, 2015). Future studies should further investigate if rewards/punishments can indirectly impact the association between curiosity and the preferences for narrative and identity features, presentation features, social features, and manipulation/control features.

Results showed that deprivation sensitivity was not a significant predictor of any structural characteristics in a video game. This could be due to how participants perceived the items measuring deprivation sensitivity. In the 5DCR, deprivation sensitivity takes an avoidant approach towards eliciting curiosity (i.e., displaying curiosity to reduce anxiety from not knowing an answer). Conversely, in the VGCS, the items are querying about a person's enjoyment towards the structural characteristics. Given prior knowledge that the study revolved around curiosity and video gaming, which is an enjoyable activity, participants could have interpreted the deprivation sensitivity items as being more positive and fun. For example, when viewing the deprivation sensitivity item of "I work relentlessly at problems that I feel must be solved" in the context of a video game, participants could have viewed persistence to solve problems and complete tough objectives as being fun and enjoyable. The notion of deprivation sensitivity is often used in puzzle games, where players are motivated by the lack of answers to complete objectives (To et al., 2016). This interpretation could have

distorted the results by attenuating the intrinsically avoidant-based motives in the deprivation sensitivity subscale, thus leading to the non-significant relationships.

## **Relationships Between Curiosity and Video Gaming Addiction and Engagement**

### ***Stress Tolerance Predicting Video Gaming Addiction***

In Chapter 6, we examined if dimensions of curiosity predicted video gaming addiction. Based on views that addiction is a separate construct from engagement (Brunborg et al., 2015; Ferguson et al., 2011), we analysed the relationships between curiosity and addiction and engagement independently. Results revealed that stress tolerance negatively predicted video gaming addiction, supporting our hypothesis. Findings were in line with studies that found positive correlations between stress and addiction (Ko et al., 2008; Rajab et al., 2020), and a significant relationship between stress vulnerability and gaming disorder (Kaess et al., 2017). This indicates that individuals who are less capable of coping with stress are more susceptible to experiencing the negative outcomes of playing video games.

To further interrogate our findings, we investigated each criterion of addiction individually. Of the four criteria of video gaming addiction, conflict and problems were negatively predicted by stress tolerance, but relapse and withdrawal were not. This was somewhat aligned with past literature, with a potential point of discrepancy stemming from the way addiction was conceptualised (e.g., Rajab et al., 2020). Firstly, some studies do not make the distinction between addiction and engagement, which could lead to distorted results. Secondly, while literature suggests that stress tolerance is negatively correlated with addiction (Ko et al., 2008; Rajab et al., 2020), past studies often classified participants as addicted or not addicted to video gaming. For instance, Rajab et al. utilised the GAS-7, and considered participants who responded “sometimes” (i.e., a score of 3 on the 5-point Likert scale) on at least four of the seven items as being addicted to gaming. An important point of difference in the present study compared to past research was that instead of distinguishing

between addicted and non-addicted video gamers, we examined problematic video gaming on a continuum (instead of dichotomising it into the mutually exclusive categories of ‘addicted’ and ‘not addicted’).

Through this more thorough lens, our findings also indicated that stress tolerance may be more closely linked to the externalised consequences of addiction, rather than internalised ones. Individuals with reduced stress tolerance were more prone to neglecting activities such as school or work (i.e., problems), in favour of playing video games. Also, those with lower levels of stress tolerance tended to get into arguments with family and friends over time spent on video games more often (i.e., conflict). According to a qualitative study by Beranuy et al. (2013), video gamers felt that pressure from parents led to intense feelings of stress, and they turned to video games as a way to relax. In turn, excessive gaming resulted in further conflict with their family. Without adequate tolerance of stress, it seems likely that video gamers may become trapped in a recurring cycle of excessive gaming and familial conflict.

In addition to deterioration of an individual’s social relationships, gaming addiction may negatively affect both work and academic performance, as addiction to video gaming may directly displace time from these other important responsibilities, leading to poorer work and scholastic outcomes (e.g., Tas, 2017). Loton (2014) corroborated this view by reporting that the mounting stress from displacement of formal activities would culminate in gaming addiction. The negative relationship between stress tolerance and gaming addiction indicates that having a buffer against stress (i.e., stress tolerance) would attenuate the adverse effects of video gaming addiction, particularly in terms of neglecting formal activities. Accordingly, we believe that there is value in building stress tolerance and focusing on intervention efforts that are more efficacious in treating externalised behavioural issues.

***Social Curiosity Predicting Video Gaming Addiction***

The hypothesis that covert social curiosity would predict video gaming addiction was supported, while the hypothesis that overt social curiosity would predict gaming addiction was not. Additionally, covert social curiosity predicted all four criteria of addiction (i.e., relapse, withdrawal, conflict, and problems). Our findings aligned with related literature speaking to the safer, indirect ways, and lower stakes nature of online interactions (i.e., covert social curiosity) possibly predicting video gaming addiction (Bhagat et al., 2020; Cornwell & Lundgren, 2001), but less so with studies suggesting that overt social curiosity predicted disordered gaming (Griffiths et al., 2011). Once again, this could be due to the present study analysing the dependant variables as scale data, instead of the polythetic format (e.g., endorsement of half, or more, of the addiction domains to be considered a gaming addict; Griffiths et al., 2011).

Our findings suggest that when distinguishing between the two aspects of social curiosity, the indirect means of learning information about others play a bigger role in the lead up to addiction, compared to direct communication with other players. This could be because of dispositional factors that align more with covert social curiosity, as opposed to its overt counterpart. For example, having high levels of social anxiety could result in gamers avoiding online social interactions, and resort to obtaining new information or achieving goals of a game via other more inconspicuous ways, such as viewing gaming profiles. Social anxiety has been shown to be significantly associated with gaming addiction (Wang et al., 2019). Further research can be conducted to investigate if there are other variables, such as social anxiety, that potentially impact covert, but not overt social curiosity.

Tangential to the above point, it is also likely that modern games no longer provide the same level of privacy and anonymity as before, thus gamers may not feel entirely comfortable with direct player interaction, and may inadvertently display lower levels of

overt social curiosity in favour of its covert counterpart. Indeed, there is a surge in new business models to optimise personal data collection and user profiling, where every player's actions are scrutinised (Kröger et al., 2023). The increasing interconnectedness between our online footprint can also be evidenced where players can login to games using a multitude of personal accounts (e.g., Google, Facebook), which may lead to lower perceived online anonymity, and therefore a need to interact with platforms and fellow users in more covert ways.

### **Implications**

The results of the present project hold several important implications for various stakeholders. Firstly, our findings advance the psychological literature by providing a deeper understanding of the interplay between curiosity and video gaming. Secondly, results can inform practitioners on potentially useful avenues for treating gaming addiction. Lastly, the project outcomes suggest ways that the gaming industry can leverage curiosity to develop more engaging games, and to optimise advertising strategies.

### ***Literature and Research***

This thesis contributes to the extant literature in several ways. Firstly, the scoping review (Chapter 3) represents the most recent attempt in providing an overview of how curiosity has been studied, namely in its dimensionality, measures, and settings. The scoping review also provides the added benefit of not focusing on specific contexts, compared to other reviews (e.g., Grossnickle, 2016; Wagstaff et al., 2020) which focused on the educational and human resource industries respectively. This means that our scoping review can potentially provide more breadth and a broader look into investigations of curiosity.

Secondly, the thesis is the first to examine the 5DCR in a non-Western context, and contributed insight into how curiosity might function in Southeast Asia. Barring some slight inconsistencies with the original study regarding the development of the 5DCR (Kashdan et

al., 2020; as noted in the earlier discussion sections), we found strong evidence for the cross-cultural applicability of the 5DCR. Accordingly, researchers can be confident in administering the 5DCR in Southeast Asia.

Thirdly, findings across the studies conducted reinforce the point that more insights can be obtained by utilising a multidimensional conceptualisation of curiosity. Based on our scoping review and validation study, it is clear that curiosity comprises multiple dimensions. Our subsequent studies, which examined the links between curiosity and video gaming behaviours, also reinforce this point: that different dimensions of curiosity can predict enjoyment of different features of video games, as well as the risk of disordered gaming. This supports the notion that curiosity should be viewed as a multidimensional construct in empirical research. Our findings also shed more light on the role of curiosity in video gaming. Much research conducted on this front was problematic, including the lack of parametric statistical analyses (e.g., Sedano, 2007), or a conceptualisation that viewed curiosity as general interest, leading to the administration of non-validated measures of curiosity (e.g., Galli et al., 2018). Using the 5DCR, our findings support the notion of individual differences in the multidimensional construct of curiosity, and how they impact enjoyment of different video gaming features.

Next, the use of video game features (i.e., structural characteristics) in the present project can also expand our understanding in video game literature. In Chapter 2, we discussed two main limitations of genres: that games are tough to classify into genres since there is no consensus on how many genres exist, and that modern games often fall into multiple genres, and thus are difficult to label. While past research has alluded to the advantages of focusing on the structural characteristics (Griffiths & Hunt, 1995), it has been marred by the lack of empirical evidence. Accordingly, our findings imply that examining the

structural characteristics of video games is a meaningful way to understand player preferences and enjoyment, without the drawbacks of game genres.

Lastly, our findings also contribute to the literature by allowing a deeper look at the role of curiosity in video gaming addiction. We found evidence that stress tolerance and social curiosity are antecedents to disordered gaming. Furthermore, by examining each of the four addiction criteria (i.e., relapse, withdrawal, conflict, and problems) independently, we provided nuance to the above findings by elucidating the specific maladaptive outcomes of gaming addiction that are affected by the abovementioned dimensions of curiosity. This knowledge can then be translated into practical implications for clinical use.

### ***For Mental Health Professionals***

Based on the finding that stress tolerance might be more linked to the externalised consequences of gaming addiction (e.g., conflict with family) compared the internalised ones (e.g., feeling bad when unable to play games), this can inform intervention efforts to better treat disordered gaming. Our findings suggest that it may be fruitful to build stress tolerance for gamers who often encounter problems with close ones. For example, Baumel et al (2021) found that an effective treatment regime for children with externalised behaviour problems was one that involved both the parents and child, albeit only when treated individually. This could prove useful in attempts to build stress tolerance in the context of treating the outward maladaptive consequences of video gaming addiction.

Relatedly, an argument can also be made to not only focus on individuals suffering from disordered gaming, but also in conjunction with family members. To this point, an effective treatment could be family therapy, where parents also receive psychoeducation about gaming to help them better understand their child's gaming behaviours (Pallesen et al., 2015). The main purpose is to increase parents' curiosity about gaming, which helps to establish (or re-establish) emotional connections (Bore et al., 2024). Such an approach has

been shown to be effective in decreasing problematic gaming, particularly instances of quarrelling with family members (Nielson et al., 2023). It appears that focusing on the different dimensions of curiosity in a bid to alleviate gaming addiction is not only useful for gamers themselves, but also through piquing the curiosity of their loved ones.

Mindfulness treatments have also shown efficacy in treating video gaming addiction, by targeting the feedback loops of stress, maladaptive coping, and playing of video games (Brand et al., 2016). Mindfulness interventions aim to improve stress tolerance via meditation and cognitive reappraisal techniques, resulting in less stress-related video gaming (Li et al., 2017). A case study conducted by Li et al. found that a participant (under the pseudonym Steve) reported no signs and symptoms of video gaming addiction after undergoing mindfulness treatment for 8 weeks, compared to pre-treatment. Moreover, cravings to play games and maladaptive cognitions related to video gaming also both decreased at the post-test, and treatment effects were sustained at a follow-up three months later. Overall, this indicates that practitioners providing help to problematic gamers should consider using mindfulness-based interventions, as they can help combat gaming addiction by targeting the stress tolerance dimension of curiosity. Interestingly, Steve also reported that after receiving the intervention, he had more curiosity about his own actions and emotions, which led to better regulation of video gaming. This raises the possibility for the inclusion of another dimension of curiosity: curiosity about the self, or intrapersonal curiosity (this is not part of the 5DCR, but we alluded to this type of curiosity in Chapter 3). Should this dimension of curiosity be implicated in the relationship between curiosity and video gaming addiction, then any treatment effort may consider improving intrapersonal curiosity above and beyond stress tolerance.

***For Industry: Game Designers, Developers, and Advertisers***

A key finding in Chapter 5 was that the thrill-seeking dimension of curiosity predicted number of hours that individuals play video games. This could be particularly useful for subscription-based games (e.g., *World of Warcraft*; Blizzard Entertainment, 2004) where gamers have to pay a monthly fee to access the game, which ensures a constant revenue stream. Game developers can also potentially focus on integrating or improving aspects in their games that would pique and sustain a player's thrill-seeking tendencies. One such aspect is violence. The use of violence and danger in video games are well-established (McCarthy et al., 2016), where the thrill of vicariously surviving dangerous or violent encounters leads to enjoyment (McCall et al., 2015). To further enhance the thrill, developers can consider creating more immersive violent scenarios. For example, virtual reality (VR) game systems allow players to be visually and aurally isolated within virtual environments, thus increasing immersion (Drummond et al., 2021). Cummings and Beilenson (2021) also found that VR creates stronger feelings of immersion compared to television screens.

We pointed out earlier that continued engagement in violent games might strengthen the bidirectional relationship between thrill-seeking and violence, hence game developers should also be cognisant of the potential negative consequences, which may include aggressive behaviour (Greitemeyer, 2022). However, a silver lining exists in that critics have argued that effect sizes are often negligible (López-Fernández et al., 2021), suggesting that there are other factors to account for in the relationship between thrill-seeking and violent video games, such as pacing of action sequences (Elson et al., 2015) and game context (e.g., cooperative versus competitive game types; Perry et al., 2018). This means that given certain game types and characteristics (e.g., slowing down the pace of action in a cooperative game), it could be possible to develop violent video games for thrill-seekers without the drawbacks.

Enjoyment of video games is a key reason why people play games (Caroux & Pujol, 2024). Our findings suggest that the pleasure experienced while exploring a game world (i.e., joyous exploration) predicted enjoyment of rewards. Thus, game developers should make design choices that reward players (be it experience points or items) who explore. As discussed earlier, given the notion that joyous explorers may prioritise game advancement over strictly the rewards themselves, game developers should ensure that any rewards given also play an instrumental role toward progression in the game.

We found that overt social curiosity (but not covert) predicted enjoyment of social features in games, which implies that developers of social games should design gameplay that encourages direct interactions as opposed to indirect interactions. This can be achieved by having shared goals and complementarity (Garcia et al., 2022). These objectives emphasise cooperation and the need to foster interdependence between players, such as grouping together to kill tougher enemies, while having complementary abilities (e.g., spells that damage the enemy, abilities that heal teammates). According to Garcia et al., the key piece of the puzzle in facilitating cooperation is communication between players, underscoring the importance of direct interactions and finding out what other players bring to the table (i.e., overt social curiosity).

Results from the thesis can also help with advertising, specifically with advergames. Advergames is a marketing strategy used to advertise products and brands using video games as a platform (Lee & Cho, 2017). Given the rise of advertisements in gaming and social media platforms, marketers have sought to customise ad content to fit users' personality and interests (Yang et al., 2022). For example, research has shown that framing an advertisement for concerns over safety and security can appeal more toward individuals high in neuroticism, while promoting intellectual stimulation was particularly effective for those high in openness (Hirsh et al., 2012). However, effect sizes were modest, which could be a product of

examining broad personality traits (i.e., the big five), which comprise multiple second order facets. Our findings suggest that the same can be achieved by focusing on a specific construct nested under the web of personality traits—curiosity. For instance, advertisements might include conversations between people to showcase social interactions, which would pique the interest of those with high levels of overt social curiosity.

Also, advertisers can consider focusing on the mobile phone gaming market as it possesses the widest outreach. Today, the video game industry is driven mainly by mobile devices (Cai et al., 2022). Over the last decade, interest of game developers and consumers have shifted from traditional gaming to mobile gaming (Wijman, 2018). On the developers' end, mobile games are cost effective to produce; from the consumers' perspective, the convenience and ease of access to mobile games make them highly popular (Mittal et al., 2022; Yang & Lin, 2019). Our findings corroborate the above, where 75% of our sample reported in Chapters 5 and 6 are mobile phone gamers, with a further approximately 75% of these individuals gaming exclusively on phones. This indicates that advertisers might get the highest return on investment when advertising in mobile phone games.

### **Limitations and Future Directions**

Several limitations should be noted. Firstly, in the validation study of the 5DCR (Chapter 4), the test-retest analysis was only conducted on a sample of 21. Given the low participation rate in the follow-up study, results should be interpreted with caution. However, studies conducted by Grüning and Lechner (2022) and Kashdan et al. (2020) have demonstrated the test-retest reliability of the 5DCR, albeit they were carried out on Western samples. Future research can consider implementing incentives (e.g., providing, or increasing remuneration) to encourage participation and ultimately providing evidence for the temporal stability of the 5DCR.

Secondly, the studies investigating the links between curiosity and video gaming behaviours and preferences, including addiction and engagement (i.e., Chapters 5 and 6) were correlational in nature, thus precluding any definitive claims regarding causation. Future research might examine the causal relationships between facets of curiosity and video gaming motivations. For example, longitudinal studies would also be a feasible option to track changes in severity of addiction, or a “tipping point” between engagement and addiction, both of which could help to better inform intervention efforts.

Thirdly, the project focused on the geographical region of Southeast Asia. While this was an informed and intended decision (primarily the lack of curiosity research in the region; see Chapter 3), it does limit the generalisability of our findings. Given that we found differences in levels of curiosity across three Southeast Asian countries (see Chapter 4), it would be premature to generalise our findings, even across Southeast Asia. However, from a video gaming perspective, the sole use of Southeast Asian samples helped elucidate avenues for further investigations. For example, China is a key market in online game consumption (Kim et al., 2015) and generates the most video game revenue globally (Statista, 2023). A prominent source of this revenue comes from microtransactions (paying for in-game items or content through purchase of virtual currency; Schwidessen & Karius, 2018). As such, it is unclear if players from countries like China prefer certain video game characteristics that involves microtransactions, such as loot boxes, over other countries. Given the prevalence of microtransactions in modern video games (Petrovskaya et al., 2022), this also represents a timely opportunity for further research into the different monetisation strategies in games.

Related to the above, many scholars have also drawn similarities between microtransactions in video games and gambling addiction (e.g., King & Delfabbro, 2020). Gamers who indulge in microtransactions can buy loot boxes, where the rewards are random, simulating slot machines in casinos (Gibson et al., 2022). In the current project, we found that

different dimensions of curiosity could predict video gaming addiction, but did not account for the presence of microtransactions. Future studies can tackle this gap by either expanding on the scope of the sample, or focus on specific games with microtransactions. Furthermore, according to a meta-analysis (Kim et al., 2022), prevalence of gaming disorder was significantly higher in Asia compared to other regions, indicating that the pattern of results might differ in another region. In particular, given lower prevalence rates of gaming addiction, it is possible that outside of Asia, curiosity might be a better predictor of video gaming engagement rather than addiction. More research would be required to verify this possibility.

Next, in Chapter 5 we did not examine the impact of the platforms that individuals gamed on as there was an imbalance which was skewed toward number of mobile phone gamers (about 75% of participants reported mobile phones as a gaming platform they used, with a further approximate 75% of these individuals gaming exclusively on phones), which impeded further investigation. While the structural characteristics would be largely consistent between a game on a mobile phone compared to a computer, the magnitude or intensity may differ. For example, gamers who enjoy presentation features such as detailed graphics and good sound quality may have different experiences depending on whether they play on a gaming computer, or a mobile phone, where visual and audio fidelity of lower quality. Future research might specifically target PC or console gamers.

Future research can consider translating the 5DCR into other languages. While the 5DCR was administered in English in the present project, adopting it in other languages would allow for a wider population to partake in curiosity research. For example, a prerequisite to take part in the present project was proficiency in the English language. According to Miskam and Saidalvi (2019), Malaysian graduates tend to have foreign language speaking anxiety, and may face difficulty when communicating in English. This

could have screened out participants who were not confident in their English language abilities. To obtain more representative samples, future research can look to utilise a translated 5DCR in the respective countries of interest. This would not only allow for more inclusivity, but also boost the applicability of the 5DCR.

Based on the finding that overt social curiosity predicted playtime in video games, one possible avenue for future research would be to delve deeper into the meaning of “social”. Our definition leaned towards being interested in interacting with other individuals (or in this case, other players within a game). However, the term “social” could also refer to social simulation games and actions (Gómez-Maureira & Kniestedt, 2019), where players carry out everyday tasks of a virtual character, and interact with other non-playable characters (NPCs). From this perspective, players do not come into contact with real players directly. Future research can examine if there are differences in how both definitions of “social” affect playtime. Should no differences exist, then video gamers can potentially reap similar benefits akin to gaming with other people, while actually playing solo.

Future studies can also examine the moderators of curiosity and gaming addiction. For example, based on findings from Chapter 6 we postulated that social anxiety could temper the association between social curiosity and gaming addiction. Accordingly, further research might be interested to examine social anxiety as a moderator. Furthermore, research suggests that poor coping styles, such as denial and substance use, can mediate the association between vulnerability towards stress and gaming addiction (Brand et al., 2014). Prospective studies can in addition, analyse if different types of coping styles (both positive and negative) mediate the curiosity dimension of stress tolerance and gaming addiction.

Finally, future research should consider developing a gold standard measure for measuring disordered gaming. Given the wide variety of gaming addiction measures in the literature, it can be challenging to select an appropriate measure for empirical studies (see

Chapter 2). While there are some measures with better psychometric properties and empirical support, there is no clear frontrunner (King et al. 2020). Moreover, some of these scales, such as the Internet Gaming Disorder Scale-9 Short Form (IGDS9-SF; Pontes & Griffiths, 2015) and the Internet Gaming Disorder Test-10 items (IGDT10; Király et al., 2017) might be misnomers. Although these measures contain the word “internet”, the construct that is being measured is often gaming addiction in general, and not strictly constrained to internet gaming, or online games. Accordingly, prospective research should account for the above when developing new measures, or refining existing ones.

### **Conclusion**

Curiosity is undeniably important in everyday life. It drives individuals toward engagement with new and novel experiences, and is a key motivator of behaviour. This thesis is inspired by the desire to better understand the intricacies of curiosity. We started off with a scoping review to consolidate the literature, from which findings provided a platform for the program of research in this thesis. We then validated the newest and most comprehensive scale of curiosity—the 5DCR (Kashdan et al., 2020) in Southeast Asia, followed by investigating the links between dimensions of curiosity and the hugely popular leisure activity of video gaming. Specifically, across two studies, we found that dimensions of curiosity differentially predicted enjoyment of structural characteristics in video games, and video gaming addiction. It is hoped that our findings shed new light on the nuances of how curiosity functions in video gaming motivations and behaviours, and that our results can benefit various stakeholders, including researchers, mental health professionals, game developers, and advertisers.

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## Appendix A

### Five-Dimensional Curiosity Scale Revised (5DCR)

Below are statements people often use to describe themselves. Please use the scale below to indicate the degree to which these statements accurately describe you. There are no right or wrong answers.

| 1                                 | 2                         | 3                           | 4       | 5                            | 6                         | 7                             |
|-----------------------------------|---------------------------|-----------------------------|---------|------------------------------|---------------------------|-------------------------------|
| Does not<br>describe<br>me at all | Barely<br>describes<br>me | Somewhat<br>describes<br>me | Neutral | Generally<br>describes<br>me | Mostly<br>describes<br>me | Completely<br>describes<br>me |

1. I view challenging situations as an opportunity to grow and learn.
2. I seek out situations where it is likely that I will have to think in depth about something.
3. I enjoy learning about subjects that are unfamiliar to me.
4. I find it fascinating to learn new information.
5. Thinking about solutions to difficult conceptual problems can keep me awake at night.
6. I can spend hours on a single problem because I just can't rest without knowing the answer.
7. I feel frustrated if I can't figure out the solution to a problem, so I work even harder to solve it.
8. I work relentlessly at problems that I feel must be solved.
9. The smallest doubt can stop me from seeking out new experiences.
10. I cannot handle the stress that comes from entering uncertain situations.
11. I find it hard to explore new places when I lack confidence in my abilities.
12. It is difficult to concentrate when there is a possibility that I will be taken by surprise.
13. Risk-taking is exciting to me.
14. When I have free time, I want to do things that are a little scary.
15. Creating an adventure as I go is much more appealing than a planned adventure.
16. I prefer friends who are excitingly unpredictable.
17. I ask a lot of questions to figure out what interests other people.
18. When talking to someone who is excited, I am curious to find out why.
19. When talking to someone, I try to discover interesting details about them.
20. I like finding out why people behave the way they do.
21. When other people are having a conversation, I like to find out what it's about.
22. When around other people, I like listening to their conversations.
23. When people quarrel, I like to know what's going on.
24. I seek out information about the private lives of people in my life.

**Appendix B**

## Mini-International Personality Item Pool (Mini-IPIP)

Below are statements people often use to describe themselves. Please use the scale below to indicate the degree to which these statements accurately describe you. There are no right or wrong answers.

|                    |   |   |   |               |
|--------------------|---|---|---|---------------|
| 1                  | 2 | 3 | 4 | 5             |
| Very<br>inaccurate |   |   |   | Very accurate |

1. Am the life of the party.
2. Sympathize with others' feelings
3. Get chores done right away.
4. Have frequent mood swings.
5. Have a vivid imagination.
6. Don't talk a lot.
7. Am not interested in other people's problems.
8. Often forget to put things back in their proper place.
9. Am relaxed most of the time.
10. Am not interested in abstract ideas.
11. Talk to a lot of different people at parties.
12. Feel others' emotions.
13. Like order.
14. Get upset easily.
15. Have difficulty understanding abstract ideas.
16. Keep in the background.
17. Am not really interested in others.
18. Make a mess of things.
19. Seldom feel blue.
20. Do not have a good imagination.

### Appendix C

#### Twenty Item Values Inventory (TwIVI)

Here we briefly describe some people. Please read each description and think about how much each person is or is not like you. Using a 6-point scale from “not like me at all” to “very much like me,” choose how similar the person is to you.

| 1                     | 2              | 3                   | 4                   | 5       | 6                    |
|-----------------------|----------------|---------------------|---------------------|---------|----------------------|
| Not like me<br>at all | Not like<br>me | A little like<br>me | Somewhat<br>like me | Like me | Very much<br>like me |

1. S/he believes s/he should always show respect to his/her parents and to older people. It is important to him/her to be obedient
2. Religious belief is important to him/her. S/he tries hard to do what his religion requires.
3. It's very important to him/her to help the people around him/her. S/he wants to care for their well-being.
4. S/he thinks it is important that every person in the world be treated equally. S/he believes everyone should have equal opportunities in life.
5. S/he thinks it's important to be interested in things. S/he likes to be curious and to try to understand all sorts of things.
6. S/he likes to take risks. S/he is always looking for adventures.
7. S/he seeks every chance he can to have fun. It is important to him/her to do things that give him/her pleasure.
8. Getting ahead in life is important to him/her. S/he strives to do better than others.
9. S/he always wants to be the one who makes the decisions. S/he likes to be the leader.
10. It is important to him/her that things be organized and clean. S/he really does not like things to be a mess.
11. It is important to him/her to always behave properly. S/he wants to avoid doing anything people would say is wrong.
12. S/he thinks it is best to do things in traditional ways. It is important to him/her to keep up the customs s/he has learned.
13. It is important to him/her to respond to the needs of others. S/he tries to support those s/he knows.
14. S/he believes all the worlds' people should live in harmony. Promoting peace among all groups in the world is important to him/her.
15. Thinking up new ideas and being creative is important to him/her. S/he likes to do things in his/her own original way.
16. S/he thinks it is important to do lots of different things in life. S/he always looks for new things to try.
17. S/he really wants to enjoy life. Having a good time is very important to him/her.
18. Being very successful is important to him/her. S/he likes to impress other people.
19. It is important to him/her to be in charge and tell others what to do. S/he wants people to do what s/he says.
20. Having a stable government is important to him/her. S/he is concerned that the social order be protected.

### Appendix D

#### Depression Anxiety Stress Scale (DASS21)

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

| 1                                                                                                                                       | 2                                                 | 3                                                             | 4                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------|---------------------------------------------|
| Did not apply to me at all                                                                                                              | Applied to me to some degree, or some of the time | Applied to me to a considerable degree or a good part of time | Applied to me very much or most of the time |
| 1. I was aware of dryness of my mouth                                                                                                   |                                                   |                                                               |                                             |
| 2. I couldn't seem to experience any positive feeling at all                                                                            |                                                   |                                                               |                                             |
| 3. I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)            |                                                   |                                                               |                                             |
| 4. I found it difficult to work up the initiative to do things                                                                          |                                                   |                                                               |                                             |
| 5. I experienced trembling (e.g. in the hands)                                                                                          |                                                   |                                                               |                                             |
| 6. I was worried about situations in which I might panic and make a fool of myself                                                      |                                                   |                                                               |                                             |
| 7. I felt that I had nothing to look forward to                                                                                         |                                                   |                                                               |                                             |
| 8. I felt down-hearted and blue                                                                                                         |                                                   |                                                               |                                             |
| 9. I felt I was close to panic                                                                                                          |                                                   |                                                               |                                             |
| 10. I was unable to become enthusiastic about anything                                                                                  |                                                   |                                                               |                                             |
| 11. I felt I wasn't worth much as a person                                                                                              |                                                   |                                                               |                                             |
| 12. I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat) |                                                   |                                                               |                                             |
| 13. I felt scared without any good reason                                                                                               |                                                   |                                                               |                                             |
| 14. I felt that life was meaningless                                                                                                    |                                                   |                                                               |                                             |

## Appendix E

### Subjective Happiness Scale

For each of the following statements and/or questions, please select the point on the scale that you feel is most appropriate in describing you.

1. In general, I consider myself:

|                               |   |   |   |   |   |                           |
|-------------------------------|---|---|---|---|---|---------------------------|
| 1                             | 2 | 3 | 4 | 5 | 6 | 7                         |
| Not a very<br>happy<br>person |   |   |   |   |   | A very<br>happy<br>person |

2. Compared to most of my peers, I consider myself:

|            |   |   |   |   |   |               |
|------------|---|---|---|---|---|---------------|
| 1          | 2 | 3 | 4 | 5 | 6 | 7             |
| Less happy |   |   |   |   |   | More<br>happy |

3. Some people are generally very happy. They enjoy life regardless of what is going on, getting the most out of everything. To what extent does this characterization describe you?

|            |   |   |   |   |   |                 |
|------------|---|---|---|---|---|-----------------|
| 1          | 2 | 3 | 4 | 5 | 6 | 7               |
| Not at all |   |   |   |   |   | A great<br>deal |

4. Some people are generally not very happy. Although they are not depressed, they never seem as happy as they might be. To what extent does this characterization describe you?

|            |   |   |   |   |   |                 |
|------------|---|---|---|---|---|-----------------|
| 1          | 2 | 3 | 4 | 5 | 6 | 7               |
| Not at all |   |   |   |   |   | A great<br>deal |

**Appendix F**

## Short Warwick Edinburgh Mental Wellbeing Scale (S) WEMWBS

Below are some statements about feelings and thoughts. Please select the answer that best describes your experience of each over the last 2 weeks.

1

2

3

4

5

None of the  
time

All of the time

1. I've been feeling optimistic about the future.
2. I've been feeling useful.
3. I've been feeling relaxed.
4. I've been dealing with problems well.
5. I've been thinking clearly.
6. I've been feeling close to other people.
7. I've been able to make up my own mind about things.

## Appendix G

### Wise Reasoning Scale

Please rate how useful the following courses of action might be if you were going to try to resolve personal conflicts.

1

2

3

4

5

Very useless

Very useful

1. Trying to put myself in the other person/people's shoes.
2. Trying to communicate to find common ground.
3. Making an effort to take the other person's perspective.
4. Taking time to get the others' opinions on the matter before coming to a conclusion.
5. Double-checking whether my opinion on the situation might be incorrect.
6. Considering whether others' opinions might be more correct than mine.
7. Looking for any extraordinary circumstances that may have affected the situation.
8. Recognizing that there may be some important and relevant information that I do not know about.
9. Trying to find a way to accommodate both perspectives.
10. Searching for a solution that could result in both people being satisfied.
11. Considering whether a compromise is possible in resolving the situation.
12. Trying to see the situation from the point of view of an uninvolved person.
13. Imagining what other people might think or feel if they were watching the situation.
14. Imagine whether an outside person might have a different opinion from mine.
15. Considering how the situation might change over time.
16. Looking for different solutions as the situation evolves.
17. Considering alternative solutions as the situation evolves.
18. Recognizing the situation could lead to a number of different outcomes.
19. Recognizing the situation could unfold in many different ways.

**Appendix H**

## Demographics Form

Sex: \_\_\_\_\_

Age: \_\_\_\_\_

Nationality: \_\_\_\_\_

Years of Education (starting from elementary/primary/grade 1, to current): \_\_\_\_\_

E.g., 6 years primary school + 4 years secondary school + 3 years bachelor program + currently in 2<sup>nd</sup> year of masters program = 15 years.

Occupation: \_\_\_\_\_

Relationship status: \_\_\_\_\_

Email (If you are interested in participating in the 5-minute follow-up study 2 months from now, kindly provide your email address): \_\_\_\_\_

**Appendix I**

## Gaming Behaviour Survey

Average time spent playing video games a day on a weekday: \_\_\_\_\_ hours

Average time spent playing video games a day on a weekend: \_\_\_\_\_ hours

How would you rate yourself as a gamer?

1

2

3

4

5

Casual

Hardcore

Gaming systems used (e.g., PS5, PC, mobile etc): \_\_\_\_\_

Most common gaming system used: \_\_\_\_\_

## Appendix J

### Video Game Structural Characteristics Survey

Please use the scale below to indicate how important you believe the following features are to the playing experience.

|                      |   |   |   |                 |
|----------------------|---|---|---|-----------------|
| 1                    | 2 | 3 | 4 | 5               |
| Not important at all |   |   |   | High importance |

1. Social interaction, communicating with other players
2. Belonging to a guild, clan or dedicated group
3. Competitive aspects, playing against other people, leaderboard rankings
4. Cooperation, working together to reach goals
5. Sharing tips and strategies about the video game with others
6. Positive comments from other players for skilful play
7. Making friends with other players in the game
8. Needing good reflexes to advance in the game
9. Mastering the controls, learning “combos” or “hot-keys”
10. The tactile sensation or “feel” of controlling the game (including force feedback, button mashing)
11. Managing resources in the game, such as items in your inventory
12. Being able to correct mistakes by reloading a save file
13. Customising in-game features, such as controls, rules, etc.
14. Using cheats to “break” the game
15. Creating your own content for the game, such as making your own maps
16. Taking on a new identity in the game
17. An emotional investment in an in-game character
18. Cut-scenes, extra non-playable story content
19. A complex game story, involving dialogue and narration
20. Different story outcomes based on your player actions
21. Linear story, same events happen every time
22. No endpoint or conclusion to the game
23. “Levelling up” a game character (including non-human characters, like a racing car)
24. Earning points, XP or other rewards
25. Parts of the game based on luck or chance, not skill
26. Being rewarded with rare, unique items for skilful play or playing for a long time
27. Doing the same thing over and over, in order to get a large reward (“grinding”)
28. Getting 100% completion in the game
29. Unlocking meta-game rewards, like “Achievement points” or Trophies
30. Sections of the game that are very difficult and require sustained effort with few mistakes
31. Playing the game on the hardest difficulty, facing very difficult challenges
32. Fast loading times between levels or multiplayer matches, and instant respawning when your character dies
33. Visual aspects, such as high-resolution textures and lighting effects
34. Sound, including music and audio effects
35. Franchise aspects, such as recognisable characters like Mario or Master Chief
36. Adult content, including explicit violence, adult themes
37. Licensed content, including recognisable real-life brands

**Appendix K****Gaming Addiction Scale**

Please answer the following questions: How often during the last six months...

|       |        |           |       |            |
|-------|--------|-----------|-------|------------|
| 1     | 2      | 3         | 4     | 5          |
| Never | Rarely | Sometimes | Often | Very often |

1. Did you think about playing a game all day long?
2. Did you spend increasing amounts of time on games?
3. Did you play games to forget about real life?
4. Have others unsuccessfully tried to reduce your game use?
5. Have you felt bad when you were unable to play?
6. Did you have fights with others (e.g., family, friends) over your time spent on games?
7. Have you neglected other important activities (e.g., school, work, sports) to play games?

**Appendix L**

## Demographics Form

Sex: \_\_\_\_\_

Age: \_\_\_\_\_

Nationality: \_\_\_\_\_

Years of Education (starting from elementary/primary/grade 1, to current): \_\_\_\_\_

E.g., 6 years primary school + 4 years secondary school + 3 years bachelor program + currently in 2<sup>nd</sup> year of masters program = 15 years.

Occupation: \_\_\_\_\_

Relationship status: \_\_\_\_\_

**Appendix M**

This administrative form  
has been removed

## Appendix N

### INFORMATION SHEET

#### **PROJECT TITLE: Investigating the Cross-cultural Validity of the Five-Dimensional Curiosity Scale Revised (5DCR)**

You are invited to take part in a research project on the cross-cultural validity of the Five-Dimensional Curiosity Scale Revised. The study is being conducted by Yow Yong Jie and will contribute to the doctoral dissertation in the Doctor of Philosophy programme at James Cook University. The study is conducted in English, so you will need to be proficient in the English language.

If you agree to be involved in the study, you will be invited to complete a series of 8 questionnaires, which include a curiosity scale, 3 scales pertaining to your personality, needs, and values, a depression and anxiety scale, a happiness scale, a well-being scale, and a reasoning scale. Finally, you will be invited to fill a simple demographics form. The questionnaires should take approximately 30 minutes to complete, and will be conducted through an online platform (Qualtrics).

Taking part in this study is completely voluntary and you can stop taking part in the study at any time without explanation or prejudice.

Should you experience any psychological distress while participating in the study, you may contact the following organisations:

**Institute of Mental Health 24-hour helpline: 6389 2222 (Singapore/JCUS participants)**  
**Befrienders Worldwide: <https://www.befrienders.org> (International participants)**

If you know of others that might be interested in this study, can you please pass on the above information to them so they may contact me to volunteer for the study.

If you are interested in participating in a 5-minute follow-up in 2 months' time, kindly provide your email at the end of the study for me to contact you. The follow-up study will take 5 minutes to complete, and is conducted through an online platform (Qualtrics).

Your responses and contact details (if you choose to participate in the follow-up study) will be strictly confidential. Your email will also be used to match your responses across both timepoints, but will be permanently removed once data has been matched (i.e., data will be anonymous).

The data from the study will be used in research publications and reports. You will not be identified in any way in these publications.

If you have any questions about the study, or are interested to know the findings and results, please contact – Yow Yong Jie, or Associate Professor Jonathan Ramsay.

\* ☐ Yes, I consent to take part in the study.

\* ☐ No, I do not consent to take part in the study.

[\*The above section is only presented on the Qualtrics page itself]

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*If you have any concerns regarding the ethical conduct of the study, please contact:*  
**Human Ethics, Research Office**  
**James Cook University, Townsville, Qld, 4811**  
**Phone: (07) 4781 5011 ([ethics@jcu.edu.au](mailto:ethics@jcu.edu.au))**

## Appendix O

### INFORMATION SHEET

#### **PROJECT TITLE: Curiosity and Video Gaming: How Curiosity Relates to Video Gaming Behaviours**

You are invited to take part in a research project about how different aspects of curiosity associate with video gaming behaviour, engagement, and addiction. The study is being conducted by Yow Yong Jie and will contribute to the doctoral dissertation in the Doctor of Philosophy programme at James Cook University. The study is conducted in English, so you will need to be proficient in the English language.

If you agree to be involved in the study, you will be invited to complete 4 questionnaires, which include a curiosity scale, a video game structural characteristics survey, a gaming addiction scale, and a survey asking about your video gaming behaviours. Finally, you will be invited to fill a simple demographics form. The questionnaires should take approximately 15 minutes to complete, and will be conducted through an online platform (Qualtrics). This study is supported by James Cook University Singapore, minimum resource funding.

Taking part in this study is completely voluntary and you can stop taking part in the study at any time without explanation or prejudice.

If you know of others that might be interested in this study, can you please pass on the above information to them so they may contact me to volunteer for the study

Your responses and contact details will be strictly anonymous. The data from the study will be used in research publications and reports. You will not be identified in any way in these publications.

If you have any questions about the study, or are interested to know the findings and results, please contact – Yow Yong Jie, or Associate Professor Jonathan Ramsay.

\* ☐ Yes, I consent to take part in the study.

\* ☐ No, I do not consent to take part in the study.

[\*The above section is only presented on the Qualtrics page itself]

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