# Beyond individual flow: Distributed flow in ice hockey, its antecedents and consequences to performance

Doctorate of Philosophy

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February 2023

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**Acknowledgements**

First and foremost, I would like to acknowledge and thank my supervisor Dr Giovanni Moneta for his support and guidance throughout this process. I would also like to thank my ice hockey contacts and friends who participated in the interviews, surveys, and recruitment of other participants as without their assistance, this research would not have been possible. Finally, I would also like to acknowledge my family as I would not have been able to complete this project without their support.

## Ethics Approval

Ethics approval for this PhD research was granted by the Research Ethics Review Panel of the School of Social Sciences - Psychology, London Metropolitan University. The research adhered to the British Psychological Society's Code of Ethics.

**Abstract**

One of the most popular psychological factors underlying sport performance has been mental toughness. However, recently, flow and metacognition are starting to receive more attention as the understanding of their potential impact is ever increasing. Flow is considered the intersection of task absorption and intrinsic enjoyment, resulting in optimal performance. Metacognition is the consciousness and understanding of one's thoughts and thought processes. Mental toughness is a wide-ranging construct generally regarded as the ability to cope through the demands and pressure while maintaining a sense of focus, confidence, and control. This PhD research aimed to extend flow theory and bring metacognition research to ice hockey as this sport has not been studied specifically with either of these nor have these elements been studied in a similar environment with such a fast-paced nature heavily dependent on team mates and requiring constant interaction. It was postulated that a new type of flow was necessary for success in this type of an environment, called distributed flow. This dissertation presents three studies that were conducted to identify distributed flow and develop and validate a self-report questionnaire to measure it validly and reliably as well as further exploratory findings of three distributed flow antecedents and two types of metacognitions.

Semi-structured interviews with 16 ice hockey players were conducted about their experiences and thoughts while playing ice hockey (Study 1, Chapter 2). The sample included six amateurs and 10 former National Hockey League (NHL) players. After the coding and analysis of these results, 15 factors were identified in three themes: distributed flow, composed of four factors, distributed flow antecedents, composed of seven factors, and metacognition, made up of four factors. A 125-item pilot Ice Hockey Questionnaire (IHQ) was developed and tested on a sample of 147 ice hockey players. Exploratory factor analysis yielded an eight-factor solution with item reduction processes resulting in a 36-item scale. Distributed flow remained, now composed of three factors instead of four but only two originals. Distributed attention split into distributed attention and external focus. These scales had the most movement with four items moving factors. The distributed flow antecedents were reduced to three, all original themes, with only one new item being added. Metacognition was reduced to just one type but further refined to consider team and individual aspects. All items were original with the addition of one. The remaining factors included metacognition of resilience: individual, metacognition of resilience: team, strategic timing, coaching impact, adaptiveness, distributed attention, external focus, and routine. The

subscales explained a total of 58 per cent of the variance. Confirmatory factor analysis was performed on a sample of 342 ice hockey players. Analysis resulted in the elimination of three items but confirmed all eight factors. The final result was a 33-item IHQ.

Participants in both studies also completed the Short Dispositional Flow Scale (SDFS-2) (Jackson, Martin, & Eklund, 2008), Short Flow in Work Scale (SFWS) (Moneta, 2017), Flow Metacognition Questionnaire (FMQ) (Wilson & Moneta, 2016), and Mental Toughness Scale (MTS) (Madrigal, Hamill, & Gill, 2013). The correlations between each factor and the psychometric measures were calculated and analysed for each study as a whole as well as taking the demographic categories into consideration. The results across both studies were compared. Furthermore, participants had the option to consent to their playing statistics to be obtained and used the further the analysis. The previous process was completed for this aspect as well. After confirming the validity of the IHQ, mediation modelling was performed to test the relationships with mental toughness and performance. Mental toughness had both a direct and indirect effect on flow, which increased performance. This finding was in line with previous research, confirming the integrity of the data and allowing for the new individual subscales to be analysed in the same fashion. The standout result from this analysis came from strategic timing. When mental toughness, strategic timing, and flow were regressed together on performance, mental toughness was not significant. This is the first time research has shown mental toughness not to have a direct impact on flow and performance. This result far exceeded expectations initially laid out for this research and has confirmed the need for further investigation into this factor specifically as well as the overall concept of distributed flow.

Overall, the findings from the three studies conducted in this dissertation confirm the existence of distributed flow and its positive relationship with performance. Five additional factors have also been identified, which can be considered distributed flow antecedents and types of metacognitions. The dissertation concludes with a summary of its limitations as well as a projection for possible future research, specifically with other sports, such as NASCAR, combat and emergency environments, and multiplayer videogames. It is believed this PhD dissertation has met its aims by having identified a new type of flow and opening the door for future research into individual elements that can eliminate mental toughness when it comes to performance prediction.

# Chapter 1: Introduction

## 1.1 Background

Initially, psychology was part of the philosophy domain with its original roots going back to the early Greek philosophers of Socrates, Plato, and Aristotle. In the mid-1800s, psychology became its own independent discipline. Some of the first studies looked at people's understanding and judgments of sensory information and processing (Schwarz & Pfister, 2016). In the late 1800s, the first laboratory dedicated solely to psychology research was opened by Wilhelm Wundt, who was also the first self-referred psychologist (Schwarz, & Pfister, 2016). Psychology quickly gained interest and multiple disciplines emerged though a theme developed of rooting itself in disease and what was 'wrong' with people, largely focusing on mental illness and negative thinking (Frederickson, 2001).

Sport psychology originated in Europe in the late 1800s. Norman Triplett was one of the first people to discover the field, and he did so with cyclists. He discovered that cyclists performed better when they rode with others in a group (Triplett, 1898). The field received very little attention for the next 30 years or so. However, in 1926, B.C. Graves, Walter Miles, and Glenn "Pop" Warner joined forces at Stanford University and came together to experiment on how to get an edge when it came to American football. They created experimental devices to test and improve reaction times on the line of scrimmage (Baugh & Benjamin, 2006). This research is what started a movement for sports whereby identifying psychological insights and various experimental techniques to get any and every possible advantage over the competition. In fact, Miles was the first to highlight the importance of isolating individual differences in an attempt to gain a competitive edge (Joyce & Baker, 2008). Since then, the concept of sport psychology has grown and become its own field, drawing interest from both amateur and professional athletes with the central concern of performance.

Martin Seligman is often credited as the founder of positive psychology. However, many of the positive psychology pillars have strong resemblance to those from William James and Abraham Maslow through humanistic psychology (Froh, 2004). Some classifications consider this a separate domain while others look at this as the beginning stages of positive psychology. What is currently viewed as positive psychology gained strong traction in the late 1990s when Martin Seligman started looking at extremely happy people and wanted to find out more about the common characteristics people have who seem to have happy and fulfilling lives (Frederickson, 2001). His research led to the birth of positive

psychology. According to Seligman, the initial theory included three paths to happiness: a pleasant life, good life, and meaningful life (Seligman, 2002). A pleasant life involves how people experience and savour positive feelings and emotions. Good life is the investigation of the effects individuals feel when engaged in primary activities. Meaningful life looks at the intersection of well-being and belonging when contributing to something larger than themselves. Since then, positive psychology has become more of an umbrella concept, veering off in many directions, not relying on one specific theory but consistently finds that focusing on the positive not only helps people feel better with their current situations but also helps to improve their future (Frederickson, 2001). Positive psychology is increasingly being applied to work, educational, and sport psychology. While traditional psychology tends to focus on mental illness and emotional disturbances and both the causes and symptoms, the positive psychology approach is more of an emphasis on thinking patterns, behaviours, and experiences and how to improve life from these perspectives.

Outside of the psychology domain, the concepts of flow and metacognition were receiving attention. Flow is the idea of being so focused, absorbed in a task, and in the zone of execution that nothing else is noticed or matters. It is often considered the state of achieving optimal performance. The concept was first identified upon investigating the intrinsic rewards that motivate people to spend countless hours engrossed in an activity. Metacognition is the awareness of one's thoughts and thought processes. This critical awareness allows for the planning, monitoring, and assessing of performance. Metacognition is often divided into positive and negative. Positive metacognitions are seen as useful or helpful, providing adaptive responses to challenging situations whereas negative metacognitions provide an uncontrollability of thought and can increase distress. The separate development and growth of these concepts allowed for the eventual overlap and induction into psychology research, especially when it comes to sports.

At first, formal research with sports mainly focused on the negative motivational states and the impact on performance. At the time, sport psychology took a page from traditional psychology research, mainly focusing on the negative attributes and impacts. Sport research addressed emotional states (Jones & Hardy 1989), anxiety (Gould & Krane, 1992), or stress (Gould, Jackson, & Finch, 1992). A few studies stepped out from the norm to look at peak experience (Ravizza, 1984) along with mental states during peak performance (Cohn, 1991; Garfield & Bennett, 1984; Jackson & Roberts, 1992). While these studies shifted the focus when it comes to sports psychology, they were just beginning to open the field and did not specifically address the flow experience while playing sports. The mediating variable in

these studies was never flow but rather other factors that could impact performance. A few years prior, the concept of flow had been identified, classifying components of optimal performance, taking a more positive approach than had previously been done but had not been considered in the sporting environment just yet. The previous research with sport touched components of flow in their research but did not look at flow as a full concept with regard to its role in performance. The studies did not look at the intrinsic rewarding factor of sport participation and the direct link to optimal performance, which is a fundamental component of flow. In a sense, they danced around flow without specifically addressing it in a sporting context. This study is looking at the merger of sport psychology, specifically in relation to flow and metacognition, and positive psychology and how to achieve optimal performance with these components, specifically in ice hockey.

While sports are often grouped together as a particular area, every sport has a different type of environment. Individual and team are the most common distinctions, but arguably it goes deeper than binary classification. In that regard, it is only considering the moment of competition (Evans, Eys, & Bruner, 2012). Sports such as tennis, golf, wrestling, and fighting can all be seen as an individual effort but took hundreds if not thousands of hours training and competing with team mates to get to that point. NASCAR is also seen as an individual sport but actually takes a full team working closely together under tight time pressures during the pit stops and repairs. Gymnastics is a sport that has both team and individual capacities simultaneously. In some ways, there is a spectrum when it comes to team sports as well. Some sports are considered team sports but are still quite independent in nature. Running and swimming relays are an example in this category. In these environments, there is still an opportunity for team members to pick up the slack of team mates if necessary. However, the majority of their performance is still done at the individual level. There is no direct interaction involved with the team mates that contributes to performance. Some team sports have the team together with no direct interaction with the opponent. Volleyball is an example of this case because the net literally separates the two teams. Each team is in their own bubble. Some team sports are more spread out but do interact with the opponents, such as football, basketball, field hockey, and handball. Finally, some team sports have a more dependent nature and are reliant on team mates for success. Ice hockey, American football, rugby, and synchronised sports, such as synchronised swimming, ice skating, and diving are examples in this category. One athlete's success is literally dependent on his or her team mate and his or her successful execution of the task. Despite the dichotomous approach that is

regularly given to sports, the individual differences are actually noteworthy and should be taken into consideration when it comes to performance research.

The game of ice hockey is most commonly associated with Canada. However, people in countries all over the world are lacing up the skates and giving it a go. In the United States, hockey participation has grown a staggering amount with the amateur participation rate increasing by 211,693 people, which is over a 60 percent increase in the last 25 years (USA Hockey, 2021). This growth in popularity can also be seen at the university level with over 150 universities sponsoring varsity hockey teams in 2020 in the United States, translating to hundreds of thousands of dollars being given to students in the form of scholarships (O'Rourke, 2021). In the professional sector, it is one of the top professional sports leagues in the world in terms of revenue. The National Hockey League (NHL) is number six, grossing $4.4 billion annually, behind the National Football League, Major League Baseball, National Basketball Association, Indian Premier League, and the English Premier League (Randjelovic, 2020). Britain has what has become known as the Elite Ice Hockey League (EIHL), incorporating 10 teams stretching throughout England, Scotland, Wales, and Northern Ireland (EIHL, 2015). The EIHL is technically the only professional sports league to span throughout the U.K. and have representation from the four Home Nations. Just behind football and rugby union, ice hockey is the third largest spectator sport to take place in the U.K. (EIHL, 2021). Despite this staggering growth in popularity, research with ice hockey has largely focused on the physical aspect, specifically injury rehabilitation and prevention, but has not investigated the mental aspects of the game.

Figure 1 below shows the markings of an ice rink with the small circles locations where face offs take place. Faceoffs are the act of the referee dropping the puck between opposing players. This is how the match starts and how the play resumes after any stoppages, such as a goal or an offsides call. The game itself is a team sport played on ice skates where players use ice hockey sticks to control and advance a puck made from rubber. Each team has five skaters and one goalie on the ice at the same time. Conventionally, there are three forwards and two defence. The objective of the game is to score a goal by getting the puck past the opponent’s goalie. The team with the most goals at the end of the match wins. Contact is allowed in the sport. Men play with an additional allowance of body checking, which is the act of deliberately using the body to separate the player from the puck by knocking the opponent into the boards or the ice. The women’s game does not allow for body checking. The game is predominately played 5v5. However, there are times when a team might have fewer players due to penalties, such as deliberate tripping a player or having too

many players on the ice. Alternatively, a team might decide to have more skaters should they decide to pull their goalie for an aggressive attack. Traditionally, the game is played with three 20-minute periods with time only running whilst the puck is in play. After each period, the teams change ends. Naturally, recreation and youth leagues will often play shorter periods.

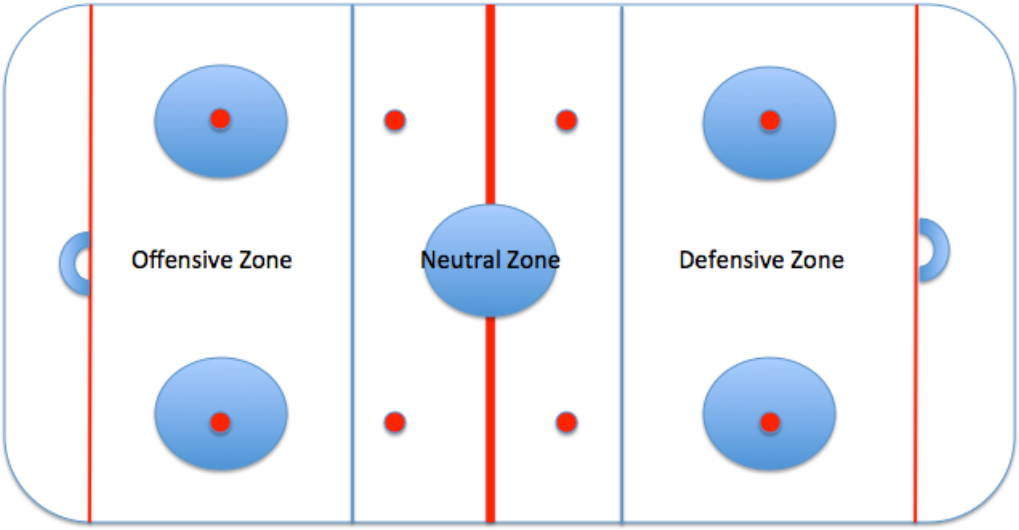


Figure 1: Ice Rink Visual

### 1.2 Study Constructs

The development and maintenance of performance is essential in elite athletes. Everybody within the organisation depends on it from the athletes themselves to the coaching staff to the managers and scouts trying to build the best performing, cohesive unit. Making it to the elite status is difficult and requires incredible discipline and perseverance, but staying there can be argued to be more difficult because the athletes have even more distractions, people constantly trying to take their spot and the most difficult and intense competition they have ever experienced, competing against athletes at the highest level. With everything on the line, how they handle their mental side of the game and remain focused is essential. Mental toughness has long been held as a cornerstone of athlete success. More recently, other psychological factors, such as flow and newly metacognition, are starting to be noticed for their role played in success and performance. While every athlete is different, they all must deal with monitoring their flow, metacognition, and mental toughness.

Since inception, flow has always been associated with optimal performance. Any time a new environment or context has been identified, flow research has been extended and

confirmed to exist in the new capacity. Ice hockey and flow have not explicitly been linked previously. Therefore, a deeper dive into the concept of flow is necessary to understand what is already known and how it might apply to the ice hockey context.

### 1.2.1 Flow

The idea of flow through the concept of optimal experience was first described by Robert Woodworth in the early 1900s (Woodworth, 1918). He observed both adults and children and noted their effortless absorption in activities. For the next 50 years or so, research took many angles trying to explain people's motivation and commitment to activities without necessarily receiving any external rewards, but no concrete conclusions were drawn (Hebb, 1955; White, 1959). The term flow was coined by Mihalyi Csikzentmihalyi in the 1970s after studying a variety of creative people, aiming to find out what made them feel doing what they were doing was worth spending so much of their life (Csikszentmihalyi, 2004). From growing up in Europe during the time of World War II, he noticed the difficulty adults faced and a lack of resiliency when it came to tragedies from the war impacting them (TED, 2008). This event sparked an interest in philosophy and psychology and a desire to further investigate the factors involved with a life worth living. He started his investigation into what makes people happy in everyday life in the 1960s. He first started with creative people, such as artists, musicians, and scientists (TED, 2008). Many of those people did not expect any fame or fortune, and he wanted to know what made them feel doing what they were doing was worth spending so much of their life and what made it feel meaningful and worth doing. In the first interviews, he conducted a common word emerged: flow. With that, Csikszentmihalyi identified the flow experience.

He was the first person to empirically investigate the idea of optimal performance. Despite the difference in background of the people interviewed, he identified six common themes presented in the flow experience, published in his book *Beyond Boredom and Anxiety* (1975/2000). The first is focused concentration, meaning the individual is completely involved and present with the task at hand. The next is the blending of action and awareness, which means there are no individual worries of oneself; the task and person are felt as one. The third theme, loss of self-consciousness, builds on this idea, forgetting about personal problems and only focusing on the task at hand. The next theme is a sense of control over actions. The fifth component is the transformation of time whereby the person's subjective experience of time is altered. Finally, the individual partakes in an autotelic experience, for

intrinsic reward, nothing external. Further research led to the addition of three more components: unambiguous feedback, in which the individual has clear, immediate, measurable progress, a specific goal, and the balance between skill and task (Csikszentmihalyi, 1990). The overall experience of flow can be defined as a state of operation, either mental or physical in which a person is completely absorbed in an experience, functioning at full capacity, solely yielding intrinsic rewards (Csikszentmihalyi, 1975; Hefferon & Boniwell, 2011). This state is believed to affect both the experience and the performance of the person undergoing this phenomenon. The concept of flow has been applied and researched in a variety of contexts, ranging from work environments (Delle Fave, & Massimini, 2003; Moneta, 2017; Quinn, 2005), to academia (Cermakova, Moneta, & Spada, 2010; Shernoff, Csikszentmihalyi, Shneider, & Shernoff, 2003), to even playing videogames (Kaye, & Bryce, 2012; Vella, Johnson, & Hides, 2013). Despite the variety of settings, flow has been confirmed to exist in all settings.

Further analysis of flow shows a variety of factors can impact the existence and experience of flow. A few studies have identified specific personality traits, which seem to affect one's tendency to experience flow. Jackson and Roberts (1992) found that those who reported high mastery orientation actually experienced flow on a more frequent or regular basis than athletes with low mastery orientation. Athlete engagement is another factor that has been associated with increasing flow (Swann, 2016). Anxiety has also been linked with flow (Gould & Krane, 1992). Interestingly, anxiety has been shown to be both an antecedent and an inhibitor of flow (Koehn, Donald, & Paramei, 2018). Athletes who either experience lower levels of anxiety or who can use it as a facilitative tool are more likely to experience flow than those with higher anxiety levels (Wiggins & Freeman, 2000). The key with this is the correct balance of skill and task and is argued to be essential to experience flow (Barthelmäs & Keller, 2021). Otherwise, anxiety has been shown to be a consequence and inhibitor of the flow experience, particularly if and when a mismatch exists between the challenge and skill (Csikszentmihalyi, 1975; Fong, Zaleski, & Leach, 2015; Koehn, Donald, & Paramei, 2018). Despite these differences, everyone from these studies has been found capable of experiencing flow; the differences dictate the frequency or intensity.

#### 1.2.1.1 Types of Flow

Flow was thought to be only an individual experience at first (Walker, 2010). One of the first studies identifying flow occurring in a group context was with teachers. The study

investigated the intrinsic rewards of university teaching and found that the majority of teachers identified social interactions as the dominating core intrinsic reward, which contradicts that flow is a solitary experience (Froch, Menges, & Walker, 1993). Since then, limited research has explored the phenomenon of social flow and when it does, it tends to use individual flow scales to measure it (Keeler, Roth, Neuser, Spitsbergen, Waters, & Vianney, 2015). Despite this finding, publications on social flow almost 30 years on are still largely at the theorised level (Walker, 2021).

The most recent addition to social flow research came from Walker (2021) where he has posited there are two types of social flow: co-active and interactive. According to Walker (2021), co-active flow occurs in the presence of others but does not require any communication or interaction between people whereas interactive flow involves and requires the explicit cooperation, coordination, and communication among group members and all members are in a state of flow. As Walker has never conducted any research in this area, this classification is speculation, but he has theorised the concept of interactive flow.

Walker (2021) theorised three conditions and group processes necessary to achieve interactive flow. The first is a small group able to have immediate face-to-face communication. The second is that the proficiency of the group and the challenge ahead must be in alignment, and the third is the tasks must be unique for each team member but complimentary in nature. Once these three conditions are present, it is then possible for three group processes to take place. The first theorised group process is a group-centred perspective, which is predicted to retain group members better than groups who do not identify as closely together and subsequently experience less social flow. The second process is the abiding attention of group member behaviour. Finally, a continuous sharing of emotional reactions is the third group process, which can be experienced through team mates as well as audiences.

The theorised outcomes and effects take place both at the individual and group levels. For individuals, it is expected that individuals will feel invincible and powerful and express emotions of happiness and joy. It is also expected that despair and dread will be experienced if and when an individual is ostracised from the group and grief if the group disbands (Walker, 2021). At the group level, it is expected that the group will perform excellently, which will then increase the development of the group. There is also the possibility to repeat and normalise social flow (Walker, 2021).

Naturally, there are a number of limitations to this theorisation. The first of which is his classification of a group and the necessary components. The specific sizes have not been

outlined, but it has been pointed out that too large of a group could inhibit the experience. If there are restrictions to this, they need to be understood and detailed. Furthermore, immediate face-to-face communication has been noted as a necessity, but some of the examples where interactive flow could be present elicit other forms of communication. For example, sports such as synchronised sports and ice hockey often rely on body position for feedback. Synchronised skaters might be facing the back of their team mates but notice a misstep and make an adjustment to the performance, keeping everyone in line despite deterring from the original programming. Alternatively, an ice hockey player might get behind the defence and not want to alert the opponents he or she has gotten open so will lift the stick high in the air to get the attention of a team mate who has the puck, looking up the ice, to make the pass. In both situations, no verbal communication and potentially not even eye contact was made yet it can be argued the participants were able to exchange immediate communication and possibly display interactive flow. Another limitation is the continuous sharing of emotional reactions. While there might be times when that is helpful, in sporting contexts, there are equally times when players need to separate themselves either from their team mates or the crowd. Such examples include when a player is struggling or having an off game, it could be necessary for other players to have an individual resilience that is not impacted by the negative player. Additionally, if a team is losing and the crowd is booing, the players will need to separate themselves from feeding off of that energy to create momentum and turn the game around. Continuous emotional sharing during these times does not seem beneficial for the interactive flow experience. Moreover, the theorised outcomes are largely at the subjective level with limited ability to be measured empirically. Actual research needs to be conducted in this area as a number of conditions seem to exist, but the limitations around them do not seem to be clear.

The concept of social flow was the first to take other people into consideration while one experiences flow. The initial classification progressed the field, making flow a social concept, but it did not look at the group as a whole; it only considered one person experiencing flow rather than everyone's flow experience and the dynamic impact it could have. The new theorised classification of interactive flow as social flow is a deviation from the previous contextualisation in itself as one type does not involve any interaction between people whereas the other type depends on it. Naturally, measuring the intensity of social flow is difficult as a universal approach has not been defined, nor has the purpose. Flow, by definition, delivers intrinsic rewards but adding groups, organisations, and communities into the mix merits further exploration.

Group flow was the next type of flow to be classified and can be defined as a collective state of mind in which the entire group is performing at the top level (Sawyer, 2007). This type of flow looks at the group as a whole rather than an individual's experience within a group. Sawyer's research of this phenomenon looked at both jazz ensembles and street basketball players. While these activities go on, they are nonstop and require participants to focus on what the other people are doing while planning their reactions. With nothing rehearsed or planned, every move and note is created on the fly. Sawyer (2007) identified ten conditions to enable group flow. The first is an explicit group goal. The key in group contexts is to have a balance between a specified goal and open-ended room so that competition and problems just shift the focus rather than get any team members off track. The second is close listening. Team members are listening intently to each other. Complete concentration is the third condition. Particularly for fast-paced sports, players are constantly keeping track of both teammates and opponents, requiring full concentration with everyone in motion. The next condition is the blending of egos. For group flow to occur, all members must be in sync and perform as if they are thinking with one mind. The sixth condition is equal participation. The individuals must be on the same level and able to contribute at the same level. Even just one person can block group flow. Familiarity is another key component. Teammates must be familiar with each other and the playing styles. However, the styles cannot be too similar or there is not enough of a challenge. The next condition is communication. Without communication, there is no chance all teammates will be on the same page. Keeping it moving forward is another important aspect. Team members need to listen to what is being said, accept it and then build on it to keep progressing. The last condition is the potential for failure. To experience group flow is special, so many components and people coming together for one experience. It cannot happen without the entire group.

While these conditions specific to group flow provide insight into flow and how interactions with other people can impact the experience, these conditions have not been studied with structured team sports. Professional sports teams are different than those studied by Sawyer. Jazz ensembles are relatively unstructured in nature. They do not have an explicit goal. They want to perform well and entertain the audience, but that goal is vague and can be argued to be subjective. Street basketball teams obviously want to win the game, but the setting is informal and skills along with the experience can vary among participants. Professional sports teams are more like work project teams. They have specific, concrete goals: win games, make the playoffs, and win championships. The leagues will crown one

team champion at the end of the season. To get there, they must make the playoffs. Even though each season will be different, teams know roughly how many points to make it to the playoffs, which translates to an idea of the minimum numbers for games won. For the NHL, all teams play 82 games in a season. Each game offers two points, which means 164 points are up for grabs each season. A win constitutes two points for the victorious team. If a game is tied after regulation, both teams will get at least one point, regardless of the outcome, with the winning team getting the second one as well, which allows for a lot of movement throughout the season in terms of rankings. Generally speaking, 100 points is a safety net for making the playoffs. Teams with 90 or more points will usually make it, but it can be a cut-off, depending on the season. Anything below that will most likely not make the playoffs. Additionally, the environment is constantly changing, often with a hierarchy system of some sorts, even if it is unspoken. Rarely do teams have equal participation. In the case of ice hockey, players frequently have specific roles, whether it be goal-scoring, setting up plays, or being a physical presence on the ice. Not all of these roles will have the same ice time. Additionally, teams frequently match lines, especially as the teams get more competitive. This means that they want certain players matching up against each other to either balance out skill levels or try to create an advantage. The game itself is already fast-paced but this component makes it even faster and a further element of a constantly changing environment. Players must be monitoring all players on the ice, particularly when the other team changes, to know if they need to get off the ice or need to immediately jump on for a specific matchup. In a sense, group flow needs to take on a social psychology aspect and add a social component of flow in a group setting. A merger of the concepts needs to be properly established.

The concept of group flow has also been extended to work environments through studying collective flow, specifically its relationship with collective efficacy (Salanova, Rodríguez-Sánchez, Schaufeli, & Cifre, 2014). Collective flow involves the social psychological process of emotional contagion. Group members often unconsciously replicate and mirror the facial expressions, body positions, and emotions of group members (Bavelas, Black, Lemery, & Mullett, 1987; Rapson, Hatfield, & Cacioppo, 1993). Thus, it is believed flow experiences can spread from one member to another member in the group, resulting in a more enjoyable experience of flow than individual flow (Salanova, Rodríguez-Sánchez, Schaufeli, & Cifre, 2014; Walker, 2010). This leads to the importance of collective efficacy, which is considered the group's shared belief to organise and execute whatever action is required to achieve the task at hand (Bandura, 1997).

A longitudinal study was conducted with 250 university students across 52 groups to complete three creative tasks each to investigate the relationship between collective flow and collective efficacy (Salanova, Rodríguez-Sánchez, Schaufeli, & Cifre, 2014). One hour was allocated for each task, but only the second two were analysed. The perceived collective efficacy scale was used (Salanova, Llorens, Cifre, Martínez, & Schaufeli, 2003). Collective flow experience was measured by a group task absorption scale and group task enjoyment scale (two self-constructed items) (Salanova, Llorens, Cifre, Martínez, & Schaufeli, 2003). Group challenge and group skills were measured by the multiplicative of two self-constructed items, ranging from 0 to 6 (Salanova, Rodríguez-Sánchez, Schaufeli, & Cifre, 2014). The study confirmed collective efficacy beliefs predict the collective flow experience over time, and a feeling of collective flow also boosts efficacious feelings within the group, resulting in a reciprocal relationship. The study sought to find relationships between collective efficacy, collective flow, and collective challenges and skills over time, but that was unsuccessful. The study also expected the more collective efficacy that existed for the first task, the more collective flow that group would experience for the second, but that result was unfounded. Naturally, this study comes with a number of limitations. The first of which being all self-reported data without any performance measures. Further studies are clearly needed in different environments, particularly when performance can be measured and is essential. Additionally, 85 per cent of the sample was female, so more variety is needed. Furthermore, student groups were utilised. It needs to be replicated in sporting environments as well as other professional contexts. Overall, the study does provide further groundwork and understanding for collective flow, but there are still considerable gaps in the knowledge.

Since its inception, further investigation has been done on this phenomenon. However, a lack of consensus exists with the definition as various terms have been used, including networked flow, shared flow, combined flow, contagious flow, and collective flow among others (Pels, Kleinert, & Mennigen, 2018; Salanova, Rodríguez-Sánchez, Schaufeli, & Cifre, 2014). Sometimes these items were used interchangeably (Culbertson, Fullagar, Simmons, & Zhu, 2015; Heyne, Pavlas, & Salas, 2011). Some research has shown Sawyer's (2007) conceptualisation of group flow (Armstrong, 2008; Primus, & Sonnenburg, 2018) while others have used it as a building block for further developing the model to the Networked Flow Model (Gaggioli, Chirico, Mazzoni, Milani, & Riva, 2017; Gaggioli, Milani, Mazzoni, & Riva, 2011; Galimberti, Chirico, Brivio, Mazzoni, Riva, Milani, & Gaggioli, 2015) while still others went back to Csikszentmihalyi's (1990) original concept to build a group flow concept out differently (Duff, Giudice, Johnston, Flint, & Kudrick, 2014;

Kiili, Perttula, & Tuomi, 2010). Naturally, a broad approach of classification will result in a variety of approaches for measurement. Some have qualitatively measured it either by interviews or structured observations (Admiraal, Huizenga, Akkerman, & Ten Dam, 2011; Armstrong, 2008; Hart, & Di Blasi, 2015; Kaye & Bryce, 2012) while others have adapted individual flow questionnaires to group flow (Gaggioli, Mazzoni, Milani, & Riva, 2015; Kaye, 2016; Zumeta, Basabe, Wlodarczyk, Bobowik, & Páez, 2016; Zumeta, Oriol, Telletxea, Amutio, & Basabe, 2016). Clearly though progress has been made, it is not without its limitations. Some studies would look at the shared state and performance, but others did not focus on performance (Pels, Kleinert, & Mennigen, 2018). Furthermore, having heterogeneous definitions and content limits the understanding and generalisability of the findings. Without a comprehensive, inclusive definition, it is difficult to understand the concept which then limits the understanding of the impact it has and where and how it can be experienced.

Most recently added to the flow family is the idea of team flow, which has, in part, been conceptualised to address some of the current voids in flow research as well as the limitations for the experience within group settings (van den Hout, Davis, & Weggeman, 2018). Team flow is believed to be a group state whereby all team members are participating in the same activity and working together for the same purpose. Seven conditions are necessary to achieve a state of team flow. The first condition is collective ambition. This condition essentially explains the reason for the team's existence, constituting shared values and a shared sense of intrinsic motivation. The next condition is a clear common goal. Aligned personal goals is the third conditions in which each team member has specific, meaningful and challenging goals that align with the collective ambition of the club. High skill integration is the fourth condition. For this condition, the team tasks are distributed according to individual strengths and preferences to optimally utilise the talent on the team. The next condition is open communication, which allows for all team members to be on the same page and understand how each team member is contributing to the team. The final two conditions are safety and mutual commitment. Safety is necessary. So players feel they can celebrate their successes but have support during failures. This element allows team mates to push themselves to reach their full potential while eliminating any unnecessary risks. Finally, mutual commitment describes individual team members each committing to common goals and understanding the process to achieve them.

Once these conditions are met, the potential exists to achieve team flow (van den Hout et al., 2018). Team flow involves four characteristics: holistic focus, sense of unity,

sense of joint progress, and mutual trust. These characteristics integrate a number of concepts from previous flow research (Csikszentmihalyi, 1990; Snow, 2010). Holistic focus is achieved when all team members are completely focused on their individual tasks while understanding how they are each contributing to the team's purpose. There is full alignment of individual thoughts and actions to greater objectives of the whole. This component effectively extends Snow's (2010, p.2) condition of "having total concentration on the shared activity" to the team as a whole. Concentration on the team level that results in a loss of the sense of time for the full team also come from this characteristic (Csikszentmihalyi, 1990). The next condition, sense of unity, is achieved through cohesion whereby individual members have a shared intrinsic motivation to engage as a team. To achieve this state, team members must have a loss of self-consciousness whereby their focus is contributing to the team's goal (Csikszentmihalyi, 1990). Surrendering one's personal identity to that of the collective team's is the blending of egos (Sawyer, 2007). This leads into the next characteristic, which is a sense of joint progress, involving synergetic interactions that then provide feedback for how the team is doing as a whole. That feedback then informs the next collective action which translates down at the individual level of each team member's required personal contributions. The resulting goal is a comprehensive feeling of accomplishment and satisfaction (van den Hout et al., 2018). Sense of joint progress is a team feeling of action and awareness merging in individual flow (Csikszentmihalyi, 1996). Lastly, mutual trust is the result of individual confidence as well as confidence in each team member along with the feeling of a safe environment. This characteristic is achieved through the feeling of control so they are not feeling failure but feel confident that they can respond to any situation presented to them (Engeser & Schiepe-Tiska, 2012). Mutual trust effectively incorporates confidence and control and extends them to the collective experience.

There are believed to be five benefits to team flow. Collaboration and getting an edge is hugely important, and it is possible team flow can aid in these areas. Team flow could increase the feelings of belonging in the team (van den Hout et al., 2018). It is possible that that then motivates the team members to tackle a greater challenge next time. It has been found that team members that have confidence in each other then expend greater individual effort (Bandura, 1982). Greater discretionary effort is linked to more task engagement and higher performance (Bakker, Oerlemans, Demerouti, Slot, & Ali, 2011., 2011; Bakker & Demerouti, 2008). Another benefit is that it is expected team flow will yield positive skill development, satisfaction and performance (van den Hout et al., 2018). Having team mates engaged with the task and experience allows for feedback and thus real-time improvement.

Overall, it is believed team flow will be a strong predictor of team performance as well as morale.

Despite being the first concept to unite the two most common types of documented flow, it has not come without its limitations. The first most obvious limitation is that it is mostly a theoretical conceptualisation. Two studies have been conducted to confirm team flow. The first was through the development of the Team Flow Monitor (TFM), which quantitatively showed team flow could be measured and was positively related to team outcomes (van den Hout, Gevers, Davis, & Weggeman, 2019). However, this was mostly through students as the sample. The second study was qualitative involving four different sample groups. The first was five semi-structured interviews with people from mental health organisations. The second was 10 semi-structured interviews with team experts. The third was with 25 teams online answering open ended questions about team flow experiences, obstacles, and fulcra, and finally a further 12 semi-structured interviews with practitioners and researchers of team work (van den Hout, & Davis, 2022). The team flow conceptualised framework was used as the basis with the interview responses slotting into the areas where relevant. The results concluded that all of the team flow conditions need to exist but also found that a sense of autonomy is necessary, which is not detected in the current framework. It was also noted that there seems to be an ideal intersection of reflection, coordination, and focus with team members, which again is not explicitly detailed in the current model nor is increased happiness, which was also noted (van den Hout, & Davis, 2022). The specific team flow characteristics and benefits were not overtly noted. Further limitations of this study include the fact that no empirical data was used when it came to performance. Furthermore, team flow was only investigated in business contexts. Additionally, the specific industries were not known, which could impact the experience as how interactive the teams were and how fast-paced the environments were could influence interactions and experiences. Further studies are clearly required to both confirm this result and extend it to other population samples. The vast majority of research extending flow into a new domain is done qualitatively first to allow for the exploration and understanding of any subjective experiences. Since this is the first time taking other people into consideration whilst experiencing flow, it can be argued that not taking a stronger qualitative approach can limit the full understanding of this phenomenon, especially since the qualitative aspects were done retroactively by nature and some findings are outside of the current framework of understanding. This can be applied to all aspects: antecedents, team flow dimensions, and consequences. Practical research is essential to move past theoretical possibilities. Another

limitation is that a team is defined as “a small number of people” (Katzenbach & Smith, 1993, p.112). This definition lacks specificity. Van den Hout, & Davis (2022) had one health care organisation say teams should not be larger than 12 people. However, this could be industry and task-specific. Again, practical research is needed to fully understand any limitations or parameters of team flow. This research has focused on work teams, which means it might not extend to other areas, such as sports or leisure activities. Based upon the precedent of previous research, it is likely will extend to these types of environments, but that is an assumption. In a different context, the dimensions might not all be weighted evenly in terms of necessity. It is likely adjustments will need to be made as sports teams often involve larger numbers. For example, 11 people are on the pitch at once for football, 15 for rugby. Ice hockey is a little different as only five skaters and a goalie are on the ice at one time, but the players rotate through very quickly and thus all 20 skaters could end up playing with each other throughout the course of the game. It is possible these sorts of teams would not be able to experience team flow due to the high number of players involved. Furthermore, depending on the task and environment, everyone on the team will have different strengths and roles and thus might not be possible for every single member to experience flow due to the team dynamic. A field goal kicker in American football could be an example of this as his role is so limited and sometimes not needed much at all. He might not actually experience flow at all during his very limited spurts of performance or if he is in flow, it might not be due to the team dynamic while other positions might be susceptible to team flow. Clearly, research into this concept is needed to more fully understand in practical application and eventually be able to confirm if this type of flow is possible in other areas, particularly sports.

#### 1.2.1.2 Duality of Flow

Although rarely considered, flow states actually differ from activity to activity, depending on the intensity and duration. In reality, flow states fall on a continuum with the ends being deepflow and microflow. Naturally, deepflow is the flow occurrence during longer, complex activities (Csikszentmihalyi, 1975) whereas microflow exists during shorter, less intense experiences (Lavone & Main, 2019). As such, a disconnect exists as the majority of research has been based on deepflow but actually investigates activities more likely to elicit microflow (Lavoie, Main, & Stuart-Edwards, 2021). Furthermore, a lack of consensus exists when it comes to the dimensionality of flow. The vast majority of research utilises the unidimensional view of flow, (Martin & Jackson, 2008; Schiefele, 2013) but other

possibilities have been proposed. Some research has suggested that flow is three primary experiences (concentration, loss of self-consciousness, and task and person viewed as one) (Csikszentmihalyi & Csikszentmihalyi, 1992; Moneta, 2017) while two experience sets have also been proposed (Engeser, 2012).Even though discrepancies exist, empirical investigation in this area is only starting to receive attention.

Six studies with almost 3,000 total participants investigated the duality of flow and found two dimensions exist: fluency and absorption (Lavoie, Main, & Stuart-Edward, 2021). Fluency involves uninterrupted thought and action while absorption relies on sustained full attention. In these studies, both performance-oriented and leisure activities were incorporated and demonstrated specific relationships with both flow antecedents and consequences. Fluency was only related to antecedents of flow while absorption was only related to flow consequences. Furthermore, through mediation, the dimension of flow fluency can mediate the absorption dimension. These studies concluded in the emergence of the two-dimensional flow scale (Derryberry, & Reed, 2002).

While these studies and results further the conceptualisation and understanding of flow, they naturally have limitations that must be taken into consideration. First of all, they did not include any sports or athletes at all. Taking into consideration the variety of types of sporting environments and impacting variables, these results may not directly overlap in those contexts. Secondly, it was all individual-based with no interaction or impact of other people, either as a helper or inhibitor taken into consideration. As working and athletic environments would likely include these factors, again this perspective needs to be expanded to further environments to test the generalisability. While some of the activities had an element of performance, they were mostly leisure based. Since previous studies have shown differences in flow states based upon the activity, this is still an area for further investigation (Engeser & Baumann, 2014). A further limitation is the limited nature of possible antecedents and consequences included in the study. Obviously, it was not possible for a full, encompassing list, but future considerations based on previous flow research include individual differences (Keller, Bless, Blomann, & Kleinböhl, 2011; Keller, Ringelhan, & Blomann, 2011; Peifer, Schulz, Schächinger, Baumann, & Antoni, 2014; Teng, 2011; Baumann, Lürig, & Engeser, 2016). A concept that has not been previously linked to flow research, but these findings could present the doorway as a possible antecedent is attentional control theory.

Attentional control theory extends the processing efficiency theory (Eysenck & Calvo, 1992), which is based on two assumptions. The first is that a fundamental difference

exists between performance effectiveness and processing effectiveness. As the name suggests, performance effectiveness is the quality of performance while processing efficiency is the relationship between the use of processing resources and performance effectiveness (Derakshan & Eysenck, 2009). Anxiety is believed to play a stronger inhibiting role on processing efficiency compared to performance effectiveness. The second assumption is that anxiety impairs the main component of the memory system. Attentional control theory takes these assumptions further adding the assumption that anxiety impairs both negative attentional control and positive attentional control. The negative attentional control aids with preventing attention to stimuli that is irrelevant to the task. Positive attentional control, on the other hand, involves switching attention between or within tasks, depending on the situation, to maximise performance (Eysenck, Derakshan, Santos & Calvo, 2007). Since inception, empirical support has been found for all of the additional assumptions (Derakshan & Eysenck, 2009; Liu, Shen, & Li 2019). In terms of flow and performance research, flow and improvement in attention have been associated though not much consideration has been devoted to this link (Harris, Allen, Vine, & Wilson, 2021). Attentional focus and performance have also been positively linked (Memmert, Simons, & Grimme, 2009). Moving forward, these relationships and any possible overlap will be important to investigate and understand more comprehensively.

#### 1.2.1.3 Flow with Sports

Despite research confirming the link between flow and both performance and experience, the application of flow to sports didn't start to receive attention until the 1990s. Previous research with sport up until that point focused on the negative aspects of the experience, whether it be motivational states (Jones & Hardy, 1989), anxiety (Gould & Krane, 1992), or stress (Gould, Jackson, & Finch, 1992). A few studies stepped out from the norm to look at peak experience (Ravizza, 1973; 1984) along with mental states during peak performance (Cohn, 1991; Garfield & Bennett, 1984; Jackson & Roberts, 1992). While these studies shifted the focus when it comes to sport psychology, they were just beginning to open the field and did not specifically address the flow experience while playing sports. A couple of factors could have contributed to the initial lack of flow and sport research. Flow measurements at that stage had not been continuous sport participation friendly, meaning beepers and remote control buzzers have frequently been used in non-sport contexts, but

these would both interrupt flow and be difficult to access or carry in the middle of spot competition.

Susan Jackson was one of the first to research flow with sports, starting with elite figure skaters (Jackson, 1992). When it comes to sports, flow has been studied in a variety of settings, from recreational to elite, from individual athletes to teams (Jackson, 1992, 1995, 1996; Jackson, Kimiecik, Ford, & Marsh, 1998; Jackson & Csikszentmihalyi, 1999; Jackson, & Eklund, 2002; Stein, Kimiecik, Daniels, & Jackson, 1995; Stavrou, Jackson, Zervas, & Karteroliotis, 2007). Flow has been determined to be present in all four contexts with positive link existing between athletes in a state of flow and peak performance (Jackson & Roberts, 1992). However, considerable more attention has been devoted to elite athletes than recreational ones as they seem to experience flow more regularly as well as get into a deeper state of flow throughout their training and competition (Bakker et al., 2011).

Since this breakthrough, flow has been studied in a number of sporting contexts, looking at its existence with rock climbers (Canham, & Wiley, 2003; Norsworthy, Thelwell, Weston, & Jackson, 2017), cyclists (Lindsay, Maynard, & Thomas, 2005), football (Bakker et al., 2011) and tennis players (Young; 2000), to name just a few. Flow has been found in all of these sports, across different nationalities, genders, and skill levels. Flow has been studied and identified across all levels from recreational to elite though most commonly identified with elite athletes (Bakker et al., 2011; Bernier, Thienot, Codron, & Fournier, 2009; Canham & Wiley, 2003; Chavez, 2008; Norsworthy et al., 2017). When it comes to elite athletes, studies have been conducted to determine the experience, occurrence, and controllability of flow. These studies have looked at a variety of athletes, ranging from university to semi-professional to professional to nationally and internationally ranked athletes. An assortment of nationalities has been investigated, including American, Canadian, Dutch, English, and French. An even wider variety of sports have been studied with swimmers (Bernier et al., 2009), cyclists (Lindsay, Maynard, & Thomas, 2005), figure skaters (Jackson, 1992;), rock climbers (Canham & Wiley, 2003), football players (Bakker et al., 2011), tennis players (Young, 2000), and golfers (Hodge, Lonsdale, & Jackson, 2009; Jackson 1995). Flow has been determined to exist in all of these contexts.

Despite its widespread existence, there are still a number of factors unknown with this concept. When exactly these flow states occur is still somewhat uncertain (Chavez, 2008). In addition, despite athletes experiencing flow, the frequency is still reported to be on rare occasions (Jackson, 1992). The majority of sports are looking at individual sports. Even football is more individual than other tem sports, like basketball, baseball, American football,

and synchronised sports. These sports have received little if any attention. When they do, it is often from the angle of differences in gender rather than how the environment is impacting the flow experience (Coterón, Sampedro, Franco, Pérez-Tejero, & Refoyo, 2013). No sporting environment is the same, and these differences have not been taken into consideration in terms of the impact they could have on the flow experience. The focus has just been does it exist, which is important, but is it different and how is it different are also important questions to ask but have been neglected. The specific number of people has not been addressed when it comes to a group experience. Team flow is the first to put a figure on it, but it is still a conceptualised form. To date, flow studied with team sports has taken a somewhat limited approach in that individual flow scores are found and averaged throughout the team instead of taking an interactive approach. Furthermore, the majority of sports studied are not overly physical. It might be that more physical sports involve additional elements not previously noted. While considerable insight has been gained in the last 30 years with regards to flow and sports, further investigation is needed to include a wider variety of sporting environments as well as other measures to control for influencing factors, such as personality traits. For further understanding of athletic success, a deeper investigation into the mental aspects of sports might be required.

#### 1.2.1.4 Flow Measurements

The first tool developed to measure flow was the Flow Questionnaire (FQ) (Csikszentmihalyi & Csikszentmihalyi, 1988). This tool took some of the descriptions from Csikszentmihalyi's (1975/2000) research and asked the respondents if they had experienced similar feelings and if so in what activities. They are also asked to rate their experience. While brief and somewhat novel, this method does have a number of strengths. The first is providing a single, clear definition of flow. The three statements capture the essence of the constructs with no ambiguity (Moneta, 2021). It also rules out non-flow experiencing participants who do not identify with the flow statements. This is a strong argument for its ability to measure the prevalence of flow. The prevalence of flow can also be measured through participants freely listing the activities in which they experience flow. The open-ended approach could help to extend flow research to a variety of activities quickly. Unfortunately, the FQ does not measure the intensity of flow or allow for a straightforward understanding of how perceived skills and challenges are influencing the flow state in the selected activity. Other measurement methods were created to address these shortcomings.

Although it was not specifically designed for flow, the experience sample method (ESM) was next used to measure flow (Csikszentmihalyi and Larson, 2014). This is a longitudinal research methodology, usually used throughout the course of a week, whereby participants report their thoughts, feelings, behaviour, and any environmental circumstances. Participants have pagers that go off as many as eight times a day, and then they respond to the experience sampling form (ESF), which contains 13 categorical items, asking about the activity, context, motivation, and interest of the activity and 29 scaled items, measuring the intensity of feelings. This method is designed to capture the experience while it's happening, which is the major advantage of this approach as the participants are clear about their feelings rather than reporting them in a reflective way. However, this advantage is also a major disadvantage as it does interrupt people during their activity, which could be argued to disrupt the flow experience. Additionally, repeatedly sampling throughout the course of the week is not always possible.

In an attempt to combat these difficulties, the Flow State Scale (FSS) was created (Jackson & Marsh, 1996). This 36-item instrument has for items measuring each of the nine flow dimensions. A sample of 394 athletes was used to validate the study with two-thirds of the sample male and one-third female. While a total of 38 nationalities were represented, 84 per cent were either from the United States or Australia. The sample included a full range in ability from recreational to national with the majority being recreational athletes. The average reliability of the scales was 0.83 with each of the nine scales having a reliability of at least 0.8. Confirmatory factor analysis (CFA) supported the nine scales. The development of the FSS was found to be a success, and the scale is meant to be completed after a specific event to assess the experience of flow from that specific situation.

Assessing the flow experience is important, but the FSS does not address an athlete's predisposition to find flow as a stable characteristic or personality trait. This gap led to the creation of the dispositional flow scale (DFS) (Jackson & Eklund, 2002). This 36-item scale targets a specific activity and then the frequency of the experience. Like the FSS, the DFS has four items for each flow dimension.While the FSS and DFS were found to have acceptable reliability and factor structures, improvements could still be made, which led to the creation of the DFS-2 and FSS-2. The DFS-2 uses a 5-point Likert scale with responses ranging from never to always whereby respondents are rating the frequency of experiencing flow characteristics during their specified activity. The Jackson and Eklund (2002) validation paper found coefficient alpha estimates of reliability ranging from 0.78 to 0.90. The FSS-2 also uses a 5-point Likert scale with responses ranging from strongly disagree to strongly

agree, and respondents rating the extent to which they experience flow characteristics. The Jackson and Eklund (2002) validation paper found coefficient alpha estimates of reliability ranging from 0.80 to 0.92. Both of these scales have been proven to be a valid and reliable way of measuring flow.

Despite these successes, the call for even shorter measurements came, leading to the development of the SDFS-2 and SFFS-2 (Jackson, Martin, & Eklund, 2008). If used in sports, coaches might be using these for multiple participants and thus the full versions could become tedious. Alternatively, if they are being used in projects with multiple measures, shorter measures decrease the participant burden. To develop the new scales, one item was chosen from each flow criteria of the full forms for a total of nine items. Analysis was conducted on the short scales from the previous studies and found the coefficient estimates of reliability to be 0.74 from the DFS-2 and 0.78 from the FSS-2 (Jackson & Eklund, 2002). In the validation study, short flow dispositional scale had 692 responses while the short flow state scale had 865 responses. The short scales were tested for correlations with the long scales, and both were found to have acceptable values. The dispositional scale ranged from 0.66 to 0.83 with a mean of 0.76, and the state scale ranged from 0.65 to 0.82 with a mean of 0.73 (Jackson et al., 2008). Accordingly, both scales are a good representation of the long ones.

To address flow in more general terms, the Flow Short Scale was created (Rheinberg, Vollmeyer, & Engeser, 2003). The scale has been used in two separate ways. The scale itself includes 13 items, the first 10 of which measure the flow construct and the additional three measure factors about the activity performed, such as demand, skills, and the perceived fit of demand and skills, not the actual flow construct. It has been argued that the scale itself includes 10 items, and the additional three are used separately (Schiepe-Tiska & Engeser, 2017). Unfortunately, published information regarding the validity and reliability of the FSS is scarce. Of the published studies, most are not in English and have only used the Exploratory Factor Analysis method (Rheinberg et al., 2003; Engeser & Rheinberg, 2008). The internal consistency reliability was reported to be 0.92 for the flow factor.

With increased attention of the flow experience in the organisational context, the Short Flow in Work Scale (SFWS) was developed (Moneta, 2017). The SFWS is a three-item scale with four response options including never or almost never true for you, sometimes true for you, often true for you, and always or almost always true for you. The directions state to rate each item according to how true it is for the participant. As part of the development of the SFWS, four studies were conducted to determine the validity and reliability of the scale.

The first study had a convenience sample of 582 workers form a variety of backgrounds. The median age was 34.82 with a standard deviation of 10.53 years. Females comprised 51.5 per cent with females making up the rest. The SFWS was administered as an online survey. The results confirmed unidimensionality. Study two evaluated the construct validity in two waves on a new sample. The full convenience sample had 172 workers from various occupations with 101 of them completing both waves. The median age was 39.2 with a standard deviation of 11 years. Males constituted the majority of this sample with 57.4 per cent. CFA using LISREL8.8 (Jöreskog & Sörbom, 1996) and maximum likelihood (ML) estimation were used to evaluate the construct validity and factor invariance. The goodness of fit was assessed with the chi-square test (Jöreskog & Sörbom, 1996). Hu and Bentler's (1999) criteria were used to assess the models for close fit. The cut off points were 0.05 for the Root Mean Square Error of Approximation (RMSEA) and 0.95 for the Comparative Fix Index (CFI) and the Non-Normed Fit Index (NNFI). Cronbach's alpha was satisfactory for both waves. The chi-square test was nonsignificant, confirming the model fits and all other goodness of fit statistics revealed excellent fit, indicating the latent variable of flow is similar in both administrations, which confirms configural invariance. The third study had the highest sample size of 492 workers who completed the SFWS, FSS (Engeser & Rheinberg, 2008), SDFS-2 (Jackson, Martin, & Eklund, 2008), the Utrech Work Engagement Scale (UWES-9) (Schaufeli & Bakker, 2002), and the Positive and Negative Affect Scale Short Form (I-PANAS-SF) (Thompson, 2007). The results indicated that the SFWS correlated fairly with both flow scales, which correlated strongly with each other. This means that the convergent validity is satisfactory but inferior to the other flow scales. The UWES-9 and the I-PANAS-SF correlated strongly with each other. The other two flow scales also correlated strongly with both of them, but the SFWS only correlated moderately. Consequently, the discriminate validity is satisfactory and superior than that of the other flow scales. The last study assessed the construct validity and factor invariance as a state measure. The study involved 118 workers from a variety of occupations with a median age of 30.44, standard deviation of 8.47 and 59.3 per cent being male. Participants completed an online workday survey everyday throughout the duration of a work project. A total of 468 surveys were completed with a mean time-lapse of 1.46 days. The results corroborated the factorial validity and factorial invariance of the scale. All and all, these tests confirm that the SFWS produces both valid and reliable results when measuring flow both as a domain-specific disposition and as a workday state.

With the conceptualisation of team flow made, a team flow monitor (TFM) became necessary to measure this experience (van den Hout, Gevers, Davis, & Weggeman, 2019). The first version was known as TFM-v1 and included 84 closed questions answered on a 7-point Likert scale, ranging from strongly disagree to strongly agree and four open ended questions for a qualitative approach as well. All 11 flow elements were included in these questions. The validation study included 252 students, comprising of 54 project teams. The average age was 21.59 with a standard deviation of 2.86 years, and 151 were male with 101 female. The descriptive statistics eliminated nine items. Sense of unity and mutual trust together explained about 82 per cent of the variance with a KMO of 0.944. A sense of joint progress items loaded on mutual trust, and items measuring holistic focus were not distinctive enough. Measures were taken to address these issues, which resulted in a 63-item scale. This sample included 561 individuals in 110 teams. All team flow constructs were found to be strongly related. Team flow was found to be positively related to both team and individual outcomes. The findings support team flow as a second-order model consisting of two factors: team flow prerequisites and team flow characteristics, which is a large strength of this study along with the creation of the first measurement tool for team flow. However, the study does have a couple of limitations to note. The first is that the majority of the teams were student teams rather than working ones in the business world. Their dynamic and experience could be totally different than work environments, so the generalisability of the results is in question. It is likely the connection between the variables is more complex than the questionnaire is able to explain or at least would require much larger and diverse sample sizes to explore.

Overall, a variety of measures have been used to measure and assess flow each with their own strengths and limitations depending on the situation. In some instances, quantitative measures are not the most effective measurement of flow, as it is quite a subjective experience (Jackson & Kimmiecik, 2008). Participants might feel they are being put into a mould and not fully able to express their experiences in regards to performance and flow. Additionally, measuring flow in individual and team sports can be quite difficult. With the exception of the development of the TFM, all studies measuring flow in the team environment have measured group flow, essentially combining the measurements for the individual players to provide an overall team flow measure. However, a weakness is that not all players will experience the same level of flow and their flow levels can feed off of their teammates. Therefore, a new measure is needed to take into consideration the concept of interdependent and interconnected flow.

The connection between flow and performance has been investigated for over 50 years. The basis lies in the idea that peak experience implies peak performance (Palomäki, Tammi, Lehtonen, Seittenranta, Laakasuo, Abuhamdeh, Lappi, & Cowley, 2021). Strong empirical evidence has confirmed Csikszentmihalyi's (1975/2000) findings (Chen & Sun, 2016; Engeser & Rheinberg, 2008; Sumaya & Darling, 2018; Stavrou et al., 2007). While dozens of studies have been conducted taking various angles to this relationship, it seems to be just tipping the iceberg in terms of depth of this connection and the factors involved. Other studies have found a positive relationship between flow and performance but weakly, which could potentially indicate other factors at play (Garcia, Codonhato, Mizoguchi, do Nascimento Junior, Aizava, Ribas, M. L., ... & Fiorese, L., 2019; Jin, 2012; Schüler, & Brunner, 2009). Furthermore, some studies have found to relationship at all (Delrue, Mouratidis, Haerens, De Muynck, Aelterman, & Vansteenkiste, 2016; Engeser, & Rheinberg, 2008; Keller, & Bless, 2008; Keller, & Blomann, 2008). A recent meta-analysis concluded consistent medium-sized relationships between flow and performance. However, across those 22 studies, there was not enough consistency or evidence to uncover the full extent of this relationship (Harris, Allen, Vine, & Wilson, 2021). There are so many more environments and factors to study and take into consideration in terms of their impact of the flow experience and achieving optimal performance. It's possible different types of flow result from different tasks, thus contributing to the variability of the results (van der Linden, Tops, & Bakker, 2021). It is also possible flow experience is affected by different stages of skill development (Cowley, Palomäki, Tammi, Frantsi, Inkilä, Lehtonen, … & Lappi, 2019; Palomäki et al., 2021). Furthermore, the concept of attention shifting and positive impacts or inhibitors seems a logical step to expand to and take into consideration as this field expands. The understood importance of attention shifting now raises the issue of identifying factors that can facilitate the self-regulation of cognitive processes and attention. Identifying their importance is the first step, but aiding and maximising them is the next. To bridge that gap, a deeper understanding of cognitive processing is needed.

### 1.2.2 Metacognition

The idea of metacognition was first explored by Aristotle over 2,000 years ago in his work *On the Soul* (Colman, 2015). He stated that the mind and the thoughts are one in the same, meaning what thinks and what is thought are uniform. Essentially, everything that is thought about during the day is done in the mind and what one uses to construct those images

and ideas becomes thinking. He also points out that thinking is neither sense nor imagination. The senses are physical and can be confirmed as factual whereas thinking can be abstract and false. Imagination, on the other hand, forms new ideas or images not present to the senses nor includes original thoughts or ideas (Morgan, 1931). Thus, thinking is somewhat unique and on its own. He finally goes on to explain the two faculties of thinking, effectively explaining the process of thinking. The first part involves previous knowledge and information acquired by the mind believed to be true. The second part then takes this knowledge and information and combines it into new and unexplored ideas. Overall, Aristotle made powerful observations and had an impressive understanding of the workings of the mind in his time but was clearly just scratching the surface.

Descartes (1637/1999) also had what is now considered to be in depth metacognitive ponderings. He concluded that the mere action and ability he had to think about his thinking gave concrete proof of his own existence. He took many angles into consideration, such as acknowledging that his perceptions might be defective and considering that his memories of his past experiences might actually be wrong. The possibility of both of these has since been confirmed (Hochberg, 2003; Loftus, 2004). Decartes concluded that the existence of self-reflection implies one has a nonphysical soul. This proposed contradiction became known as Comte's paradox. The mind both functioning and observing itself function seems paradoxical (Metcalfe, 2008). This idea stems from the view of metacognition as indivisible rather than fragmentary. However, perception itself is actually fragmentary despite the illusion of being a continuous whole (Hochberg, 2003; Simons & Chabris, 1999). This is because the illusory perceptual continuity is created from the expectation of what will be seen and heard. People can have large blind spots even without the notion of having holes in their consciousness (Metcalfe, 2008). It has been proposed that two levels of consciousness exist: a base level and a meta-level (Nelson & Narens, 1990). Therefore, consciousness is infinite.

Psychological theory made a large shift in the 1960s, moving away from the conditioning model that had dominated the field and introducing cognition (Schunk, 2008). The focus shifted towards the learners and how they encode, process, store, and retrieve information, rather than environmental variables. It opened the door to the idea of a person being an active seeker and processor of information rather than a passive recipient. This shift opened the door for the conceptualisation of metacognition. The term metacognition was first put forward by John H. Flavell in 1979. Metacognition is an awareness of one's own cognitive processes, or simply put thinking about thinking. Metacognition encompasses two components: knowledge about cognition and regulation of cognition (Baker & Brown, 1984).

Metacognitive knowledge refers to an individual's awareness of one's own cognitive process. Metacognitive knowledge involves understanding of three variables: personal, task, and strategy. Personal variables encompass the knowledge of how one learns and processes information. Task variables take into consideration the nature of the task and those specific processing demands. Strategic variables involve the understanding of the where and when to use specific strategies to tackle the problem. Regulation of cognition is like a feedback loop. If a breakdown occurs, one plans, monitors, and revises to get back to the desired state. Alternatively, even if a breakdown has not occurred, regulation is necessary for maintenance.

Sport provides a fascinating arena to study metacognition as athletes are in highly dynamic and stressful situations, continuously testing their abilities and aiming to extend their achievements. Metacognition was first brought to sports through the form of expertise. Expertise is the characteristics, skills, and knowledge, leading to superior reproducible performance that distinguishes expert performers from less-skilled ones (Ericsson, Hoffman, & Kozbelt, 2018). One of the first studies to link thoughts, sport performance and expertise was by de Groot (1965) looking at world-class chess players. He analysed the thoughts that mediated the selection of moves and concluded that the chess players could perceive good moves within seconds, and their vast knowledge of the game configurations mediated those selections. Less than 10 years later, this research was taken a step further, proposing the first theory of expertise (Simon & Chase, 1973), using human information processing as the framework (Newell & Simon, 1972). The theory states that through many years of expertise, the players develop extensive knowledge of specific patterns and store them in their memory. The expert players are able to group the individual pieces into meaningful patterns whereas the less skilled players focus on individual pieces or less complex patterns, limiting the memory's ability to recall chess positions. The immediate recall of meaningful positions has been tested in basketball (Allard, Graham, & Paarsalu, 1980), football, and American football (Starkes, Helsen, & Jack, 2001; Williams, Davids, & Williams, 1990). While the connection between expertise and attentional control theory has not previously been explored, it does seem overlaps do exist and the possibility of these aspects impacting performance is there. The grouping and remembering of pieces and patterns requires both attention focus and shifting. With research finding that other sports utilising the same strategy, the components or aspects of attentional focus and shifting need to be brought to sport performance research as well and it might be best through metacognition.

The initial expertise model (Simon & Chase, 1973) has been criticised for being too restrictive when it comes to the limitations of short-term memory and the demands required.

Further research suggested that the experts developed skills for the rapid coding of information in the long-term memory, thus expanding the capacity of the short-term memory (Ericsson, 1996; 1998; Ericsson & Kintsch, 1995; Ericsson & Lehmann, 1996). As a result, experts have the ability to expand their working memory capacity which allows them the ability for planning, reasoning, and evaluating to achieve superior performance (Ericsson & Delaney, 1999). Furthermore, research has repeatedly shown that experts perform better than novices. However, the relationship between memory and actual performance has not always varied as strongly as the actual performance between groups. (Ericsson, Patel, & Kintsch, 2000; Ericsson & Smith, 1991; Williams & Davids, 1995). Therefore, further clarification or research is needed to accurately conclude that superior performance can be mediated by cognitive processes.

Feedback from the original models of expertise led to the development of the expert performance approach (Ericsson & Smith, 1991). This model identified three stages of expert performance. The first stage involves the observation of performance to design tasks to allow the skills to be reproduced outside of competition. The second stage determines the mediating mechanisms that lead to expert performance, and the third stage details the necessary learning and processes to develop expertise (Ericsson & Smith, 1991). Essentially, one needs to capture expert performance, identify underlying mechanisms, such as specific movements and cues and then understand how that expertise was developed. Future expert athletes can then replicate this process to get to the level of performance they desire.

While the expert performance approach (Ericsson & Smith, 1991) took many of the shortcomings of previous research into consideration to further the understanding, it does not come without its own shortcomings. The first criticism of this model is that due to the dynamic environment, sports often times involve situations that are not actually possible to repeat exactly (Ericsson, 2003). Athletes or teams might have practiced set plays but often times need to think on their toes and adapt to the factors at play. Countless events can happen that cannot be anticipated, such as the opponent's exact positioning or a player might lose balance or the timing might be off and thus the play needs to be adjusted on the fly. When it comes to team sports, individuals possess different skills and are likely to have different roles on teams depending on the skills of team mates. This aspect makes it difficult to capture the essence of expert sport performance as a component of variability or adaptability might need to be taken into consideration. Furthermore, for filming sequences or plays, it might be necessary to film from multiple perspectives to understand expert performance from each position and angle. While it is possible to achieve this to yield a comprehensive view and

understanding of expert performance, resources and accessibility might provide limitations to full knowledge and understanding. This model also does not take into consideration any knowledge of the opponent and the advantage that could have or the score or time of the match. An ability to know an opponent's weakness and exploit it could strongly indicate an expertise in sport but is likely to be situational and could be difficult to measure. Similarly, the score or time remaining in a game could change an athlete's performance. Once again, these factors are situational and would take more stringent measures to analyse any potential impacts they have.

The theory of deliberate practice was next introduced to further explain expertise (Ericsson, Krampe, & Tesch-Romer, 1993). Expert performance analysis determined that intense practice for at least 10 years is the key. Both individual differences and characteristics previously believed to be inherent talent are actually the products of deliberate practice. The 10-year rule was extended to chess (Charness, Krampe, & Mayr, 1996) and sports (Ericsson et al., 1993; Starkes, Deakin, Allard, Hodges, & Hayes, 1996) and found to be true. The contribution of deliberate practice to expertise, (Ericsson et al., 1993) however, has caused some debate in subsequent research. Research has provided conflicting results when it comes to practice hours, starting ages, and cognitive abilities (Baker & Young, 2014; Gobet & Campitelli, 2007; Hambrick, Oswald, Altmann, Meinz, Gobet, & Campitelli, 2014). It is worth noting that comparing research results of chess and other sports might not be entirely reasonable as it is possible further motor skills are needed in more active sporting contexts, liming the comparability of the results. While the current findings support that perceptual-cognitive skills can be enhanced through practice and specific interventions (Williams & Grant, 1999), research is far from comprehensive in this area and thus considerable further attention is needed for further confirmation as well as the understanding of any potential limitations. Research with football has confirmed that elite players spend considerable more time working on drills requiring good decision-making skills compared to less elite players (Ward, Hodges, Starkes, & Williams, 2007). Part of this difference, however, could be down to skills and abilities where less elite players need to get the basics down before progressing. Once again, more research is needed and in a variety of sports to more conclusively understand this observation. Perhaps research comparing different groups of elite athletes would be able to shed more light on the impact and quality of practice activities.

For decades, scientists viewed thinking and action as opposites (Laakso, 2011; Moran, 2012). The introduction of the motor cognition paradigm opened the door to include action in psychology research (Jeannerod, 1994). This model stipulated the importance of

understanding action rather than movement. The introduction of this paradigm opened the door for the collaboration between sport psychology, cognitive psychology, and cognitive neuroscience researchers (Moran, 2009). One of the first studies to specifically look at sport and metacognition came from Nietfeld (2003) who researched middle distance runners. The study sought to compare the runners' use of internally-focused metacognitive strategies rather than externally-focused thoughts during competition. The results found overwhelming evidence for reporting internally-focused strategies. The majority of thoughts reported consisted of monitoring one's body and strategies for race tactics during competition. Finally, a strong connection was found between the strategic knowledge and performance regulation ability.

From here, research with athletes largely focused on meta-imagery, or a person's "beliefs about the nature and regulation of their own imagery skills" (Moran, 2002, p. 415). Results showed a prevalence of using imagery in high-pressure, difficult situations (Weinberg, Butt, Knight, Burke, & Jackson, 2003). Findings have also shown athletes have a strong understanding of imagery processes as well as sophisticated meta-imagery control skills (MacIntyre, & Moran, 2007a,b). Meta-imagery has been added as another factor to differentiate experts from novices (Moran, Guillot, MacIntyre, & Collet, 2012).

Bless, Keller, and Igou (2009) proposed a model of metacognition involving declarative knowledge, feelings, and memories. They argue that these three components are relevant when making decisions in a given situation. Sometimes feelings and information do come to mind even when not relevant, which could cloud an individual's judgment. The researchers contend that metacognitive knowledge can control for unwanted influences. Studies have confirmed these aspects individually (Martin, 1986; Schwarz, 2002; Sternberg & Sternberg, 2012; Strack & Bless, 1994), but the model in its entirety has not been practically applied.

Research next looked to investigate metacognition with different skill levels and experience in runners. The results confirmed elite endurance runners used metacognitive processes (Brick, MacIntyre, & Campbell, 2015). The runners noted periodically monitoring both their internal states and external environment. The results led to a six-step framework. The first step is the planning stage before the run. The next step takes place while running and involves monitoring the process through metacognitive feelings. Next, the runner stimulates cognitive control and then accepts the appropriate cognitive strategy. A practical example of these steps might be noticing pain, feeling like the race and running are difficult and then relaxing to control cognition. The runner then makes a judgment of this strategy to

determine the effectiveness and then will either continue use of this strategy or change to a new one. After the race has concluded, the runner reviews and evaluates to inform the plan before the next race when this process starts over.

Bringing a metacognitive model specifically for sports and athletes is largely helpful for the progression of the understanding of metacognition in sporting contexts (Brick et al., 2015). The model has been created with only elite athletes in mind, which makes sense as they are the most experienced, but it might not be transferrable to other skill levels or might need to be refund as recreational runners have not been found to plan before the race (Brick, Campbell, Sheehan, Fitzpatrick, MacIntyre, 2020). Perhaps this could be used as a basis for intervention strategies to foster the development and utilisation of metacognition in sport. The athletes have a process to work towards with established review stages to continuously evaluate their progress and effectiveness to best understand what works for them and areas to focus on for enhanced performance. Additionally, this model needs to be confirmed with other sports. It is likely this process can be transferred to other sports, but there might need to be additional steps added for group contexts or different types of competition environments.

Research has also been conducted with recreational runners and found limited use of metacognitive skills (Brick et al., 2020). Only a few of the runners engaged in metacognitive planning or reviewing. The cognitive strategies seem to develop through experience, often resulting from an unpleasant event. Most recently, it has been proposed that metacognition could be shaped by culture (Heyes, Bang, Shea, Frith, & Fleming, 2020). Culture can take two forms: genetically and by culture learning. Research has held the assumption that genetic evolution plays a role in the development of metacognition (Mercier, & Sperber, 2017; Schwarz, 2004). Cultural learning involves two or more parties, one of whom has accrued metacognitive skills who then teaches those skills to others. The knowledge party can deliberately teach this information, but it can also be transferred through the person casually leaking information and being picked up by the others. This model argues metacognition is comprised of three components: discrimination, interpretation, and broadcasting (Heyes et al., 2020). Discrimination is the act of distinguishing metacognitive feelings from one another to ensure the correct message is shared with the cognitive system to elicit the appropriate response. Interpretation is understanding the significance of metacognitive representations, which sometimes can be misleading (Reber, Schwarz, & Winkielman, 2004).The metacognitive representations are then broadcasted to others, which can be done both verbally and nonverbally. Metacognition is necessary for people to know themselves as individuals as well as in a collective group.

#### 1.2.2.1 Metacognition Measures

The measurement of metacognition is difficult as people are often not explicitly aware of the processes that take place. One of the first quantitative measures created was the Metacognitions Questionnaire (MCQ-65) (Cartwright-Hatton & Wells, 1997) to measure beliefs about worry and intrusive thoughts. The initial items were created from interviews with 25 undergraduate students as well as transcripts from cognitive therapy with patients diagnosed with Generalised Anxiety Disorder, Obsessive Compulsive Disorder, Hypochondriasis, and Panic Disorder. Ninety-four items were created to measure six factors and administered to 314 undergraduate and graduate students in the initial validation study. Factor analysis results in the elimination of 15 items and one factor, which was then presented to a further sample of 306 undergraduate and graduate students. Analysis resulted in a five factor, 65-item scale. The Cronbach alphas ranged from 0.72 to 0.81.

A few years later the MCQ-65 was then shortened to the MC-30 (Wells & Cartwright-Hatton, 2004). Six items were selected from each factor to create the shortened version. A convenience sample of 182 participants was used with a mean age of 33.5 and 65 per cent female. Both of exploratory and confirmatory factor analysis was performed to test the construct validity, which indicated an acceptable fit, consistent with the original MCQ-65. The internal consistency and convergent reliability were both good. Cognitive confidence, positive beliefs about worry, cognitive self-consciousness, negative beliefs about the uncontrollability of thoughts and danger, and beliefs about the need to control thoughts make up the five subscales.

While the MCQ-30 looks at maladaptive beliefs and coping strategies, nothing existed to look at adaptive metacognitive traits, which led to the creation of the Positive Metacognitions and Positive Meta-Emotions Questionnaire (Beer & Moneta, 2010). Thirteen highly self-regulated and resilient individual were interviewed to identify adaptive metacognitive beliefs. Thematic analysis revealed three metacognitive components involve confidence in: eliminating perseverative thoughts, interpreting emotions as cues, and setting flexible but attainable goals. The participant statements were used to extract 49 items about the cognitive and emotional processes during challenging situations. The initial validation study consisted of a convenience sample of 313 participants. Factor analysis resulted in 18 items contributing to three factors. A validation study of 475 participants was conducted. The confirmatory factor analysis showed the model does not fit strictly but is a good fit.

#### 1.2.2.2 Metacognition Critique

Despite the attention that metacognition has received throughout the years, there are still considerable voids in the research findings. The first issue is the definition. Flavell's (1979) definition essentially separates cognitive knowledge from metacognitive knowledge, but he even acknowledges there might not be a difference. The difference lies in how the information is used, not the information itself (Livingston, 2003). There is also a lack of coherence when it comes to associated terms. Metacognitive awareness, metacognitive beliefs, metacognitive skills, self-regulation, metamemory are just a handful of the terms that have been associated with metacognition (Veenman, Van Hout-Wolters, & Afflerbach, 2006). Different definitions of these terms have also been used, so there is no surprise research has produced conflicting conclusions about the relationships. For example, self-regulation has been found to be superordinate to metacognition (Winne, 1996; Zimmerman, 1995) and a subordinate component (Brown & DeLoache, 1978; Kluwe, 1987). Clearly more research is needed to more rigorously define both metacognition and its parameters. Furthermore, a number of the studies involve introspection and self-reflection, so knowing the true awareness of cognitive processes is difficult (Brown, 1980). This is not a new issue when it comes to psychological research (Ach, 1905; Baldwin, 1909; Kuhlman, 1906), but nonetheless it has still not been overcome.

Generally speaking, metacognition research has mostly focused on variables that were more easily measurable and could be quantified. While it is understandable for ease, it keeps the door wide open for other variables that might have a strong impact but are undetected. Additionally, most of the research has used retrospective techniques. However, possibly more complete pictures and conclusions could be drawn if longitudinal studies were used or even control groups with the current structures for relationship evidence with different variables. Longitudinal research could also account for a wide variety of situations, such as different types of wins and losses (large score / performance discrepancies or come from behind wins). Studying metacognition with these specific types of situations could shed more light on the phenomenon or elicit more details with the more difficult situations. Each sport has domain-specific aspects when it comes to training and competition. Considerable further research is needed across many more sports as a one-sized-fits-all approach is likely inapplicable. However, it is possible some basic generalisations will be transferrable across sports.

When it comes to metacognition research with sports specifically, the research is very much in its infancy as it's not an area that has received much attention throughout the years.

Metacognition in team sports is an unexplored topic but arguably a very important one as athletes need to be understanding and monitoring their own states but also have the ability to recognise and understand those of their team mates as that could impact their performance and what is required of them. Furthermore, specific types of metacognitions have not been explored or identified at all but is an approach worth investigating. It could be that previous research has taken too broad of an umbrella approach, and a more pinpointed approach identifying specific types might be valuable.

### 1.2.3 Metacognitions of Flow

Flow specific metacognitions is a concept that has received little attention but could actually be extremely insightful and influential to the future of flow research. The groundwork was first studied by Beer and Moneta (2010) looking at metacognitions from a positive psychology perspective and found evidence for adaptive metacognitive traits. Maladaptive metacognitive traits had a moderate negative correlation while intrinsic motivation and adaptive coping had positive correlations. It was further suggested they could have potential adaptive functions on flow, which has been supported in a worker sample (Beer, 2011; Moneta, 2015). Adaptive metacognitions had both direct and indirect effects fostering flow through the mediation of positive affect.

Flow metacognitions are considered people's awareness of and the specific beliefs of the flow state, strategies for both achieving and maintaining flow, and the following consequences (Wilson & Moneta, 2012). The FMQ was developed based upon the assumption that people would activate metacognitions specific to the flow state, which would both facilitate and predict the occurrence of flow. The first study tested this assumption through the pilot scale development (Wilson & Moneta, 2012). A convenience sample of 371 British workers completed the Flow Questionnaire (Csikszentmihalyi & Csikszentmihalyi, 1992). These results, in addition to semi-structured interviews with 13 UK professionals regarding the flow experience at work along with strategies to achieve and maintain flow, were used to inform the questionnaire. From the data coding process, two data constructs emerged, the first being a belief that flow does improve performance for each person and the second was how it occurred with some participants believing it was due to random events while others expressed awareness of conditions for it to occur, therefore, meaning flow could at least partially be initiated or self-regulated (Wilson & Moneta, 2012).

An opportunity sample of 204 students completed the FMQ. The mean age was 26.2 with a standard deviation of 6.8 years, and 64 per cent were female (Wilson & Moneta, 2012). The first part asked participants if they were familiar with flow through an abridged version of the flow questionnaire, basically describing the flow experience and asking participants if they had experienced something like that and if so to list up to five activities with which they have experienced it. They were then asked to select a work or study activity most representative of the flow experience, and if was not an option, a leisure activity was selected. The participants then completed the FMQ with that activity in mind.

Exploratory factor analysis (EFA) was performed on the sample. The Kaiser-Meyer-Olkin Measure of sampling adequacy was 0.79 and the Bartlett's Test of Sphericity was significant, confirming good factorability of the data (Bartlett, 1954; Kaiser, 1974). Two components were identified. The first involved thoughts about the usefulness of being in flow, and the second about self-regulation of being in flow (Wilson & Moneta, 2012). The next step was to shorten the scale through factor loading analysis and ALPHAMAX macro for SPSS (Hayes, 1997), which resulted in six questions for component one and six questions for component two. Component one had a Cronbach's alpha coefficient of 0.84 for development and 0.83 for cross validation of the sub-sample while component two had a value of 0.82 for development and 0.79 for the cross validation sample. The component one subscale was renamed Beliefs that Foster Flow Achievement, and the component two subscale was renamed to Confidence in Ability to Self-Regulate Flow (Wilson & Moneta, 2012).

Construct validity was assessed through confirmatory factor analysis (CFA). A convenience sample of 159 people experiencing flow at work was used. The mean age was 37.3 with a standard deviation of 10.99 years (Wilson & Moneta, 2012). Maladaptive metacognitions were measured through the 30-item MCQ-30 (Wells & Cartwright-Hatton, 2004) and the Positive Metacognitions and Meta-Emotions Questionnaire (PMCEQ) (Beer & Moneta, 2010) measured confidence in extinguishing perseverative thoughts and emotions, confidence in interpreting own emotions as cues, restraining from immediate reaction and mind setting for problem solving, and confidence in setting flexible and feasible hierarches of goals. Participants completed three flow scales with their flow at work experience in mind to assess flow intensity. These scales included the SDFS-2 (Jackson, Martin, & Eklund, 2008), FSS (Rheinberg, Vollmeyer, & Engeser, 2003) and the SFWS (Moneta, 2017). The frequency of flow was measured through the abridged version of the flow questionnaire in the first study.

CFA using LISREL 8.8 (Jöreskog & Sörbom, 1996) confirmed the two factors as latent variables. Internal consistencies for all measures were satisfactory to good, and the chi-squared test was significant (Wilson & Moneta, 2012). In terms of concurrent validity, both FMQ-1 (Beliefs that Flow Fosters Achievement) and FMQ-2 (Confidence in Ability to Self-Regulate Flow) correlated positively with the three flow measures, implying a more intense flow experience is the result of flow metacognitions. They also correlated positively and significantly with the metacognitive traits. Hierarchical regression analysis confirmed predictive validity. The hierarchical regression confirmed that confidence in ability to self-regulate flow was a better predictor of intensity of flow in work than measures of maladaptive and adaptive metacognitions. The FMQ also better predicted the frequency and percentage of time spent in flow compared to the established flow measures (Wilson & Moneta, 2012). All of these studies of the FMQ have proven its significance and usefulness as a research tool.

While flow metacognition research is very much still in its infancy and still requires further research both from a general perspective and from a sport perspective, it is showing strong, promising results that it does exist, is important, and does foster flow and performance. This angle needs to be replicated from a widespread perspective to further understand the dimensions and any environmental specific factors that could be involved. Another point to consider when it comes to flow and metacognition research is mental toughness. Mental toughness has continuously been shown to foster flow and in turn enhance performance. Therefore, it is important to understand its evolution thus far and to include it in subsequent flow research. As the understanding of flow progresses, its relationship with mental toughness needs to be monitored to see what changes, if any, result in that relationship. An overlap between mental toughness and metacognition is possible but has not been investigated previously. Accordingly, a thorough understanding of mental toughness to date is necessary.

### 1.2.4 Mental Toughness

It can be argued that as athletes make it to the most elite levels, the physical differences can be minute. However, the performance differences can still be significant. They are required to navigate high pressure, high emotional conditions, and their ability to respond can be the difference maker and ultimate make or break point for their success. The concept of mental toughness (MT) is considered to be this edge, which has received the vast

majority of its attention both in the popular and academic presses since the start of the 21st century (Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015). While little debate seems to exist on the necessity of this construct, the definition and classification has been more elusive. However, the majority of research in the last two decades has focused on two MT conceptualisations (Gucciardi, 2020).

The first conceptualisation is the 4C's model of MT: commitment, control, challenge, and confidence (Clough, Earle, & Sewell, 2002). This theory is actually rooted in the Kobasa & Maddi hardiness theory (Kobasa, 1979; Maddi & Kobasa, 1984). This theory proposes personality hardiness as a state personality trait characterized by three core beliefs that protect against the effects of stress on one's health and performance. Individuals must have a commitment to experience during stressful times while feeling a sense of control over his or her experience and viewing the stressful situation as a challenge that is normal and vital for growth and development (Maddi, 2004). The fourth C to this model of MT is confidence because of its accepted prominence in sport success. These important components for sport performance have been confirmed in sport settings (Moritz, Feltz, Fahrback, & Mack, 2000; Woodman & Hardy, 2003) as well as on MT specifically (Gucciardi, Gordon, & Dimmock, 2008; Jones, Hanton, & Connaughton, 2002). The 4C's model has become the most preferred framework for studying MT in sport settings (Gucciardi, 2017; Lin, Mutz, Clough, & Papageorgiou, 2017), but has also been extended to other contexts, such as education (McGeown, St Clair-Thompson, & Clough, 2016) and business (Clough, Earle, & Strycharczyk, 2008).

The second most commonly cited conceptualisation is from the work of Jones, Hanton, and Connaughton (2002). They were the first researchers to take an empirical approach to understanding MT. They had 10 athletes who had represented their country at the international level brainstorm a definition of MT and the ideal fundamental attributes. Jones et al. (2002, p.209) reported the following definition:

> Mental toughness is having the natural or developed edge that enables you to: (i) generally, cope better than your opponents with the many demands (competition, training, lifestyle) that sport places on a performer; (ii) specifically, be more consistent and better than your opponents in remaining determined, focused, confident, and in control under pressure.

The participants also identified 12 specific attributes of MT. An unshakable self-belief in the ability to achieve competition goals as well as that they possess the abilities to be better than their opponents were ranked as the two most important characteristics. An unlimited desire to

succeed, increased determination to bounce back from setbacks, thriving off of competition pressure, accepting and coping with competition anxiety, not experiencing adverse effects from others' performances, fully focusing despite personal life distractions, ability to switch on and off the sport focus, remaining fully focused on the task at hand despite competition-specific distractions, transcending the boundaries of physical and emotional pain while performing, and maintaining psychological control during unexpected events were the remaining 10 mental toughness characteristics in descending order of importance. This definition has been used in single sport research and has been confirmed, specifically in cricket (Bull, Shambrook, James, & Brooks, 2005), Australian football (Gucciardi et al., 2008) and football (Thelwell, Weston, & Greenlees, 2005).

Thelwell et al. (2005) conducted two studies to test the support for Jones et al.'s (2002) definition of MT. The first involved six internationally recognised male professional football players who were interviewed about their perceptions of MT along with the essential characteristics necessary. Overall, they all shared a MT understanding that resembled Jones et al. (2002) except they said that mentally tough individuals always (rather than generally) cope better than their opponents. The second study included 43 male professional soccer players who rated their agreement with the definition from the previous study. The scale was 1=totally agree and 10=totally disagree, and the results showed a mean of 2.2 and standard deviation of 1.4.

A couple years later, Jones et al. (2007) extended their study to confirm their definition of MT. Eight superelite athletes (winning seven Olympic gold medals and 11 world-championship titles), three coaches, and four sport psychologists took part in the study and approved the definition of MT with an average agreement of 9.33 (SD=1.05) out of 10. Interestingly, they identified 30 attributes as characteristics of mentally tough athletes as opposed to just the 12 that the previous study yielded, so it is possible the higher the level the athlete, the more in tune with the specifics they are as to what is required to cultivate MT. Essential characteristics were also identified, including focusing, desire, self-belief, coping with anxiety and dealing with hardship (Jones et al., 2007).

Other research groups have taken an inductive approach, generating their own conceptualisations of MT, drawing on the experiences of athletes, coaches, exercisers, and other support personnel. Research has looked generally at MT across multiple sports (Cook, Crust, Littlewood, Nesti, & Allen, 2014; Potgieter, & Fourie, 2001; Slack, Butt, Maynard, & Olusoga, 2014; Weinberg, Butt, & Culp, 2011) as well as sport specific for cricket (Bull et al., 2005; Gucciardi & Gordon, 2009), Australian football (Gucciardi et al., 2008), football

(Coulter, Mallett, & Gucciardi, 2010), and ultramarathon (Jaeschke, Sachs, & Dieffenbach, 2016). The specific terms describing the individual attributes of MT varied across all of these studies, but the themes concerning belief, control, focus, motivational drive, and the regulation of thoughts and feelings during training, competition, and relating to sporting outcomes were present and consistent.

Research has also extensively looked at the characteristics of mentally tough performers. The characteristics and references have been organised in Table 1 below for ease. Even though there is variety in opinion when it comes to these characteristics, there does seem to be agreement that MT is reflected by the athlete's ability to cope with stress and any anxiety associated with the high pressured competitive situation.

| Description | References |
|---|---|
| High levels of optimism, confidence, self-belief, and self-esteem | (Bull, Albinson, & Shambrook, 1996; Favret & Benzel, 1997; Goldberg, 1998; Gould, Hodge, Peterson, & Petlichkoff, 1987; Graham & Yocom, 1990; Hodge, 1994; Loehr, 1986, 1995; Luszki, 1982; Pankey, 1993; Taylor, 1989; Woods & Desmond, 1995) |
| Achieving consistency | (Gould et al., 1987; Graham & Yocom , 1990; Loehr, 1982; Williams, 1988) |
| Desire, determination, and commitment | (Bull et al., 1996; Goldberg, 1998; Hodge, 1994; Loehr, 1982; Luszki, 1982; Tunney, 1987; Williams, 1988) |
| Focus and concentration | (Goldberg, 1998; Graham & Yocom, 1990; Jones, 1982; Loehr, 1982; Luszki, 1982; Tunney, 1987) |
| Willpower, control, motivation, and courage | (Bull et al., 1996; Favret & Benzel, 1997; Gould et al., 1987; Graham & Yocom, 1990; Hodge, 1994; Loehr, 1982; Tunney, 1987; Woods & Desmond, 1995) |

Table 1: MT Characteristics and References

With the understanding that MT could be acquired (Bull et al., 2005; Jones et al., 2002, 2007; Thelwell et al., 2005), the focus then shifted to the development and maintenance. Research has found the development and maintenance of MT to be categorized into four sections: three development and one maintenance phase (Connaughton, Hanton, & Jones, 2010). The first phase is initial involvement to the intermediate level, which typically lasted six to 10 years. During this phase, participants did not have MT and were mostly participating for socialisation though still reported being competitive and frequently learning new skills quicker than their peers or teammates. The next phase was intermediate to elite level, typically lasting three to six years. This phase was noted as the turning point where most of MT was developed. Participants experienced increased competitiveness, felt they could control their training environment and felt they were able to handle both success and

failure. The final development stage was elite to Olympic/World Champion status, typically lasting two to four years. Participants gained international competitive experience and success and an understanding of the value of a supportive network. Participants also increased their psychological skill usage through reflective and rationalisation exercises of both competition successes and failures (Connaughton et al., 2010). As their performance expectation and execution levels were rising, so too their psychological skills needed to keep up with their competitive edge. Finally, participants reached the maintenance years, lasting two to five years. No further skills needed to be developed, just maintained (Connaughton et al., 2010). Mental skills can be thought of as a muscle that needs to be continuously exercised to maintain the strength.

Recent investigation into MT with ultra-marathon runners has suggested that a threshold of MT might be necessary to achieve desired performance and once that threshold is met, other factors could make a bigger impact on performance (Brace, George, & Lovell, 2020). This result is extremely interesting and could likely take future research down a different path than it is currently pursuing. Obviously, this is the first sort of finding like this, so it needs to be validated and extended to other sports. However, this finding does show the importance of further understanding the relationship of MT with other constructs, such as flow and metacognition as well as future ones to be discovered. This is showing the possibility of thresholds existing, which then means the understanding of how other factors are impacting performance is crucial to get that extra edge.

#### 1.2.4.1 MT Measures

The most utilised instrument to measure MT is the Mental Toughness Questionnaire-48 (MTQ48; Clough et al., 2002; Gucciardi, Hanton, & Mallett, 2012). The MTQ48 is based off of the 4C's model (Clough et al., 2002). The 48 items were created from a literature review as well as opinions of the 4C's from athletes, coaches, and sport psychologists. The items strived to provide as comprehensive of a view as possible. The questionnaire was tested with 600 athletes from a variety of sports and received a reliability coefficient of 0.91 (Clough et al., 2002). Kline (1999) recommends a minimum acceptable level of 0.70 for all subscales when it comes to the reliability of psychological constructs. The MTQ48 has reached that level, and the individual results can be seen below in table two. In terms of construct validity, the MTQ48 has significant relationships with self-image ($r = 0.42$),

optimism (r = 0.48), life satisfaction (r = 0.56), trait anxiety (r = 0.57), and self-efficacy (r = 0.68) (Clough et al., 2002).

| MTQ48 Sub Scales | Number of Items | Cronbach's Alpha |
|---|---|---|
| Challenge | 8 | 0.71 |
| Commitment | 11 | 0.80 |
| Control | 14 | 0.74 |
| Emotional Control | 7 | 0.70 |
| Life Control | 7 | 0.72 |
| Confidence | 15 | 0.81 |
| Confidence in Abilities | 9 | 0.75 |
| Interpersonal Confidence | 6 | 0.76 |
| Whole Scale | 48 | 0.91 |

Table 2: Initial Scale Reliabilities of the MTQ48 (Clough et al., 2002)

Even though the MTQ48 is the most popular MT measurement tool, it has not come without criticism. There is conflicting evidence when it comes to testing internal consistency. As a whole, studies have confirmed internal consistency (Kaiseler, Polman, & Nicholls, 2009; Dewhurst, Anderson, Cotter, Crust, Clough, 2012). However, the MTQ48 subscales have reported inadequate levels of internal consistency (Crust & Keegan, 2010; Kaiseler et al., 2009; Levy, Polman, Clough, Marchant, & Earle, 2006; Nicholls, Levy, Polman, & Crust, 2011). The emotion and life control subscales have been reported as the most problematic. Factorial validity has also received mixed results. Studies have either showed mixed support (Perry, Clough, Crust, Earle, & Nicholls, 2013) or support for exploratory structural equation modeling (ESEM) but not CFA (Gerber, Kalak, Lemola, Clough, Perry, Pühse, Brand, 2013). However, the samples were not restricted to just athletes.

The psychometric properties of the MTQ48 have also been explored though limited support has been found (Birch, Crampton, Greenlees, Lowry, & Coffee, 2017; Clough et al., 2002; Connaughton, Hanton, Jones, & Wadey, 2008; Crust, 2008; Gucciardi et al., 2012; Perry et al., 2013). It should be noted, however, that limited attention has been devoted to individual differences in MT across sport levels to date (Crust, 2008; Golby & Sheard, 2004). In terms of achievement levels, insignificant mean differences have been reported across over 600 athletes, (Nicholls, Polman, Levy, & Backhouse, 2009). A positive relationship was found between the MTQ48 and physical activity (Gerber et al., 2013). The most recent test of the psychometric properties of the MTQ48 involved over 1,000 participants ranging from 18

to 58 years old, grouped in categories of elite and amateur athletes and nonathletes (Vaughan, Hanna, & Breslin, 2018). The results supported the scale's reliability achieving acceptable internal consistency both at the total and subscale levels. This study was the first to examine the scale across expertise levels, but the results indicate caution when using the MTQ48 with athletic populations as the athlete group experienced the largest degree of misspecification in the factor structure.

Madrigal, Hamill, and Gill (2013) operationalised the Jones et al. (2002, 2007) conceptualisations of MT into a self-report tool. The scale started with 54 items, 32 of which came directly from Jones et al. (2007), and the remaining 22 came from consultations from four athletes and coaches. Two hundred seventy-one athlete responses made up the exploratory factor analysis, testing 2-factor, 3-factor, and 4-factor solutions. The results confirmed a strong preference for single factor. All items that received a general factor value lower than 0.55 were removed. The result is an 11-item scale known as the Mental Toughness Scale (MTS). The Cronbach's alpha value is 0.86, and the concurrent validity evidence showed meaningful correlations with dispositional flow, shyness, and social desirability (Madrigal et al., 2013). A follow up study with 143 college basketball players confirmed the unidimensional structure, internal reliability of 0.86, and magnitude of factor loading of greater than 0.40.

#### 1.2.4.2 MT Critique

While considerable attention has been devoted to MT, there are still limitations in the understanding and implications of the findings to date. MT is an interesting dichotomy. On the one hand, it is one of the most used terms in sport psychology, but, on the other hand, the lack of consensus when it comes to a definition indicates a deficiency of understanding. It is almost used as more of an umbrella term, which can include the ability to handle pressure, cope with stress, or bounce-back from failure (Bull et al., 2005; Dennis, 1981; Gould et al., 1987). This lack of cohesion results in a range of findings. As a result, finding consistency or even patterns is difficult and thus the generalisability of MT is limited. While Jones et al. (2007) helped to establish more uniform parameters, their work has received some criticism. Their study only involved 10 athletes, and there is also a lack of empirical evidence supporting their findings (Crust, 2008; Gucciardi et al., 2008). It is interesting subsequent studies have not followed to prove or disprove this definition but rather just accept it and use it for investigating relationships with MT and their specific athlete sample. There have also

been inconsistencies in the definitions of athlete groups as well as the measurement of MT in the studies to date (Cowden, 2016). These inconsistencies also limit the generalisability of MT.

Sports can be different in terms of the physical skills they require. Perhaps the definition of MT should take a sport-specific approach (Crust, 2008). The mentally tough requirements of one sport might be different than another. Those differences could also potentially extend across genders and even between team and individual sports. Ice hockey could be a case where gender plays a significant role in the difference of MT necessary and experienced with successful athletes as the game is largely different between genders. While the female game is physical and body contact is inevitable, full checking is not allowed unlike the men's leagues where part of the game strategy is being physical and checking a player (physically running into the player to separate him from the puck to then gain control of the puck). Furthermore, at the professional level, fighting is allowed and sometimes even encouraged to change the momentum of the game and even get the crowd involved to pep up the team. Fighting is strictly forbidden in the women's game. So while there is significant crossover between the men's and women's games in terms of the rules and strategies, the physicality aspects could result in significant differences when it comes to the MT necessary for success with ice hockey.

An additional point to note is that considerable research when it comes to MT has been done on sports from developed, westernised societies (Cowden, 2016). It is important to acknowledge cultural distinctions in self-identities amongst participants. It is possible that MT could be thought of and applied differently in more collective societies or within more culturally diverse and less affluent groups. Once again, this potentially limits the generalisability of the findings to date.

### 1.2.5 Research Void

Despite the research attention that flow, metacognition, and MT, arguable the three most relevant psychological factors underpinning sport performance, have received, most of it has been at the individual level (Walker, 2010). The team sports that have been studied with these factors have been in a limited capacity and never with sports requiring continuous interaction with teammates (Bakker et al., 2011; Chavez, 2008; Young, 2000). Research conducted thus far has adopted an individual difference approach, rather than a social psychology approach. Social psychology research has identified that qualitatively, people

think, act, and feel different in group contexts compared to individual settings (Asch, 1956; Lewin, 1952; Zimbardo, 1969). Social contexts can be complex, introducing variables that can both facilitate and inhibit the experience of flow (Froh, Menges, & Walker, 1993; Zajonc, 1965). They can also be viewed in terms of existence on a continuum, ranging from 'mere presence' whereby individuals perform the task and others are present but passively so (Zajonc, 1965) to co-active situations in which people perform tasks side-by-side but still not interacting to highly interdependent situations where group performances require cooperate and coordinated efforts (Hackman, 1987). In group situations and cohesive teams, team members become agents of flow, feeding off of each other and building the experience. In a sense, group flow needs to take on a social psychology aspect and add a social component of flow in a group setting. A merger of the concepts needs to be properly established. This need is further exacerbated in highly stressful, dynamic, and fast-paced environments. These types of situations will likely have an even stronger need for a social psychology aspect incorporated into them and thus need to be explored to see any new components or dynamics that are needed to excel in these situations.

Metacognition is extremely limited when it comes to sports and sport research. It was included in the early stages of research with the expertise model and since it has evolved, it has been brought to running through specific metacognitive processes. While that angle is an interesting perspective and has shed more light onto the concept of metacognition, it has not taken into consideration that specific types of metacognitions could also exist that could enhance performance individually or possibly facilitate the experience of flow. Furthermore, since only elite athletes have been studied when it comes to metacognition, it is possible that is limiting the understanding of this component and its relationship with performance as there could be stages of progression to developing metacognition that aids and enhances sport performance. The exploration of metacognition experienced at various ability levels is an area of future exploration that could yield dividends.

In terms of MT, a deeper understanding of its connections with flow and metacognition is necessary. MT has been shown to enhance flow, which, in turn, enhances performance (Meggs, Chen, & Koehn, 2019). Flow has been shown to enhance MT which in turn enhances performance. Perhaps other components not discovered yet could enhance it further or more powerfully impact it in a different way. Furthermore, the relationship between MT and metacognition is unchartered territory. Bringing these components together has the potential to jointly benefit performance. Clearly these three components have overlap

that has not been addressed previously. They need to be brought together to more fully understand them individually as well as the impact they can have on each other.

A sport like ice hockey requires continuous interaction and collaboration with team members. Additionally, team members on the ice are constantly changing. With this type of an environment, these concepts need to be studied in a systems approach. The players operate much like a supply chain, receiving from one player and feeding onto another. Therefore, it is likely additional components are needed to foster team flow and team performance. It is likely an element of attention needs to be added as athletes are required to distribute their attention across many different things at the same time, such as team mates, opponents, and the location of the ice with regards to their responsibilities in that area. The game involves constant motion and thus these elements are in perpetual flux, which requires the continuous monitoring and reacting. Likewise, specific metacognitions will be necessary as players are individually focusing on more factors at once while participating in a highly interconnected and interdependent environment. It is possible to have an even further dimension to group flow as it has never been studied in such an inter-dependent, high-paced environment.

### 1.2.6 Relevance

All and all, performance is a vast topic and can be influenced by countless factors. Every athlete is different and thus will view the importance and impact of all of these factors on performance differently. However, the more that is understood about all of these factors and possible implications they can take, the more researchers can understand the extent to which performance will be impacted. While correlations between flow, metacognition, and MT individually with performance are helpful, the field needs to move beyond the correlations and test casual relations, which can then be used to create interventions, striving for ultimate performance from players, coaches, management, and owners, everyone involved in the professional organisation. Additionally, different sports take on different environments and contexts and therefore how flow, metacognition, and MT are experienced and measured will be different depending on the context. Further research is necessary to see how flow is experienced in such a fast-paced, highly changing context as this sort of an environment and these conditions have never been studied. Therefore, new measures will likely be needed to take into consideration the differences experienced both at the individual and team levels. The implications for this understanding are endless from helping athletes to reach their highest potential, to coaches understanding where the athletes are coming from and how to

motivate them, to managers in professional organisations knowing what to look for and avoid when drafting future club players. Numerous stakeholders have the potential to benefit from these findings, especially at the professional level. The athletes and coaches, first and foremost, will be directly affected and will need to be monitoring the flow and make adjustments to foster it as much as possible. Scouts and agents are next to be affected as the results of this study could impact the type of athlete they sign for a contract. It might even be a potential predictor of future success. Sport psychologists also need to be aware of these results, as it might be a new area to focus on with athletes to enhance performance. Last but certainly not least, there could be serious implications for scientists as it has the potential to open the door to a new type of flow, which will require thorough research to fully understand its components. While research and understanding has grown immense in the last few decades, there is still considerable ground to cover to have a total picture and allow all invested parties to be on the same page.

Despite the progress that has been made when it comes to understanding flow and metacognition in sporting environments, there are still voids in the research findings that need to be addressed and thus research is needed. Extending flow research to a new sport is the first gap, but arguably more importantly, extending it into a completely new type of environment opens the potential to either find more components necessary or a new type of flow entirely. The purpose of this study is to explore the presence of flow and metacognition for ice hockey players. The study will examine the psychological processes at play for ice hockey players to determine what similarities and differences are present compared to previous research of sports that are not as interactional and dependent on teammates. It is possible a new type of flow entirely is needed, such as a distributed flow, for optimal performance with these parameters. The interactive approach will take into consideration the processing of multiple factors at once, such as focusing on oneself, the opponents, team mates, and the location of the ice. To be successful in this type of environment, the component of distributed attention is likely necessary. This component would build off of aspects from the attentional control theory but go beyond that as it is more than an antecedent; it is a component of the flow experience in its own right. Further constructs will exist without question but all will be derived from the data, which will be obtained through both qualitative and quantitative methods.

### 1.2.7 Study Plan and Expectations

To address the previous research voids discussed, interviews with ice hockey players, both amateurs and former professionals, will be conducted to get a variety of experiences, abilities, and perspectives. This approach allows for the opportunity to gain as much detail and depth as possible about these areas of exploration. The coding and analysis of these results will then inform the questionnaire design to test if these new constructs are quantitatively measurable and if so what relationships they possess with previously established psychometric measures along with performance. The results of the first quantitative study will then need to be verified and validated. The results from the quantitative study will be analysed with any modifications deemed necessary made and then the results will be verified. This multi-layered approach will open the door to a more comprehensive understanding of the flow phenomenon and the potential factors at play. The goals are first to identify flow exists within ice hockey but then take it a step further to see if a new type of flow is present in this context. Assuming this is the case and it can be identified, the next goal will be to measure it and determine its relationship with performance. The ultimate goal is the detection of a distributed type of flow that aids in performance.

This research is expected to yield new and emerging themes for flow. Ice hockey is a mixture of the four types of flow environments: individual, social, group, and team. It is possible that if these four environments are mixed, a new type of flow exists to be successful and reach optimal performance. This type of flow could be distributed flow and require hockey-specific themes. One such theme is an environmental aspect. Since the players are so dependent on each other, other people's emotions or support could play a stronger role in the flow experience than has been detected before. Distributed attention is likely an element that needs to be considered as well. With ice hockey being a faster paced sport than has been studied before along with so much happening at the same time, it is likely that attention distribution factors in to the flow experience. Players need to focus on a number of different aspects at once and it is only when they have that distribution appropriate that they can reach flow. Another new theme could be discipline. Ice hockey is a sport where everyone has a role in the team and on the ice, and players need to find balance between being disciplined and focused on their own task while helping a team mate in need or switching roles momentarily if the situation dictates. Adaptiveness is a final new potential element. This can come in two forms from adapting to whom the athlete is playing with on the ice, such as a forward's line mates or defence partner and also adapting the style of play based on what opportunities the

other team is giving if they are leaving certain parts of the ice open or playing with a specific strategy. The team as a whole right down to the individual players need to adapt their style of play and counteract the opponent's strategy.

As previously mentioned, metacognition is the reflection and critical analysis of thoughts and the process of thinking. With regards to metacognition in this research, hockey-specific themes are expected to be present as well. Attention is likely to have a metacognition factor whereby players need to be aware of what they are focusing on and when and at what points that distribution allocation needs to change. For example, players need to shift their attention to the opponents depending on where they are on the ice or what has happened, such as a turnover or the opposition breaking free to be able to accept a pass and be on a breakaway. Metacognition of resilience is another theme likely to be present. Throughout the course of the game, mistakes are guaranteed to be made. To be successful, players will have to strategise the resilience to counteract those mistakes to maintain performance levels and avoid a dip. Just as discipline is likely to factor in for flow, role metacognition is likely to be present so players know and understand their role within a team and also mentally and physically stick with it throughout the duration of the game. All and all, these factors likely exist in other sports despite playing a specific role in ice hockey. However, research in terms of specific types of metacognitions has not been conducted on a broad scale and thus remains unexplored and unchartered territory. Even resilience in sports is still in its infancy. While resilience in a general psychological context has been researched for a number of decades, it is only sporadically addressed within the sport psychology domain (Galli, & Gonzalez, 2015).Therefore, not enough studies have been conducted for a full consensus of the intricacies of resilience in sport.

The previous anticipated hockey-specific themes are likely to be present within both sample sets as they are universally necessary for hockey success. However, it is also expected that there will be differences between the interview sets as the amateurs and professionals will have different experiences of hockey. Professionals will likely have more detailed descriptions as they have spent considerable more time with the sport and likely more deeply analysed success factors. On the flip side, a lot more might come natural to them, so it might be more difficult to dig out key components. It is likely more components of flow will be highlighted for the professionals because they will have it itemised out more than the non-professionals. This is particularly true for any antecedents or aspects facilitating flow. Assuming that flow fosters performance, meaning high performance means more flow, the professionals will have likely relied on flow more than the amateurs and consequently

established routines to expedite and assist in this process. The metacognition aspect is likely to be the strongest difference between the two samples. The higher the level one plays, the more awareness is needed of thoughts, which will then possibly translate into identifying key antecedents and metacognitions necessary to get players into flow. This information will be critical to the understanding of distributed flow.

# Chapter 2: Qualitative Study (Study 1)


## Abstract

The first step in bringing flow and metacognition research into ice hockey is through qualitative measures to permit for the largest scope of overlap in established parameters whilst allowing for the potential of new ones due to the unique nature of the environment. Sixteen ice hockey players were interviewed, composed of six amateurs and 10 former National Hockey League (NHL) players. The semi-structured interviews elicited their thoughts and experiences while playing ice hockey. Both thematic and content analysis were employed to deepen the analysis of pre-established norms while also allowing for a further level of analysis between the amateurs and professional samples. The coded results were scanned for the individual flow dimensions, and any themes outside of those dimensions were categorised as distributed flow or distributed flow antecedents. Any themes eliciting awareness of thought were categorised together as types of metacognitions. Individual flow was confirmed to be present in both samples. The further coding and analysis revealed 15 factors across three themes. The first was distributed flow, composed of four factors: distributed attention, strategic timing, team support, and discipline. The next was distributed flow antecedents, made up of seven factors. These factors included routine, coaching impact, adaptiveness, game recovery, veteran presence, accountability, and staying even. Four types of metacognition made up the final factor: role metacognition, metacognition of resilience, metacognition of risk-taking, and role model metacognition. The results confirmed the existence of individual flow within ice hockey as well as the potential of distributed flow, distributed flow antecedents, and types of metacognition that require further research to confirm their scope and impact.


## 2.1 Introduction

To support filling some of the gaps in the current understanding of the flow experience and metacognition at play, research into ice hockey is needed. The first step in this process is to interview ice hockey players about their experience and thoughts while playing ice hockey. When introducing flow to a new discipline, research generally takes a qualitative approach (Jackson, 1992; 1996; Lamont & Kennelly, 2012; Partington, Partington, & Olivier, 2009; Sawyer, 2007). While this process does elicit results, there are risks in approaching a new context with a one size fits all mentality. This approach has the potential to limit the creativity of the process. It could stifle the evolution of the construct and possibly

prevent further development. Therefore, utilising this approach in part maintains the reliability that previous research has shown but also extending it opens the door more fully to a more comprehensive understanding of the phenomenon as well as the possibility of introducing a new type of flow.

For this research, the subjective descriptions and interpretations from the athletes are essential for understanding this phenomenon in different environments. Questions combining prior theory around flow and hockey specific nuances best allow for extending flow research to a new sport while also allowing for the sport and environment-specific themes to emerge. Though the sample size will be smaller than usual for quantitative research, adding scales to measure both flow and metacognition of the participants takes the research a step further to measure the flow experience within the established constructs. The quantitative aspect gives a way to back up any themes that were explored in the qualitative analysis.

Conducting this process with two samples: amateurs or recreational players and former professional players provides a number of benefits. First of all, it potentially confirms the existence of flow across all skill levels. This pattern has been followed in the past with previous sport flow research (Jackson, 1992, 1995, 1996; Stavrou et al., 2007; Stein et al., 1995) but it will be important to confirm that this trend continues in a new sport. The responses between the two samples can then be compared to determine differences in the strengths of the experiences. This analysis further opens the door to explore any large discrepancies to determine if they can be deciding factors for the potential of a player. What's more, the quantitative aspect gives a way to back up any themes that were explored in the qualitative analysis. For example, if certain components were not found with the current flow constructs, they might not be found quantitatively either, further backing the claim they are unnecessary for ice hockey flow. Inversely, if something is identified quantitatively but not qualitatively, it could point to the direction of further research and investigation.

## 2.2 Method

This study is mainly qualitative, but with the analysis of the flow and metacognition scale scores, it partially utilises a mixed methods approach. This study was twofold, the first of which was with non-professional players and the second was with former NHL players.

### 2.2.1 Participants

To extend this research to ice hockey, an amateur or non-professional sample was first explored. Amateur athletes are easier to acquire for research. The process was first conducted on these participants to confirm flow does, in fact, exist when playing ice hockey. This result then sanctioned the need for further exploration with former professional athletes. In previous research, flow has been confirmed in both types of samples, but the experience is stronger and more detailed with professional or elite athletes (Jackson, 1992; 1996; Swann, Keegan, Piggott, & Crust, 2012). The NHL is the highest level of professional hockey in the world. Thus, interviewing former players from this league is the perfect place to start as the stepping stone to bring flow research into ice hockey. It is important to determine if this pattern holds true with this case as well, and if it does, then the professional interviews are needed to get the most information about the experience and parameters as possible. Once the interviews are conducted and coded, comparisons can be made between the two samples to shed further light on any learning curve that might exist for the flow experience and metacognitions necessary to perform at the elite level. This study received ethics approval through the university and all participants provided informed consent.

#### 2.2.1.1 Amateur Participants

The amateur interview sample consisted of six interviews. The amateurs were required to have at least five years of experience playing ice hockey. The highest level experienced was not important, but the overall understanding of the game was, which is why five years' experience was used as the minimum, but in fact all players had more than that. Participants were all male and had been playing on average for 23 years. The sample included two Americans, one Canadian, one Dutch, and two British participants. Tables 3 and 4 below show the available statistics for the participants. These tables are not a full representation of the whole sample or of all of the hockey the sample has played as not all leagues record and save statistics. Another shortcoming of these statistics is that they could be slightly skewed because there is more variation in league hockey in terms of abilities and sometimes limited options of leagues to play in. So this could explain some of the extremes, such as large numbers of points if they are playing in a league beneath their skill level or no points if they are playing above their skill level.

| Years in University Hockey | Position | Games Played | Goals | Assists | Points | Penalty Minutes |
|---|---|---|---|---|---|---|
| 2 | Forward | 20 | 7 | 6 | 13 | 4 |
| 5 | Forward/Defence | 45 | 6 | 7 | 13 | 0 |
| 8 | Forward/Defence | 84 | 97 | 69 | 166 | 40 |

Table 3: Amateur Interviewees' Available University Statistics

| Years in League Hockey | Position | Games Played | Goals | Assists | Points | Penalty Minutes |
|---|---|---|---|---|---|---|
| 1 | Forward | 17 | 8 | 6 | 14 | 26 |
| 2 | Forward | 25 | 1 | 5 | 6 | 18 |
| 4 | Forward | 51 | 13 | 10 | 23 | 0 |
| 6 | Forward | 115 | 71 | 84 | 155 | 28 |

Table 4: Amateur Interviewees' Available League Statistics

#### 2.2.1.2 Former Professional Participants

Ten former NHL players were interviewed. Eight were Canadian, and two were American. Ages ranged from 32 to 65 with the average being 53.8 years of age. Time in the NHL ranged from four years to 14 years. Players were required to have played a minimum of three seasons and at least 50 games. Breaking into the league can be difficult. Teams roster more players than are allowed to dress for games, and these players are known as healthy scratches. The players are full members of the team and participate in all trainings but do not participate in the game. Sometimes it can be a one-off to rest whereas other times the same players are frequently healthy scratches depending on the performance, strategy the team is implementing, and cohesion the team is currently experiencing. Additionally, there can be frequent movement up and down between the NHL and the minor league affiliate teams, depending on season situational factors, such as performance and injuries. These criteria allow for ample exposure to the league and the requirements, both physical and mental, needed to be successful at that level. The sample played an average of 8.5 seasons in the NHL. In terms of statistics, the sample played over 4,000 games within the NHL, accumulated 2,178 points and accounted for 3,533 penalty minutes during the regular season. Collectively, the players played 221 games with 141 points and 251 penalty minutes in the postseason. The sample included 10 skaters, divided evenly by forwards and defence. Goalies were decided not to be included with this research as their experience and perspective of the game is different than the skaters' and getting a large enough sample both qualitatively and then quantitatively to confirm the qualitative findings was determined to be too difficult

given the timeframe limitations, particularly as this research was conducted during the Covid-19 pandemic. The statistics by player can be seen in Table 5.

| | | Regular Season | | | | | | Post Season / Playoffs | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Seasons in NHL** | **Position** | **Games Played** | **Goals** | **Assists** | **Points** | **Plus/ Minus** | **Penalty Minutes** | **Games Played** | **Goals** | **Assists** | **Points** | **Penalty Minutes** |
| 4 | Defence | 174 | 4 | 38 | 42 | 19 | 89 | - | - | - | - | - |
| 5 | Forward | 256 | 3 | 16 | 19 | -3 | 725 | - | - | - | - | - |
| 6 | Defence | 74 | 1 | 15 | 16 | -15 | 59 | - | - | - | - | - |
| 7 | Defence | 280 | 14 | 66 | 80 | -26 | 86 | 8 | - | - | - | - |
| 7 | Defence | 211 | 8 | 22 | 30 | 0 | 631 | 9 | - | - | - | 55 |
| 8 | Forward | 455 | 86 | 196 | 282 | -40 | 220 | 26 | 6 | 6 | 12 | 12 |
| 11 | Forward | 403 | 77 | 120 | 197 | -3 | 220 | 32 | 4 | 4 | 8 | 36 |
| 11 | Defence | 454 | 17 | 49 | 66 | 4 | 385 | 15 | 1 | 1 | 2 | 8 |
| 12 | Centre | 717 | 153 | 163 | 316 | -106 | 631 | 40 | 8 | 10 | 18 | 57 |
| 14 | Forward | 1000 | 369 | 761 | 1130 | -97 | 487 | 91 | 35 | 66 | 101 | 83 |

Table 5: Professional Interviewees' Statistics

### 2.2.2 Materials

All interviews were semi-structured, following the same guide but left openings when responses required follow up or when hockey-specific situations and themes needed to be further explored. Semi-structured interviews are the most commonly used qualitative research method as they are both versatile and flexible (DiCicco-Bloom & Crabtree, 2006; Kallio, Pietilä, Johnson & Kangasniemi, 2016). This method is suitable for studying perceptions and opinions of topics (Barriball & While, 1994) as well as meaningful issues to allow for the expression of diverse perceptions (Cridland, Jones, Caputi, & Magee, 2015). Essentially, this method allows for consistency throughout the sample with the opportunity to gain as much insight as possible as players are able to open up about their specific experiences. The first questions were all individual in the beginning based upon personal knowledge and research about each player individually. This was to establish a rapport and get the interviewee in the mind-set to think about hockey and answer questions. In terms of the interview guide, questions were asked from the individual perspective as well as ones impacted by team mates and opponents. They were also designed to prompt any flow themes as well as thought awareness while playing to elicit any specific types of metacognitions. The locations of the ice in addition to different scoring situations were considered to give as comprehensive of a picture as possible. If participants confirmed their focus was different depending on whatever variable was being discussed, further probing questions were asked to gain as much insight as possible. Additionally, any specific points related to a player's role or playing journey were addressed in individual interviews. Examples include an enforcer being asked about maintaining focus throughout the game when shifts and ice time were limited or players who went up and down in the league frequently about the differences in focus and mental preparation and resilience required. The interview guide can be found in Appendix 2.

When flow research has been extended to new sports, it has always been done through confirmation of known themes, meaning confirming individual flow in the new environment (Jackson, 1992; 1996; Lamont & Kennelly, 2012; Partington et al, 2009). Every sport has individual aspects even within a team. Continuing this precedence is the logical first step for new research. When new types of flow have been identified, such as group or social flow, they have had some of the original components and then extended on from there based on the new environment (Sawyer, 2007; Walker, 2010). Moreover, research about sport performance is retroactive by nature. It makes sense to start individually as players are most

likely to have the strongest memories on that level and then expand from there to see what environmental and personnel impacts exist on the ice hockey experience.

Following the interview, participants were given four questionnaires, which can be found in Appendix 3. The first two were the Flow Short Scale (Rheinberg, Vollmeyer, & Engeser, 2003) and the Short Flow Dispositional Scale 2 (SDFS-2) (Jackson, Martin, & Eklund, 2008), which measure the original nine components of flow as proposed by Jackson and Csikszentmihalyi (1999). This research treated the two scales in the Flow Short Scale separately, just utilising the 10 items as it is solely focused on the flow construct and not the perceived demand/skills fit. The third flow measure is the Short Flow in Work Scale (SFWS) (Moneta, 2017), measuring the intensity of the flow experience. The last measure is the Flow Metacognition Questionnaire (FMQ) (Wilson & Moneta, 2016), which, as the name suggests, measures the metacognitions of flow.

### 2.2.3 Procedure

Players were approached through personal channels. The researcher had personally played ice hockey with the entire amateur sample. The former professional sample was also obtained through personal channels of the researcher through either personal playing experience or being introduced to other players through the personal acquaintances.

To orientate the hockey players with flow and metacognition, they were given an information sheet with details of both concepts as well as the nature of the study. When flow and flow metacognition research has been performed in the past, participants have been given the definitions and asked if they have ever had such experiences and then told that those experiences would be called flow and asked to refer to those experiences as they answer the questions (Moneta, 2017; Wilson & Moneta, 2016). This process is to ensure all participants are on the same page and correctly understanding and referencing the same parameters. As the questions are meant to probe the specifics of the experience, there is no need for secrecy about the experience as that could actually hinder the research process. The briefing, consent, and debriefing forms can be seen in Appendix 1. The same interview schedule was used for both samples. Semi-structured interviews were conducted, ranging from 30-45 minutes in which all participants were asked the same questions with additional follow up questions or individual role-specific questions where necessary. The interview guide can be found in appendix 2.

Upon completion of the interviews, participants were given the four questionnaires to complete. All of the amateurs completed the questionnaire. Due to time constraints, one of the former professional participants was not able to complete the questionnaire, so only nine responses were recorded for the former professionals.

#### 2.2.3.1 Data Analysis

The interviews were audio recorded and then transcribed. One of the most common forms of qualitative research analysis is thematic analysis, which, as the name suggests, examines and records themes to extract the meanings and concepts from data (Guest, MacQueen, & Namey, 2012; Tjandra, Osei, Ensor, & Omar, 2013). Thematic analysis provides a flexible and systematic method for qualitative analysis and is useful in highlighting similarities and differences across data sets as well as identifying any unanticipated insights (Braun & Clarke, 2006). This method was determined to be a better fit for this research than interpretative phenomenological analysis (IPA), another common qualitative research method. IPA is generally used for very small samples and a more narrowed and idiographic focus (Smith & Shinebourne, 2012). Therefore, since two samples were to be compared and a patterned-meaning across both data sets was expected, thematic analysis was well suited for this research. This approach was deemed the better option to allow for the possibility of new or unanticipated themes to open the door to a new type of flow.

Thematic analysis was carried out of the verbatim transcripts in a two-step procedure whereby the specific quotes were examined to identify raw data themes. This procedure was recommended by Patton (1990) and has been used by a number of sport psychology researchers (Jackson, 1992; Jackson, 1996; Weiss, Barber, Ebbeck, & Sisley, 1991). This method has been followed for all of the interviews in both phases. A deductive coding process was employed first to detect individual flow components as the first step was to extend previous flow research to ice hockey. After that process had been completed, the transcripts were assessed for additional themes. An inductive coding process was employed for this step so that their responses completely steered the results and would not be clouded by any previous research findings. Statements eliciting specific strategies, feelings, and thought processes were taken from all of the interviews and compiled together. Then, the items were grouped by theme.

Content analysis was also utilised in this research and can take place in a number of different ways. One of the most common transforms qualitative data into quantitative data by measuring the frequency of certain themes (Vaismoradi, Turunen, & Bondas, 2013). The purpose is to essentially examine who says what and any effects of that in the content (Bloor & Wood, 2006). It was used for this research to add an objective element to the analysis and gain as much insight from these interviews as possible.

Although it is not overly common to include both thematic and content analysis within the same research, it has been done to deepen the analysis past pre-established norms (Amabile & Kramer, 2011; Amabile, Schatzel, Moneta, & Kramer, 2004). For this research, the majority of analysis was through thematic analysis to elicit as deep of meaning and explanation of the themes as possible, and content analysis was restricted to the number of mentions of each themes, the number of different players who mentioned the theme, and the total word count for the theme. This further analysis allows for deeper understanding of the new themes as well as a further level of analysis between the amateur and professional samples as it is possible to see how strongly the themes were valued. The number of players, or the scope, from the sample is clearly important to take into consideration with the analysis and interpretation of the results. This way, one or two players strongly valuing a particular theme would not be overvalued just because there were a number of mentions regarding it or the high word count. The strength of the theme is discussed both in terms of the salience of the theme as well as the frequency. As a general rule, the themes that were strong in both salience and frequency were regarded as the most important followed by high salience and then high frequency.

After each section, a table sums up the results for the dimensions. The table lists the number of mentions and then divides those mentions out to the individual and team perspectives, listing that information in digit and percentage format. Scope refers to the number of different participants who mentioned it, and the percentage sample is the scope out of the total interview sample (six for the amateurs and ten for the professionals).

The amateur and professional results were analysed separately. Once that analysis was complete, they were then compared. As flow research has been extended to sports qualitatively, it has typically taken the approach to do so with the same level of athletes and then compare the findings with others (Bakker et al., 2011; Canham & Wiley, 2003; Chavez, 2008). It is through the comparison between accomplished and less accomplished athletes that one has the opportunity to identify themes that are unique to the former and hence may be essential to develop psychological resources that foster a successful career. First, the

results from the four categories: individual flow, distributed flow, distributed flow antecedents, and metacognition, were compared between the two samples. Then the elements were classified into three categories: distributed flow components, distributed flow antecedents, and metacognition. When analysing the responses, common themes were grouped together. The responses were then interpreted to determine the impact that specific theme would have on the player or the game. That information then determined which category the theme fit into, which means there could be movement from previous flow research. For example, a theme might be detected which is classified as an individual flow component. However, based upon the description and context, that theme might be determined to be an antecedent in this context.

The results and analysis took part in four phases. The first was the content and thematic analysis of the amateur interviews. The coded results were scanned for the individual flow dimensions, and any themes outside of those dimensions were categorised as dimensions of distributed flow or antecedents. Any themes eliciting awareness of thought were categorised together as types of metacognition. The new findings for both flow and metacognition were then analysed. The next was the content and thematic analysis for the professional interviews, which followed the same process. Then, the results between the two samples were compared to determine any differences in the flow experiences and metacognitions between the amateur and former professional ice hockey players. These differences could shed light on the most essential aspects as they are present in both samples as well as the learning curve to go from amateur to professional where one sample had more prominent experiences of a particular dimension. Finally, the quantitative results were tallied and compared against both samples and then against the qualitative findings to see if the findings matched, or held consistent, or if any differences were noted between the results. It is important to see if the findings are replicated through both studies as it provides further credibility to the interview results, and any discrepancies highlight potential avenues for further investigation.

## 2.3. Results and Discussion

### 2.3.1 Amateur Analysis

#### 2.3.1.1 Amateur Individual Flow

Out of the original nine flow components, seven were found to be present. The seven confirmed themes were concentration, task and person viewed as one, intrinsic rewards, specific goal, loss of self-consciousness, balance between skill and task, and sense of control. From a content analysis perspective, concentration had nine mentions from five different players with two of them being reverse. This dimension had the highest response rate out of all of the individual flow dimensions. Thematically, the responses confirm concentration is necessary, and the reverse mentions confirm how much impact distracting thoughts can have on the game. Unsurprisingly, all but one of the responses were at the individual level rather than from a team perspective. The next component was task and person viewed as one, which had seven mentions from four different players from the content analysis. From a thematic analysis perspective, these responses reflected a dialled in concentration on the player doing his job. Intrinsic rewards was the third strongest detected individual flow dimension with seven mentions from four different players content-wise. Thematic-wise, these responses highlighted the players wanting to have fun and enjoy their environment. Specific goal was another strong presence from the content analysis with six mentions from half of the sample. The thematic analysis showed the overall feeling was the players knowing what they needed to do and going out and executing it. Next was loss of self-consciousness, which content-wise, had seven mentions but only from two players. Thematically, these responses emphasised the importance of being relaxed and not overthinking or being preoccupied by anything. Balance between skill and task was the sixth dimension detected and the content analysis revealed four mentions again from only two players. However, those two players had the strongest hockey background in the amateur sample and thus this dimension might only come into play with more experienced or skilled players. The thematic analysis revealed that out of the four mentions, three were positive with a focus on being relaxed and confident even if the team was trailing in the game. The reverse mention explained the lack of balance between skill and task often means when the team goes behind in a game, they do not recover since they do not believe they can. Finally, sense of control only had one mention content-wise, and thematically, it was in the context of focusing on the present and changing what is

happening to control the game. Even though all of the individual flow components were not detected with this sample, three-fourths of them were only missing clear feedback and transformation of time. These results confirm aspects of individual flow are present in ice hockey.

The two missing individual flow components were clear feedback and transformation of time. These two dimensions not being present within ice hockey could be due to the nature of the game. In terms of clear feedback, there could be less ambiguity with performance feedback than in other sports studied with flow as it is instantaneous and obvious. Consequently, it might not be relevant for flow within an ice hockey context. A feeling of transformation of time might not be involved with ice hockey as the game is so fast-paced to begin with that it is a natural feeling as part of the game that time has flown by. Alternatively, these dimensions might not be detected with amateurs but necessary at the professional level and thus will be identified in their interviews. A summary of the results can be seen in Table 6.

| Individual Flow Characteristics | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Concentration | 9 | 8 | 89% | 1 | 11% | 5 | 83% | 219 |
| Task and Person Viewed as One | 7 | 7 | 100% | - | - | 4 | 67% | 70 |
| Intrinsic Rewards | 7 | 3 | 43% | 4 | 57% | 4 | 67% | 98 |
| Specific Goal | 6 | 2 | 33% | 4 | 67% | 3 | 50% | 156 |
| Loss of Self-consciousness | 7 | 5 | 71% | 2 | 29% | 2 | 33% | 150 |
| Balance Between Skill and Task | 4 | 2 | 50% | 2 | 50% | 2 | 33% | 70 |
| Sense of Control | 1 | 1 | 100% | - | - | 1 | 17% | 11 |

Table 6: Amateur Individual Flow Results

#### 2.3.1.2 Amateur Distributed Flow

Four distributed flow components were identified that have not been included as flow dimensions in previous research: distributed attention, discipline, team support, and strategic timing. These components could be necessary for distributed flow. The content analysis revealed that distributed attention had the highest percentage sample with all but one

participant recognising it through 10 mentions. It is clearly an interactive component with seven mentions being from a team perspective and only three from an individual viewpoint. By the nature of the game, ice hockey has many different things happening at once and thus a player's focus is constantly changing depending on the location of the ice and the player's individual responsibility in response to the threat of the opposing players, which was highlighted by the thematic analysis. Going along with this idea is a player's need for discipline and sticking to his own job. Discipline had the highest number of mentions at 11 from two-thirds of the sample from a content analysis perspective. Thematically, interviewees described the need to be disciplined to focus on themselves and their own job and not get caught up worrying about their teammates and trying to do their jobs as well. A player can only take care of one job at a time and needs to have faith the other jobs will be taken care of by teammates. Even though players need to focus on themselves and their own jobs, they also need to support each other throughout the game. By the nature of the game, there are certain situations where players might need to momentarily change roles with a teammate to help make a play or cover a mistake. These situations involve both of the previous two new flow dimensions as players need to be focused on multiple things at once to recognise this situation and discipline to just do the new role until a change back to the original job is available. Content-wise team support had nine mentions from four participants while thematically it was present in both physical and emotional contexts. From an emotional standpoint, one interviewee described a case where the team was struggling to come together and had let in a number of goals during the first period. During the break before the second period started, he called the goalie over to tell him to relax and explained that the whole team is there for him. This player was emphasising the fact that ice hockey is a team sport and everyone is there to support each other. Even though the goalie is the last line of defence, he is not alone out there. During the game, everything is moving quickly so the players do not always have a chance to talk to each other, especially the defence with the offence. So the period breaks can be very important to show support and bring everyone together to talk as a team rather than separating them and talking about individual strategies for positions. The physical aspect comes from supporting each other on the ice and not having players hog the puck, skating end to end, especially if they end up losing it and causing a turnover without being able to finish and score. These components could have been prevalent in the interviews due to the distinct nature of ice hockey, which is why they have not been found in other flow sport research. Lastly, the content analysis revealed strategic timing had seven mentions from half of the sample. The thematic analysis showed the mentions were split between referring

to shifting the momentum of the game and knowing when to time the change to make the shift. One player described a situation where the line combinations were not working and the other team had scored a number of goals in the beginning of the game. The player asked the coach to change the line combinations back to what they had been in a previous game that worked, and the coach said to wait until the start of the next period to which the player responded that it would be waiting too long to do that and the momentum needed to shift then to have it going into the next period. The coach did then change the lines and the team was able to come from behind to win the game. Hockey has a strong presence of momentum and being able to both understand and time that momentum is crucial for success. The other half were in terms of understanding the timing of the game and executing a specific play at the right time as well as having the right attitude at the right time, like having fun as much as possible but knowing when to kick it in high gear and be serious.

When it comes to saliency and frequency, distributed attention was the strongest in both saliency and frequency. Strategic timing is thought to be just as important because even though it is the lowest in terms of the frequency measures, it is still very potent in the explanation. Discipline and team support are in the middle. They are not overly impressive in either saliency or frequency but since they have both, they should still be considered and not overlooked. The full overview can be seen below in Table 7.

| Distributed Flow Characteristics | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Distributed Attention | 10 | 3 | 30% | 7 | 70% | 5 | 83% | 245 |
| Discipline | 11 | 9 | 82% | 2 | 12% | 4 | 67% | 265 |
| Team Support | 9 | 1 | 11% | 8 | 89% | 4 | 67% | 271 |
| Strategic Timing | 7 | 2 | 29% | 5 | 71% | 3 | 50% | 156 |

Table 7: Amateur Distributed Flow Results

Distributed flow antecedents were the next category, and these interviews identified two: adaptiveness and game recovery. The content analysis showed adaptiveness had the highest percentage sample with two-thirds of the sample each having one mention. Thematically, the amateurs described adaptiveness in the context of adapting to line mates with a strong preference towards playing with the same line mates throughout the season. Even though it is not always possible, playing with the same line mates builds chemistry and allows each player to play his own style of game rather than changing and adjusting to fit the style of new line mates. Since ice hockey is such an interdependent sport, familiarity with

people on the ice can impact and boost performance during a game and likewise has the potential to have the equivalent adverse impact with lack of familiarity. Game recovery, on the other hand, had four mentions from two different participants from the content analysis. The thematic analysis revealed that all of the mentions were from an individual perspective. Game recovery is the idea of balancing processing and addressing issues from the previous game with moving on to thinking about the upcoming game. The one player stated he had a short memory and did not spend much time reflecting on the previous game. It could be that this approach is necessary not to feel bogged down for the next game with past mistakes that cannot be corrected at this stage. It is also possible that reflection is necessary in order to build and progress. Thus, this could be something that the professionals do but might not exist at the amateur level. Other mentions included visualising scoring goals. Playing hockey and being successful would play in the background of the player's mind while leading up to a game. These two distribut flow antecedents played a role in the flow experience for the amateur players and will need to be compared to the professional results to have a more complete understanding of their role and importance.

Neither of these two antecedents was overly impressive in terms of salience but both still had substance. Adaptiveness had double the frequency of game recovery. It will be interesting to compare this result with the professionals to see if this result sticks or it could be an amateur identifier.

| Distributed Flow Antecedents | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Adaptiveness | 4 | 4 | 100% | - | - | 4 | 67% | 197 |
| Game Recovery | 4 | 4 | 100% | - | - | 2 | 33% | 106 |

Table 8: Amateur Distributed Flow Antecedents

#### 2.3.1.3 Amateur Metacognition

These interviews also identified four types of metacognition: metacognition of resilience, role metacognition, role model metacognition, and metacognition of risk-taking. These were determined to be metacognition instead of just cognitions because they involve a high order of cognitive process. The items showed a level of awareness, reflection, and control of thought process rather than just thought process, which would constitute cognition. From a content analysis perspective, metacognition of resilience was the strongest metacognition type present with 21 mentions from all six participants. The thematic analysis

revealed this type of metacognition took place in two different contexts: during the game and after the game. The majority of comments were in reference to during the game in various forms such as the game getting off to a bad start, getting off the ice after making a bad play, or keeping consistent attention even when chances of scoring are not producing results as to not get down, change the focus, or lose positivity. When individual players and even the team as a whole was not troubled by these events, the team had resiliency. Four of those mentions came from one participant who emphasised having the right temperament and not being troubled during the game. Although not as numerous, some of the mentions discussed thinking about the game or specific plays after it had concluded and practicing specific skills as to not repeat those mistakes the next game. In a sense, the in game metacognition of resilience was all mental while the post-game version was physical practice to not have an emotional scar or weakness for the next game. Role metacognition was the second strongest with 18 mentions also from everyone in the sample revealed from the content analysis. Thematically, this dimension was present both in the context of a role within a team and a role on the ice doing a specific job. In terms of a team role, one respondent stated:

> *In championship teams that I've played on, and there have been a few, there was a definite closeness. And a familiarity as players and people. Everybody knew where they were in the pecking order of the changing room and the ice and accepted that because they were just happy to be a part of that team. Players that may have been a star on another team but were very average on this team took that in stride and were happy to do the best they could and support.*

*From an on ice perspective, one respondent explained:*

> *I guess you could answer this in a very hockey related sense in terms of who you are paying attention to on the other team and also kind of your responsibilities on that particular section on the ice, whether or not you are containing a player or whether or not you are fore-checking trying to win back possession.*

From these descriptions, role metacognition is clearly related to task and person being viewed as one from individual flow as well as discipline in distributed flow and could be the metacognition necessary to achieve both. The content analysis showed the remaining two types of metacognition had two mentions from two different players. Thematically, role model metacognition is the act of watching other people and either mimicking their state of flow as best as possible or seeing what is not working and learning that way. This type of learning method is common in countless activities and makes sense players would utilise this method in ice hockey as well. Metacognition of risk-taking can be described as almost the

inverse of discipline experienced with distributed flow. The score and the amount of time left in the game both being in an unfavourable position impact discipline (i.e. a team is trailing late in a game) and result in more risk-taking and individual play. The metacognition of that situation coupled with discipline can present balance in that scenario. These results are especially interesting as this is the first time specific types of metacognition have been identified with sport performance. Obviously, metacognition of resilience and role metacognition are extremely strong for both saliency and frequency. Role model metacognition and metacognition of risk-taking are noticeably lower and considerably less significant. Unless the professional interviews yield opposite results, these two are not likely to be strong contenders for the scale development and validation studies. The full breakdown for this category is shown below in Table 9.

| Types of Metacognition | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Metacognition of Resilience | 21 | 16 | 74% | 5 | 26% | 6 | 100% | 475 |
| Role Metacognition | 18 | 14 | 78% | 4 | 22% | 6 | 100% | 500 |
| Role Model Metacognition | 2 | 2 | 100% | - | - | 2 | 33% | 88 |
| Metacognition of Risk-Taking | 2 | 1 | 50% | 1 | 50% | 2 | 33% | 86 |

Table 9: Amateur Types of Metacognition

Overall, the first stage of interviews yielded strong results. They have confirmed that flow does exist within ice hockey. They have also identified unique characteristics of flow to be considered in an ice hockey context. Furthermore, the interviews, have confirmed the strong need for metacognition encompassing all aspects of the game. The next stage is to conduct the same interviews with former professional players to both confirm the presence of these components and possibly open the door for additional ones that might provide insight into getting to the professional level.

### 2.3.2 Professional Analysis

#### 2.3.2.1 Professional Individual Flow

Thematic analysis of the former professional interviews confirmed eight of the original nine flow dimensions, which can be seen in Table 10. Intrinsic rewards was the only dimension not present in the professional interviews. It is possible intrinsic rewards are not actually necessary for this type of flow, or they might be a consequence rather than a flow dimension. Alternatively, the players may not have looked at playing ice hockey as an intrinsically rewarding experience since it was considered their job.

The content analysis revealed sense of control was the strongest original flow theme present for the former professional players with 16 mentions from 60 per cent of the sample. The overall message thematically was that not everything in the game of hockey can be controlled, but rather when players focus on what they can control, good things happen. This blinder view came in two forms from focusing on the individual game and not being able to control teammates to collectively understanding they cannot control the other team's strategy but they can come together and control their own, which is where the focus needs to be. Back to the content analysis, loss of self-consciousness had fewer mentions with 9 and a lower sample percentage at 50 per cent. Thematically, five of the mentions were very strong flow explanations, three at the individual level and two discussing winning the Stanley Cup at the team level. The remaining four mentions were focusing on the importance of being in the present moment and not letting outside matters cloud the focus as that can negatively impact reaching that level. To achieve the ultimate goal for a professional hockey player, this facet needs to be taken a step further to include the team dynamic. Balance between skill and task had fewer mentions with only six but had the same sample scope of 50 per cent from the content analysis. The thematic analysis revealed that every single example mentioned confidence as being the difference maker for performance. The next flow dimension of concentration had mentions from five players. All eight of these mentions confirmed the significance of concentration for success during an ice hockey game. Interestingly, one pointed out that he was able to be distracted throughout the course of the game. However, when he was on the ice for his shift, he rarely got distracted. Another mentioned a reset strategy in a sense whereby if he noticed his mind wandering while on the bench, he would refocus himself back to the game. This is an interesting distinction with flow for ice hockey specifically since players have a number of short shifts throughout the game, it is possible

concentration takes place in stages and continual refocusing is sometimes necessary throughout the course of the game. Content-wise task and person viewed as one was the fifth flow dimension with two mentions from two different players. Both were from the individual perspective. Clear feedback only had one mention. Thematically, it highlighted the impact of positive reinforcement and the boost it can give on confidence and playing performance. Returning to the content analysis, specific goal had two mentions from one player. Thematic analysis showed that both of those mentions were in reference to the specific goal of scoring every shift. While most shifts that goal is not realised, that is the specific goal for most forwards each shift. The final flow component was the transformation of time, detected with just one mention from one player. Shifting from the content analysis to the thematic analysis, this example denoted the feeling of the play slowing down with the right plays standing out quicker than usual, almost making the game feel easier than normal.

| Individual Flow Characteristics | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Sense of Control | 16 | 14 | 87% | 2 | 13% | 6 | 60% | 411 |
| Loss of Self-consciousness | 9 | 7 | 78% | 2 | 22% | 5 | 50% | 434 |
| Balance Between Skill and Task | 6 | 2 | 33% | 4 | 67% | 5 | 50% | 240 |
| Concentration | 8 | 5 | 100% | 0 | 0% | 5 | 50% | 295 |
| Task and Person Viewed as One | 2 | 2 | 100% | 0 | 0% | 2 | 20% | 44 |
| Clear Feedback | 1 | 1 | 100% | 0 | 0% | 1 | 10% | 92 |
| Specific Goal | 2 | 2 | 100% | 0 | 0% | 1 | 10% | 132 |
| Transformation of Time | 1 | 1 | 100% | 0 | 0% | 1 | 10% | 44 |

Table 10: Professional Individual Flow Results

These results confirm that individual flow does exist in ice hockey with all dimensions except for one being detected. Some dimensions were clearly more prevalent than others. Further analysis is needed for any new potential flow themes, antecedents, and consequences to further understand the flow experience in ice hockey.

#### 2.3.2.2 Professional Distributed Flow

These interviews confirmed four distributed flow components: distributed attention, strategic timing, team support, and discipline. The content analysis showed distributed attention had the highest response rate with 13 mentions from seven different players. The thematic analysis showed the majority of focus was spent on oneself but focusing on the opponent was a large second to both notice and exploit weaknesses. Minimal attention was spent focusing on teammates. Players need to firstly focus on themselves to ensure they are playing properly, but in order for them to play optimally, they do need to be aware of their opponents to maximise every opportunity given. Trusting teammates is essential, especially at that level, and the more trust in teammates allows for less attention spent on them to better optimise personal play. The second strongest item according to the content analysis was strategic timing, which had nine mentions from five participants. Thematic analysis revealed this component also came in different forms. The most common mentions involved reading the game and reacting appropriately. This reference is in game, in the moment. The next most common reference was modifying the team game for the opponent. This strategy takes place during pre-game preparations. It is not as time-critical and is a more proactive approach rather than reactive. The final two forms were tied in mentions with two each. The first was doing something during the game to shift the momentum from the opposition to their team and the second was a reverse reference where the score line could act as a distraction. If a team is up by a number of goals, they are not as tuned into the timing of the game. Team support was the next strongest item with eight mentions from four different players content-wise. Naturally, all of these mentions were from a team perspective. This theme emphasised encouragement, camaraderie, and communication. In terms of encouragement, players viewed giving their all on the ice would help on the scoresheet as well as encourage teammates. Camaraderie came in the form of team cohesion and was viewed as the difference maker when facing a more skilled team as those bonds pushed the team to fight for each other on the ice and beat teams, which were considered stronger skill-wise. Communication can aid in the camaraderie of a team. One player sums it up:

> *I never played on a bad team that had good communication. You know, throughout the coaching staff, the players, whatever it was, all of the bad teams I played on, there was shit going on behind closed doors.*

Communication is essential from everybody, and without it, the team does not stand a chance of success. Finally, discipline had just four mentions from three different players from the

content analysis. Thematically, there was one mention of discipline in terms of self-focus where the player was focused on doing his own job and felt like everyone else was responsible for pulling their own weight. The other mentions were at the team level, whether it was focusing on the team as a whole or focusing on the opponent. One player explained the more quality and higher level of players on the team, the more the focus shifts to the opponent because information is valuable at that stage. The lower the level, the less that information matters and the more focus needs to be on team play since the team is more limited in that context. Even though the NHL is the most elite professional league in the world for ice hockey, there are still skill discrepancies between players on a team and teams within the league, so this distinction is still relevant even at that highest level. Even though distributed attention had the strongest results within the sample, all three seem to be important for distributed flow in ice hockey and are contributing factors to the experience as can be seen from the breakdown in Table 11.

As with the amateurs, distributed attention was top in both saliency and frequency. Strategic timing was not as strong for frequency but still potent in the descriptions. Team support was solid on both, so it is expected to play somewhat of a role. Finally, discipline deserves attention and consideration but not expected to play a strong future role.

| Distributed Flow Characteristics | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Distributed Attention | 13 | 2 | 15% | 11 | 85% | 7 | 70% | 435 |
| Strategic Timing | 9 | 7 | 78% | 2 | 22% | 5 | 50% | 303 |
| Team Support | 8 | 0 | - | 8 | 100% | 4 | 40% | 537 |
| Discipline | 4 | 1 | 25% | 3 | 75% | 3 | 30% | 173 |

Table 11: Professional Distributed Flow Results

These interviews also identified seven distributed flow antecedents. These seven antecedents were routine, adaptiveness, coaching impact, accountability, game recovery, veteran presence, and staying even. From the content analysis, routine was the highest ranking by far with 23 mentions from everyone in the sample. Thematically, the references fit into four categories: routine for the sake of consistency, food preparation, reverse mentions, and studying film. There were 16 mentions from the players that stated they had a daily routine, particularly for game days, but they did not feel it was superstitious at all; it was just there so there was consistency while constantly traveling and being in a new place. In terms of food preparation, the players liked to eat or have their coffees at certain times on game

days and after the game focus on recovery and getting nutrients back into their bodies. The two reverse mentions were from a forward who said that they did not get enough rest throughout the season, and he felt like he started the season off in his best shape and throughout the course of the year, he would feel run down. He was, however, one of the older interviewees from the sample. Players nowadays have more optional skates throughout the season to allow for rest time and recovery. It is quite possible that this aspect is no longer relevant in today's NHL. Finally, one of the enforcers from the sample stated he would study tape of the fighters on other teams to know what to expect and prepare for games. Adaptiveness was the second strongest distributed flow antecedent with 13 mentions from eight different respondents according to the content analysis and thematically was explained by coaches not changing the line combinations too much because they wanted consistency, but sometimes a change was necessary. The players viewed the change as an opportunity to create something new or make a change in their game while understanding the need to communicate more with their new line mates to ensure players were clear on style of play and playing within their comfort zone. The next antecedent was coaching impact with a content analysis result of 11 mentions also from seven different players. The thematic analysis noted how important that relationship was to their performance. Common themes included allowing the players to play and trusting in their abilities to allow them to maximise their performance, good communication, and understanding the individual player's needs.

The next three antecedents of accountability, game recovery, and veteran presence all had responses from four different participants. Accountability had the most mentions with seven. However, thematically, the seven mentions came from different angles, from players being held accountable for their performance and sometimes being held out of the line-up to the enforcer's view:

> *But there were still moments where one of the teammates needed to get put in his place, and I was also kind of asked to do that job too, even if it was a superstar.*

The coaches were also discussed as instilling a level of accountability for everyone. No matter the role within the team, everyone needs to be held accountable for players to reach top performance, and sometimes a reminder, which can come in different forms, is necessary. Game recovery had one less response with six, but thematically they were universal, stating the need to unwind and reflect on what had just happened in the previous game before shifting focus onto the next one, which typically happened the next day or day of the game, depending on the schedule. Players confirmed the need to take time to process and recover from a game before moving on to preparation for the next one. Finally, veteran presence was

another one with a universal message from the four responses, stating the veteran presence, largely in the form of leadership, can set the tone for the entire team. To have players who have been through it before as the nucleus of the team, showing the new guys the ropes can get everyone on the same page, which fosters team success. The last antecedent is staying even, described content-wise with three mentions from two different players. Staying even is important, particularly at the NHL level because the season is so long. It is easy to get overtaken in the high and low moments. That consistency is also important when players are bouncing back and forth between the NHL and the lower league as often happens at the beginning of a player's professional career or if they are struggling with performance. So an even-keeled nature can help with a more consistent and frequent experience of flow.

As shown in Table 12 below, routine, adaptiveness and coaching impact are top three for both saliency and frequency and thus expected to be the most important going forward. Accountability and veteran presence are next in terms of saliency and thus expected to possibly be important. Game recovery and staying even are the lowest and not expected to be large contributors but still should be investigated. Overall, these seven antecedents are interesting and show the necessary components for hockey players to experience. They confirm the players have spent considerable time analysing their game and the necessary factors to perform optimally.

| Distributed Flow Antecedents | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Routine | 23 | 23 | 100% | - | 0% | 10 | 100% | 711 |
| Adaptiveness | 13 | 11 | 85% | 2 | 15% | 8 | 80% | 356 |
| Coaching Impact | 11 | 7 | 64% | 4 | 36% | 7 | 70% | 561 |
| Accountability | 7 | 5 | 71% | 2 | 29% | 4 | 40% | 200 |
| Game Recovery | 6 | 6 | 100% | - | 0% | 4 | 40% | 115 |
| Veteran Presence | 4 | 0 | - | 4 | 100% | 4 | 40% | 203 |
| Staying Even | 3 | 3 | 100% | - | 0% | 2 | 20% | 136 |

Table 12: Professional Distributed Flow Antecedent Results

The professional interviews did not yield any distributed flow consequences. It is possible that since the professionals viewed playing ice hockey as their job, they were more focused on the flow experience and the factors that can both assist and inhibit its occurrence than analysing any consequences.

#### 2.3.2.3 Professional Metacognition

These interviews identified four types of metacognition: role metacognition, metacognition of resilience, metacognition of risk-taking, and role model metacognition. The content analysis revealed that role metacognition was the strongest theme and had support from all participants except for one. The thematic analysis showed that from an individual perspective, it is about recognising the individual role within the team because it can come in so many different forms. This was the most common explanation of the element. However, it also came in terms of understanding the role of everyone else on the team and adjusting your role to best fit the situation, meaning one's role might change depending on the strengths of the people with whom he is on the ice. Different roles can require different mental strategies throughout the game. A goal scorer was just focused on scoring goals and then once that happened, he would want to go to the bench and reset so he was focused on his next shift to try to score another one while an enforcer pointed out he would need to stay alert throughout the game but would not be as engaged with it as his ice time would be much more limited, which presented a large mental challenge. Ultimately, since putting together a hockey team is largely like fitting together a puzzle, everyone needs to make sure they fit together. Players need to know their individual roles as well as the overall big team picture. Everyone fitting together pushes for optimal performance, which can be the tipping point to edging out the competition. With 18 mentions from eight different participants, metacognition of resilience was the next strongest theme from a content analysis perspective. Thematically, this item also came in different forms. The first was in terms of having the ability to set bad plays aside and just move forward though no particular strategy or routine was mentioned to assist with this. There was one inverse mention about being angry with oneself if a mistake was made and then thinking about what needed to be done the next shift. It seems this player was one step short of a reset when being on the bench between shifts and thus he might not have been able to fully experience flow while playing or reach that state as often. It was pointed out that the quicker a player got a chance to recover from a mistake, the easier it was. The final angle was for when a player missed a shot or a play and he would make a point to do something physical the next day to erase the emotional scar of it. This way the next time that player thought of that shot or skill, he would just remember the good attempts and not the emotional scar of missing it. The next content analysis of metacognition of risk-taking identified seven mentions also from six players. The thematic analysis revealed two of the mentions were from the team perspective, emphasising the importance of playing smart hockey, which is

especially important against good teams so the players always know where to go with the puck if they got in trouble. Out of the five individual mentions, all of those responses except for one were dependent on the score of the game. If the team was ahead, players noted taking fewer risks and relaxing more than in games when they had to play catch-up. The other response was in terms of changing positions and explained that if a player is not comfortable with his position, he might play more conservatively, which is not good for the game of hockey. Ultimately, metacognition of risk-taking is determined on comfort. These two responses are inversely related to the nature of the game. If the team is ahead, they are comfortable and take fewer risks; if they are behind, they are not comfortable and therefore are forced to take risks. However, if a player is not comfortable in his position, he is not going to take risks. Risks are an inherent part of the game and managing those risks are essential, which requires metacognition of risk-taking. So, from a team perspective, risks are not necessarily good, but from an individual one, they are more welcomed. It could be that if an individual player takes a risk that backfires, there is a whole team to cover for it, so the impact is not as great as if the team as a whole is taking risks and they do not pay off so there is no one to compensate and thus they get burned. This is why it is important for the team as a whole to play smart, so the recovery in these situations is quick and easy. The final type of metacognition was role model metacognition with two mentions from two players content-wise. On the other hand, thematically, as the name suggests, role model metacognition is looking to others and replicating their behaviours, such as teammates who are in flow, or learning from smart hockey players as much as possible.

Table 13 below shows to compiled results. Role metacognition and metacognition of resilience are top two for both salience and frequency, so they are expected to be the most important. Metacognition of risk-taking is not expected to be as strong but present. Role model metacognition is likely to be dropped but still deserves further investigation. All and all, these interviews confirm a variety and depth of thoughts players have during games, many of which are sport specific and could be significant to help players more frequently reach a state of flow when playing ice hockey.

| Types of Metacognition | Mentions | Individual Mentions | Individual Percentage | Team Mentions | Team Percentage | Scope | Percentage of Sample | Word Count |
|---|---|---|---|---|---|---|---|---|
| Role Metacognition | 28 | 18 | 64% | 10 | 36% | 9 | 90% | 1,383 |
| Metacognition of Resilience | 16 | 15 | 94% | 1 | 6% | 7 | 70% | 875 |
| Metacognition of Risk-Taking | 7 | 5 | 71% | 2 | 39% | 6 | 60% | 201 |
| Role Model Metacognition | 2 | 1 | 50% | 1 | 50% | 2 | 20% | 43 |

Table 13: Professional Metacognition Results

#### 2.3.2.4 Positional Analysis

Since more information is known about the professionals in terms of position and career statistics, further analysis can be performed about their responses. Professionals usually specialise in one position whereas amateurs often end up playing multiple positions, depending on each team they play on and what the needs are of that specific team and the individual's skills. If professionals change positions, it is likely between a winger and centre whereas amateurs often play both forwards and defence. Therefore, their experience is not as specialised. Their responses were grouped according to position of forwards and defence and further scrutinised to see if any additional insight can be sought.

##### 2.3.2.4.1 Individual Flow

In terms of individual flow characteristics, both positions experienced loss of self-consciousness, balance between skill and task, task and person viewed as one, sense of control, and concentration. The responses were universal for loss of self-consciousness and balance between skill and task. All players described the same feeling when describing a loss of self-consciousness, and confidence was the common requirement to achieving a feeling of balance between skill and task. For task and person viewed as one, each only had one player mention it and both viewed it from a personal perspective. Sense of control was much stronger for the defence while concentration was stronger for the forwards. For sense of control, the defence had twice the number of mentions and sample percentage. The forward mentions came from a position of focusing on what they can control on the ice to positively change personal and team momentum. About two thirds of the defensive mentions were

along the same lines, just not quite as strong. Interestingly, the other mentions were from a reverse perspective of taking what the game gives them and reacting. For concentration, the forwards had three times the number of mentions and stronger descriptions as the two defence references were split with one saying he sometimes got distracted during a game and the other saying he might not have always had the right focus on things within the game but never had his mind wonder outside of hockey during a game. The forward mentions were stronger in terms of maintaining concentration throughout the game and even sometimes using the time on the bench to reset so the player is wired and ready to go as soon as he hits the ice for his next shift.

Specific goal was only experienced by the forwards. The responses for specific goal from were position specific, focusing on scoring goals. It is not a surprise the defence would not have any mentions in this category as their goal on the ice is not as specific. They are responsible for limiting the amount of shots the other team gets and assisting with the offensive play, but they do not have as cut and dry of a job as the other two positions do. The seventh individual flow characteristic of clear feedback was only detected by the defence. The response emphasised receiving positive reinforcement from the coaches and knowing where he stood with them in terms of performance. It is not a surprise for this position to crave that information it is one of the last lines of defence and can feel as though it is their fault if a goal is let in. Sometimes they will make mistakes and it will be their fault, but other times it might be the forwards making a mistake to create an odd-man rush and that is where they need the reassurance. Finally, while transformation of time only had the one mention from the defence, it was a detailed description of the game appearing to slow down and all of the right plays standing out at the right time.

Overall, the further breakdown of these findings is interesting from a positional perspective and can be seen quantitatively in Table 14 on the next page. They largely correspond as to be expected by the different roles within the team. It makes sense for both positions to experience loss of self-consciousness, balance between skill and task, and task and person viewed as one as they are experience specific in terms of playing hockey and not dependent upon the role within the team. Sense of control being stronger for defence fits the idea of the defence largely dictating the game. Without a stable defensive structure, it is difficult to push forward with offensive opportunities. Specific goal and concentration make sense to go together in the context of scoring goals and concentrating on that task. It is logical for the forwards to have more and/or stronger detections than the defence experienced. Similarly sense of control and clear feedback make sense to be more defence focused as their

task is to keep the opposition away from the goalie, so it makes sense they will be striving for a stronger feeling of control while also be craving more feedback. The lone mention of transformation of time is difficult to make a conclusive decision upon its role specific application.

| Individual Flow Characteristics | Forward | | | | Defence | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Loss of Self-consciousness | 7 | 3 | 60% | 336 | 2 | 2 | 40% | 99 |
| Balance Between Skill and Task | 4 | 3 | 20% | 172 | 2 | 2 | 40% | 68 |
| Task and Person Viewed as One | 1 | 1 | 20% | 24 | 1 | 1 | 20% | 22 |
| Sense of Control | 5 | 2 | 40% | 103 | 11 | 4 | 80% | 308 |
| Concentration | 6 | 3 | 60% | 213 | 2 | 2 | 40% | 82 |
| Specific Goal | 2 | 1 | 20% | 132 | - | - | - | - |
| Clear Feedback | - | - | - | - | 1 | 1 | 20% | 92 |
| Transformation of Time | - | - | - | - | 1 | 1 | 20% | 44 |

Table 14: Professional Individual Flow by Position

**2.3.2.4.2 Distributed Flow**

All four distributed flow components were experienced by both positions. The forwards had higher percentage samples in all except for distributed attention. In terms of distributed attention, the forwards were unanimous in their responses revolving around focusing on opponent weaknesses to exploit. From a defensive perspective, three of the seven responses emphasised focusing on the opposition while the other four were individual based. The defence having the most responses as well as the only ones to have variance in focusing on themselves and the opposition makes sense from a hockey perspective because they will need to do more scanning of potential threats while also paying attention to their own teammates to notice if someone is out of position and thus the opposition is getting an advantage or to capitalise on an offensive break with a quick turnover. Their positon almost

requires them to do more scanning throughout the game and to take themselves into consideration more than others might. Strategic timing was the next strongest with 60 per cent from the forwards and 40 per cent from the defence. The responses from both groups were unanimous for this category, stating that a team generally has knowledge of the opponent's strategies and thus during a game could adapt their play accordingly to put themselves in the best possible position. It is essential to recognise an opportunity and capitalise on it. Players often view hockey as a game of mistakes with the goal of forcing the opponent to make the first one. In terms of team support, the forwards require more support from teammates to be successful, which could be why they had a stronger experience of it than the defence did. However, the defence mentions were still very much in line with the forwards' perspective. The forwards need people to pass them the puck, make plays, and score goals whereas defence need to shut down the opposition, which is easier with teammate support but can happen more individually easier than a forward's role can. Finally, discipline being detected by both groups is also logical based upon position requirements. In terms of responses, the forwards and defence were in agreement with an emphasis on self-focus. One forward pointed out the more quality of players on your team, the more valuable information about the opponent is since they will have the skill to take advantage of it, but ultimately, it is most important to focus on oneself on both the team and individual levels.

| **Distributed Flow Characteristics** | **Forward** | | | | **Defence** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Distributed Attention | 6 | 3 | 60% | 251 | 7 | 4 | 80% | 184 |
| Strategic Timing | 4 | 3 | 60% | 126 | 5 | 2 | 40% | 177 |
| Team Support | 6 | 3 | 60% | 358 | 2 | 1 | 20% | 180 |
| Discipline | 3 | 2 | 40% | 160 | 1 | 1 | 20% | 13 |

Table 15: Professional Distributed Flow by Position

#### 2.3.2.4.3 Distributed Flow Antecedents

Once again, both positions experienced all seven distributed flow antecedents as seen on Table 16 on the next page. Routine was by far the strongest with the most references and highest word counts from the entire sample. Coaching impact, adaptiveness, and game recovery were all stronger for the forwards than the defence. The next strongest detection was coaching impact with 80 per cent sample percentage in forwards, 60 per cent in defence. In

terms of response content, the forwards emphasised trust from the coach and the coach's ability to recognise the talent and strength on the team and giving players creative freedom to make the most of the skills. The defence, on the other hand, emphasised a preference for coaches holding everyone accountable on the team along with positive reinforcement. Adaptiveness was the next strongest distributed flow antecedent with 100 per cent sample percentage in forwards and 60 per cent in defence. The overall message was a preference for playing with the same line mates but an ability to adapt to new partners when necessary. Finally in this category, the responses for gamer recovery were unanimous in emphasising relaxing and a recovery period following one game before starting to prepare for the next one.

Veteran presence and accountability were both stronger for defence than forwards with 60 per cent of the defence experiencing them compared to just one forward for each. The responses for veteran presence were unanimous for viewing it as important for the team and valuing the leadership it can bring to get everyone on the same page and working as a unit throughout the whole organisation, not just the players on the ice. The accountability responses followed the same pattern with the forward response being in alignment with the defence appreciating accountability on teams and the forward, as an enforcer, saying it was sometimes his job to hold people accountable on a team. Lastly, staying even was just detected by one forward and one defender and was viewed by both players as not riding a roller coaster during the season with the highs and lows but rather keeping an even keel.

| **Distributed Flow Antecedents** | **Forward** | | | | **Defence** | | | |
|---|---|---|---|---|---|---|---|---|
| | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Routine | 13 | 5 | 100% | 323 | 10 | 5 | 100% | 395 |
| Coaching Impact | 6 | 4 | 80% | 291 | 5 | 3 | 60% | 270 |
| Adaptiveness | 9 | 5 | 100% | 226 | 4 | 3 | 60% | 130 |
| Game Recovery | 4 | 3 | 60% | 74 | 2 | 1 | 20% | 45 |
| Veteran Presence | 1 | 1 | 20% | 25 | 3 | 3 | 60% | 178 |
| Accountability | 1 | 1 | 20% | 35 | 6 | 3 | 60% | 165 |
| Staying Even | 1 | 1 | 20% | 79 | 2 | 1 | 20% | 57 |

Table 16: Professional Distributed Flow Antecedents by Position

**2.3.2.4.4 Metacognition**

When it comes to different types of metacognitions, both positions once again experienced all of them. Role metacognition was the strongest out of all of them with 100 per

cent forward sample percentage and 80 per cent from the defence. Both the forwards and defence responses clearly confirmed knowing one's own role within the team. The defence further supported this by being aware of other people's roles and adjusting their own style of play accordingly. Metacognition of resilience was the next strongest for both samples with the forwards experiencing 60 per cent sample percentage and the defence with 80 per cent. Interestingly, all of the answers emphasised the importance but came at it from a slightly different angle. One forward stated that playing regularly helped his resiliency so that he never had too long to dwell on a negative play. Another had a physical response to limit the emotional scaring from mistakes whereas the defensive responses were solely the mental approach of moving on and not dwelling on it. The defence responses could be categorised into two groups with about half describing the mental struggle that exists when players are going back and forth between leagues before they became permanent NHL players and the other half not having a routine per se for handing the mental side of the game but realising its importance and the difference it can make when being able to handle it.

Metacognition of risk taking was stronger for the defence than the forwards with five mentions from four different defenders and just two mentions from two different forwards. Four of those mentions revolved around the score in the game and noted the differences in feelings in terms of being tenser when losing and working harder to try to get back into the game. Two of the defence mentions revolved around playing smart hockey, which makes sense they would be the position to emphasise that point. The final defensive mention was in terms of changing positions from forward to defence and then playing more conservatively due to feeling less comfortable, which was noted to be potentially detrimental in the game of hockey.

Finally, role model metacognition was experienced evenly between the two groups with just one detection from each position. Though neither response was detailed, they both agreed to be learning and feeding off of others to achieve a state of flow for role model metacognition. The full results can be seen in Table 17 on the next page.

Overall, while the positional analysis is not the highlight of the research findings, it does provide an interesting perspective and one that has not been taken with previous flow research to date. As it currently stands, sport flow or metacognition research has not looked at differences by position, so extending the research findings one step further is an important step to be continuously expanding the understanding of these phenomena. The differences make sense when it comes to the mechanics of the sport, which does support the validity of the interviews and the extraction of the themes from the transcripts.

| | Forward | | | | Defence | | | |
|---|---|---|---|---|---|---|---|---|
| **Types of Metacognition** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Role Metacognition | 14 | 5 | 100% | 657 | 14 | 4 | 80% | 726 |
| Metacognition of Resilience | 5 | 3 | 60% | 180 | 11 | 4 | 80% | 695 |
| Metacognition of Risk-Taking | 2 | 2 | 40% | 39 | 5 | 4 | 80% | 162 |
| Role Model Metacognition | 1 | 1 | 20% | 16 | 1 | 1 | 20% | 27 |

Table 17: Professional Metacognition by Position

### 2.3.3 Sample Comparison

In order to fully understand the implications for this research, analysis comparing the responses between both samples is required. The individual responses for the group are interesting to determine the broad themes necessary for ice hockey, but the comparison is helpful to understand the significance of each component and to open the door for scale development and eventually predictive analysis.

#### 2.3.3.1 Individual Flow Comparison

Out of the original nine individual flow components, six were found in both samples: sense of control, loss of self-consciousness, balance between skill and task, concentration, task and person viewed as one, and specific goal. Out of this group, sense of control was the strongest for the professionals and the weakest for the amateurs in terms of both saliency and frequency. While the amateur sample only had one mention from one player, it was along the same lines as those from the professionals. This discrepancy points to being important in the professional game and a potential indicator of a more advanced view of ice hockey from amateurs. Therefore, it will be interesting to see if this distinction is noticed quantitatively as well.

Loss of self-consciousness and balance between skill and task mirrored each other with 50 percentage sample for professionals and just 33 per cent for the amateurs. In the content analysis, loss of self-consciousness experienced more mentions for both samples, however. The amateur responses were significantly shorter and mostly consisted of having a clear mind whereas the professionals were much more descriptive and clearly describing a

state of flow. Thematically, it was specific feelings of not being able to do anything wrong and seeing the game almost slower than it is so the right plays stand out extra as well as having more vivid and elaborated descriptions that make their descriptions stand out from the amateurs. In terms of balance between skill and task, while the professionals had more mentions and also more detail in their responses, the overall message of both of these was similar, emphasising the importance of confidence from a thematic perspective. As previously noted, these participants did have the strongest hockey background in the amateur sample, showing the importance of this dimension for hockey progression. Concentration is next on the list as the strongest for the amateurs and in the middle for the professionals in terms of saliency and frequency. The professionals had stronger and more salient descriptions of concentration during games and of not getting distracted, but otherwise the responses were very similar in this instance.

The final two individual flow dimensions in this section are task and person viewed as one and specific goal, both of which were stronger for the amateurs. In terms of the task and person being viewed as one, from the content analysis, the amateurs had seven mentions, but the professionals only had two. Thematically, the amateur interviews mostly came at it from an individual job perspective and being one with their role on the team. The two professional references were the same. Specific goal had six mentions from half of the sample for the amateurs whereas it only received two mentions from one of the professionals content-wise. The thematic analysis was interesting because the amateurs had a couple of mentions of specific plays arranged and then executed when they stepped on the ice. There was also a mention of getting the puck to a particular player. It makes sense to some degree that this sort of a reference would not exist in the professionals. As the teams become more skilled, the more dependent on teamwork they become to be more successful. They will certainly practice set plays, particularly off of face-offs, but they are likely to have more creative freedom, as they are able to read and react to the game at a much faster pace. They will not be as confined to a plan that was made before getting onto the ice. However, with that being said, most teams will have a top goal scorer or two, the “go to” person so to speak, so they could still have this strategy, but it was not mentioned. The two mentions for the professionals revolved around scoring. That was the goal for each shift. Naturally, that objective will not be recognised most of the time, but that is what the player was stepping on the ice to do each sift. It is also possible that role metacognition comes into play with this dimension for the professionals as their responses were from the individual level more than

the team like with the amateurs. The professionals might be so ingrained with their role, that their specific goals are more from an individual, role specific, perspective.

Two dimensions were found for the professionals but not for the amateurs, which were clear feedback and transformation of time. However, the content analysis showed both only had one mention from one player. Thematically, as to be expected, the clear feedback response confirmed the importance of this information for players. Honestly, whether it is good or bad, can really help the development and performance of players. Transformation of time for the professionals was described as the game feeling slower than it actually was so that the right plays stood out. Perhaps for the amateurs, there was too large of a gap between the possessed skill and perception of the task and thus they were not able to achieve that feeling and playing was more of a cognitive experience for them.

The content analysis revealed one dimension was found in the amateurs but not the professionals. The thematic analysis showed intrinsic rewards were present in the form of being fun and enjoyable and people wanting to be there. It is possible that this is another component not necessary for ice hockey flow nor distributed flow. It is also possible that it could only be necessary for people at a more beginner level, not for professionals. Team cohesion and camaraderie existed as themes present for the professionals. However, it was more from the context that if the relationships exist, the results will be better, but it was clear that they were not looking for those relationships as intrinsic rewards. They are not there to make friends; they are there to win and if that happens there is likely positive consequences. Therefore, that aspect was listed as a distributed flow antecedent for the professionals. The full breakdown can be seen in Table 18.

| | Amateur | | | | Professionals | | | |
|---|---|---|---|---|---|---|---|---|
| **Individual Flow Characteristics** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Sense of Control | 1 | 1 | 17% | 11 | 16 | 6 | 60% | 411 |
| Loss of Self-consciousness | 7 | 2 | 33% | 150 | 9 | 5 | 50% | 434 |
| Balance Between Skill and Task | 4 | 2 | 33% | 70 | 6 | 5 | 50% | 240 |
| Concentration | 9 | 5 | 83% | 219 | 8 | 5 | 50% | 295 |
| Task and Person Viewed as One | 7 | 4 | 67% | 70 | 2 | 2 | 20% | 44 |
| Specific Goal | 6 | 3 | 50% | 156 | 2 | 1 | 10% | 132 |
| Clear Feedback | - | - | 0% | 0 | 1 | 1 | 10% | 92 |
| Transformation of Time | - | - | 0% | 0 | 1 | 1 | 10% | 44 |
| Intrinsic Rewards | 7 | 4 | 67% | 98 | - | - | 0% | 0 |

Table 18: Individual Flow Sample Comparison

#### 2.3.3.2 Distributed Flow Comparison

In terms of distributed flow, both sets identified the same four components: distributed attention, strategic timing, team support and discipline. From a content perspective, the professionals had 13 mentions of distributed attention, and the amateurs had 10 accounts of it. Thematically, the professionals were again more specific in terms of their descriptions and breakdown percentages of focus. Five factors were identified to impact it: performance, both team and individual with considerably more attention placed on themselves during poor performance, score, teammates when someone is in trouble, opponents, and the location of the ice. The location of the ice was more of a theme for the amateurs, and the opponents for the professionals. It is possible that the professionals have more skill and are better able to recognise a weakness and capitalise on it. The non-professionals might need to break down the game more, which is why they mention the location of the ice. They might require more thinking of the basics of the game whereas the former professionals might be more natural with that aspect or have it as second nature and

thus focus on the more detailed intricacies of the game. Ultimately, it is clearly a necessary component for ice hockey flow and naturally the professionals understand it more comprehensively than the amateur athletes. This confirms it is necessary for distributed flow, but what they focus on determines the level of play.

Back to the content analysis, strategic timing had a percentage sample of 50 per cent for both samples though the professionals had a couple more mentions and almost double the word count. Interestingly, from the thematic perspective, the amateurs mentioned planning and executing set plays whereas the professionals did not. It might be that professionals are able to read and react to the game much quicker, so planning plays is not as crucial. Both groups did, however, mention the importance of changing the momentum in the game. The professionals additionally mentioned being familiar with the opponents so that could help players make adjustments and capitalise on opportunities. This is another example of the professionals taking this metacognition a step further.

Team support had a higher sample percentage in the amateur interviews with two-thirds compared to just under half in the professionals as discovered from the content analysis. While the professionals had one fewer mention, they did have double the word count describing this dimension. Thematically, however, the amateurs had a strong element of support, encouragement, and reassurance, which could be because the lower skilled players will need that more. The professionals had an interesting take with communication and the camaraderie between the players being significant themes and viewed as strong contributors to achieving team success. The rest of the responses were from an individual level where people are acknowledging they are responsible for themselves so there is only so much a player can do to help his teammates. They said that they can encourage their teammate, but there were strong elements of personal accountability and responsibility, which is almost the reverse of the amateur interviews in a couple of the responses. They had less of an emotional feel to the responses overall compared to the amateur. This could be another example that it is necessary for distributed flow and hockey, but how it is present will determine the ability expected from the player.

The last element of discipline had a larger gap between the samples in the content analysis with the amateurs having 11 mentions and the professionals with only four. For the amateurs in the thematic analysis, focusing on oneself and one's own job was a clear, reoccurring theme. For the professionals, on the other hand, one mention was on individual focus but the others were self-focus in terms of the whole team focusing on themselves rather than each player focusing on himself individually. By the time the players get to that level,

focusing on themselves during a game could come so natural that the focus shifts more towards the team as a whole or the opposition as evident in distribution of attention. These differences in descriptions will be important for the scale development stage to be able to ascertain the ability and project success for the player.

Distributed attention had the highest frequency for both the amateurs and the professionals but far more potent for the professionals, so it is expected to be very important going forward. Inversely, discipline is the lowest on both accounts for the professionals but one of the highest for the amateurs. It will be interesting to see how this factor plays out in subsequent studies as it is likely not a deciding factor for higher level play. For both the professionals and amateurs, team support was more salient than frequent, which could mean certain aspects are very important but not necessarily the whole dimension. Interestingly, strategic timing was the lowest on both accounts for the amateurs but was second strongest in frequency for professionals. Even though it was second lowest for salience, it was still noticeably higher than discipline, therefore, indicating a likely importance moving forward. A summary of these findings can be seen in Table 19.

| | **Amateur** | | | | **Professionals** | | | |
|---|---|---|---|---|---|---|---|---|
| **Distributed Flow Characteristics** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Distributed Attention | 10 | 5 | 83% | 245 | 13 | 7 | 70% | 435 |
| Strategic Timing | 7 | 3 | 50% | 156 | 9 | 5 | 50% | 303 |
| Team Support | 9 | 4 | 67% | 271 | 8 | 4 | 40% | 537 |
| Discipline | 11 | 4 | 67% | 265 | 4 | 3 | 30% | 173 |

Table 19: Distributed Flow Comparison

The concept of distributed flow as well as the individual dimensions require definitions. Both the professional and amateur responses have been taken into consideration. Distributed flow is defined as an individual cognitive state primarily involving distributed attention and a careful consideration of the timing of action needed whilst balancing support and discipline. The definitions of the individual dimensions can be seen in Table 20 on the next page.

| Distributed Flow | |
|---|---|
| **Dimension** | **Definition** |
| Distributed Attention | Distributed Attention is the continuous rotation of focus throughout the duration of the game. The specifics of focus will be in constant flux during the game and vary depending on performance, both at the team and individual levels, score, team mates when in trouble, opponents, and location of the ice. As each player's role changes when on the ice depending on these factors, they are always monitoring the situations and adjusting accordingly. |
| Strategic Timing | Strategic timing is the ability to read and interpret the game and understand the appropriate course of action based upon that reading. This can take place in various forms, whether it be executing specific plays, making a big play to shift momentum, or recognising and capitalising on opportunities when presented. The game of ice hockey is an extremely fast-paced and dynamic game and thus reading and understanding the timing is crucial for success. |
| Team Support | Team support is a wide encompassing dimension, involving aspects of communication, camaraderie between players, and trusting team mates when on the ice. Since ice hockey is such a team sport, players need to consistently feel that support, and that comes in many different forms. |
| Discipline | Discipline is a multifaceted component that involves individually focusing on one's own job and from the team perspective involves a split focus between focusing on the team's own systems and counteracting the opponent's strategies. While this component includes different facets, they all require discipline to be executed. |

Table 20: Distributed Flow Definitions

Both sets of interviews identified two distributed flow antecedents: adaptiveness and game recovery. Content-wise both were stronger for the professionals than the amateurs. For adaptiveness, the thematic analysis showed the amateurs had a clear preference for playing with at least one person consistently or noticing playing well with someone due to years of experience with them. It likely takes longer for the amateurs to get to that level than with professionals because they are on the ice less frequently and might not be as adaptable to other styles of play. From a content analysis perspective, the professionals had over three times the amount of mentions for this component. Thematically, they did point out that the line combinations did not change as frequently; they were fairly consistent in the NHL. They also looked at it as they needed to be able to play with anyone since it was their job, which is a strong distinction from the amateur interview context, so the line changes might impact them less even if they occurred at the same rate. Furthermore, they are on the ice more frequently and have exposure to more playing styles so a difference might not feel as impactful. Game recovery also had noticeable differences between the two samples in the content analysis with the amateurs having four mentions from two different players, and the professionals having six from four. The numerical differences were not the only differences with this dimension; thematic analysis also showed differences. The amateur's response was almost the opposite of that of the professionals where the amateur just wanted to forget about what had happened, and the professionals spent some time reflecting and relaxing on what happened before moving onto the next one. This significant difference is another strong one to explore with the scale as a potential predictor of future success.

The professionals also identified five additional distributed flow antecedents: routine, coaching impact, veteran presence, accountability, and staying even. The professionals have played the sport for a longer time as well as more intensively, which means they will be able to better pinpoint aspects that enhance their performance. These are all team sport related, which makes sense that they have not been detected in previous flow research, but they should be explored moving forward with team sports to see if these components or at least variations of these components exist within team sport setting for flow to see if they are general team flow antecedents or if they are only hockey-specific. Adaptiveness is much more salient with the professionals, and the frequency also supports that. So this dimension is expected to be important going forward. While game recovery is present in both samples, it is neither strongly frequent nor salient, therefore indicating it is not likely to be a strong contender in future research but nevertheless still needs to be explored. In terms of the professional only antecedents, all of them except for staying even are expected to play a role

in future research. Staying even did not have the presence of the other items. It is not likely to remain but was strong enough to be considered. The breakdown can be seen quantitatively below in Table 21.

| | Amateur | | | | Professionals | | | |
|---|---|---|---|---|---|---|---|---|
| **Distributed Flow Antecedents** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Adaptiveness | 4 | 4 | 67% | 197 | 13 | 8 | 80% | 356 |
| Game Recovery | 4 | 2 | 33% | 106 | 6 | 4 | 40% | 115 |
| Routine | - | - | 0% | 0 | 23 | 10 | 100% | 718 |
| Coaching Impact | - | - | 0% | 0 | 11 | 7 | 70% | 561 |
| Veteran Presence | - | - | 0% | 0 | 4 | 4 | 40% | 203 |
| Accountability | - | - | 0% | 0 | 7 | 4 | 40% | 200 |
| Staying Even | - | - | 0% | 0 | 3 | 2 | 20% | 136 |

Table 21: Distributed Flow Antecedents Comparison

The distributed flow antecedent definitions can be seen in the table on the next page.

| Distributed Flow Antecedents | |
|---|---|
| **Dimension** | **Definition** |
| Adaptiveness | While adaptiveness involves a preference for playing with the same line mates as that builds chemistry and improves performance, it also highlights viewing changing line mates as an opportunity to contribute to the team in a new but still productive way. Since there are so many players on a team, players need to take an adaptive approach to maximize individual and team performance. |
| Game Recovery | Game recovery is the method of reflecting and processing the previous game before moving on to preparing for the next one. Each player will have his or her unique unwinding practice, which is necessary to reach optimal performance in the next game. |
| Routine | A routine is the pattern of activities that each player follows to keep from overthinking before games but still allows them to maintain focus on the game. The independent actions will vary by player, but the goal of mental clarity is the same across the board. |
| Coaching Impact | Coaching impact is the influence a coach has on a player's performance. This impact comes in different forms, such as belief, reinforcement, and recognising the strengths of players. Coaching impact is also understanding at the individual level the impact that the coaching decisions at the team level have on a player. |
| Veteran Presence | Veteran presence speaks to the depth and leadership that veterans provide to a team. With so many players on a team, experience can help get everyone on the same page and push to get everyone to play better. |
| Accountability | Accountability is the idea that everyone is held responsible for their actions and contributions to the team. Players need to feel it's the same playing field where everyone is held to the same standard; otherwise, a feeling of favouritism can have negative, adverse effects on individuals and the team as a whole. |
| Staying Even | Staying even is the idea of each player maintaining a level of consistency throughout the season. Since hockey seasons typically last over six months and can be emotional, it is important players are emotionally stable during this time rather than riding a roller coaster. |

Table 22: Distributed Flow Antecedent Definitions

#### 2.3.3.3 Metacognition Comparison

Remarkably, both interview sets identified the exact same four types of metacognition. Role metacognition was the strongest for both samples by a longshot in the content analysis. The amateurs had 18 mentions from the entire sample while the professionals had 28 mentions from all but one participant. The amateurs had far more individual mentions of role metacognition than the professionals who were evenly split. The thematic analysis showed the professionals clearly take this metacognition a step further, recognising team mate roles and the potential adjustments necessary. This can be a clear distinction point for the scale development.

Metacognition of resilience was the second strongest overall in the content analysis, this time stronger for the amateurs than the professionals. The amateurs had a full sample percentage compared to 70 per cent for the professionals, but the professionals had almost double the word count. So clearly the professionals who had thought about this element before had done so thoroughly and had strong descriptions. Both samples heavily favoured individual mentions versus team mentions. The thematic analysis showed the majority of the amateur references were in terms of not getting down if the game did not start off in a favourable way for the team. They also spoke in terms of having the right temperament and not getting rattled during the game. There was one reverse mention when the team was losing to a team viewed to be stronger that the team would not come back because they did not believe they could. The professionals had similar references but also included strategies for how to deal with unfavourable events happening both during the game and afterwards to not take any emotional scars forward with them in future games. Despite the smaller frequency, the professionals were once again taking this metacognition a step further. This will be a definite scale point and could perhaps have a couple of different directions.

The third type is metacognition of risk taking, which was noted by 60 per cent of the professional sample but just a third of the amateurs. As to be expected, the content analysis showed the professionals had many more mentions as well as more depth to their descriptions. Thematically, the majority of those references were to being behind in the score and taking risks to come back. This one is strongly dependent on the score line with a deficit in the game correlating strongly towards taking more risks. Finally, role model metacognition had two examples for both sets in the content analysis. This is the only example where the word count for the amateurs exceeded that of the professionals, so it could be helpful for the learning curve of playing hockey and watching other players to progress themselves. This

element will clearly be included in the scale development and validation but is not expected to be a make or break factor.

Metacognition of resilience and role metacognition were the two strongest in both samples. Metacognition of risk-taking was so strong with the professionals that it is expected to be important. Role model metacognition is expected to be dropped in future studies. Overall, the metacognition results are very interesting. The professionals had stronger results and more mentions in two-thirds of the metacognition types, which clearly confirms the importance for metacognition. Reaching a state of flow is necessary for achieving optimal performance, but metacognition should not be overlooked as it is clearly extremely important for ice hockey success. The full comparison can be seen below in Table 23.

| | Amateur | | | | Professionals | | | |
|---|---|---|---|---|---|---|---|---|
| **Types of Metacognition** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** | **Mentions** | **Scope** | **Percentage of Sample** | **Word Count** |
| Role Metacognition | 18 | 6 | 100% | 500 | 28 | 9 | 90% | 1,383 |
| Metacognition of Resilience | 21 | 6 | 100% | 475 | 16 | 7 | 70% | 875 |
| Metacognition of Risk-Taking | 2 | 2 | 33% | 86 | 7 | 6 | 60% | 201 |
| Role Model Metacognition | 2 | 2 | 33% | 88 | 2 | 2 | 20% | 43 |

Table 23: Metacognition Comparison

Finally, the metacognition definitions are listed below.

| Types of Metacognition | |
|---|---|
| **Dimension** | **Definition** |
| Metacognition of Resilience | Metacognition of resilience is the ability to set aside any negative or discouraging events and remain optimistic in the desired outcome. This can take place either during a game and taking time to reset to be able to continue to play without previous mistakes further impacting the player or after a game with undesirable performance and physically working on the aspects or skills as to not feel impeded by those moving forward. Nobody has a 100 per cent rate in sports, but metacognition of resilience allows players to get as close to that as quickly as possible. |
| Role Metacognition | Role metacognition takes place in two forms: one from recognising and executing each player's individual role and two from identifying team mates' roles and tendencies and adjusting individual roles accordingly to make the biggest impact and contribution. With ice hockey involving so many players and roles, role metacognition is necessary both at the team and individual levels for cohesion and success. |
| Metacognition of Risk-Taking | Metacognition of risk-taking is the understanding of when to take risks and play more aggressively. Naturally, the score and time remaining in the game are often going to dictate those decisions, but it is important players are able to read when it is appropriate to take the risks and adjust their style of play accordingly. |
| Role Model Metacognition | Role model metacognition is the attentiveness of other players and the desire to both surround oneself with smart hockey players and learn from watching others as much as possible. Players can often find what works for them by modelling different tendencies from others until they find their right fit. |

Table 24: Metacognition Definitions

### 2.3.4 Quantitative Analysis

All but one of the qualitative participants also participated in the quantitative aspect of the study. The one non-participant was a professional. The amateurs consisted of six responses while the professionals consisted of 9 responses to the questionnaires. Since the sample size is so small, no significance tests were performed. Analysis has consisted of means interpretation. Analyses of the results were twofold: the first was by averaging the responses from each participant for the whole survey to get a flow score. The averages between the amateurs and professionals were then compared. The second analysis involved averaging the score for each question and then comparing the results between samples. These results can then be compared to the qualitative findings to see which findings were replicated between both studies and determine if any discrepancies exist.

#### 2.3.4.1 Flow State Scale Analysis

The average score by participant can be seen in Table 25 for both samples. The amateurs ranged from 4.9 to 5.6 with the average being 5.35. The professionals ranged from 3.5 to 6.8 with their average value being 5.57. The professionals were more extreme with a lower low value and higher high. Unsurprisingly, their average was higher as well. Four responses were below the average, and five responses were above it.

| FSS-2 | Amateur Average (n=6) | Professional Average (n=9) |
|---|---|---|
| Participant 1 | 4.9 | 6.8 |
| Participant 2 | 5.3 | 3.5 |
| Participant 3 | 5.6 | 4.3 |
| Participant 4 | 5.4 | 6.4 |
| Participant 5 | 5.6 | 6.3 |
| Participant 6 | 5.3 | 4.5 |
| Participant 7 | - | 5.3 |
| Participant 8 | - | 6.5 |
| Participant 9 | - | 6.5 |
| Average | 5.35 | 5.57 |

Table 25: Flow State Scale Participant Average Scores

| FSS-2 | X | SD |
|---|---|---|
| Amateur (n=6) | 5.35 | 0.26 |
| Professional (n=9) | 5.57 | 1.20 |

Table 26: Flow State Scale Sample Statistics

Table 27 on the next page breaks down the average scores by statement, showing the difference between the professional and amateur scores. The professionals ranked higher in all but four. The two strongest positive differences were “I feel that I have everything under control” and “I am completely lost in thought,” both of which had a difference of 1. These results are in line with the qualitative results. The amateurs only had one detection of sense of control whereas the professionals had a 55 per cent response rate. Loss of self-consciousness was also more strongly detected with the professionals than the amateurs. The second highest difference was 0.8 for “I feel just the right amount of challenge”. There were two other statements to detect loss of self-consciousness: “My thoughts / activities run fluidly and smoothly” and “I am totally absorbed in what I am doing”. These statements did not have as strong of professional to amateur differences with 0.2 and negative 0.3. However, the overall average of these statements is again in line with the qualitative ones with professionals having a higher sample percentage at 50 versus 33. The next difference was 0.6 for “I know what I have to do each step of the way.” Interestingly for this one, specific goal was more strongly detected for the amateurs than professionals qualitatively with 50 per cent versus 10 per cent. It could be that it is more natural for the professionals or even second nature so they did not mention it as much with open ended questions. However, it is still important, so when specifically asked about it, they ranked it strongly. Alternatively, with the new findings taken into consideration, it is most closely related to role metacognition, which was the strongest metacognition across both samples. Concentration was present with two phrases: “My mind is completely clear” and “I have no difficulty concentrating.” The professionals ranked the first one higher at 0.2 while the second was negative 0.5. Qualitatively, concentration was reported more frequently with the amateurs with 67 per cent beating 50 for the professionals. One statement was equal for both samples, “The right thoughts / movements occur of their own accord”. This statement corresponds with the task and person being viewed as one, which for the qualitative results was far stronger for the amateurs than the professionals. The amateurs had a 67 per cent detection rate compared to the 20 per cent the professionals experienced. The last statement had the highest negative value of 1. The statement “I don’t notice time passing” clearly identifies the transformation of time. This result is incredibly

interesting because qualitatively, there was only one mention of this factor across both samples, and it was by a professional. Clearly, this factor is in fact strong and present across both samples. It is possible the interview questions were not clear and specific enough to elicit this theme. It is also possible that the players have just gotten used to this aspect, so it is not naturally detected as a separate component. Another potential explanation is that the professional game is so much more physically demanding and intense that time does not feel as illusory to them, which is why they had the negative value against the amateur responses.

All and all, the quantitative findings generally followed the qualitative findings with a couple of notable outliers. Transformation of time was the strongest opposite result though a number of explanations could exist for this discrepancy, followed closely behind by specific goal. Task and person viewed as one and one detection of concentration were opposites as well though on a much smaller scale. The remaining items of sense of control, loss of self-consciousness, and balance between skill and task overall followed the same patterns as the qualitative results.

| FSS-2 Question | Amateur Average | Professional Average | Difference from Professional |
|---|---|---|---|
| I feel that I have everything under control. | 4.3 | 5.3 | 1.0 |
| I am completely lost in thought. | 3.7 | 4.7 | 1.0 |
| I feel just the right amount of challenge | 5.3 | 6.1 | 0.8 |
| I know what I have to do each step of the way. | 5.7 | 6.3 | 0.6 |
| My mind is completely clear. | 5.2 | 5.4 | 0.2 |
| My thoughts/activities run fluidly and smoothly | 5.5 | 5.7 | 0.2 |
| The right thoughts / movements occur of their own accord. | 5.3 | 5.3 | 0.0 |
| I am totally absorbed in what I am doing. | 6.5 | 6.2 | -0.3 |
| I have no difficulty concentrating. | 5.7 | 5.2 | -0.5 |
| I don't notice time passing. | 6.3 | 5.3 | -1.0 |

Table 27: Flow State Scale Statement Averages

#### 2.3.4.2 Short Dispositional Flow Scale 2 Analysis

The results of the individual averages can be seen in Table 28. The amateurs ranged from 3.4 to 4.4 with an average of 4.1. Two responses were below the average, three were above and the remaining one was spot on the average. The professionals ranged from 3.8 to 4.9 with an average of 4.4. For this sample, three responses were below the average, four

were above, and two were spot on the average. While the professionals seem to have the bigger spread, proportionally the distribution seems to be the same.

| SDFS-2 | Amateur Average (n=6) | Professional Average (n=9) |
|---|---|---|
| Participant 1 | 3.4 | 4.9 |
| Participant 2 | 4 | 4 |
| Participant 3 | 4.3 | 3.9 |
| Participant 4 | 4.4 | 4.6 |
| Participant 5 | 4.3 | 4.4 |
| Participant 6 | 4.1 | 3.8 |
| Participant 7 | - | 4.4 |
| Participant 8 | - | 4.9 |
| Participant 9 | - | 4.8 |
| Average | 4.1 | 4.4 |

Table 28: SDFS-2 Participant Average Scores

| SDFS-2 | X | SD |
|---|---|---|
| Amateur (n=6) | 4.1 | 0.37 |
| Professional (n=9) | 4.4 | 0.43 |

Table 29: SDFS-2 Sample Statistics

As for the individual statement comparison, the professionals scored higher in all but one question. The difference was only 0.2. Interestingly, the statement was “the way time passes seems to be different than normal.” As previously mentioned, from a qualitative perspective, the amateurs did not actually detect the transformation of time while the professionals only had one detection. This pattern is consistent with the Flow State Scale results. The largest difference was 0.7 for the statement “I have a good idea while I am performing about how well I am doing.” The difference is an interesting result because qualitatively, the amateurs did not mention this component (clear feedback) at all, and only one professional mentioned it in the interviews. This could be another example that subconsciously exists and is only brought up when directly addressed. The next highest difference detected was loss of self-consciousness with “I do things spontaneously and automatically without having to think”. This result again corresponds to the qualitative results where the professionals had the second highest number of mentions and a stronger sample percentage. Two statements were tied for the third highest difference of 0.5. The first was for sense of control with the statement “I have a feeling of total control over what I am doing.”

This result again followed the Flow State Scale results but was a much smaller difference. It is interesting to have such a difference in values even though the statements are very similar. The other one was “I have a strong sense of what I want to do”, detecting specific goal. This also followed the same pattern of a lower response than on the Flow State Scale. The next item was for balance between skill and task, measured by “I feel I am competent enough to meet the high demands of the situation”, which was once again a smaller difference than on the Flow State Scale but still following the same trend. Concentration was detected with the statement “I am completely focused on the task at hand” and had a value of 0.1. Since the net difference of the two scores from the Flow State Scale was 0.1, this result is in line. The final positive difference was 0.1 for the statement “the experience is extremely rewarding”, clearly identifying intrinsic rewards. This is another interesting result as qualitatively, half of the amateur sample identified intrinsic rewards compared to no one from the professional responses. It is possible that when directly asked, the professionals do view playing ice hockey as intrinsically rewarding, but it is not a motivator and thus not detected in the qualitative responses. The final statement “the way time passes seems to be different than normal” had a negative result of 0.1. Though not as large of a value, this result corresponds with the Flow State Scale result for transformation of time. The full breakdown can be seen on the next page in Table 30.

Overall, when it comes to the eight questions, half of them matched, or replicated, the qualitative results and half of them did not. Loss of self-consciousness, clear feedback, sense of control, and balance between skill and task all matched the qualitative findings of the professionals experiencing these dimensions stronger. All of them with the exception of clear feedback were measured with the Flow State Scale and the overall results are in agreement between both scales. Clear goal, concentration, and transformation of time all had opposite results from the qualitative. However, that pattern is in line with the Flow State Scale results; the differences with all three of those just aren’t as strong as those detected with the Flow State Scale. The remaining item is intrinsic rewards, which had a difference of 0.1 in favour of the professionals, which is the strongest difference from the qualitative responses.

| SDFS-2 Question | Amateur Average | Professional Average | Difference from Professional |
|---|---|---|---|
| I do things spontaneously and automatically without having to think. | 3.8 | 4.4 | 0.6 |
| I have a good idea while I am performing about how well I am doing. | 4.0 | 4.7 | 0.7 |
| I have a feeling of total control over what I am doing. | 3.3 | 3.8 | 0.5 |
| I feel I am competent enough to meet the high demands of the situation. | 4.2 | 4.6 | 0.4 |
| I have a strong sense of what I want to do. | 4.2 | 4.7 | 0.5 |
| I am completely focused on the task at hand. | 4.2 | 4.3 | 0.1 |
| The experience is extremely rewarding. | 4.5 | 4.6 | 0.1 |
| The way time passes seems to be different than normal. | 4.3 | 4.1 | -0.2 |

Table 30: SDFS-2 Statement Averages

#### 2.3.4.3 Short Work Flow Scale Analysis

The SWFS has four written responses, so to analyse the results, numerical values were given to each response option. Never or almost never true received the value of one. Sometimes true was given a value of two. Often true was given the value of three, and always or almost always true was given the value of four. Interestingly, the amateurs had an average of 3.7 while the professionals only averaged 3.2. For the amateurs, only one value was below the average, three were spot on, and two were above. The professionals ranged from 2.3 to 4. These results were the most dramatic difference between the samples in favour of the amateurs. The quantitative summary can be seen in Tables 31 and 32.

| SFWS | Amateur Average (n=6) | Professional Average (n=9) |
|---|---|---|
| Participant 1 | 3 | 3.7 |
| Participant 2 | 4 | 2.3 |
| Participant 3 | 3.7 | 3 |
| Participant 4 | 3.7 | 3.3 |
| Participant 5 | 3.7 | 3 |
| Participant 6 | 4 | 3 |
| Participant 7 | - | 3.3 |
| Participant 8 | - | 4 |
| Participant 9 | - | 3 |
| Average | 3.7 | 3.2 |

Table 31: SFWS Participant Average Scores

| SFWS | X | SD |
|---|---|---|
| Amateur (n=6) | 3.7 | 0.37 |
| Professional (n=9) | 3.2 | 0.48 |

Table 32: SFWS Sample Statistics

Table 33 below has the breakdown by statement, and as expected based upon the overall averages, all of the responses are significantly stronger for the amateurs. It is a very peculiar and unexpected result considering the trends in the qualitative and other quantitative results.

| SFWS Question | Amateur Average | Professional Average | Difference from Professional |
|---|---|---|---|
| When I get really involved with my work my concentration becomes like breathing…I never think of it. | 3.8 | 3.3 | -0.5 |
| Sometimes when I am working I become so absorbed that I am less aware of myself and my problems. | 3.5 | 3.1 | -0.4 |
| When I am working I am so involved in it that I don't see myself as separate from what I am doing. | 3.7 | 3.1 | -0.6 |

Table 33: SFWS Statement Averages

#### 2.3.4.4 Flow Metacognition Questionnaire Analysis

As seen in Table 34, the amateurs ranged from 3.3 to 4 for the FMQ-1 average responses with an overall average of 3.8 and 2.7 to 3.2 on the FMQ-2 with an overall average of 2.9. The professionals had wider ranges for both scales, ranging from 2.8 to 4 on the FMQ-1, averaging 3.6, and 1.8 to 3.8 on the FMQ-2 but had the same average as the amateurs of 2.9. For the FMQ-1, only four of the professional scores were at the amateur level or above.

| FMQ | Amateur FMQ-1 Average (n=6) | Professional FMQ-1 Average (n=9) | Amateur FMQ-2 Average (n=6) | Professional FMQ-2 Average (n=9) |
|---|---|---|---|---|
| Participant 1 | 3.3 | 4 | 3 | 3.8 |
| Participant 2 | 4 | 2.8 | 2.8 | 2.3 |
| Participant 3 | 4 | 3.7 | 2.8 | 3 |
| Participant 4 | 3.5 | 3.8 | 2.7 | 3.5 |
| Participant 5 | 3.8 | 3.8 | 3.2 | 2.8 |
| Participant 6 | 3.8 | 3.7 | 3 | 1.8 |
| Participant 7 | - | 3.7 | - | 3 |
| Participant 8 | - | 3.8 | - | 3 |
| Participant 9 | - | 3.8 | - | 3 |
| Average | 3.8 | 3.6 | 2.9 | 2.9 |

Table 34: FMQ Participant Average Scores

| FMQ | FMQ-1 X | FMQ-1 SD | FMQ-2 X | FMQ-2 SD |
|---|---|---|---|---|
| Amateur (n=6) | 3.8 | 0.27 | 2.9 | 0.17 |
| Professional (n=9) | 3.6 | 1.06 | 2.9 | 0.58 |

Table 35: FMQ Sample Statistics

The averages by question can be seen in Tables 36 and 37. This survey had many differences in score per question with four receiving higher amateur averages and two exactly the same. Six were higher for the professionals, but four of them were a value of 0.1 and the other two were 0.2. These results are more difficult to analyse as they do not directly correspond to other survey results or the qualitative analysis. However, in terms of metacognition detected in the qualitative results, both samples detected all of them but sometimes the amateurs were stronger and sometimes the professionals were stronger. This broad theme has been followed with these quantitative results though the same metacognitions have not been measured.

| FMQ-1 Question | Amateur Average | Professional Average | Difference from Professional |
|---|---|---|---|
| I become completely focused on the task when I am in flow. | 4.0 | 3.8 | -0.2 |
| Flow has a positive effect on the activity. | 3.8 | 3.8 | 0.0 |
| I am able to generate various ideas and options while being in flow. | 3.7 | 3.1 | -0.6 |
| I Know that by being in flow I achieve more. | 3.7 | 3.8 | 0.1 |
| My thinking becomes clearer when I am in flow. | 3.7 | 3.9 | 0.2 |
| I am more creative when I am in flow. | 3.7 | 3.8 | 0.1 |

Table 36: FMQ-1 Statement Averages

| FMQ-2 Question | Amateur Average | Professional Average | Difference from Professional |
|---|---|---|---|
| I know how I can re-create having flow if I want to. | 2.8 | 2.6 | -0.2 |
| I am able to quickly re-enter flow if I need to. | 2.7 | 2.8 | 0.1 |
| Once I start with the activity there is no stopping me getting into flow. | 2.8 | 2.7 | -0.1 |
| I know what I need to do to get into flow. | 3.0 | 3.0 | 0.0 |
| It is in my power to control when I have flow. | 3.0 | 3.2 | 0.2 |
| I am able to sustain flow for long periods. | 3.2 | 3.3 | 0.1 |

Table 37: FMQ-2 Statement Averages

### 2.4 General Discussion

Overall, this study has important implications for flow and metacognition research in general with sport as well as specifically with ice hockey. The results of this study in terms of flow are twofold. One, it has confirmed the presence of flow within ice hockey. Two, it has identified a new type of flow, known as distributed flow, with specific factors necessary for fast-paced, highly interdependent environments. The four components making up distributed flow (distributed attention, strategic timing, team support, and discipline) have never been associated with flow research before, so this finding is especially noteworthy. The most important one, as confirmed by both the saliency and frequency of the responses both samples, is the new addition of distributed attention. This is a key finding as it has not been discovered before and seems a necessity in a fast-paced, dynamic, interactive environment

such as ice hockey. Strategic timing was the next strongest followed by team support and discipline. Distributed attention, strategic timing, and discipline had the strongest flow duality perspectives. Team support incorporated the aspect of duality from a physical and emotional perspective. Perhaps distributed flow will be further confirmation of the duality that exists in the flow experience. It will also be necessary to see how these four components progress in the validation studies as the idea of team support could challenge the previous view of flow duality. These findings have pushed flow beyond an individual experience whereby the interactions between teammates are considered and impact the ability to get into flow and the experience once there. This combination of individual and joint experiences is completely unchartered territory.

While the goal of this research was not focused on fostering flow, it has shed more light onto the factors that impact it through identifying seven distributed flow antecedents. Only two of them, adaptiveness and game recovery, were identified by both samples with the remaining five  of routine, coaching impact, veteran presence, accountability and staying even solely identified by the professionals. It is interesting the amateurs did not have any antecedents not detected by the professionals. Clearly the professionals have spent considerable time thinking about the different components that can aid them in their performance as every slight edge can be the difference maker. Two of the antecedents are for before the game: game recovery and routine. Three of them mostly take place during the game: adaptiveness, veteran presence, and coaching impact. The remaining two antecedents are in the general context of playing hockey though can come into play during games: accountability and staying even. This sort of a range has not been seen in previous research, but it does make sense to start from the previous game and make sure no lingering thoughts are taken forward to the next games. That preparation continues throughout the pregame process. From there, there are game specific factors that can impact achieving a distributed flow state and just general categories that can come up throughout the course of the season, such as staying even. If a player is not able to generally stay even throughout the course of the season and is experiencing a down period, then it likely does not matter if the game specific antecedents are in place as his overarching feelings will not be in alignment. Overall, these findings are interesting to take the antecedent findings in new directions that have not previously been discussed but will hopefully be the start of uncovering more angles to better understand how to achieve the flow state. The study has also identified five specific types of metacognition necessary for ice hockey, found in both samples. Previous metacognition research with sport has been more on the general side. So confirmation of specific

metacognitions in sport is a first. As with distributed flow dimensions, the types of metacognition have both individual and team dimensions.

### 2.5 Strengths and Limitations

As the results show, this study has a number of strengths. The biggest strength is arguably the professional sample. With previous sport research, the most elite participants had the strongest flow experience and detailed explanations (Jackson, 1992; 1996; Swann et al., 2012). Having this type of a sample in this study not only confirms flow and metacognition at work during an ice hockey match but also paints the most detailed picture of both aspects. Additionally, having a comparison with the amateur sample takes the research a step further. The results confirm that flow and metacognition are necessary and present at all levels of ice hockey. The comparison then shows how much more progressed both aspects are in order to make it to the most elite level. The research clearly needs to be repeated and extended, but it has opened the door for the development of scales to specifically measure distributed flow and metacognition with ice hockey as well as psychological intervention strategies for further development and optimisation of both components. Another advantage of the research is that it looked at a variety of positions and roles players had to address as many different aspects of the game as possible. Once again further research is needed for confirmation purposes, but this study confirms that both flow and metacognition are necessary for all; it is just the type of experience that will vary depending on the role within the team. Lastly, the professional sample size as a whole has significant playing statistics, establishing strong credibility within the league. The combined experience of 4,000 games, over 2,000 points and an average of over eight years' experience provides a wealth of knowledge and understanding about the game. Overall, the information has strong credibility.

Despite all of the strengths of the study, it does not come without its share of weaknesses. Research about sport performance is retroactive by nature, especially in this case where players were being interviewed in general about their play rather than after a specific performance. The sample size was small as is typical for qualitative research but smaller than usual quantitative studies. For the professional sample, the average age was almost 54 years old, which could alter their recollection of their thoughts and experiences from their playing time. Additionally, the game could have changed between when they played and the current experience, so these results might not paint the most up to date picture of flow and metacognition within ice hockey. It is possible the game, preparation, and strategies have

changed since they played. So research needs to look at more recent or current professional players to determine if this is the case to have the most complete picture of flow and metacognition for ice hockey. Furthermore, almost all of the professional players had been involved with the same club at some point in their career. Though the experiences were at different times for some of them, it is a factor that could possibly impact the results. Thus, it might be necessary to get a more widespread professional sample. In terms of the positioning, four out of the five forwards were centres. Perhaps more wingers should be interviewed in the future to see if there is more knowledge to be gained through differences in positions. Another weakness is that nobody interviewed had won the Stanley Cup. That is the epitome for every NHL player, so players who have achieved the highest award should be interviewed as they might take these dimensions even further.

All and all, while this study positively identified flow and metacognition with ice hockey and was the first to make this association, it did not do so without some limitations in the structure and findings that need to be addressed in further research to further develop these connections. Additional research is required to both validate these findings and progress them further.

## 2.6 Conclusion

As a whole, this study opens the door for flow and metacognition research in fast-paced, interdependent environments, which previously have not been associated together. Both flow and metacognition have been confirmed to exist in ice hockey and be necessary for success, addressing the initial void in the literature and understanding of this phenomenon. The research has also taken the findings from previous research a step further in identifying a different type of flow, known as distributed flow. Even though the research was a success, further exploration is still necessary to more fully understand this phenomenon and the parameters involved. However, these results are still strong enough to create a questionnaire to measure these hockey-specific items. All identified components will receive items. Those that had different aspects associated will have multiple items. Next, the questionnaire will be tested against previous flow measures as well as subjective and objective performance measures.

If this is successful, psychological exercises can be developed to enhance distributed flow components as well as hockey specific metacognitions. After players have taken the questionnaire the first time, they can work on specific exercises to address the weaknesses

and then complete the scales again. Ideally, they will see results in two ways: one of which being on the ice and with performance and the other being on paper statistically. This also potentially provides them with a comparison for where they are mentally compared to how the professionals score. This project is opening the door to a new type of flow and measurement tool will have a wide array of implications for all stakeholders, from players to coaches, sport psychologists to scouts and researchers alike.

## Chapter 3: Scale Development and Initial Scale Validation (Study 2)


### Abstract

Upon identification of 15 possible new factors related to flow and metacognition, a pilot 125-item Ice Hockey Questionnaire (IHQ) was developed and tested on a sample of 147 ice hockey players. Only skaters were included as a large enough sample of goalies was not obtainable. Not all of the questions were relevant when it came to their position and perspective and thus future research is required to understand how flow and metacognition are experienced by goalies. Participants also completed the Short Dispositional Flow Scale (SDFS-2) (Jackson, Martin, & Eklund, 2008), Short Flow in Work Scale (SFWS) (Moneta, 2017), Flow Metacognition Questionnaire (FMQ) (Wilson & Moneta, 2016), and Mental Toughness Scale (MTS) (Madrigal, Hamill, & Gill, 2013). The correlations between each factor and the psychometric measures were calculated and analysed. Due to the sample size, Cronbach's alphas for each of the 15 factors were analysed to find initial candidates for elimination. All factors with alphas below 0.60 were eliminated. Initial analysis eliminated six factors: discipline, game recovery, veteran presence, accountability, staying even, and metacognition of risk-taking. Items in the remaining subscales were eliminated to increase the alphas as high as possible while maintaining the integrity of the scale. This analysis resulted in a further 28 items being removed, for a total of 57 items. Exploratory factor analysis (EFA) was run on the remaining 68 items with 11 factors explaining 53 per cent of the variance. Some factors lost their identity loading onto multiple factors while others, such as distributed attention split into to factors. After analysis and six accepted movements, 28 items were eliminated. EFA was run again with the remaining 40 items with eight factors explaining 56 per cent of the variance. Analysis eliminated a further 4 items, resulting in a final 36-item IHQ. Distributed flow remained but now composed of three factors instead of four: distributed attention, strategic timing, and external focus, which was the split from distributed attention. The distributed flow antecedents were reduced to three: coaching impact, adaptiveness, and routine. Metacognition was reduced to just metacognition of resilience but split into team and individual perspectives.


### 3.1 Introduction

The qualitative results were rich in depth. The coding and analysis process identified 15 new components that have not previously been associated with flow, metacognition, and sport performance research. These results now present a new challenge of accurately and

reliably assessing these new dimensions to see if they can be quantitatively measured and if so, what impact they have on performance. A number of these dimensions are closely related and also have been analysed from both the salience and frequency perspective. High salience was believed to be a stronger predictor of future importance than high frequency, but this will be tested in the quantitative results. Thus, creating a quantitative measure is necessary to determine which ones can be measured and what their relationship is with performance. It is possible there might be some overlap and thus more general, umbrella dimensions might be necessary rather than individual, specific ones. It is often the case that all themes identified in qualitative analysis do not stand up in scale development (Madrigal, Hamill, & Gill, 2013; Wilson, & Moneta, 2016). Some items disappear completely while others may shift to different themes, and sometimes the themes have to be reconstructed to encompass the new dimensions. It is expected this research will follow that pattern, but it is impossible to know the necessary movements and reductions without quantitatively measuring and analysing them.

The objective of this study was to develop a valid and reliable measure of hockey specific flow and metacognitions. This objective would be achieved through the development of a pilot questionnaire based upon the findings in Study One (Chapter 2). The questionnaire was broken down into four different categories: before the game, during the game, after the game, and in general. This approach was used because different thought processes exist throughout the duration of the game as well as in the general context of the ice hockey season and using this categorisation allows for capturing that.

The preliminary questionnaire items were tested on a sample of hockey players with exploratory factor analysis then run to understand the underlying factor structure. Both statistical and conceptual factors were taken into consideration to reduce the total item count, establishing an optimal number of items to be included in the final questionnaire. Participants also completed four additional measures: Short Dispositional Flow Scale (SDFS-2) (Jackson, Martin, & Eklund, 2008), Short Flow in Work Scale (SFWS) (Moneta, 2017), Flow Metacognition Questionnaire (FMQ) (Wilson & Moneta, 2016), and Mental Toughness Scale (MTS) (Madrigal, Hamill, & Gill, 2013). All of these measures were discussed in Chapter 1. Once the variables have been confirmed from this study, their correlations will be tested with these psychometric measures. It is expected that significant correlations will exist between the majority of variables and psychometric measures. However, they will remain relatively weak as it is expected these variables will be different from the previously established measures. Flow and flow metacognition questionnaires are obviously needed as that is the

basis of this research, and the new variables need to be established to be related but different than the previously discovered aspects. MT is included as it has been established as it has been shown to positively impact flow, which positively impacts performance (Jackman, Swann, & Crust, 2016; 2020; Meggs, Chen, & Koehn, 2019). It is firstly important to confirm these new variables are different than MT though likely to be correlated. Once this has been established and the variables have been confirmed, they can next be used in mediation modelling in the validation study. Study 2 resulted in the establishment of a final questionnaire to measure hockey specific flow and metacognitions.

## 3.2 Method

### 3.2.1 Participants

A sample of 147 forwards and defence was recruited. Goalies were excluded from this study as some questions were skater-specific, meaning they are not relevant for a goalie's perspective. It was determined to be too difficult to get a large enough sample of goalies to test a reduced goalie-specific version of the questionnaire due to the external circumstances (i.e. the off season during the Covid-19 pandemic). When more favourable study conditions arise, this is an area for further exploration. Prior experience playing ice hockey was the only prerequisite for completing the questionnaire.

Seven demographic questions were asked: gender, position, age category, playing experience, years played, education level, and nationality. Forty-four per cent of the sample was female and 54 per cent was male. Sex was unknown for two participants. Two-thirds of participants were forwards at 67 per cent with 33 per cent playing defence. Age was determined based upon seven categories: 17 or younger, 18-20, 21-29, 30-39, 40-49, 50-59, and 60 or older. Thirty-one per cent of participants were 30-39 years old, 28 per cent were 21-29 years old, 12 per cent 18-20 years old, both 40-49 years old and 50-59 years old had 10 per cent, 5 per cent were 60 or older, and just four per cent was 17 or younger. In terms of experience, players listed themselves in one of five categories: beginner, intermediate, advanced, semi-professional, and professional. The vast majority were advanced at 47 per cent, 30 per cent were intermediate, 12 per cent were semi-professional, 10 per cent were beginner, and just one per cent was professional. Years played was the next demographic item and like ages, participants were categorised: 1 year or less, 1-5 years, 6-10 years 11-15 years, 16-20 years, 21-25 years, 26-30 years, and 31 or more years. The largest group was 6-

10 years at 22 per cent, both 11-15 and 16-20 years had 16 per cent, 21-25 had 13 per cent, 31 or more years had 12 per cent, 1-5 years had 8 per cent, 26-30 had 7 per cent, and 1 year or less was the lowest at 6 per cent. The fifth demographic item was education level with five options: GCSE's, A-levels, undergraduate, graduate, and doctorate. Undergraduate was the highest category with 35 per cent, but graduate was just behind at 33 per cent. The middle category was A-levels at 18 per cent, and the final two were GCSE's and doctorate, both tied with 7 per cent each. With 75 per cent having advance degrees, the sample was clearly very educated. Eleven different nationalities were represented with this sample. When more than one nationality was listed, the first one was assumed predominate and thus was used for the demographic analysis. The top three were U.S. (53 per cent), U.K. (22 per cent), and Canadian (15 per cent). Swedish and Finnish each made up four per cent. Austrian, French, Slovak, Swiss, Thai, and Turkish each had one per cent.

### 3.2.2 Procedure

This study received ethics approval through the university's Research Ethics Review Panel, confirming it conforms to the British Psychological Society's Code of Ethics and Conduct (British Psychological Society, 2018). All participants provided informed consent. The consent form can be seen in Appendix 5.

Participants were recruited through personal channels as well as online using social media to attract as wide of a variety of sample as possible. Personal channels were people with whom the researcher had directly played hockey. They, obviously, had played on other teams and had other contacts, so they were requested to share the questionnaire and recruit participants for the survey as well to get a wide range of perspectives. Some of the researcher's former professional contacts, different than those interviewed, also shared the survey on their social media as many of their followers were assumed to be hockey players. Furthermore, the survey was sent to numerous teams directly through contact pages and coaching emails found from researching leagues throughout the world.

The study was conducted solely online and averaged about 20 minutes to complete. All questions except for the name were required to proceed to the next section. Thus, there were no missing values when it came to analysis. The name was requested; however, it was not required. Participants had the option to include their name, which would then be used to consult online statistical information from previous performance to allow for further analysis and conclusions to be made, but all participants were welcome to remain anonymous if they

preferred. Participants then completed demographic questionnaire items followed by the pilot flow and metacognition questionnaire along with the SDFS-2 (Jackson, Martin, & Eklund, 2008), SWFS (Moneta, 2017), FMQ (Wilson & Moneta, 2016), and MTS (Madrigal, Hamill, & Gill, 2013).

### 3.2.3 Measures

A 125-item scale has been developed, which can be seen in the appendix. The statements were taken directly from the interview responses and coded results from both the amateurs and professionals. Both sets of interviews and all of the coded topics were used to create questionnaire items. This was to quantifiably verify the qualitative conclusions. For example, the amateurs identifying something the professionals didn't likely means it is not significant moving forward but needs to be verified before being excluded. Also, an amateur's wording of a topic could resonate and be more meaningful than the way a professional explained it. Therefore, some topics had items that were similarly worded with slight differences to include both choices and find the best possible choice to move forward. The statements were kept as directly as possible with some modification sometimes necessary to fit the questionnaire style of delivery. One example from each subscale can be seen in Table 38.

All of the new components had a minimum of three items to measure them. Ones that had multiple aspects involved with them naturally had more to measure each aspect to determine if the component did, indeed, incorporate all of these aspects or if some were more relevant and necessary than others. Metacognition of resilience had the most with 21 items as this component had the widest variety of coded responses. It is important to get every aspect of each component represented to find the most crucial ones necessary. Multiple items for each target construct as psychometric research emphasises a more reliable assessment (Marsh, Martin, & Hau, 2006; Williams, Ford, & Nguyen, 2002).

The questionnaire was made online through Google forms surveys and was separated into four sections: before the game (6 questions), during the game (83 questions), after the game (6 questions), and in general (30 questions). The preamble asked participants to read each item and imagine themselves playing ice hockey and the experiences they have had while playing ice hockey games. Items were scored on a four-point Likert scale (1= strongly disagree, 2=disagree, 3=agree, and 4=strongly agree. There was no neutral point so participants had to make a decision on each item. The preamble read as follows:

> *Please read each item and imagine yourself playing ice hockey and the experiences you have had while playing ice hockey games. The statements have been broken down into four sections: before the game, during the game, after the game, and generally while playing. Please select the response per question which appears to be the most appropriate one for you while carrying out this activity.*

Additionally, each section had a separate preamble which can be seen below. Before the game:

> *Please read each item and answer in the context of preparing to play an ice hockey game. To help frame the question, imagine the phrase "before the game" to start each statement. Think of your experience and behaviour before the game to approach each statement.*

During the game:

> *Please read each item and answer in the context of while playing an ice hockey game. To help frame the question, imagine the phrase "during the game" before each statement. Think of your experience and behaviour during the game to approach each statement.*

After the game:

> *Please read each item and answer in the context of while playing an ice hockey game. To help frame the question, imagine the phrase "after the game" before each statement. Think of your experience and behaviour after the game to approach each statement.*

General context of playing ice hockey:

> *Please read each item and answer in the context of while playing an ice hockey game. These questions are in the general context of playing hockey during a game or throughout the season. Think of your experience and behaviour in general to approach each statement.*

Additionally, for the participants who shared their name and their playing statistics were located online, games played, goals, assists, total points, and penalty minutes were recorded. As some players would have played many more games than others, goals per game, assists per game, total points per game, and penalty minutes per game were calculated to keep everyone on the same proportional playing field. The plus/minus rating is also an important statistic, but since many amateur leagues do not keep track of this, it was not included as it was not available for the majority of players.

| Subscale | Item | Original Statement | Origin |
|---|---|---|---|
| Routine | I have a routine to keep focused on my game. | "I tried to have a routine so I can keep my focus on where my tasks were at, but I tried not to make it superstition." | Professional, Forward |
| Role Metacognition | I've had shifts where I've thought, "I've done exactly what I needed to do." | I think I've had shifts where I've thought, "I've done exactly what I needed to do on that shift." | Amateur |
| Distributed Attention | My decisions are often guided by what the opposition is doing. | “Yeah I think you'd have to be aware of who is on the ice on the other team because you may play it differently than against someone else.” | Professional, Defence |
| Coaching Impact | I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. | “On a team level, the higher levels you get, it really comes down to the coach being able to allow his team to play the game at its highest level, have his players play with the utmost focus, and allowing each player to get the best out of himself. If you can accomplish that as a coach, it doesn’t matter how good or how bad your x’s and o’s are, you’re gonna have some success because you need to maximise every player’s ability." | Professional, Forward |
| Adaptiveness | I build chemistry from playing with the same person. | “I do think in a perfect world, you get put together with as a unit and you stay with that unit as much as you possibly can. The chemistry that can build can make a heck of a difference.” | Amateur |
| Strategic Timing | For the most part, I am able to recognise an opportunity and capitalise on it. | “When the opportunity comes, recognise it and make something happen. But don't try to force it.” | Professional, Defence |
| Veteran Presence | We have leaders on my team and the rest of us follow suit. | “It starts with leadership. You know, successful teams even going back to junior hockey, and if your people who were supposed to be our best players, your leader, if they did it the right way it seemed to follow suit.” | Professional, Defence |
| Metacognition of Risk-Taking | When my team in behind, I take more risks. | “I think if you are losing, you are more willing to take risks. You tend to see that with your teammates as well. They will try to be heroes and hog the puck a bit too much.” | Amateur |

| | | | |
|---|---|---|---|
| Game Recovery | I unwind from my previous game before I begin to prepare for the next one. | “So you have to do that unwinding before you can start back up for the next one." | Professional, Defence |
| Accountability | I play better on a team where everybody is held accountable. | "The best guys just held everybody accountable, open line of communication. They had fun with the guys, but they didn't let anything you know slack off, like you knew if you screwed up, there was going to be some accountability there.” | Professional, Defence |
| Metacognition of Resilience | I am able to set aside a mistake I've made and continue playing without it affecting me. | “I remember that the only thing I tried to focus on when bad plays happen was literally I can't bring it back so what I do next if I'm still thinking about that bad play, I'm gonna have another bad play and another bad play and another bad play. So I literally I used to call it park it. I just park it over to the side and then focus on like the next shift or the next play that I made. I always tried to make it simple and make it positive, so that I could start you know the momentum swing back into the good areas.” | Professional, Forward |
| Discipline | I trust my team mates to do their jobs. | “Everyone typically accepts you do your job and you have to give your teammates some trust.” | Amateur |
| Team Support | I expect my team mates to make the generous play rather than hogging the puck themselves. | “If I pass to somebody, I expect them to return the favour at some point or at least pass it on to somebody who is in a better position. I don’t even care if it’s me. Just make the generous play to advance things instead of hogging it up the ice.” | Amateur |
| Staying Even | I feel consistent throughout the hockey season. | “It's one of those things you want to get better and stay consistent; you can’t ride the roller coaster.” | Professional, Defence |

| | | | |
|---|---|---|---|
| Role Model Metacognition | I feel like I can learn from watching other players. | “Real instrumental in that was watching Gretzky when I was a kid. Watching him, he would make mistakes, but there was no recovery time. It was instant, he would be chasing he puck back, or he would go back into position, or he would just get off the ice. But it never seemed to faze him, and I think that is one of the reasons why he was so good.” | Amateur |

Table 38: IHQ Subscale Explanation

### 3.2.4 Statistical Analysis

Factor analysis is a form of data analysis that allows for relationships and patterns to be easily identified and interpreted in a data set. Factor analysis is essentially a variable reduction technique that combines interrelated variables and reduces them into a smaller data set called factors (Pedhazur& Schmelkin, 1991; Tinsley & Tinsley, 1987). This method principally tests a qualitative theory or hypothesis to see if it can be measured in a quantitative form.

The first step is exploratory factor analysis, which creates the operational representative of theoretical constructs essentially as a theory development model (Gorsuch, 1983). From there, the goal is to reduce the number of variables as much as possible while still being able to explain and interpret the results. To do that, factor extraction and factor rotation must be considered. As it was believed these variables were all related, the total variance and the common variance should be equal. Therefore, principal component analysis was used. There has been debate in terms of the criteria in selecting the optimal number of components, but for social science research extracting factors that explain roughly 50-60 per cent is generally the goal (Hair, Anderson, Tatham, & Black, 1992; Pett, Lackey, & Sullivan, 2003). This was the criteria for this data set. Once the number of factors has been determined, factor rotation must be considered. Again, since it was believed that these factors were correlated and not independent, oblique rotation was applied, specifically promax. It's been stated that with oblique rotations, all techniques produce similar outputs and therefore no technique is largely preferred over another (Fabrigar, Wegener, MacCallum, & Strahan, 1999).

This process is mostly directly useful for data sets with over 300 responses. Since this research possibly included 15 factors with fewer than 300 responses, it was not ideal for this method to be applied initially (Comrey & Lee, 1992). Therefore, the Cronbach's alphas for each of the 15 components were first analysed to find initial candidates for elimination. All factors with alphas below 0.60 were eliminated as it was determined even a larger sample would not increase them enough to be significant. Any factors with alphas higher than 0.60 were scrutinised to find candidates for elimination. Items that did not improve the alpha were eliminated first as it was determined they were not positively contributing to the result. Then items which could increase the alpha were removed. In subsequent analysis when alphas for each factor were considered instead of the predetermined subscales, items that did not keep with the majority of the theming were also eliminated. All items also needed at least a

correlation of 0.30 in the pattern matrix as anything lower than that would mean an extremely weak relationship (Tabachnick, Fidell,& Ullman, 2007).

## 3.3 Results

### 3.3.1 Exploratory Factor Analysis on Pilot IHQ (125 items)

Initially, 12 items were identified as being reverse and thus were automatically recoded before the initial analysis. These items were 8, 18, 22, 34, 38, 42, 57, 75, 81, 83, 88, and 100. Although it was anticipated that exploratory factor analysis could not be run on the full set of items due to the limited sample size, it was run to ensure an alternative initial elimination method was needed. The preliminary EFA showed 12 factors, explaining 45 per cent of the variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.21, and Bartlett's Test of Sphericity (Approximate $X^2 = 13761$, $p < 0.001$) was significant, indicating unfavourable factorability of the data (Bartlett, 1954). Furthermore, analysis of the pattern matrix showed no consistent theming with all factors mixed together, not holding individual integrity. The pattern matrix can be seen in Appendix 7.

Alpha analysis of each individual subscale was then carried out. This analysis resulted in elimination of five sub-scales: discipline (0.39), game recovery (0.40), veteran presence (0.48), accountability (0.50), and metacognition of risk-taking (0.59). Individual items from these scales were removed to get the alphas as high as possible, but they all fell below the minimum 0.60 threshold. Staying even had an initial alpha of 0.28. The removal of one item resulted in an alpha jump to 0.63. However, with just two items remaining, this subscale also had to be removed as a factor was determined to need at least three variables (Tabachnick, Fidell, & Ullman, 2007). This process resulted in the elimination of 29 items.

An unexpected result of the alpha analysis showed two items in distributed attention (15 & 21) were negative and thus needed to be reverse coded. Once these were recoded, alpha analysis was carried out on the remaining scales. Items were removed one by one to increase the alpha of the scales as high as possible while still maintaining the integrity of each subscale. Two subscales, coaching impact and metacognition of resilience, did not require any items to be removed. Some only needed one item to be removed to increase the alpha, such as role model metacognition and strategic timing whereas others, such as team support, had seven items removed to reach the minimum 0.60 threshold. This analysis resulted in a further 28 items being removed for a total of 57 items removed in the first round. The full list

of item reductions can be seen in Table 39. The new alpha column represents the alpha value after the item had been deleted. The final alphas for the nine remaining subscales can be seen in Table 40.

| Subscale | Initial Alpha | Item for Removal | New Alpha |
|---|---|---|---|
| Routine | 0.57 | 4. I try not to have a superstitious routine. | 0.66 |
| | | 6. If I don't play well in a game, I change my pregame routine for the next one. | 0.66 |
| | | 92. I am focused on replenishing nutrition. | 0.67 |
| | | 5. My routine is consistent as long as I have been playing well in the previous matches. | 0.73 |
| Role Model Metacognition | 0.60 | 115. I make an effort to surround myself with smart hockey players. | 0.62 |
| | | 7. When I play, I focus on getting the puck to one or two key players. | 0.60 |
| Role Metacognition | 0.52 | 11. I stick to my position. | 0.64 |
| | | 96. I know where I am in the pecking order of the changing room and the ice and accept that. | 0.64 |
| | | 13. I don't let my line mates' playing style or skill dictate how I play my game. | 0.70 |
| | | 12. I do my own job(s). | 0.70 |
| Adaptiveness | 0.58 | 16. I easily adjust to the players with whom I am playing. | 0.59 |
| | | 22. I can be mentally affected negatively by changing my line mates. | 0.64 |
| | | 44. When I change line mates, I communicate more to find out their comfort zone for playing and adjust my own. | 0.66 |
| | | 67. When I'm asked to play with a new partner or line, I view it as an opportunity to make something new and productive for the team. | 0.72 |
| Distributed Attention | 0.47 | 43. I blur out my own team and just focus on the opposition. | 0.48 |
| | | 14. My focus depends on where I am on the ice and the responsibilities with that location. | 0.50 |
| | | 49. I am mostly focused on my objectives on the ice. | 0.50 |
| | | 65. If I'm not playing well, I mostly focus on myself. | 0.63 |

| | | | |
|---|---|---|---|
| | | 58. I am constantly adjusting to what is happening in the game. | 0.63 |
| Strategic Timing | 0.55 | 10. I play worse when I am focused on myself. | 0.64 |
| | | 18R. When my team has a comfortable lead, I sometimes find my mind wanders to thoughts outside of hockey. | 0.62 |
| | | 40. I expect my team mates to make the generous play rather than hogging the puck themselves. | 0.44 |
| Team Support | 0.43 | 32. There are a few people on my team who score most of the goals. | 0.45 |
| | | 74. When I make a mistake, my team mates cover for me. | 0.45 |
| | | 50. I need to play with players who I can feed the pucks. | 0.47 |
| | | 75. My confidence can be affected by those with whom I'm on the ice. | 0.59 |
| | | 87. I feel more confident when certain team mates are on the ice. | 0.59 |
| | | 97. I play better on teams that feel close and have a strong sense of camaraderie. | 0.60 |

Table 39: Round One Subscale Item Removal Process with Alpha

| Subscale | Final Alpha |
|---|---|
| Routine | 0.73 |
| Coaching Impact | 0.73 |
| Role Model Metacognition | 0.62 |
| Role Metacognition | 0.70 |
| Adaptiveness | 0.72 |
| Distributed Attention | 0.64 |
| Team Support | 0.60 |
| Strategic Timing | 0.62 |
| Metacognition of Resilience | 0.76 |

Table 40: Round One Analysis Final Subscale Alphas

### 3.3.2 Further Survey Reduction

The initial analysis resulted in the elimination of 57 items. EFA was then run again with the remaining 68 items. This time, the 11 factors explained 53 per cent of the variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.624, just above the 0.6 cut off. Bartlett's Test of Sphericity (Approximate $X^2 = 4825$, $p < 0.001$) was significant. These results indicate an acceptable factorability of the data (Bartlett, 1954).

While the pattern matrix maintained much stronger factorial identities than the first time, some factors lost their identity with items loading on multiple factors, thus requiring further analysis and critique. The pattern matrix can be seen in Appendix 8. Team support, role model metacognition, and role metacognition all lost their individual identities, loading onto multiple factors. Metacognition of resilience loaded onto two different factors. Upon further analysis, it was determined that one was from an individual perspective and one was from a team perspective. Distributed attention also loaded onto two separate factors. One was more of an internal focus, which remained being called distributed attention, and one was a focus outside of oneself, which became known as external focus. The alphas for each factor were then calculated to determine if the new factors should be kept and if any of the movements held merit from statistical and then conceptual aspects. The eliminated items can be seen in Table 41. Both Factor 4 and Factor 11 were eliminated. Factor 4 had eight items from four different subscales. Three of those items were removed due to a lack of consistent theming. The remaining items had an alpha of 0.57 and removing any further items would only lower it. Factor 11 was eliminated entirely as the three items did not theme well together.

| Subscale | Initial Alpha | Item for Removal | New Alpha |
|---|---|---|---|
| Factor 1 | 0.79 | 29. I'm not affected much by my team mates making a mistake. | 0.8 |
| | | 86. I get bothered by negative things less than my team mates do. | 0.82 |
| Factor 2 | 0.76 | 8R. It's difficult for me to change positions during a game. | 0.77 |
| Factor 3 | 0.75 | 46. My team is stable even if we are losing in a game. | 0.75 |
| | | 59. My team has a balance of having fun but being serious when we need to be. | 0.75 |
| Factor 4 | 0.67 | 9. I've had shifts where I've thought I've done exactly what I needed to do. | |
| | | 17. Getting lucky bounces can shift the momentum for my team. | 57 |
| | | 37. If the other team scores during my shift, I take a few seconds when I get to the bench to reset. | |
| Factor 5 | 0.70 | 41. I watch as many players as possible. | |
| | | 116. I watch my team mates' tendencies to know if I need to adjust my play accordingly. | 0.66 |
| Factor 6 | 0.70 | 52. I try to cover my team mates when they make a mistake | 0.74 |
| | | 26. I usually play with the same line mates. | |
| | | 99. I play with the same line mates for most of the season. | 0.75 |

| | | | |
|---|---|---|---|
| | | 123. There are players with whom I play exceptionally well from years of playing together. | |
| Factor 7 | 0.52 | 81R. I start to chase the game when I am getting chances to score but not capitalising on them. | 0.71 |
| | | 93. If I missed a shot or play during the game I think I should have made, I work on it at the next practice to make sure the skill is honed in. | 0.73 |
| Factor 8 | 0.36 | 79. After I score, I want to get off the ice to reset before my next shift. | 0.42 |
| | | 42R. I feel strongly affected when the team morale is low. | 0.65 |
| Factor 9 | 0.73 | 105. I watch professionals play and study their tendencies. | 0.73 |
| Factor 10 | 0.69 | 69. I feel like I can learn from watching other players. | 0.69 |

Table 41: Round Two Subscale Item Removal Process with Alpha

| Subscale | Final Alpha |
|---|---|
| Factor 1 | 0.82 |
| Factor 2 | 0.77 |
| Factor 3 | 0.75 |
| Factor 5 | 0.66 |
| Factor 6 | 0.74 |
| Factor 7 | 0.73 |
| Factor 8 | 0.65 |
| Factor 9 | 0.73 |
| Factor 10 | 0.69 |

Table 42: Round Two Analysis Final Subscale Alphas

Six movements were accepted. One item (110) moved from role metacognition to adaptiveness. This item specifically addressed recognising one's own role within a team, which is clearly the metacognition of one's role. However, as it is expected that the number of variables would be reduced through this process, it is understandable that this item could fit into adaptiveness as one must be able to recognise his or her own role to then be able to adapt it depending on the situation. One item (31) moved from team support to strategic timing. This item discusses knowing where to go with the puck when in trouble, which inherently requires an element of team support. An argument could be made that if one feels he or she is in trouble with the puck, then the correct decision will require strategic timing. One item (66) moved from role metacognition to strategic timing. This item involved a player's ability to do exactly what is needed for the team. During the initial coding, this item was identified as a role item. However, what is needed for the team could change based upon the situation, thus requiring strategic timing. One item (77) moved from strategic timing to metacognition of resilience: team. This item discusses a player working harder after the team has let in a goal. This item was listed as strategic timing as it involved understanding the timing of the game and a strategy for that particular time. However, with the addition of metacognition of resilience: team this move makes sense. Two items (19 & 62) moved from strategic timing to distributed attention. Item 19 talks about adjusting the style of play based upon the team and item 62 about making the opponent make a mistake before that player. There is an element of timing to both of these. However, to execute these strategies, an element of distributed attention is required, thus justifying this move. Factor 8 was not entirely cohesive as a theme, but since the final alpha was at 0.65, it was determined to keep

those remaining items to see how they loaded for a third run of EFA and if any of them moved to different subscales that made more sense.

The second round eliminated 28 items. EFA was run again with the remaining 40 items. Eight factors explained 56 per cent of the variance. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.708. Bartlett's Test of Sphericity (Approximate $X^2 = 2300$, $p < 0.001$) was significant. These results indicate an acceptable factorability of the data (Bartlett, 1954). This time the pattern matrix showed extremely strong individual factorial identity for all eight factors. The pattern matrix can be seen in Table 74 in Appendix 9.

| Subscale | Initial Alpha | Item for Removal | New Alpha |
|---|---|---|---|
| Factor 1 | 0.83 | 88R. If we go down against a strong team, part of me doesn't believe we can come back. | 0.83 |
| Factor 2 | 0.63 | 71R. If I'm not getting a regular shift, I find it difficult to keep focused. | 0.76 |
| | | 108. I can easily take different roles in a team. | 0.76 |
| Factor 5 | 0.70 | 53. I communicate with my team mates to learn their tendencies. | 0.67 |

Table 43: Round Three Subscale Item Removal Process with Alpha

| Subscale | Final Alpha |
|---|---|
| Factor 1 | 0.83 |
| Factor 2 | 0.76 |
| Factor 3 | 0.75 |
| Factor 4 | 0.73 |
| Factor 5 | 0.67 |
| Factor 6 | 0.75 |
| Factor 7 | 0.69 |
| Factor 8 | 0.73 |

Table 44: Round Three Analysis Final Subscale Alphas

There was one final move of one item (83) moving originally from team support to distributed attention. This item talks about not being able to directly impact team mates if they are struggling. This was a reverse mention of team support, but in order to even consider impacting and helping a team mate, the element of distributed attention is necessary to even recognise the need. This analysis resulted in the removal of four items, but all of the factors maintained consistent theming with the lowest alpha being 0.67. The removed items can be seen above in Table 43. EFA was run once again to ensure the same consistent result.

### 3.3.3 Exploratory Factorial Analysis on Final IHQ (36 Items)

EFA was run the final time on the remaining 36 items. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.71, and Bartlett's Test of Sphericity (Approximate $X^2$ = 1978, $p < 0.001$) was significant, indicating good factorability of the data (Bartlett, 1954). The total variance explained was 58 per cent. Tables 45 and 46 listed below show the descriptive statistics and correlations of the final eight factors as well as the full pattern matrix for the final solution.

| Variables | X | SD | Alpha | 2. | 3. | 4. | 5. | 6. | 7. | 8. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Metacognition of Resilience: Individual | 2.74 | 0.61 | 0.83 | 0.33** | 0.43** | -0.13 | 0.07 | 0.17* | 0.08 | 0.19* |
| 2. Metacognition of Resilience: Team | 2.80 | 0.61 | 0.75 | | 0.22** | -0.06 | 0.13 | 0.14 | 0.15 | 0.12 |
| 3. Strategic Timing | 3.06 | 0.55 | 0.76 | | | -0.02 | 0.12 | 0.41** | 0.09 | 0.35** |
| 4. Coaching Impact | 3.16 | 0.65 | 0.73 | | | | 0.25** | 0.01 | -0.13 | 0.39 |
| 5. Adaptiveness | 3.45 | 0.52 | 0.75 | | | | | 0.09 | -0.02 | 0.09 |
| 6 Distributed Attention | 2.94 | 0.57 | 0.67 | | | | | | 0.18* | 0.15 |
| 7. External Focus | 2.64 | 0.60 | 0.69 | | | | | | | -0.05 |
| 8. Routine | 2.73 | 0.68 | 0.73 | | | | | | | - |

Table 45: Means, standard deviation, Cronbach's alpha values, and correlations of Study 2 variables (n=147; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed))

| Questionnaire Item | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 |
|---|---|---|---|---|---|---|---|---|
| 38(R). If I make a mistake, I stew over it for a while. | 0.833 | -0.133 | 0.099 | -0.116 | -0.055 | -0.115 | 0.025 | -0.073 |
| 23. I don't stew over my mistakes when I get regular ice time. | 0.776 | -0.046 | 0.004 | 0.174 | 0.038 | -0.05 | -0.029 | -0.026 |
| 85. If I make a bad play, I set it aside immediately and move on. | 0.717 | 0.022 | 0.053 | -0.071 | -0.054 | -0.105 | -0.164 | 0.024 |
| 34(R). I can feel easily defeated. | 0.656 | 0.032 | 0.084 | -0.016 | -0.064 | -0.041 | 0.101 | -0.079 |
| 76. I am able to set aside a mistake I've made and continue playing without it affecting me. | 0.571 | 0.223 | 0.073 | -0.236 | 0.048 | 0.075 | -0.042 | 0.049 |
| 63. I tend to view things positively. | 0.569 | 0.09 | -0.028 | -0.036 | 0.059 | 0.183 | 0.025 | 0.048 |
| 24. I feel more resilient because of my positivity. | 0.509 | 0.065 | 0.156 | 0.227 | -0.137 | 0.045 | 0.127 | 0.186 |
| 80. My team as a whole feels resilient even when we are behind in a game. | -0.239 | 0.775 | 0.023 | -0.102 | 0.053 | 0.141 | -0.091 | -0.025 |
| 70. I feel a sense of resiliency with my team when we get behind in a game. | 0.064 | 0.767 | -0.014 | 0.107 | -0.022 | 0.07 | -0.107 | -0.012 |
| 82. I don't feel phased if the game starts off badly for my team. | 0.058 | 0.764 | 0.093 | -0.014 | -0.072 | -0.056 | -0.002 | 0.02 |
| 68. I don't feel discouraged if my team gets off to a bad start. | 0.209 | 0.65 | -0.045 | -0.017 | 0.046 | -0.269 | 0.15 | 0.072 |
| 77. I work harder after my team has let in a goal to get the momentum back on our side. | 0.087 | 0.504 | -0.054 | 0.085 | 0.083 | 0.095 | 0.029 | -0.184 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 30. For the most part, I am able to recognise an opportunity and capitalise on it. | 0.125 | -0.009 | 0.76 | 0.005 | 0.013 | 0.092 | -0.069 | -0.014 |
| 31. When I get in trouble, I know where to go with the puck. | 0.119 | -0.05 | 0.746 | -0.158 | -0.019 | 0.143 | -0.127 | 0.009 |
| 66. I tend to do exactly what I need to do for the team. | 0.118 | 0.099 | 0.675 | 0.051 | 0.062 | -0.044 | 0.024 | -0.123 |
| 27. I force opportunities. | -0.077 | -0.021 | 0.577 | 0.068 | -0.043 | 0.22 | 0.049 | 0.206 |
| 117. I often crave positive reinforcement from my coach. | -0.16 | -0.033 | 0.145 | 0.76 | -0.104 | -0.094 | 0.045 | -0.078 |
| 102. My belief in my coach pushes me to play better. | -0.011 | 0.093 | 0.09 | 0.73 | 0.009 | -0.052 | 0.23 | 0.005 |
| 125. I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. | 0.137 | 0.026 | -0.257 | 0.701 | 0.013 | 0.177 | -0.172 | 0.072 |
| 122. I play better when I like my coach and my coach likes me. | 0.02 | -0.062 | -0.152 | 0.682 | 0.182 | 0.072 | -0.2 | -0.004 |
| 112. Playing with the same person often benefits my performance on the ice. | -0.041 | -0.012 | -0.094 | -0.046 | 0.854 | 0.035 | 0.055 | -0.077 |
| 109. I build chemistry from playing with the same person. | -0.12 | 0.031 | 0.212 | 0.108 | 0.757 | -0.059 | -0.112 | -0.058 |
| 56. Playing with the same person(s) allows me to play better. | -0.054 | 0.1 | -0.123 | -0.052 | 0.756 | -0.063 | 0.106 | 0.21 |
| 110. I recognise what my individual role is on a team. | 0.195 | -0.119 | 0.185 | 0.087 | 0.544 | 0 | 0.077 | 0.121 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 62. Part of my strategy is to make the opponent make a mistake before I make one. | -0.002 | -0.034 | 0.24 | 0.072 | 0.056 | 0.683 | -0.019 | -0.068 |
| 48. My decisions are often guided by what the opposition is doing. | -0.234 | 0.173 | -0.123 | -0.138 | -0.053 | 0.677 | 0.129 | 0.046 |
| 61. I focus on the opponents to find a weakness to exploit. | 0.075 | -0.136 | 0.155 | -0.058 | 0.104 | 0.653 | 0.062 | -0.045 |
| 19. I adjust my style of play based upon the team I'm playing against. | -0.112 | 0.057 | 0.178 | 0.086 | -0.235 | 0.612 | 0.02 | 0.081 |
| 83(R). If my team mates are struggling, I don't feel like I can directly impact them. | 0.295 | 0.047 | -0.081 | 0.163 | 0.051 | 0.419 | 0.087 | -0.056 |
| 15(R). I'm more focused on myself than my team mates. | 0.007 | 0.038 | 0.003 | 0.026 | 0.019 | 0.112 | 0.778 | -0.071 |
| 21(R). I'm more focused on myself than the opponents. | 0.186 | -0.153 | -0.314 | -0.108 | -0.092 | 0.118 | 0.771 | 0.077 |
| 36. I play better when I'm not focused on myself. | -0.246 | 0.05 | 0.115 | 0.267 | -0.005 | -0.132 | 0.698 | 0.025 |
| 78. I focus more on my team mates than myself. | 0.02 | -0.049 | 0.032 | -0.163 | 0.21 | 0.103 | 0.612 | -0.147 |
| 3. I have a routine so I can keep focused on my game. | 0.012 | -0.089 | 0.065 | 0.073 | -0.008 | -0.058 | 0.004 | 0.857 |
| 2. I have a routine to keep me from thinking too much before the game. | 0.035 | -0.001 | -0.225 | -0.009 | 0.059 | 0.073 | -0.145 | 0.808 |
| 1. I have a clear routine. | -0.115 | 0.006 | 0.29 | -0.142 | 0.09 | -0.049 | 0.043 | 0.697 |

Table 46: Pattern matrix for the 36-iten pilot IHQ (eight-factor solution; promax rotation, N=147)

The resulting optimal subscale for Factor 1 (metacognition of resilience: individual) comprised of seven questions. This factor highlights an individual's strength to view the game and circumstances positively and optimistically rather than feeling victimised. All of these items are original items but further refined for just an individual perspective:

- If I make a mistake, I stew over it for a while. (Reverse) (Item 38)
- I don't stew over my mistakes when I get regular ice time. (Item 23)
- If I make a bad play, I set it aside immediately and move on. (Item 85)
- I can feel easily defeated. (Reverse) (Item 34)
- I am able to set aside a mistake I've made and continue playing without it affecting me. (Item 76)
- I tend to view things positively. (Item 63)
- I feel more resilient because of my positivity. (Item 24)

The resulting optimal subscale for Factor 2 (metacognition of resilience: team) comprised of five questions. This factor takes metacognition of resilience: individual to the team collective. All but one of these items were from the original metacognition of resilience again further refined to a team perspective. One item was originally with strategic timing:

- My team as a whole feels resilient even when we are behind in a game. (Item 80)
- I feel a sense of resiliency with my team when we get behind in a game. (Item 70)
- I don't feel phased if the game starts off badly for my team. (Item 82)
- I don't feel discouraged if my team gets off to a bad start. (Item 68)
- I work harder after my team has let in a goal to get the momentum back on our side (Item 77)

The resulting optimal subscale for Factor 3 (strategic timing) comprised of four questions. This subscale has now taken more of an individualised approach than initially conceptualised but is essentially the ability to read the game and take appropriate action. This subscale was not a very good initial match as only half of the items were originally from strategic timing with one from role metacognition and one from team support:

- For the most part, I am able to recognize an opportunity and capitalize on it. (Item 30)
- When I get in trouble, I know where to go with the puck. (Item 31)
- I tend to do exactly what I need to do for the team. (Item 66)
- I force opportunities. (Item 27)

The resulting optimal subscale for Factor 4 (coaching impact) comprised of four questions. This subscale details the coach's recognition of the impact he or she has at both the individual and team levels and the different ways it can take form. All of these items are originals with no additions or removals:

- I often crave positive reinforcement from my coach. (Item 117)
- My belief in my coach pushes me to play better. (Item 102)
- I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. (Item 125)
- I play better when I like my coach and my coach likes me. (Item 122)

The resulting optimal subscale for Factor 5 (adaptiveness) comprised of four questions. Adaptiveness is the recognition of building chemistry playing with the same players while understanding one's role in that dynamic. This subscale had three original items and one from role metacognition:

- Playing with the same person often benefits my performance on the ice. (Item 112)
- I build chemistry from playing with the same person. (Item 109)
- Playing with the same person(s) allows me to play better. (Item 56)
- I recognise what my individual role is on a team. (Item 110)

The resulting optimal subscale for Factor 6 (distributed attention) comprised of five questions. Distributed attention is the awareness of one's self, strategy, and strengths in relation to opponents and team mates and interpreting what adjustments to make. This subscale was also largely different than the original classification with only two original items, two from strategic timing, and one from team support:

- Part of my strategy is to make the opponent make a mistake before I make one. (62)
- My decisions are often guided by what the opposition is doing. (Item 48)
- I focus on the opponents to find a weakness to exploit. (Item 61)
- I adjust my style of play based upon the team I'm playing against. (Item 19)
- If my team mates are struggling, I don't feel like I can directly impact them. (Reverse) (Item 83)

The resulting optimal subscale for Factor 7 (external focus) comprised of four questions. This subscale emphasises a focus outside of oneself but still within the game context. All of these items were original distributed attention items as the scale split into two separate ones:

- I'm more focused on myself than on my team mates. (Reverse) (Item 15)
- I'm more focused on myself than the opponents. (Reverse) (Item 21)

- I play better when I'm not focused on myself. (Item 36)
- I focus more on my team mates than myself. (Item 78)

The resulting optimal subscale for Factor 8 (routine) comprised of three questions. Routine is the balance between focusing before a game without overthinking through a predetermined set of activities in preparation for the game. All of these items originally came from this subscale:

- I have a routine so I can keep focused on my game. (Item 3)
- I have a routine to keep me from thinking too much before the game. (Item 2)
- I have a clear routine. (Item 1)

### 3.3.4 Correlational Analysis

The correlations between the new variables and the psychometric measures were calculated and can be seen in Table 47. Metacognition of resilience: individual, metacognition of resilience: team, strategic timing, distributed attention, and adaptiveness all had significant correlations with every measure. Routine was significant with all of the measures except for SWFS. However, they were low correlations. External focus was the next, only significant with SWFS and FMQ-1 but once again low with both of these. Coaching impact was only significant with MTS but was a very low correlation. In terms of strength, strategic timing had the strongest correlations in four of the five psychometric tests. Metacognition of resilience: team beat strategic timing with SWFS. Strategic timing was moderately correlated with SWFS, FMQ-1, and FMQ-2 but strongly correlated with SDFS-2 and MTS. Both Metacognition of resilience: team and metacognition of resilience: individual had fair correlations with all of the variables except for one low one. Metacognition of resilience: individual was lowly correlated with FMQ-1 while metacognition of resilience: team was lowly correlated with FMQ-2. Distributed attention was lowly correlated with SWFS and FMQ-1 but moderately correlated with SDFS-2, FMQ-1, and MTS. Adaptiveness was also lowly correlated with SWFS but also with FMQ-2 and MTS and then moderately correlated with SDFS-2 and FMQ-1. All of these correlations were significant at the 0.01 level. While some variables had stronger and more correlations with the pre-existing psychometric measures than others, all of the new variables had at least one significant correlation, thus confirming their importance and potential new contributions. Since the

correlations were not too strong, it indicates that the new scales measure somewhat distinct variables, which further confirms the integrity of the findings.

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .420** | .322** | .285** | .364** | .331** |
| Metacognition of Resilience: Team | .352** | .459** | .389** | .266** | .341** |
| Strategic Timing | .657** | .325** | .427** | .413** | .602** |
| Coaching Impact | 0.082 | 0.073 | 0.129 | 0.009 | .170* |
| Distributed Attention | .315** | .280** | .216** | .353** | .314** |
| Routine | .186* | 0.079 | .170* | .241** | .304** |
| Adaptiveness | .329** | .223** | .323** | .173* | .255** |
| External Focus | 0.065 | .211* | .197* | 0.156 | -0.066 |

Table 47: Correlations Between Measured Variables and Psychometric Measures (n=147; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)). SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

These correlations were then run again itemised into the demographic categories to determine if any significant differences existed based upon these classifications. These charts can be found in Appendix 9. The first comparison was males v females. Any correlation coefficients found to be significant in one sample but not the other were compared using an online calculator of Fisher's 2 transformation (Weiss, 2011). With gender, 11 differences were noted, coaching impact and routine with SDFS-2, distributed attention, adaptiveness, and external focus with SWFS, distributed attention and external focus with FMQ-1, metacognition of resilience: team, routine, and adaptiveness with FMQ-2, and adaptiveness with MTS. After calculating the z-scores for all of these, it was determined the only significant difference was for coaching impact and SDFS-2 with a two-tailed p-value of 0.017, and it was determined that males have a significantly stronger correlation than females do. Naturally, one significant difference over so many comparisons could happen by chance alone. However, it is possible this difference is important or merits further investigation. Ice hockey is traditionally a male dominated sport, both in participation and coaching. There are more male hockey coaches than female coaches and research has shown differences when it comes to coaching styles and impact due to gender (Norman, 2016; Norman & French, 2013). This difference alone does not conclusively support this but could be further evidence of that.

The same process was conducted comparing forwards and defence. It should be noted that there were almost double the responses for defence than forwards and thus any differences could be attributed to that factor. Eighteen differences were detected, which were metacognition of resilience: individual, coaching impact, routine, and adaptiveness with SDFS-2, strategic timing, distributed attention, adaptiveness, and external focus with SWFS, metacognition of resilience: individual, distributed attention, routine, adaptiveness, and external focus with FMQ-1, metacognition of resilience: team and routine with FMQ-2, and metacognition of resilience: individual, coaching impact, and adaptiveness with MTS. Out of these differences between the positions, 14 of them were determined to be not significantly different with two tails. Out of the four differences determined to be significant, only one, metacognition of resilience: individual with SDFS-2, was stronger for forwards. It could be that forwards are looking at their role from a more individualistic viewpoint and thus resilience at the individual level is more important for them to achieve flow. The ones stronger for defence than forwards were coaching impact with SDFS-2 and metacognition of resilience: team and routine with FMQ-2. In terms of coaching impact with SDFS-2, since there was almost double the responses from males to females in this category, which could be playing a role in this response and more of a contributor to this result than the position itself. When it comes to metacognition of resilience: team and FMQ-2, defence might be looking at their role from a collective team standpoint, thus highlighting the importance of metacognition of resilience: team and that would in turn help those players self-regulate flow. The defence also might be feeling more pressure as being the last line of defence and having a routine might also help facilitate their self-regulation of flow, which could be the reason for this result.

The correlations between the performance statistics and both the psychometric measures and the new measured variables were also analysed. The results are displayed in Table 48 and Table 49. Distributed flow was also included in with the psychometric measure analysis. In terms of statistics, games played, goals, assists, points, and penalty minutes were all recorded. Goals, assists, total points and penalty minutes per game were also calculated to put all players on the same playing field, so players with longer or shorter seasons would not skew the data.

Out of the previously established psychometric measures, only SWFS and MTS had significant correlations. Interestingly, the three correlations with SWFS were negative and were with games played, assists, and total points. MTS was positively significant with penalty minutes per game. No previous research has quantifiably looked at these correlations

before, so there are no results to use as a comparison. However, none of these results were expected. Obviously, more significant correlations were expected. No negative correlations were expected. However, if one was to exist, it would have been thought to be between MTS and penalty minutes per game as an easy argument would be the stronger the MTS, the fewer the penalty minutes per game. Alternatively, since enforcers are known for intentionally getting penalty minutes, it could be that they need stronger MT due to their role and limited ice time during games, which would explain this result. In terms of distributed flow, there were positive significant correlations with goals, goals per game, assists per game, and total points per game. This is a very promising result as the per game categories show it is impacting players regularly regardless of the season length.

| Statistical Categories | Psychometric Measures | | | | | |
|---|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS | Distributed Flow |
| Games Played | -0.016 | -.242* | -0.009 | -0.12 | 0.188 | -0.046 |
| Goals | 0.013 | -0.096 | 0.185 | -0.014 | 0.087 | .228* |
| Goals Per Game | 0.071 | 0.075 | 0.167 | 0.048 | 0.083 | .295** |
| Assists | -0.219 | -.303** | -0.028 | -0.193 | 0.018 | 0.155 |
| Assists Per Game | -0.134 | -0.078 | -0.095 | -0.138 | -0.094 | .270* |
| Total Points | -0.125 | -.227* | 0.073 | -0.122 | 0.052 | 0.201 |
| Points Per Game | -0.044 | -0.006 | 0.036 | -0.06 | -0.012 | .341** |
| Penalty Minutes | -0.097 | -0.072 | 0.102 | 0.127 | 0.176 | 0.048 |
| Penalty Minutes Per Game | -0.064 | 0.112 | 0.115 | 0.22 | .244* | 0.065 |

Table 48: Correlations Between Statistic Categories and Psychometric Measures (n=76; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

Next, the individual variable correlations were analysed, shown on the next page in Table 49. Metacognition of resilience team and individual, coaching impact, and distributed attention did not have any significant correlations with any of the variables. Distributed attention was unexpected to not have an individual result as distributed flow had significant results. Strategic timing had the most with four low positive correlations, but they were all with the original categories of games played, goals, assists, and total points, not the standardised ones per game. This result was also unexpected as distributed flow only had a significant correlation with goals as an original category. External focus had three and they were all per game variables: goals per game, assists per game, and points per game. Goals per game and assists per game were low positive ones, and points per game was a fair positive correlation. This result makes sense as an external focus is necessary to make plays and get points in the game and is in line with the distributed flow result. Adaptiveness was next with only two, both of which were negative: penalty minutes and penalty minutes per game. It makes sense these are negative correlations as teams are at a disadvantage playing a player down with penalties, thus changing the line combinations and style of play. Finally, routine had just one correlation with goals per game. Unexpectedly, the correlation was low but negative, which could be due to the element of spontaneity in scoring goals, which would, therefore, lead to an opposite relationship with routine.

| Statistical Categories | Measured Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Metacognition of Resilience: Individual | Metacognition of Resilience: Team | Strategic Timing | Coaching Impact | Distributed Attention | Routine | Adaptiveness | External Focus |
| Games Played | 0.028 | -0.215 | .295** | 0.088 | -0.147 | 0.113 | -0.087 | -0.180 |
| Goals | 0.011 | -0.119 | .290* | 0.090 | 0.044 | -0.082 | 0.007 | 0.144 |
| Goals Per Game | 0.010 | -0.016 | 0.145 | 0.078 | 0.171 | -.291* | 0.008 | .264* |
| Assists | -0.095 | -0.160 | .252* | 0.078 | -0.008 | 0.065 | -0.072 | 0.088 |
| Assists Per Game | -0.132 | -0.015 | 0.090 | 0.007 | 0.146 | -0.006 | 0.055 | .284* |
| Total Points | -0.051 | -0.154 | .290* | 0.091 | 0.014 | -0.003 | -0.039 | 0.122 |
| Points Per Game | -0.078 | -0.019 | 0.141 | 0.051 | 0.190 | -0.173 | 0.040 | .333** |
| Penalty Minutes | 0.037 | 0.049 | 0.074 | 0.006 | -0.036 | 0.015 | -.299** | 0.060 |
| Penalty Minutes Per Game | 0.146 | 0.143 | 0.034 | -0.035 | -0.024 | 0.033 | -.319** | 0.108 |

Table 49: Correlations Between Statistic Categories and Measured Variables (n=76; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed))

### 3.4 Discussion

The aim of Study 2 was to present the development of a questionnaire for the measurement of hockey specific flow, antecedents, and metacognitions. This was achieved by designing a pilot measure and testing it on a sample of ice hockey players. EFA with item reduction procedures resulted in 8 factors measured through a 36-item questionnaire. The eight items explained 59 per cent of the variance and were labelled metacognition of resilience: individual, metacognition of resilience: team, strategic timing, coaching impact, adaptiveness, distributed attention, external focus, and routine. This questionnaire captures the essence of the themes identified in the qualitative study, discussed in Chapter 2, with the strongest emphasis on distributed attention, external focus, and strategic timing as these three factors together make up distributed flow and have not been established in previous research. However, the usefulness of this questionnaire as a research tool still needs to be established in Study 3.

#### 3.4.1 New Definitions

With all of the movements and reductions of items as well as the addition of a new dimension, new definitions are needed to fully encompass the final eight dimensions. The definition for distributed attention needed to change as two items came out of that original dimension. The definition of the new item of external focus can be seen below in Table 50 along with the adjusted definition for distributed attention. The essence of strategic timing remained the same, but some of the specifics were eliminated due to the reduction of items for that dimension. These adjustments have streamlined the concept of distributed flow with all three of these dimensions involving elements of flow duality as well as attentional control and shifting. As a result of the individual dimensions changing, the definition of distributed flow also changes. Distributed flow is an individual cognitive state balancing focus between oneself and the external to allow for the necessary personal adjustments to be made whilst taking a careful consideration of the timing of action needed.

| Distributed Flow | |
|---|---|
| **Dimension** | **Definition** |
| External Focus | External focus is the lack of focus on oneself with the emphasis placed on external factors, such as team mates or the opponents. With the game constantly in motion, players must devote some focus outside of themselves to then be able to understand their role and timing in the situation. |
| Distributed Attention | Distributed Attention is the recognition of the opponent's actions, strategies, and weaknesses and the appropriate adjustment to one's own style of play to capitalise on the presented opportunity. |
| Strategic Timing | Strategic timing is the awareness and understanding of the timing of the game, allowing players to recognise when an opportunity exists to capitalise on it. This also involves knowing what to do for the team and when. |

Table 50: Distributed Flow Definitions

In terms of the definitions for the distributed flow antecedents, adaptiveness was the only one out of the three remaining antecedents to change from the qualitative analysis. Since the only items left involve playing with the same partner or line mates, only that aspect has remained from the original definition.

| Distributed Flow Antecedents | |
|---|---|
| **Dimension** | **Definition** |
| Adaptiveness | Adaptiveness is the recognition that playing with the same person allows for chemistry to build and performance to benefit. |
| Routine | A routine is the pattern of activities that each player follows to keep from overthinking before games but still allows them to maintain focus on the game. While the independent actions will vary by player, the goal of mental clarity is the same across the board for players. |
| Coaching Impact | Coaching impact is the recognition of the influence a coach has on a player's performance. This impact comes in different forms, such as belief, reinforcement, and recognising the strengths of players. Coaching impact is also the understanding at the individual level the impact that the coaching decisions at the team level have on a player. |

Table 51: Distributed Flow Antecedent Definitions

Since all types of metacognition have been eliminated apart from resilience and that one has been separated into the two categories of individual and team, new definitions have been created for these. Previously, post-game physical activities had been included with metacognition of resilience, but these definitions only take part during the game itself and can be seen in Table 52 below.

| Types of Metacognitions | |
|---|---|
| **Dimension** | **Definition** |
| Metacognition of Resilience: Individual | Metacognition of resilience at the individual level is the ability for a player to have the mental strength and resistance to not beat himself or herself up after a bad play or easily feel defeated. The player is also able to view things positively and continue playing without any adverse effects during the game. |
| Metacognition of Resilience: Team | Metacognition of resilience at the team level means that the individual player still feels the same spirit of the metacognition at the individual level but from the collective team whole. The players as a whole stick together to maintain that collective strength makes it even easier to maintain at the individual level. |

Table 52: Metacognition Definitions

### 3.4.2 Strengths and Limitations

As to be expected, this study had both strengths and limitations. In terms of the strengths, a wide variety of skill, experience, and nationalities were included in the study. This helps to show that these factors are relevant across the board, not just impacting one type of ice hockey player. Also incorporating both males and females in the study is important because often studies focus on one gender, especially for sports which are strongly associated with one gender participation, such as ice hockey. Therefore, incorporating both genders and also showing the similarities in the findings is important not only for these findings but also for future research directions. A final strength is incorporating a wide range of statistical analysis.

Naturally, this study does not come without its limitations. The biggest weakness was the small sample size. A sample size under 300 is not ideal for factor analysis and reduction given the number of items considered. However, that was overcome through thorough alpha analysis to ensure the strongest result and conclusion. The small sample size also affects the

statistical analysis. Not asking for specific league information was also a limitation as that could have helped to find further stats available. Even with more statistical information available, there will always be some errors at the amateur level. For professionals, people are professionally doing the stats and they have replays to ensure they get everything correct, but that is not possible with the amateurs. Frequently it happens that the referee did not see both people who passed the puck before the goal was scored, thus missing an assist on the play or incorrectly give credit to the wrong player. Once the scoresheet is uploaded, it is kept with the league, but frequently there are errors on the sheet, which could be a contributing factor to the limited significant correlation results. The most recent statistical information was sought out to be the most valuable as this was the closest to when they were filling out this information. However, for many of the players, that was the 2019-2020 season, which was cut short due to Covid-19 and worldwide lockdowns, halting the hockey season. Furthering this point, people were completing the questionnaire outside of the hockey season. Since people had not been able to play hockey recently, some of the specifics of the questions might not have been at the forefront of their minds like they would had it been straight after a game or at least during the middle of the regular season. It is possible the players' perspectives might not be as comprehensive as desired or slightly skewed due to the unexpected removal from the sport. Additionally, with so many changes going on with people's lives during that time in other areas, that could have affected their mind-set in general and thus impacted the results of this study. Finally, over half the sample population was from the US and 68 of the total sample was from North America. North American style hockey is often different from European or Russian (Kahane, Longley, & Simmons, 2013) and so that does have the potential to strongly skew the results. The study did not have the time or resources to translate the questionnaire into multiple languages. However, that could be an area for further exploration to see if there are any differences in these items and relationships across different continents or countries.

### 3.5 Outlook on Chapter 4

In order to build upon the findings generated by Study 2, Study 3 (presented in Chapter 4), utilised a much larger and diverse sample of ice hockey players. Replicating this study on a different sample allows for an assessment of the robustness of the findings as well as an opportunity to further establish and replicate the concurrent validity and predictive

validity findings. This replication is necessary to confirm the contribution and importance of these new findings.

## Chapter 4: Further Scale Validation and Testing (Study 3)


### Abstract

With the 36-item IHQ identified, confirmatory factor analysis (CFA) was performed on a sample of 342 ice hockey players. The initial analysis showed the Chi-square test was significant though the model did not strictly fit. Two criteria were set to improve the fit and lower the Chi-squared value: a factor loading of lower than 0.30 and an error measurement value of 0.90 or above. Three items were eliminated, and CFA was carried out again. The Chi-squared value improved to 952.42. the other goodness of fit statistics again confirmed a close fit. The final result was a 33-item IHQ. Mediation modelling was next performed to test relationships with mental toughness and performance. Mental toughness had both direct and indirect effects on flow, which in turn increased performance. As this finding was in line with previous research findings, the integrity of the data was confirmed, opening the door to analysing the new subscales in the same fashion. Strategic timing outperformed expectation. When mental toughness, strategic timing, and flow were regressed together on performance, mental toughness was not significant. This is the first-time research has shown mental toughness not to have a direct impact on flow and performance. Clearly further research is needed into this factor specifically as well as into the overall concept of distributed flow.


### 4.1 Introduction

The success of Study 2 in establishing the 36-item Ice Hockey Questionnaire (IHQ) now shifted focus onto confirming and validating those results on a different, larger, and more robust sample. The objective of Study 3 was threefold. The first aim was to further establish and confirm the construct validity of the 36-item scale measuring eight factors with the aim of corroborating all eight factors. The three factors of distributed flow will be independently analysed afterwards these three factors have not been established in any previous flow, metacognition, or sport performance research, so further analysis of them is necessary to validate these findings. The second aim was to evaluate the predictive validity of these eight factors with performance as was done in Study 2. Finally, mediation modelling was used to test the legitimacy of these eight factors as a research tool by assessing their concurrent validity through assessing their relationships with flow and MT and their predictive validity with performance.

In terms of the first two objectives, it is expected that the results will be corroborated. However, it is also expected that the Cronbach's alphas as well as the correlation coefficients

will be slightly lower than those in Study 2 as is often the case when different sample sizes are compared. Since Study 3's sample size was over double that of Study 2, it opens the door for slightly lower correlations, but on the whole, everything is expected to follow in line. In Chapter 3, metacognition of resilience: individual, metacognition of resilience: team, strategic timing, distributed attention, and adaptiveness all had significant relationships with all of the psychometric measures. It is expected the results of this study will follow in line with these though it is likely the values will be lower due to the larger sample size. Coaching impact and external focus had the fewest significant results and thus will be a critical area of analysis if the expectation of decreased significance due to the larger sample comes true.

Mediation modelling is the process of explaining the relationship between an independent variable and the dependent variable, through the inclusion of a third variable, known as the mediating variable. Instead of a direct relationship between the independent and dependent variables, this model proposes that the independent variable influences the mediating variable, which then in turn influences the dependent variable. This process is helpful to quantify relationships between variables, particularly when non-observable variables are involved. Previous research shows MT supports flow, which in turn influences performance in a positive way (Jackman, Swann, & Crust, 2016; 2020; Meggs, Chen, & Koehn, 2019). The more MT one has, the stronger the experience of flow, which translates to the better performance. Since previous research has shown that MT is a major psychological predictor of performance, if any of the individual scales turn out to predict performance over and beyond that of MT, it would be considered a great achievement and finding of this research and even further justify the need for further exploration of these results. All of the individual scales will be modelled. However, arguably, the three most important scales in this analysis will be the three individual scales that make up distributed flow: distributed attention, strategic timing, and external focus. It is expected that if any of these will exceed the results of MT, it would be distributed attention and/or strategic timing as these dimensions have been identified since the first study. Study 2 introduced the concept of external focus, but its legitimacy is still more in question as it still needs to be validated in Study 3, and distributed attention and strategic focus have remained relatively consistent throughout the previous two studies.

## 4.2 Method

### 4.2.1 Participants

A new sample of 342 ice hockey players was recruited through personal and online channels. Thirty-seven per cent were female, and 63 per cent were male. Sex was unknown for two participants. Just over two-thirds were forwards at 68 per cent, and 32 per cent were defence. In terms of age, the two largest categories were 30-39 and 20-29 years old with 33 per cent and 30 per cent respectfully. The next category was 40 to 49 years old with 15 per cent. Eighteen to 20 years old, 17 or younger, and 50-59 years old were descending at 8 per cent, 7 per cent, and 6 per cent. Finally 60 or older was the smallest with just one per cent. Playing experience was the next category with advanced and intermediate taking the top two spots with 40 and 36 per cent. Semi-professional was in the middle with 11 per cent. Beginner and professional were the lowest with 8 and 5 per cent. For the most part, years played were more evenly spread. The top three were 6-10 years, 11-15 years, and 1-5 years with 19, 18, and 17 per cent. The next category was 16-20 years with 15 per cent followed by 21-25 years with 13 per cent. Thirty-one or more years was the next with 9 per cent and then 26-30 years at 8 per cent. One year or less was the lowest at just one per cent. In terms of education, undergraduate was the strongest category at 42 per cent. A-levels and graduate degree were tied at 23 per cent. GCSE's had 8 per cent, and doctorate had 4 per cent. For nationality, the top four were U.S. (39 per cent), Canadian (28 per cent), U.K. (21 per cent), and New Zealand (4 per cent). Sweden, Germany, Netherlands, Hong Kong, Irish, and Slovakian all had one per cent. There was only one participant from Australia, Belgium, Bulgaria, Finland, France, Latvia, Luxembourg, Malaysia, Russia, Serbia, and Singapore.

### 4.2.2 Procedure

As with Study 2, this study received ethics approval through the university's Research Ethics Review Panel as it conforms to the British Psychological Society's Code of Ethics and Conduct (British Psychological Society, 2018). All participants provided informed consent. The consent form can be seen in Appendix 5.

Participants were again recruited through personal and online channels. The personal channels were people with whom the researcher had directly played hockey, but they were from different teams than those contacted for Study 2, so there was no crossover or overlap.

Those participants had also played on other teams and had other contacts, so they also shared the questionnaire with their contacts. This survey was also sent directly to numerous teams, again different than those from the first study, either through the contact pages online or direct coach emails. Lastly, the survey was posted on Reddit, an online network of communities where people can connect based upon their interests and hobbies. They have pages specifically for ice hockey players, so the request was shared there as it would directly reach anyone who has an account on the site and connected to those pages.

The study was again conducted solely online and took less than 10 minutes to complete. As with Study 2, all questions except for the name were required to proceed to the next section. Accordingly, there were no missing values when it came to analysis. The name was again requested but not mandatory. It was explained that including a name would be utilised to consult online statistical information from previous performance to allow for further analysis and conclusions to be made, but all participants were welcome to remain anonymous if they preferred. Participants then completed demographic questionnaire items followed by 36-item IHQ and then the Short Dispositional Flow Scale (SDFS-2) (Jackson, Martin, & Eklund, 2008), Short Flow in Work Scale (SFWS) (Moneta, 2017), Flow Metacognition Questionnaire (FMQ) (Wilson & Moneta, 2016), and Mental Toughness Scale (MTS) (Madrigal, Hamill, & Gill, 2013).

### 4.2.3 Measures

Everything followed the same format and pattern as Study 2. All specifics and directions are listed in the Method section of Chapter 3. Due to the reduction in items, the items per section were significantly reduced, and there were only three sections instead of four: before game (3 questions), during the game (26 questions), and (7 questions). The same preambles and scales were used throughout. See appendix 10 for the 36-item IHQ.

## 4.3 Results

Once the theory has been created and the initial measurement has been established, it then needs to be tested and evaluated, which comes through confirmatory factor analysis.

### 4.3.1 Confirmatory factor analysis on 36-item IHQ

Five items had been identified as reverse in Study 2 and thus were automatically recoded before initial analysis. These items were 4, 9, 10, 20, and 29. Confirmatory factor analysis (CFA) was carried out on the 8-factor model using LISREL 8.8 (Jöreskog & Sörbom, 1996). The maximum likelihood method of estimation was ustilised to determine parameter values of the model and the probability of distribution. While it is not the most popular method when it comes to psychology research, it is a standard approach for statistics and why it was used in this research (Myung, 2003). All eight factors were identified as latent variables. The initial output showed the chi-square test was significant ($X^2$ = 1222.67, df = 566, p < 0.001), with the model not strictly fitting. The other goodness of fit statistics did, however, confirm a close fit (CFI = 0.90, RMSEA = 0.058, 90% CFI for RMSEA: 0.054-0.063, NNFI = 89) based on the standards set out by Hu and Bentler (1999).

The model was inspected for ways to improve the fit and lower the chi-square value. The standardised solution was analysed to identify any items for elimination. Two criteria were set as grounds for elimination: one, a factor loading of lower than 0.3 and two, an error of measurement value of 0.90 or above. The candidates for elimination based upon these criteria can be seen in Table 53.

| Factor | Statement | Factor Loading | Measurement of Error |
|---|---|---|---|
| Metacognition of Resilience: Team | I work harder after my team has let in a goal to get the momentum back on our side. | 0.17 | 0.97 |
| Distributed Attention | If my team mates are struggling, I don't feel like I can directly impact them. (Reverse) | 0.32 | 0.90 |
| Adaptiveness | I recognise what my individual role is on a team. | 0.22 | 0.95 |

Table 53: Initial CFA Candidates for Elimination

### 4.3.2 Survey Shortening

After eliminating the above three items, CFA was carried out once again. The internal consistencies of all measures were satisfactory to good (Bernstein, 1994). The chi-square test was significant ($X^2$ = 952.42, df = 467, p < 0.001), with the model not strictly fitting. However, other goodness of fit statistics once again confirmed a close fit (CFI = 0.92, RMSEA = 0.055, 90% CFI for RMSEA: 0.05-0.06, NNFI = 0.91) based on the standards set out by Hu and Bentler (1999). The final results can be seen in Table 54 below where the

numbers on the left hand side are the standardised error of measurement, and the right hand side numbers are the factor loadings for each factor. The statements for each item can be seen in Table 55. The coding for Lisrel can be found in Appendix 12.

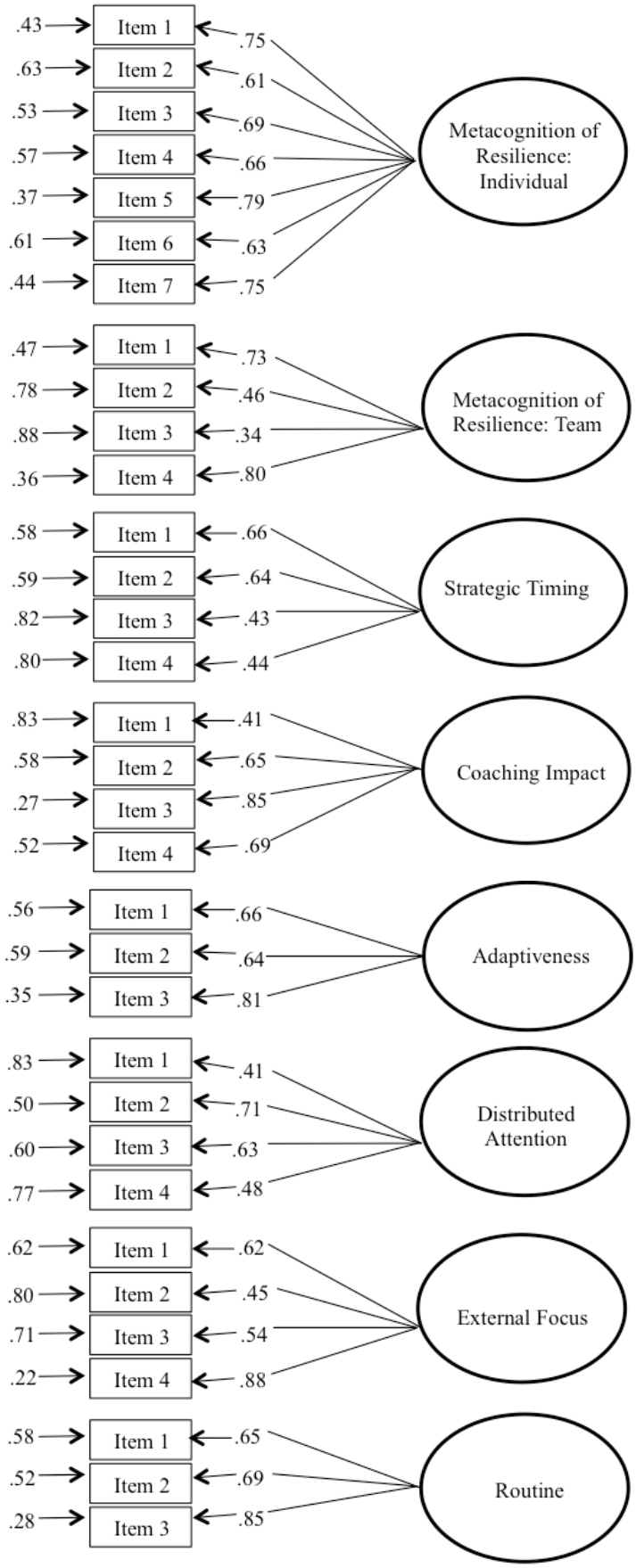


Table 54: Standardised Factor Loadings and Measurement of Errors from CFA

| Final Ice Hockey Questionnaire Items | | |
|---|---|---|
| Scale | Number | Statement |
| Metacognition of Resilience: Individual | Item 1 | If I make a bad play, I set it aside immediately and move on. |
| | Item 2 | I can feel easily defeated. |
| | Item 3 | I don't stew over my mistakes when I get regular ice time. |
| | Item 4 | I feel more resilient because of my positivity. |
| | Item 5 | I am able to set aside a mistake I've made and continue playing without it affecting me. |
| | Item 6 | I tend to view things positively. |
| | Item 7 | If I make a mistake, I stew over it for a while. |
| Metacognition of Resilience: Team | Item 1 | I don't feel discouraged if my team gets off to a bad start. |
| | Item 2 | I feel a sense of resiliency with my team when we get behind in a game. |
| | Item 3 | My team as a whole feels resilient even when we are behind in a game. |
| | Item 4 | I don't feel phased if the game starts off badly for my team. |
| Strategic Timing | Item 1 | For the most part, I am able to recognise an opportunity and capitalise on it. |
| | Item 2 | When I get in trouble, I know where to go with the puck. |
| | Item 3 | I tend to do exactly what I need to do for the team. |
| | Item 4 | I force opportunities. |
| Coaching Impact | Item 1 | My belief in my coach pushes me to play better. |
| | Item 2 | I often crave positive reinforcement from my coach. |
| | Item 3 | I play better when I like my coach and my coach likes me. |
| | Item 4 | I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. |
| Adaptiveness | Item 1 | Playing with the same person(s) allows me to play better. |
| | Item 2 | I build chemistry from playing with the same person. |
| | Item 3 | Playing with the same person often benefits my performance on the ice. |
| Distributed Attention | Item 1 | I adjust my style of play based upon the team I'm playing against. |
| | Item 2 | I focus on the opponents to find a weakness to exploit. |
| | Item 3 | Part of my strategy is to make the opponent make a mistake before I make one. |
| | Item 4 | My decisions are often guided by what the opposition is doing. |
| External Focus | Item 1 | I'm more focused on myself than on my team mates. |
| | Item 2 | I'm more focused on myself than the opponents. |
| | Item 3 | I play better when I'm not focused on myself. |

| | | |
|---|---|---|
| | Item 4 | I focus more on my team mates than myself. |
| Routine | Item 1 | I have a clear routine. |
| | Item 2 | I have a routine to keep me from thinking too much before the game. |
| | Item 3 | I have a routine so I can keep focused on my game. |

Table 55: Final Ice Hockey Questionnaire Items

Table 56 shows the modelled standardised correlations while Table 57 shows the data's correlations. From the model, the highest correlation is strategic timing with distributed attention at 0.66. The next highest was metacognition of resilience: individual with strategic timing at 0.46. There was a correlation coefficient of 0.43 for metacognition of resilience: individual with metacognition of resilience: team and distributed attention with external focus. The rest of the correlations were below 0.4. In terms of the observed correlations, the strongest one was in fact strategic timing with distributed attention at 0.42, significant at the 0.01 level. Metacognition of resilience: individual with strategic timing was the next highest at 0.35, also significant at the 0.01 level. Metacognition of resilience: individual and metacognition of resilience: team had a significant correlation of 0.33 while distributed attention and external focus had a 0.31 correlation, both of which were significant at the 0.01 level. While the actual values were lower than those from the model, the pattern very closely matched. There were other significant correlations, but they were all lower than 0.3. This result confirms the data is in line with the model.

| Variables | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| 1. Metacognition of Resilience: Individual | 0.43 | 0.46 | -0.23 | 0.02 | 0.22 | 0.14 | 0.06 |
| 2. Metacognition of Resilience: Team | | 0.29 | -0.13 | 0.00 | 0.08 | 0.15 | 0.10 |
| 3. Strategic Timing | | | 0.05 | 0.18 | 0.66 | 0.19 | 0.36 |
| 4. Coaching Impact | | | | 0.33 | 0.19 | 0.00 | 0.12 |
| 5. Adaptiveness | | | | | 0.21 | 0.16 | 0.10 |
| 6 Distributed Attention | | | | | | 0.43 | 0.27 |
| 7. External Focus | | | | | | | 0.11 |
| 8. Routine | | | | | | | |

Table 56: Standardised Correlations from CFA

| Variables | X | SD | Alpha | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Metacognition of Resilience: Individual | 2.98 | 0.61 | 0.86 | 0.33** | 0.35** | -0.19** | 0.03 | 0.14** | 0.10 | 0.06 |
| 2. Metacognition of Resilience: Team | 2.79 | 0.55 | 0.69 | | 0.22** | 0.03 | 0.08 | 0.08 | 0.10 | 0.14* |
| 3. Strategic Timing | 2.98 | 0.48 | 0.60 | | | 0.09 | 0.13* | 0.42** | 0.11* | 0.27** |
| 4. Coaching Impact | 3.14 | 0.63 | 0.73 | | | | 0.27** | 0.15** | 0.03 | 0.12* |
| 5. Adaptiveness | 3.48 | 0.50 | 0.74 | | | | | 0.19** | 0.14* | 0.08 |
| 6 Distributed Attention | 2.79 | 0.62 | 0.64 | | | | | | 0.31** | 0.17** |
| 7. External Focus | 2.56 | 0.61 | 0.71 | | | | | | | 0.35 |
| 8. Routine | 2.72 | 0.76 | 0.77 | | | | | | | |

Table 57: Means, standard deviation, Cronbach's alpha values, and correlations of Study 3 variables (n=342; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed))

The dimensions of distributed flow were grouped together and run separately to assess these findings separately from the IHQ. The chi-square test was significant ($X^2$ =124.61, df = 51, p < 0.001), though the model was not a strict fit. The other goodness of fit also confirmed a satisfactory fit (CFI = 0.93, RMSEA = 0.065, 90% CFI for RMSEA: 0.051-0.08, NNFI = 0.91) based on the standards set out by Hu and Bentler (1999). A model with the standarised factor loadings along with the measurement of errors can be seen below in Table 58. The descriptive statistics can be seen in tables 59 and 60. The Lisrel code for this output can be found in Appendix 12.

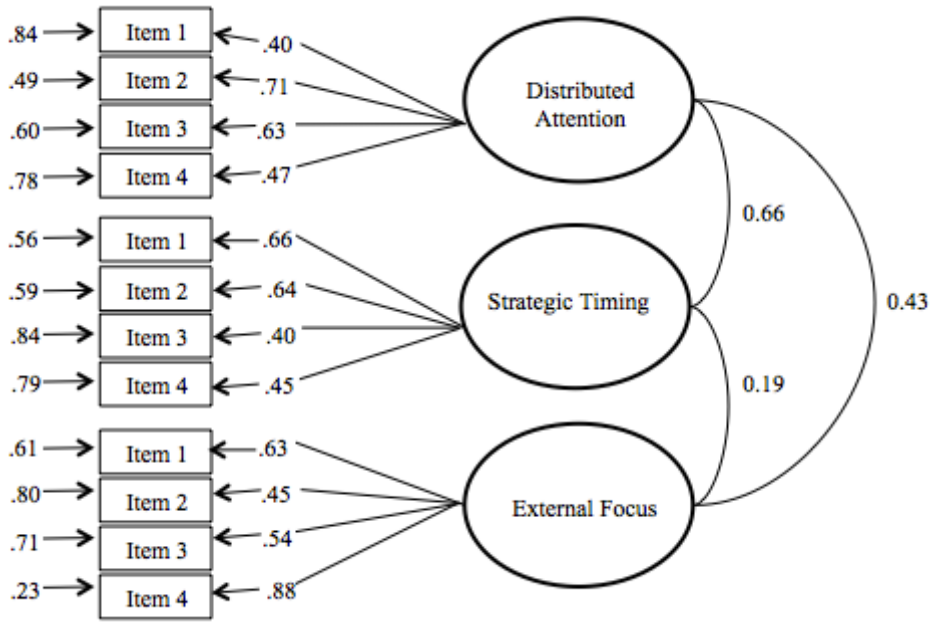


Table 58: Standardised Factor Loadings and Measurement of Errors for IFQ

| Variables | 2 | 3 |
|---|---|---|
| 1. Distributed Attention | 0.66 | 0.43 |
| 2. Strategic Timing | | 0.19 |
| 3. External Focus | | |

Table 59: Standardised Correlations for IFQ

| Variables | X | SD | | |
|---|---|---|---|---|
| | | | 2 | 3 |
| 1. Distributed Attention | 2.79 | 0.62 | 0.42** | 0.31** |
| 2. Strategic Timing | 2.98 | 0.48 | | 0.11* |
| 3. External Focus | 2.56 | 0.61 | | |

Table 60: Means, standard deviation, Cronbach's alpha values, and correlations of IFQ (n=342; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed))

### 4.3.3 Concurrent Validity

The correlations between distributed flow and the psychometric measures were calculated and can be seen in Table 61. Distributed flow was calculated as the average of distributed attention, strategic timing, and external focus. All measures had significant correlations, the strongest being with the SDFS-2 (Jackson, Martin, & Eklund, 2008) and the MTS (Madrigal, Hamill, & Gill,2013). However, they are low enough to determine that distributed flow is distinct from the previously established measures but still related, which was to be expected.

| **Psychometric Measure** | **Distributed Flow** |
|---|---|
| SDFS-2 | 0.399** |
| SWFS | 0.196** |
| FMQ-1 | 0.292** |
| FMQ-2 | 0.326** |
| MTS | 0.379** |

Table 61: Correlations Between Distributed Flow and Psychometric Measures (n=342; ** Correlation is significant at the 0.01 level (2-tailed); SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

The correlations between the variables and psychometric measures were once again calculated and can be seen in Table 62. Metacognition of resilience: individual, metacognition of resilience: team, strategic timing, distributed attention, and routine all had

significant correlations with every measure. Adaptiveness was significant with SDFS-2, FMQ-1, and MTS. Coaching impact was significant with just FMQ-1 and MTS. Interestingly, external focus was not significantly correlated with any of the measures. Strategic timing had the strongest correlations with all five measures.

These results are mostly in line with the expectation. Metacognition of resilience team and individual, strategic timing, and distributed attention were all expected to be significant across the board. Adaptiveness was expected to be correlated with all of the psychometric measures but lost the correlations with the SWFS and FMQ-2. The two most unexpected results were that coaching impact gained a significant correlation, and external focus lost the previous two. These changes could all be due to the differences in sample size and will be further explored in Chapter 5.

| **Measured Variable** | **Psychometric Measures** | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .348** | .162** | .208** | .359** | .267** |
| Metacognition of Resilience: Team | .235** | .133* | .217** | .284** | .279** |
| Strategic Timing | .629** | .285** | .395** | .445** | .560** |
| Coaching Impact | 0.057 | 0.070 | .170** | -0.004 | .152** |
| Distributed Attention | .337** | .125* | .262** | .272** | .275** |
| Routine | .239** | .135* | .230** | .286** | .385** |
| Adaptiveness | .253** | 0.104 | .292** | 0.081 | .152** |
| External Focus | 0.008 | 0.030 | 0.032 | 0.048 | 0.039 |

Table 62: Correlations Between Measured Variables and Psychometric Measures (n=342; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

As with Study 2, these correlations were then run again, itemised into demographic categories to determine if any significant differences existed based upon these classifications. These charts can be found in Appendix 12. Once again, the first comparison was males versus females. Any correlation coefficients found to be significant in one sample but not the other were compared using the online calculator of Fisher's z transformation (Weiss, 2011). Study 3 showed 10 differences: metacognition of resilience individual and team, coaching impact, distributed attention, and routine with SWFS, metacognition of resilience: individual with FMQ-1, metacognition of resilience: team and distributed attention with FMQ-2, and coaching impact and adaptiveness on MTS. After calculation of the z-scores for all of these,

it was determined only one was statistically different, which was that of coaching impact and SWFS. The result showed that it is statistically stronger for females than males.

This process was then repeated for the forwards and defence. Nine differences were identified this time, which were metacognition of resilience individual and team and routine with SWFS, coaching impact with FMQ-1, and metacognition of resilience: individual, coaching impact, and adaptiveness with MTS. From calculating the z-scores of all of these, it was determined none of these differences were statistically significant.

### 4.3.4 Predictive Validity

Once again the correlations between the performance statistics and the psychometric measures, including distributed flow were analysed. The results are shown on the next page in Table 63. Out of all of the statistical categories, there were only two significant ones with the previously established psychometric measures. SWFS and FMQ-2 were both significantly correlated with points per game. Distributed flow was negatively correlated with goals and total points.

| Statistical Categories | Psychometric Measures | | | | | |
|---|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS | Distributed Flow |
| Games Played | 0.131 | -0.061 | -0.062 | -0.029 | 0.176 | -0.175 |
| Goals | 0.068 | 0.002 | -0.008 | 0.021 | 0.15 | -.206* |
| Goals Per Game | 0.05 | 0.099 | 0.061 | -0.063 | 0.029 | -0.045 |
| Assists | 0.147 | 0.062 | 0.005 | 0.082 | 0.178 | -0.159 |
| Assists Per Game | 0.16 | 0.111 | 0.11 | 0.117 | 0.073 | 0.066 |
| Total Points | 0.063 | 0.008 | -0.034 | -0.006 | 0.126 | -.242* |
| Points Per Game | .203* | 0.115 | 0.117 | .213* | 0.176 | 0.153 |
| Penalty Minutes | 0.182 | 0.026 | -0.017 | 0.083 | 0.171 | -0.093 |
| Penalty Minutes Per Game | 0.172 | 0.108 | 0.091 | 0.09 | 0.063 | 0.04 |

Table 63: Correlations Between Statistic Categories and Psychometric Measures (n=96; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

The correlations between the performance statistics and the new measured individual variables were also analysed. When it comes to playing statistics, metacognition of resilience both team and individual, strategic timing, and coaching impact did not have any significant correlations. Distributed attention and routine both had three correlations. All three correlations for distributed attention were negative but were with measured variables (games played, goals, and total points). Routine had positive correlations once again with measured variables (games played, assists, and penalty minutes). External focus had negative correlations with goals and total points. Finally, adaptiveness was negatively correlated with games played. All of the results are displayed on the following page in Table 64.

| Statistical Categories | Measured Variables | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Metacognition of Resilience: Individual | Metacognition of Resilience: Team | Strategic Timing | Coaching Impact | Distributed Attention | Routine | Adaptiveness | External Focus |
| Games Played | 0.016 | 0.035 | 0.053 | 0.088 | -.203* | .377** | -.213* | -0.167 |
| Goals | 0.040 | -0.039 | 0.104 | 0.147 | -.215* | 0.196 | 0.007 | -.250* |
| Goals Per Game | 0.040 | -0.074 | 0.141 | 0.032 | -0.027 | -0.096 | 0.043 | -0.157 |
| Assists | 0.021 | 0.009 | 0.102 | 0.116 | -0.190 | .218* | -0.090 | -0.183 |
| Assists Per Game | 0.065 | -0.077 | 0.097 | 0.102 | 0.015 | 0.055 | 0.069 | 0.043 |
| Total Points | 0.017 | 0.005 | 0.076 | 0.112 | -.256* | .235* | -0.088 | -.256* |
| Points Per Game | 0.052 | -0.064 | 0.125 | 0.096 | 0.123 | -0.030 | 0.113 | 0.081 |
| Penalty Minutes | 0.098 | -0.018 | 0.058 | 0.174 | -0.041 | .258* | -0.085 | -0.176 |
| Penalty Minutes Per Game | 0.003 | -0.061 | 0.007 | 0.063 | 0.117 | 0.163 | -0.028 | -0.044 |

Table 64: Correlations Between Statistic Categories and Measured Variables (n=96; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed))

### 4.3.5 Mediation Modelling

The final analysis for Study 3 was mediation modelling through Process (Hayes, & Little, 2018). The first step was to see how this data set compared to previously established models in sport psychology. It is assumed this data would follow suit as the intention was to confirm previously established theory explicitly within ice hockey and then take it further. This data's support of previous theory builds credibility in the data set, providing leverage for its expansion into other areas not previously studied. All variables were first standarised before any analysis was conducted.

Model 4 was utilised to determine the relationship within this data set of MT, flow, and self-rated performance. The first output was the regression of flow on MT, which had a highly significant ($p < 0.001$) correlation of 0.514 with a confidence interval of 0.423-0.606. Performance was then utilised as a dependent variable with MT and flow. The flow correlation was reduced to 0.275, which is to be expected as part will be taken away with MT added in at 0.172. Both values were significant with flow $p < 0.001$ and MT $p<0.003$. Finally, the direct and indirect effects of MT on performance were analysed. The direct effect of MT on performance was 0.172, $p < 0.003$, and confidence interval of 0.057-0.286, and the indirect effect of MT through mediation of flow on performance was significant as well with a correlation coefficient of 0.142 and confidence interval of 0.080-0.212. Essentially, MT has both a direct and indirect effect on flow with flow explaining a part of the effect of MT on performance. These findings are in line with the previous research, confirming these trends continue within ice hockey specifically and opening the door for modelling of the newly established variables.

The next step was to look at the individual scales of distributed flow to determine how they fit with this and validate their place in distributed flow. Model 6 was utilised for all of these regressions for a chained mediation. The first component tested was strategic timing. The regression of strategic timing on MT showed that MT is a good, strong predictor of strategic timing with a correlation coefficient of 0.560, $p < 0.001$, and a confidence interval of 0.472-0.649. For the regression of flow, both MT and strategic timing predicted flow and were significant at the $p < 0.001$ level. Strategic timing had a much stronger effect at 0.500 vs 0.236. The final regression with all three variables show performance is predicted by strategic timing and flow but not MT. MT was not significant and had a negative lower bound for the confidence interval. The correlation coefficient for strategic timing was 0.237 at the $p < 0.001$

and a confidence interval of 0.104-0.370, and the correlation coefficient of flow was 0.165 with $p < 0.01$ and a confidence interval of 0.037-0.294.

This model in Table 65 shows that MT has no direct effect on performance. However, all three possible indirect effects are significant together and individually. The table below shows the correlation statistics as well as the different pathways. In conclusion, these findings are in line with previous research for what concerns the role of flow as a mediator and adds an extra mediator that's more primitive than flow, which also predicts performance both directly and indirectly to flow. The inclusion of this mediator makes the direct effect of MT on performance not significant. Strategic timing and flow explain the effect of MT on performance.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway |
|---|---|---|---|---|---|
| Total | 0.218 | 0.043 | 0.138 | 0.306 | |
| Indirect 1 | 0.133 | 0.041 | 0.053 | 0.214 | MT ➡ Strategic Timing ➡ Performance |
| Indirect 2 | 0.039 | 0.017 | 0.010 | 0.074 | MT ➡ SDFS-2 ➡ Performance |
| Indirect 3 | 0.046 | 0.018 | 0.012 | 0.084 | MT ➡ Strategic Timing ➡ SDFS-2 ➡ Performance |

Table 65: Indirect Effects of MT, Strategic Timing, and Flow on Performance

The next component analysed was distributed attention. Model 6 was once again used and confirmed distributed attention is predicted by MT with a correlation coefficient of 0.275, significant at the $p < 0.001$ level and a confidence interval of 0.173-0.378. Flow is predicted by both MT and distributed attention, but MT is much stronger with a correlation coefficient of 0.456 compared to 0.211 for distributed attention. Both were significant at the $p < 0.001$ level. MT had a confidence interval of 0.364-0.549 compared to 0.119-0.304 for distributed attention. With all three variables together, MT and flow are significantly related to performance, but distributed attention is not.

In terms of direct and indirect effects, the results are displayed on the next page in Table 66. The direct effect of MT on performance is significant. Only two of the indirect effects are significant: MT to flow to performance and MT to distributed attention to flow to performance. The statistics of all of the relationships can be seen in the table below. While not as impressive as the strategic timing result, this model is still important. Although it does not eliminate MT, it is still an indication that if distributed attention is intervened, there could be more flow and better performance.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Total | 0.155 | 0.034 | 0.090 | 0.222 | | | | | |
| Indirect 1 | 0.027 | 0.016 | -0.003 | 0.060 | MT | ➡ | Distributed Attention | ➡ Performance | |
| Indirect 2 | 0.114 | 0.023 | 0.057 | 0.174 | MT | ➡ | SDFS-2 | ➡ Performance | |
| Indirect 3 | 0.015 | 0.006 | 0.005 | 0.028 | MT | ➡ | Distributed Attention | ➡ SDFS-2 | Performance |

Table 66: Indirect Effects of MT, Distributed Attention, and Flow on Performance

The final component analysed from distributed flow was external focus. As can be seen in Table 67, MT is not a predictor of external focus as the correlation coefficient was 0.040 and $p > 0.467$. Additionally, external focus is not a predictor of flow as the correlation coefficient was a negative value of 0.012 and $p > 0.793$. Finally, external focus is not a predictor of performance. The results of the indirect relationships can be seen in the table below. The only one that was significant was MT to flow to performance, excluding external focus. Based on this analysis, external focus is irrelevant to flow and performance and unrelated to MT. Although this is both an unexpected and undesirable result, external focus will remain in the model and is under scrutiny for further research.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Total | 0.139 | 0.033 | 0.075 | 0.205 | | | | | |
| Indirect 1 | -0.002 | 0.005 | -0.014 | 0.006 | MT | ➡ | External Focus | ➡ Performance | |
| Indirect 2 | 0.141 | 0.033 | 0.079 | 0.207 | MT | ➡ | SDFS-2 | ➡ Performance | |
| Indirect 3 | -0.0001 | 0.0009 | -0.002 | 0.002 | MT | ➡ | External Focus | ➡ SDFS-2 | ➡ Performance |

Table 67: Indirect Effects of MT, External Focus, and Flow on Performance

These models show distributed flow will foster individual flow. Strategic timing actually also fosters performance independently of individual flow. Distributed attention, on the other hand, predicts performance only through the mediation of individual flow.

The next step was then to look at the other individual scales to determine their relationship with MT, flow, and performance. Metacognition of resilience: individual is predicted by MT with a correlation coefficient of 0.267, significant at the $p < 0.001$ level and a confidence interval of 0.164-0.370. Flow is predicted by both MT and metacognition of resilience: individual, but MT is much stronger with a correlation coefficient of 0.454 compared to 0.227. Both were significant at the $p < 0.001$. MT had a confidence interval of 0.362-0.547 compared to 0.135-0.319 for metacognition of resilience: individual. With all

three variables together, MT and flow are significantly related to performance, but metacognition of resilience: individual is not. In terms of direct and indirect effects, the direct effect of MT on performance is significant. All three possible indirect effects are significant together and individually, which can be seen in the below table.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 0.143 | 0.034 | 0.078 | 0.215 | | | | | | |
| Indirect 1 | 0.003 | 0.015 | -0.027 | 0.034 | MT | ➡ | Resilience: Individual | ➡ | Performance | |
| Indirect 2 | 0.123 | 0.030 | 0.066 | 0.186 | MT | ➡ | SDFS-2 | ➡ | Performance | |
| Indirect 3 | 0.017 | 0.006 | 0.007 | 0.031 | MT | ➡ | Resilience: Individual | ➡ | SDFS-2 | ➡ Performance |

Table 68: Indirect Effects of MT, Metacognition of Resilience: Individual, and Flow on Performance

The next scale was metacognition of resilience: team, which is predicted by MT with a correlation coefficient of 0.279, significant at the $p < 0.001$ level and a confidence interval of 0.176-0.381. MT and metacognition of resilience: team both predict flow, but MT is the main predictor with a correlation coefficient of 0.487 at the $p < 0.001$ level while metacognition of resilience: team was only 0.010 with a p-value of 0.04. With all three of them regressed together, metacognition of resilience: team is no longer significant. Flow is stronger with a correlation coefficient of 0.282, confidence interval of 0.167-0.391, and a p-value of $< 0.001$. MT had a correlation coefficient of 0.183 with a confidence interval of 0.066-0.300, and a p-value of 0.002. When it comes to direct and indirect effects, the direct effect of MT on performance was significant. All of the indirect effects were significant. Interestingly, the first indirect effect of MT on metacognition of resilience: team on performance was negative with a value of -0.015 as shown below in Table 69.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Total | 0.131 | 0.035 | 0.064 | 0.201 | | | | | | |
| Indirect 1 | -0.015 | 0.015 | -0.046 | 0.014 | MT | ➡ | Resilience: Team | ➡ | Performance | |
| Indirect 2 | 0.137 | 0.032 | 0.079 | 0.205 | MT | ➡ | SDFS-2 | ➡ | Performance | |
| Indirect 3 | 0.008 | 0.005 | 0.001 | 0.018 | MT | ➡ | Resilience: Team | ➡ | SDFS-2 | ➡ Performance |

Table 69: Indirect Effects of MT, Metacognition of Resilience: Team, and Flow on Performance

The sixth scale tested was coaching impact. MT does predict coaching impact with a correlation coefficient of 0.152, confidence interval of 0.046-0.257, and a p-value of 0.005. With MT and coaching impact together, only MT predicts flow with a correlation coefficient of 0.518 and significant at the $p < 0.001$ level. With all three together on performance, MT and flow predict performance, but coaching impact does not. MT has a correlation coefficient of 0.160, confidence interval of 0.044-0.275, and p-value of 0.007. Flow has a correlation coefficient of 0.277 and confidence interval of 0.163-0.392, significant at the 0.001 level. The direct effect of MT on performance was 0.160 with a p-value of 0.007. All of the indirect effects were significant, but the strongest one excluded coaching impact seen below in Table 70.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway |
|---|---|---|---|---|---|
| Total | 0.154 | 0.034 | 0.092 | 0.225 | |
| Indirect 1 | 0.011 | 0.010 | -0.005 | 0.033 | MT ➡ Coaching Impact ➡ Performance |
| Indirect 2 | 0.144 | 0.033 | 0.083 | 0.212 | MT ➡ SDFS-2 ➡ Performance |
| Indirect 3 | -0.001 | 0.002 | -0.006 | 0.003 | MT ➡ Coaching Impact ➡ SDFS-2 ➡ Performance |

Table 70: Indirect Effects of MT, Coaching Impact, and Flow on Performance

Routine is the next scale and is predicted by MT with a correlation coefficient of 0.385 and confidence interval of 0.287-0.483, significant at the $p < 0.001$ level. When routine and MT are regressed together on flow, routine is not a predictor of flow, but MT is with a value of 0.496 and confidence interval of 0.397-0.595, significant at the $p < 0.001$ level. The pattern continues with all three variables on performance. Routine is not significant. Flow is a stronger predictor with a correlation coefficient of 0.273 and confidence interval of 0.158-0.388, significant at the $p < 0.001$ level while MT had a value of 0.155, confidence interval of 0.034-0.276, and a p-value of 0.012. For direct and indirect effects, the direct effect of MT on performance is significant as well as all of the indirect effects. The strongest was, however, the one without routine as can be seen below.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway |
|---|---|---|---|---|---|
| Total | 0.158 | 0.037 | 0.086 | 0.232 | |
| Indirect 1 | 0.018 | 0.022 | -0.023 | 0.064 | MT ➡ Routine ➡ Performance |
| Indirect 2 | 0.135 | 0.032 | 0.075 | 0.199 | MT ➡ SDFS-2 ➡ Performance |
| Indirect 3 | 0.005 | 0.006 | -0.006 | 0.018 | MT ➡ Routine ➡ SDFS-2 ➡ Performance |

Table 71: Indirect Effects of MT, Routine, and Flow on Performance

Finally, adaptiveness was analysed, which is predicted by MT with a value of 0.152, confidence interval of 0.047-0.258, and a p-value of 0.005. Both MT and adaptiveness predict flow, but MT is substantially stronger with a correlation coefficient of 0.487 and confidence interval of 0.396-0.578, significant at the $p < 0.001$ level compared to 0.178, 0.088-0.270, and p-value of 0.0001. When all three variables are together to predict performance, adaptiveness is not significant. Flow is the strongest with a correlation coefficient of 0.277 and confidence interval of 0.160-0.395, significant at the $p < 0.001$ level while MT had values of 0.172, 0.057-0.287, and p-value of 0.003. MT has a direct effect on performance, and all of the indirect effects were significant. It should be noted, however, that MT on adaptiveness on performance was negative, and the strongest effect did not include adaptiveness as can be seen below.

| Indirect Effect | Effect | Significance | Lower Bound | Upper Bound | Pathway |
|---|---|---|---|---|---|
| Total | 0.141 | 0.033 | 0.081 | 0.207 | |
| Indirect 1 | -0.001 | 0.009 | -0.020 | 0.018 | MT ➡ Adaptiveness ➡ Performance |
| Indirect 2 | 0.135 | 0.033 | 0.075 | 0.202 | MT ➡ SDFS-2 ➡ Performance |
| Indirect 3 | 0.008 | 0.004 | 0.002 | 0.016 | MT ➡ Adaptiveness ➡ SDFS-2 ➡ Performance |

Table 72: Indirect Effects of MT, Adaptiveness, and Flow on Performance

**4.4 Discussion**

The aim of Study 3 was to validate the final 36-item questionnaire (developed in Study 2). CFA on the ice hockey player sample corroborated the 8 subscales and further corroborated the reduced 3-item scale of the new findings. Three items were determined to be removed, which resulted in a final IHQ of 33 items. Statistical analysis showed that it is not a strict fit but did confirm a good fit.

Further analysis of modelling yielded both impressive and unexpected results. Potentially, the most interesting results are those of strategic timing, distributed attention, and external focus as contributors to the newly identified distributed flow. Although it was not explicitly expected, arguably the most impressive result was that of strategic timing

bypassing the need of MT to positively impact flow and performance. To date, no other variable has been shown to make that contribution on flow and performance while eliminating MT. Clearly further research is needed to replicate this result as well as potentially extend it, but this initial finding is extremely impressive and promising. The results from distributed attention were not as impressive as it did not eliminate the need of MT but did confirm the role in mediation. Accordingly, it is likely that should distributed attention be enhanced, it would positively impact flow and performance, but further research is needed to both confirm this assumption and identify practices to intervene distributed attention. Since external focus was only added as a result of Study 2, it was not expected to be the largest contributing variable of distributed flow. However, it was largely unexpected to be unrelated to MT and irrelevant to flow and performance. It is possible that external focus is a necessary element but was not accurately represented with the selected scale items as it was identified through redistributing previous items rather than identifying it solely on its own. Perhaps these items are necessary but need additional ones to completely encompass the variable. Alternatively, it is also possible "good" and "bad" external focus exists and thus the variable needs to be reconceptualised and see if further research yields different results. Further research is needed before the decision to eliminate it entirely can be reached.

Out of the remaining five variables that were modelled the same way, all of them had indirect effects. None of them had as strong of a result as strategic timing, which was to be expected as these variables though still important were not viewed to be as large of a contribution to the research as the distributed flow variables. Both coaching impact and adaptiveness had one negative effect and the strongest ones excluded the new variables. These variables have not been the strongest in other measurements, so this result was not entirely unexpected but again merits further investigation before any decisions to remove them from the scale can be reached.

Obviously, strategic timing is the most impressive and greatest contribution out of all of these findings. Apart from external focus, all of them have been shown to be related in some capacities to MT, flow, and performance. Unexpectedly, external focus was the biggest surprising result though the argument exists for the necessity of further exploration before any full conclusions are drawn and variables removed from the model. Further research is needed for all of these variables and relationships to confirm and potentially extend them or even remove them. All and all, this research shows the importance of capturing something else that has to do with the interaction that goes on in the field or in this case on the ice, psychological processes specifically used or not used to deal with the dynamic in seemingly

interactive processes. The more one is able to deploy those processes, the higher the likelihood of experiencing flow and the higher the performance.

### 4.5 Strengths and Limitations

Naturally, this study comes with both its strengths and limitations. The biggest strength was the large, diverse sample size. Achieving a sample over 300 people from 21 different nationalities helps provide a rich in depth perspective to the results. Once again, a large variety of skill and experience was included, and both males and females were included within the survey. As with the first round, statistical analysis was included, and some hockey seasons were starting to resume by the time this study was conducted, so at least some of the players had gotten back on the ice since the initial shutdowns from the Covid-19 pandemic. The ice hockey specific thought processes would be more in the forefront of their minds.

While some hockey was beginning to resume across the globe, not everywhere was able to open rinks. As with the first round, with people not being able to play for an extended period of time, some of the specifics of the questions might not have been at the forefronts of their minds as they would have been during a full hockey season. Additionally, there was a smaller statistical sample than ideal with this size of a sample. This comes down to two factors: one, not asking for specific league information or links to player stats possibly contributed to finding less statistical information and two, many players did leave their names and it was visible they were new university students playing for their university, but due to Covid-19, their seasons had been either delayed or cancelled and thus their stats were not available. This sample once again heavily favoured North American hockey players with a total of 69 per cent. While a large number of nationalities where included, the sample did not deliver on substantial percentages of them. Finally, relying on self-related performance is a limitation. Obviously, there could be some personal bias, which could impact it both positively and negatively. Having more substantial objective measures or even utilising coaching opinions could help get a more comprehensive view and eliminate at least some of that bias.

# Chapter 5: Discussion and Conclusions

## 5.1 Introduction

The theoretical basis of this research was grounded in Csikszentmihalyi's (2000) flow theory and its potential links to metacognition. The overall aim of this PhD research was to extend flow research to a new environment, specifically ice hockey, and identify a new construct, distributed flow, which has not been previously identified along with capturing any other factors outside of distributed flow that could impact performance.

Ice hockey was believed to be the ideal context for the undertaking of identifying distributed flow because it is more fast-paced and interdependent on players or team mates than any other setting in which previous flow research has been conducted and is a sport growing at an astounding rate across the globe. Previous research with ice hockey has largely been at the physical level with very little attention given to the mental aspect of the game. These factors together made it the prime target for an investigation into individual flow in addition to a different flow, specific metacognitions, and any other aspects that could potentially assist with these findings or impact performance on their own.

The research showed that distributed flow does exist, comprised of strategic timing, distributed attention, and external focus and is positively related to performance over and beyond other well-established predictors of performance. The research also identified five other components related to performance, together making up the Ice Hockey Questionnaire (IHQ). This final chapter summarises the key findings and conclusions, implications and applications of the findings, and explores future research directions.

## 5.2 Research Process

The initial expectation of this research was that another type of flow existed in an interactional capacity. Naturally, the specifics and intricacies of this dimension were not entirely known as it was just hypothesised at this stage. At the time when this research was started, previous research had confirmed individual flow in sports (Bakker et al., 2011; Bernier et al., 2009; Canham & Wiley, 2003; Chavez, 2008; Norsworthy et al., 2017; Jackson, 1992, 1995). Flow with sports was mostly studied with individual sports. When it has been brought to a group context, it had still been from a more individualised perspective whereby the researchers were essentially measuring individual flow in collective events. The individual flow scores were averaged to measure collective flow. While this method was an improvement to start to take a more collective approach, it still did not take into consideration

the interdependent nature of sports and the impact that can have on the flow experience. The other types of flow which have been identified to date either have not been brought to sports or have only been done so in an extremely limited capacity. The idea of social flow existing within sports has not been studied; it has only been theorised through interactive flow. There is disagreement in the paraments of social flow as the original classification took other people into consideration but kept the experience as individual, only depending on others for intrinsic rewards whereas the newer classification includes two components: one that contradicts the original saying interaction with others is not involved and the other where it is a shared experience (Froch, Menges, & Walker, 1993; Walker, 2021). However, the new social flow classification has only been conceptualised, never tested and measured either qualitatively or quantitatively (Walker, 2021). Group flow has taken off in many different directions, but this lack of cohesion in approach and premise largely limits the conceptual understanding and generalisability of this concept. Additionally, the studies looking into group flow in sporting contexts are severely limited, mostly focusing only with street basketball. Finally, team flow does take a more collective approach to flow. However, it was conceptualised after this research project had begun. It is still very much in its infancy as it has only been studied with students and has not yet been taken into any sporting environments. So this research was unable to incorporate any of these findings and conclusions. While it does take a more collective approach than previous flow research, it still does not incorporate any aspects of focus or processing numerous events at the same time. Furthermore, the majority of the study was conducted with student working teams with some participants from adult working teams. These environments are not the same as fast-paced, interdependent sporting environments.

While the details of this research's findings were not known in advance, certain components were expected to be present, such as an environmental component, a distributed attention component, a discipline component, and an adaptiveness component. While it was suspected new types of antecedents were likely to be present, no specific attention was dedicated to those prior to conducting this research. This research was also targeting metacognition with the expectation that despite the lack of attention in previous research, specific types of metacognition not only existed but also were helpful and contributed to flow and performance. Metacognition of attention and metacognition of resilience were two specific types expected to be present.

Given the exploratory nature of some research questions, it was determined both qualitative and quantitative methods were necessary. Qualitative allowed for the broad

overview approach to gain as many potential contributory factors as possible while quantitative was used to verify the qualitative results as well as laser in the focus on specific areas viewed to have the highest relevance. The first step was qualitative research with amateur and former professional ice hockey players through semi-structured interviews to gain as much knowledge and understanding as possible. The variety in experience and skill provides the opportunity for the all-encompassing perspective on the potential contributory factors. This step first brings flow to ice hockey, which previously has not been done before. Naturally, that is the basis and starting point of potentially identifying a new type of flow. When flow has been brought to a new environment, it has always been confirmed to be present as was expected here, but nevertheless, that first step still needed to be taken for ice hockey. A total of 16 players were interviewed. The interviews were audio recorded, transcribed, and then coded inductively. Analysis took part through both thematic analysis and content analysis. While this combination is not the norm, it has been utilised in past research and was determined appropriate in this research to gain as much insight from these interviews as possible. Both saliency and frequency were measured and taken into consideration for evaluating the importance for a found dimension. Salience or potency was typically weighted heavier as it provided the richest and deepest understanding of the construct. However, a theme being mentioned across a wide portion of the sample is clearly important as many players would have identified it as a contributory aspect to their performance. Analysis first confirmed the existence of individual flow within ice hockey and then identified distributed flow, comprised of four components, distributed flow antecedents, which included seven different ones, and four different types of metacognition. Initial definitions of all of these components were created based upon these results.

The next step was to quantitatively verify these results through scale development and validation studies. The 15 identified factors became their own individual subscale. Items were taken as directly as possible from the coded results from both the amateur and professional interviews, addressing every aspect mentioned within the factor. The result was a 125-item questionnaire. Study 2 resulted in 147 responses. As that was too few for EFA, alpha analysis of each individual theoretical subscale was performed to find initial candidates for elimination. Once those items were eliminated, EFA was run to result in 36 items, making up eight subscales. The results as a whole corresponded to some extent to the original themes, but there were some shifts. Routine and coaching impact were completely original themes. Adaptiveness had one addition. Strategic timing and distributed attention had the biggest shifts with only half the items as originals. The results showed a shift in metacognition of

resilience to show individual and team aspects as well as the addition of external focus, which came completely from distributed attention. Additionally, some items shifted throughout this process, thus the initial definitions were reconfigured. A second quantitative study was then conducted to verify these results, which included 342 responses. CFA eliminated 3 items, resulting in a 33 item questionnaire, measuring eight factors. The concurrent and predictive validity was then analysed followed by mediation modelling to determine the final assessment of the results.

The process of research led to the identification of distributed flow, distributed flow antecedents, and metacognitions. The dimensions that make up distributed flow were considered to be the key findings as that was the main intent of this research. The distributed flow antecedents and metacognitions were more exploratory as they were believed to exist and be contributory but not focal points of the research.

### 5.3 Key Findings

Initially, distributed attention was thought to be the continuous rotation of focus throughout the game, depending on individual and team performance, score, team mates, and the location of the ice. This dimension was expected to be extremely important going forward as it had the highest levels of saliency and frequency between both samples of interviewees, amateurs and professionals. The quantitative research confirmed it was very important. However, it had more complexity than initially realised and became two dimensions: distributed attention and external focus. The distributed attention definition then shifted to an individual approach whereby the recognition of the opponent's actions, strategies, and weaknesses dictates adjustments to one's own style of play to capitalise on the opportunities presented. In terms of the correlational results in Study 2, distributed attention's results were quite impressive with positive, significant correlations with all of the psychometric measures. The top were with the Confidence in Ability to Self-Regulate Flow and the Short Dispositional Flow Scale 2 (SDFS-2) with the Mental Toughness Scale (MTS) just behind. This makes sense as a key component of distributed flow that it would be the strongest related to flow metacognitions, flow, and MT. There were no significant correlations with the statistical categories. In Study 3, distributed attention had positive, significant correlations with all of the psychometric measures. This time, the SDFS-2 was the strongest followed by the MTS with the Confidence in Ability to Self-Regulate Flow just behind. Interestingly, games played, goals, and totals points all had significant correlations but were negative. This

result was not deemed to be meaningful due to the extremely small sample size of this data. Finally, the modelling showed MT predicted distributed attention and indirect relationships between MT, distributed attention, flow, and performance, indicating if distributed attention is intervened, more flow and better performance could result.

External focus, as the name suggests, is the lack of focus on one's self replaced by focus on external factors, such as team mates and opponents. In that sense, external focus was initially thought to be necessary for distributed attention to take place. External focus did not end up having as impressive of results as distributed attention. In Study 2, external focus was positively, significantly correlated with Short Flow in Work Scale (SWFS) and Beliefs that Flow Fosters Achievement. However, these were very weak correlations. Interestingly, it was positively related to goals per game, assists per game, and total points per game. This result was particularly promising and interesting linking focusing on external factors to contributing on the goal sheet. Unfortunately, those results did not hold up in Study 3 with no significant correlations with any of the psychometric measures. With the performance statistics, there were two significant correlations with goals and total points, but both were negative. It is possible that a focus on the external distracts from scoring goals and thus total points. However, since this result was not corroborated in Study 2, the full meaning was unknown. The modelling results were also disappointing as MT does not predict external focus, and external focus does not predict flow or performance. Although external focus did not hold the strength and importance expected in the validation study, it still merits further investigation because it might require wider scope that was not possible to achieve as it was only extrapolated from a previously identified theme. Perhaps more specific investigation into this theme would yield more comprehensive results to make a final determination on its validity.

Team support was the next distributed flow element, which included communication, camaraderie, and trust between team mates. In the qualitative analysis, this dimension was determined to be more salient than frequent. Since the dimension was wide ranging, it was expected to be more streamlined, but the dimension still thought to remain important. Slightly unexpectedly, the factor as a whole did not stand up and thus was eliminated. However, two items did move to two different factors, one to distributed attention and one to strategic timing. Since it was originally comprised of 13 items, it was expected more items than that would have remained, but these two maintained their importance within the distributed flow domain.

Strategic timing was thought to be the next most important element of distributed flow. This element was determined to be the ability to read and interpret the game with the

understanding of the appropriate course of action based upon that reading. Strictly speaking, strategic timing was an unexpected finding for the distributed flow phenomenon. However, adaptiveness was a two-part dimension expected to be included, which was not. One aspect was a player adapting his or her own style of play based upon the opportunities presented from the other team. This aspect is closely tied to strategic timing. So it was determined the initial evaluation of adaptiveness was inaccurate and should have been more focused on the strategic timing element. After its addition to distributed flow from the qualitative research, it was expected to play a strong role in distributed flow but still rank behind distributed attention. Strategic timing was once again underestimated as it had by far the strongest correlations in Study 2. Strategic timing was positively, significantly correlated with all of the psychometric measures with extremely strong correlations with the SDFS-2 and the MTS. In terms of the statistical categories, there were positive, significant relationships with games played, goals, assists, and total points. It is possible the more games a player plays, the more the strategic timing is developed, which results in more goals, more assists, and naturally more total points. Since these were the original categories and not standardised to goals, assists, and total points per game, their full importance is not fully understood.

Interestingly, Study 2 showed a shift in the construct of strategic timing. This dimension started with 11 items and was reduced to just four, but only two of them are original strategic timing items. The other two came from role metacognition and team support. The definition then shifted to the awareness and understanding of the game and one's role in the team to capitalise on opportunities. The psychometric measure correlations were duplicated in Study 3. However, this time there were no statistical category correlations. The modelling results even further surpassed the expectations of strategic timing. No factors were expected to eliminate the direct effect of MT on performance, but strategic timing was shown to have done that. That result was a big surprise but also very promising in regards to future research with this factor specifically.

Finally, discipline was the last distributed flow dimension, which was defined as the balance of focus and execution between one's own job, the team's systems, and counteracting the opponent's strategy. This element was considered to be the weakest of the distributed flow results, especially from the professional standpoint, as there was enough salience to understand its existence as a dimension but not enough to suggest a strong impact. Therefore, it was not expected to play a large contributory role in subsequent research. As expected, discipline was not found to be a deciding factor and was eliminated in the first round of alpha analysis in Study 2.

## 5.4 Exploratory Findings

The next round of analysis involved the distributed flow antecedents. Both the distributed flow antecedents and types of metacognition were exploratory in nature. Previous research has identified some flow antecedents, so it was assumed distributed flow would have antecedents as well. However, it is impossible to fully know and understand all constructs of a new finding within one study so these dimensions were thought to be contributory to the knowledge and understanding of distributed flow but not the focal point. This approach was also used with types of metacognition as those aspects have not received attention in previous research but was hypothesised they both existed and were beneficial. Again, this research wanted to explore these options but did not highlight or focus on them as the primary focus was the identification of distributed flow.

Adaptiveness was the first one and was defined as the preference for playing with the same line mates to build chemistry and improve performance while viewing the changing of line mates as an opportunity to still contribute to the team in a new but productive way. Since adaptiveness was the most salient and frequent amongst both samples, it was expected to be important going forward. Study 2 confirmed the importance of adaptiveness. The factor originally had 10 items, which was reduced to three, joined by one original role metacognition item. In terms of correlations with the psychometric measures, adaptiveness was positively, significantly related to all of them. The two strongest were the SDFS-2 and the Beliefs that Flow Fosters Achievement. Adaptiveness is related to the experience of flow as well as the understanding of the importance and benefits of flow. Interestingly, the only significant relationships with the statistical categories were with penalty minutes and penalty minutes per game, but both of these were negative. Perhaps adaptiveness is actually multi-faceted where an adaptive perspective with the intention of benefitting the team is positive and linked to the flow experience whereby being adaptive and changing line mates essentially through punishment due to penalties is actually negative. In Study 3, adaptiveness maintained the strongest positive, significant relationships with the SDFS-2 and the Beliefs that Flow Fosters Achievement but lost positive, significant relationships with the SWFS and Confidence in Ability to Self-Regulate Flow. Adaptiveness and the MTS were still positively correlated just to a lower degree. The performance statistical correlations also saw a shift where the only significant relationship was with games played and again was negative. Clearly further investigation in this area is needed to make any conclusions. The modelling results showed MT predicts adaptiveness, and both MT and adaptiveness predict flow though

MT is substantially stronger. With all three variables together to analyse the prediction on performance, adaptiveness is not significant. Overall, adaptiveness is a strong finding of this research but requires further investigation as the totality of this component does not seem to be uncovered yet.

While game recovery was also present in both samples, it was not expected to be a contender in future research as it was noticeably less salient than other themes. Game recovery was defined as the individual approach of reflecting and processing the previous game before starting the preparation for the next one. As expected, game recovery was eliminated during the first quantitative study. It was important to explore its potential impact as both samples detected it, but with the frequency outperforming the salience, its lack of depth was noticed and thus it was eliminated.

The remaining antecedents were just present for the professionals. Routine was the first one expected to play an important role in further studies as it had the highest frequency in the professional sample along with a strong salience to compliment it. Routine was considered to be the patterned set of activities performed individually by each player with the intention of maintaining focus on the upcoming game without overthinking it. Once again as expected, routine was confirmed to play an important role in subsequent research, making it to the final eight items. Although four of those items were removed along the way, the remaining three items were original routine items. Routine's contribution was further confirmed through the correlational analysis. Although they were all low correlations, routine was positively, significantly correlated with all of the psychometric measures except for the SWFS in the first quantitative study. The strongest was with the MTS, which makes sense. Having a routine could help keep players focused and strengthen MT. In terms of the performance statistical analysis, the only significant correlation was actually a low negative one with goals per game. Once again, this is logical as there is often an element of spontaneity to scoring goals, and having a routine would be the opposite of that. When it came to the validation study, the correlations between routine and the psychometric measures only got stronger. This time, there were positive, significant correlations with all of them. The relationship between routine and MTS had increased to a moderate correlation. When it comes to the predictive validity of the statistical categories in the validation study, the correlations changed to only measured variables of games played, assists, and penalty minutes. However, all of them were positive with the strongest between games played and routine. Since all of the players came from different teams and leagues, the lack of standardised results is an inconclusive determination of this finding. Finally, the mediation

modelling showed routine is predicted by MT, which was to be expected as confirmed by their relationship in the correlational analysis from both quantitative studies. However, when flow and performance were added, the strongest effect was without routine. Overall, routine is an important finding with this research as it is positively related to flow and performance. Unexpectedly, the biggest contribution of routine is that of its relationship with MT independently. Although that was not the aim of this research, it merits further independent investigation.

Coaching impact was the next factor expected to play an important role. It was a little less frequent in the interviews than routine and adaptiveness but still very salient in the responses. Coaching impact was defined as the influence a coach has on a player's performance through belief, reinforcement, and recognising the strengths of players. As expected from the qualitative results, coaching impact was confirmed to be important in the quantitative results and possibly most impressively is comprised of the same four original items with no additions or removals throughout the development and validation studies. The correlational analysis in the first round resulted in only one low, positive, significant correlation with the MTS. Although more correlations would have been nice to see, it makes sense the one significant relationship would be with the MTS as feeling like one has support and encouragement from the coach could then help increase personal MT. After seeing the results from the correlational analysis with the psychometric measures, it was not unexpected to not have any significant relationships between coaching impact and any of the performance statistical categories. While the validation study confirmed the results from the statistical correlation analysis of Study 2, it added a low, positive significant correlation between coaching impact and the Beliefs that Flow Fosters Achievement in addition to confirming the same relationship with the MTS. These results show coaches can help players understand the importance and benefits of flow within their specific sport and role as well as personal MT. Finally, the modelling results were in line with the previous finding MT does predict coaching impact. As with routine, when flow and performance are added to the equation, the strongest effect excludes coaching impact.

Veteran presence and accountability were the next two antecedents, which are similar to each other in terms of salience and frequency. Comparably speaking, it was not expected they will have the impact anticipated of others at least individually. Even so, there was enough potency there that it was possible some of the items might move onto other factors. Veteran presence was considered to be the depth and leadership veterans provide to the team to get everyone on the same page. Accountability, on the other hand, was the idea that all

players are held to the same standard in terms of being held responsible for their actions and contributions to the team. However, the expectation did not prove to be the case as both were eliminated during the very first round of analysis due to unacceptable alpha values. There is some overlap in their theming. It could have been a mistake to create two separate constructs with these items, and perhaps a joint, comprehensive construct would have been better thus would have made an impact in Study 2. Future research could be devoted to exploring this possibility.

Staying even was the last distributed flow antecedent, which was defined as each player maintaining a level of consistency throughout the season rather than riding a roller coaster of high highs and low lows. Staying even was largely expected to be dropped, especially compared to the other factors but still had enough saliency to merit initial investigation. As expected, this dimension was dropped during the first round of analysis during Study 2. With only three items, there was not much wiggle room, and all three items were not able to meet the minimum alpha requirement. Once again this dimension could have been spread too thin, and they could have been more beneficial on a different dimension making a more comprehensive picture.

The last category is the types of metacognitions. Role metacognition was expected to be the most significant of the metacognition results. It had the highest frequency and saliency for both samples. The professionals, especially, were very descriptive and looking at this aspect from multiple angles and perspectives. Role metacognition was a two-part dimension which involved recognising and executing one's individual role on the team as well as identifying team mates' roles and tendencies and then adjusting the individual role accordingly to make the biggest impact and contribution. Extremely unexpectedly, role metacognition did not stand up in the quantitative phase. It did have an initial alpha of 0.70. However, during the first EFA, it lost its individual integrity as a separate dimension. Out of the 12 original items, only two moved to other dimensions where the movements were accepted. One was to adaptiveness while the other was to strategic timing. It is understandable there is some overlap with these dimensions as the metacognition of one's role can lead to adaptiveness and an understanding of strategic timing.

Metacognition of resilience was the second most salient across both samples of interviewees and again expected to play a significant role moving forward in further research. Metacognition of resilience became even more important than previously anticipated as it was not only the only metacognition to stick in the final results but also became two separate ones: one from the team level and one individually. Metacognition of resilience: individual

was made up of all original items, no additions. Metacognition of resilience: team had all but one original items with one coming from strategic timing. Both of these proved important during the psychometric correlational analysis as all correlations were positive, significant ones in Study 2 and Study 3. For metacognition of resilience: individual, they all decreased from Study 2 to Study 3, but the top two across both studies were with the SDFS-2 and the Confidence in Ability to Self-Regulate Flow. It should be noted the MTS was not far behind. As resilience has not specifically been addressed when it comes to previous flow research or specific types of metacognition, it is very interesting to see the strong relationship with flow as well as flow metacognition of self-regulation. Metacognition of resilience: team had much larger differences between Study 2 and Study 3. The correlation with the SWFS in Study 2was the strongest but the weakest in Study 3. Interestingly, the weakest in Study 2 was with the Confidence in Ability to Self-Regulate Flow but was the strongest for Study 3. Clearly these results are more difficult to interpret but confirm the need for further investigation. Neither of these two dimensions had any significant relationships for the statistical categories for either study. This likely means that metacognition of resilience is not independently impacting performance but is through flow and flow metacognitions. This can be seen with the modelling results. MT predicted both metacognition of resilience: individual and team. Flow was also predicted by MT and each of the dimensions though MT was stronger for both of the results. When flow, MT, and each of the types of metacognition of resilience were regressed on performance, all of the relationships were significant, but the strongest was without metacognition of resilience. Overall, this is clearly an important finding and one that seems to impact performance through other avenues, which means further investigation is necessary.

Although it was extremely close to the cut off, metacognition of risk-taking was eliminated in the first round of analysis. Metacognition of risk-taking was defined as the understanding of when taking risks and playing more aggressively are the appropriate course of action. It is possible some of these items could have moved to other dimensions, such as strategic timing, as they are likely to be related and share some overlap, but that was not possible with the criteria set forth in this research.

Finally, role model metacognition was present in both samples of interviewees yet stronger for the amateurs. Overall, it was strongly lacking salience and was limited in terms of frequency, so it was expected to be dropped. The qualitative study defined it as an attentiveness of other players as well as a desire to surround oneself with smart hockey players to learn as much as possible from others. A little surprisingly, role model

metacognition passed the first round of analysis, but once EFA started, the items did not maintain their integrity and thus it was eliminated.

Quite possibly the biggest takeaway of this research is how intertwined all of the identified constructs are with each other. The initial perspective was that all of these aspects were separate, much like individual pieces of a puzzle fitting together to result in a full picture. This research has shown that is not the case. They are more interwoven together with more overlap than previously anticipated. Thus, future research needs to keep that perspective in mind because it could be that what is known so far is not actually the full, complete picture just yet as pervious research to date has taken a too linear perspective. This could mean that some eliminated items should actually be reintroduced in further research. So incorporating this philosophy in subsequent research could actually shift the conclusions from these findings as well as potentially open new doors for unexpected findings. Now that light has been shed on a new path, it could change the trajectory of the understanding and approach when it comes to flow, metacognition, MT, and resilience in relation to performance.

### 5.5 Contribution to Knowledge

This research was distinctive because it was the first to extend flow research to ice hockey specifically but also anything in that type of an environment where the activity is extremely fast-paced and interdependent on other people. This research also further yielded both hypothesised and exploratory findings. The qualitative study identified individual flow was present as well as distributed flow, distributed flow antecedents, and types of metacognitions. The quantitative validation studies resulted in a 33-item IHQ, which included eight different dimensions: distributed attention, strategic timing, external focus, adaptiveness, coaching impact, routine, metacognition of resilience: team, and metacognition of resilience: individual.

The major contribution and key finding of this research was the identification of distributed flow. Aspects of distributed attention, strategic timing, and external focus have not been considered in previous research. All three of these take on the consideration of the duality of flow, showing the need for uninterrupted thought and action while simultaneously sustaining full attention (Lavoie, Main, & Stuart-Edward, 2021). Strategic timing was clearly the strongest finding out of these as it was found to eliminate MT in terms of performance prediction, which has not been done in previous research. No variables have been shown to eliminate MT previously, only foster it. The relationships with the previously established

psychometric measures were modelled, and they showed the same relationship patterns as previous research, therefore, confirming the integrity of the data set and only giving further weight to the strategic timing discovery. Although it was not directly expected any of the findings would eliminate MT, it is a substantial result of this research, making it an extremely important area for further exploration. Distributed attention was the next strongest finding out of these three with some evolution to its constructs throughout the research process. The ultimate finding through modelling confirmed the prediction of distributed attention by MT along with indirect relationships between MT, distributed attention, flow, and performance. These findings signal the possibility of intervening distributed attention to yield more flow and better performance. While the overall conclusions of external focus were disappointing, it is still considered to be a key finding of this research and at this point a component of distributed flow. The ultimate conclusion is that further research with this construct specifically is needed as it was not identified until the conclusion of Study 2. Therefore, it is possible that it was not fully encapsulated in this research but the full picture of the construct would provide a meaningful contribution. It is equally possible that is does need to be eliminated, but that decision should not be made without further considerations.

The exploratory findings included the three distributed flow antecedents and two types of metacognition. The main takeaway from routine was its connection with MT. As previously stated, MT was originally included to further the understanding of its relationship with flow as knowledge of this phenomenon evolves as well as investigate any possible overlaps with metacognition or individual difference features. While this specific link was not anticipated, it has not been detected with previous research, showing a possible new door opening, which confirms the need for further investigation. The biggest takeaway from coaching impact was also its relationship with MT through the MTS. Although it was only a low correlation, it is still another factor not previously associated with MT. With the traditional importance associated with MT, this is another contender for future research. The angle of linking flow antecedents and MT has not specifically been investigated but clearly is ground for further exploration. Furthermore, perhaps these findings are further supplying evidence to the idea that having a threshold of MT is necessary and then other factors, such as strategic timing, play a stronger role from there and these factors help hit that threshold (Brace, George, & Lovell, 2020). The last distributed flow antecedent was adaptiveness, which was the only one to have been identified by both samples. In the qualitative studies, there were positive, significant relationships between all of the psychometric measures, just variability between Study 2 and Study 3. These findings show strong potential for further

exploration as this is the prime example for investigating differences between the amateurs and professionals different levels of play. Perhaps these differences could shed further light on the correlation variations. While comprehensive conclusions cannot be drawn from any of these antecedents, they have still yielded strong findings for this research with direction for further study with all of them. Finally, metacognition of resilience is another unique finding in this research. This type of finding has not been documented with any research in these areas, which, in turn, pushes the preconceived boundaries. Specific types of metacognition not only exist but also vary depending on the environment, which is furthering the idea previously mentioned that culture could shape metacognition (Heyes et al., 2020). Previously, it was not considered to have the same type of metacognition present at different levels. Its strong correlations with flow, flow metacognitions, and MTS indicate a promising future, but as with the other findings, further evidence is needed to validate and extend these conclusions.

In summary, the research carried out as part of this PhD dissertation was successful in identifying distributed flow, which is found to foster performance. The research also captured five factors outside of distributed flow. The distinctiveness of the additional factors from distributed flow supports the discriminant validity of the distributed flow scale. The fact that they do not all predict performance supports the predictive validity of distributed flow. These additional components together make up the IHQ and positively impact performance.

### 5.6 Generalisability of the Study Findings

While this thesis has specifically focused on ice hockey, there is an element of generalisability of these findings to a wider context, particularly to those of other fast-paced and interactive environments. It is more than likely that ice hockey is not the only type of setting that requires distributed flow to foster performance. Sports are the initial environments to extend distributed flow, but other atmospheres, including emergency and leisure ones can also be fast-moving and dependent on a team nature and thus merit distributed flow investigation as well.

The most direct environment for overlap would be other sporting contexts. Basketball could be a prime example since players are continuously running up and down the court and balancing getting open while disrupting the other team. Synchronised sports could be another situation for distributed flow as well since this area has not received previous flow attention but arguably has the highest level of dependence on teammates and their interactions.

American football is another neglected sport when it comes to flow research but is a contender for distributed flow. While the full game is drawn out over many hours and there are stoppages between plays, the individual plays share the explosive nature of ice hockey along with the interdependence on team mates to either receive the ball or block for someone else to run. NASCAR is a further option as any stop for the driver in the pit area requires an extreme interdependence on other people with huge time pressure. Volleyball is another sporting environment that could both experience and benefit from distributed flow. While opposing teams are divided by the net, the spiking player is looking at the distribution of the other team. This is the perfect environment for distributed attention which leads to strategic timing. When fakes are added in to confuse the other team, that even further confirms the interdependence of team mates and making decisions in seconds.

Outside of sports, combat is an environment that could also benefit from distributed flow as it shares the characteristics of a fast-paced environment with interdependency on fellow soldiers. Going along with that, emergency situations could be another area for exploration of the presence of distributed flow. Studying distributed flow with natural catastrophes could take this dimension even further as sometimes people are working together who have not previously worked together before or might not even know each other. Health care providers working in hospitals and emergency rooms during extreme times, such as the Covid-19 pandemic likely experienced times of distributed flow. Studying distributed flow in these types of environments could possibly shed the most light on the phenomenon. Any findings and conclusions could also potentially result in finding ways of increasing performance above the already impressive levels during these extreme times.

Finally, non-sport and less extreme environments could also experience distributed flow. Such examples could include videogames and investing. Many videogames are multiplayer and involve a team nature, competing against the computer or other teams. With this field expanding and experiencing more monetary opportunities, it is certainly a contender for further exploration. Investing during strategic times, such as day trading, times of high volatility, and during initial public offerings would be the expected prime time to experience distributed flow. Although the team dynamic would likely be slightly different, people who are working within a firm are still part of a team to a degree and there could be discussions with external peers as they would likely be making the same moves rather than competing. The traders could not just look at their own portfolios and holdings but rather keep an eye on the whole sector and bigger picture. During certain times, this would need to be done rapidly. While specific research into these environments as well as others is necessary to fully verify

the need and contribution distributed flow has on performance, it is reasonable to assume the contribution given the overlap in external factors.

### 5.7 Limitations and Directions of Future Research

This research had a number of structural limitations that should first be addressed in future research to see if these findings are repeatable or if the limitations impacted the results and addressing them changes the conclusions of this study. The first one is the age and retired status of the interviewed former professional ice hockey players. The ease and accessibility was the deciding factor for that for this thesis. Now that the initial study has been conducted with promising results, it likely opens up the door for access to current elite players, such as American university hockey, NHL affiliate teams, and even current NHL players. Everybody is looking for that extra edge. These promising results make future research more appealing to traditionally more difficult audiences but still important and critical for full understanding of these concepts. Repeating the interviews with current NHL players is the ideal scenario to see if any differences in the responses exist due to the younger age and changing nature of the game. Since the results of the qualitative study informed the quantitative ones, any deviation from these findings could change the quantitative trajectory. Thus, the same process can be implemented from this research and then the questionnaire development and validation study results could be compared with these to determine what differences, if any, resulted from the different samples.

Going along with the previous point, samples for all three studies heavily relied on North American hockey players. As previously mentioned, the style of play can vary from North America to Europe to Russia. These studies did not have the resources to translate any of the questions or ensure a more evenly distributed sample population but is a further area of exploration to see if geography has any impact on these findings or if there are any differences in the flow experience or metacognitions at play for ice hockey players. Therefore, interviews can be conducted with a more global population, and once questionnaires have been created based off of those results, they can then be translated into different languages to attracted a more diverse sample.

Another limitation with this research was its retroactive nature. Due to the time and resources required for a more real time setting, it was not possible for this study but would be an ideal condition for future research. Studying a team consistently throughout the season and getting continuous feedback during the game or as soon as a game finishes as possible would

be the most ideal situation so that the information is as fresh as possible in each player's mind and any changes in flow experiences either positively or negatively would be easier to track and analyse. This would also allow for further analysis with the stats to be done in the future as all statistical information would then be available for all players on the team. This approach also addresses another limitation of this research, which was sometimes players had played in multiple leagues during the same season and their statistics were combined for the total. However, there could be discrepancies in the skill level of their leagues and thus in one they performed better or worse. Therefore, specific research targeting the level of play could be very important as the balance between skill and task is an essential element of individual flow, and there could be variations in that with different league levels. Sticking with a team for the full season would give the most complete picture and yield a plethora of knowledge to these findings.

The next limitation was the small sample size of Study 2, which prevented some originally intended further analysis, including the questionnaire categories and qualitative differences between the amateur and professional samples. Conducting Study 2 again with a large sample size would allow for further analysis and potentially greater insight into the hypothesised constructs. The quantitative questionnaires were broken into four different categories (before the game, during the game, after the game, and in the general context of the game and seasons). Since the sample size of Study 2 was so small, no further attention or analysis was given to these classifications. However, future research with larger samples could take this aspect into consideration to see if any differences or interesting findings and conclusions exist from this perspective. Furthermore, the differences in the qualitative findings between the amateurs and former professional players could not be further explored in the quantitative studies but merit future exploration. Sometimes themes were just with one group or were much more salient with one of the two groups. Future research could look at the differences based upon the level of play to see if any trends emerge.

There are a number of potential applications in terms of team selection and coaching should the previous analysis result in significant findings. From there, longitudinal and intervention studies could be developed. For example, if distributed attention was stronger in more advanced individuals, it could be hypothesised that by fostering it and finding ways to improve it, people will improve their play more rapidly. That opens the door for even further research into different types of intervention methods and specific areas within the construct to enhance and develop to allow for a greater performance. Players could be measured in the beginning of the season, throughout, and at the end to see how they have progressed. The off

season is often a time when players focus on weaknesses to start the next season stronger than they finished the previous. These findings could potentially change the off season approach for players as well as impact the team selection processes at try-outs as coaches would be able to empirically track the gains the players have made. Should all of that be successful, it could become part of coaching and recruitment practices.

As this research was the first to directly address individual flow in ice hockey and identify distributed flow, it is just opening the door. A number of angles exist to extend these findings and potentially take them further. First of all, Study 1 can be replicated but with more specific and prying questions. The initial questions were a little vague and used as an overview so that it could identify the existence of individual flow within ice hockey and then allow for further themes to come from those generic questions. Now that those themes have been identified, more specific questions could be used to further the understanding and parameters of these themes as well as explore for the existence of more. For example, one of the questionnaire items involved "knowing what to do with the puck when in trouble". However, knowing what to do and actually doing that are two different things and further research more specifically diving into that area could be helpful, especially as that is an area many players ponder on the bench in between shifts if they feel they made the incorrect decision on the ice. Furthermore, the relationship between distributed flow and other types of flow could be investigated. It is possible some of the individual flow components play a role in distributed flow, which is one area to investigate with future work. The full flow scales would be needed for that rather than the short ones utilised in this work. It is possible that one passes from distributed flow to individual flow and/or vice versa. Specific investigation into this relationship is necessary. Another protentional relationship to investigate is distributed flow with team flow. Perhaps distributed flow aids in the team flow experience. As research continues with social flow, those findings can be compared with distributed flow. Since there is currently dissent within the social flow context and limited empirical measures, it is difficult to know how distributed flow relates to that family but is an area for future investigation as the social flow field develops.

Another potential area for further investigation is looking at some of the eliminated items in a different light. Veteran presence and accountability were eliminated in Study 2. While there are noticeable similarities with these components, they were thought to be separate. It is possible a more umbrella approach that encompasses both of these aspects together could result in a distributed flow antecedent. A more intertwined approach of some aspects of this research could result in different findings in further study. Similarly,

metacognition of risk-taking was also eliminated, just missing the cut-off by 0.01. The research needed to have a cut off to move forward as a criterion for eliminating items. However, since this research highlighted the fluidity of those items belonging to potential subscales and the overlap that exists, it is possible that some of the initially eliminated items could be contributory factors but were eliminated prior to seeing and understanding the contribution. While these factors were eliminated in this research, it could be a premature decision to eliminate these factors from further consideration in future studies.

Adaptiveness, routine, and both types of metacognition of resilience are also candidates for further investigation. Adaptiveness was initially defined closely to previous definitions, highlighting the flexibility and adjusting nature but still having a preference for consistency. Throughout the research, it shifted to building chemistry with the same person to benefit performance. This strong shift indicated the full extent of this factor is not known or understood yet. Further research into this component is necessary to understand if it does incorporate aspects from previous adaptive definitions or if it is an entirely new aspect. One unintended by-product of this research was the uncovering of the independent relationship between MT and routine. Research specifically focused on this is necessary to further understand the extent of this relationship. As MT has been shown to be so important with sport performance in other research, this link needs to be investigated to see if it can provide insight into further improving sport performance. Finally, both types of metacognition of resilience deserve further exploration as specific metacognitions have not been identified previously. It is likely these are not the only types to exist and therefore research specifically on this area needs to be conducted to further understand the impact of metacognitions of resilience while identifying any other possible ones to exist.

Obviously, the timing of the research was not the most ideal for the quantitative studies as many of the players were experiencing extended breaks from playing due to the Covid-19 pandemic. Future research could take place during the hockey season and even after games as specific game situations and score lines were not taken into consideration with this research. Other research (Bakker et al., 2011) has shown that “flow at the team level was more prevalent when the match resulted in a draw or win than when the match resulted in a loss.” This approach should be adopted with distributed flow as well to more comprehensively understand this phenomenon. Additionally, bringing the coaches’ opinions in could also take this even further as this would address the limitation of self-performance evaluation. This would allow for full teams to be researched rather than studying players

from random teams, which could help to more fully understand how different players relate to the same circumstances.

Specific research focusing on strategic timing and distributed attention individually could also shed considerable insight into these dimensions and thus further the understanding of distributed flow. Changing and optimising strategic timing to improve flow and in turn improve performance is one area for future exploration. Developing better strategic timing could be a way to have more flow and to have better performance. It is possible that strategic timing was measured better than distributed attention and an adjustment to distributed attention could yield the same results. An adjustment to distributed attention might also be able to eliminate MT and/or get on the same level as strategic timing. Further exploring the duality aspect of distributed flow in general is another possible avenue for investigation along with the attentional focus and shifting. More specifically bringing these aspects from previous research into this new type of flow could help to more comprehensively understand what is going on and how to optimise the experience.

Further investigation into the concept of external focus is another avenue of exploration. The results of Study 3 showed that external focus does not predict individual flow or performance, but as previously discussed there were limitations with the development of this dimension as it was evolved and adapted from a previous construct during Study 2 rather that fully comprised from the start. Seeing as previous research has shown that attentional focus does play a crucial role in performance, this dimension merits further investigation (Memmert, Simons, & Grimme, 2009). Perhaps future research could reconceptualise this construct to allow for "good" and "bad" external focus and see if distinguishing these aspects yields different results.

Exploration of distributed flow outside of ice hockey is another area for further research. Combat, emergency situations, control towers, rescue operations in natural catastrophes, and pandemics all often involve a bombardment of information while working with other people. As previously mentioned, it is possible people in these situations might also experience distributed flow. Bringing the findings from this study into those environments as well as studying them directly to further the understanding of time sensitive, highly dependent environments can further the knowledge of this phenomenon as well as aid in their successful execution of the tasks at hand.

## 5.8 Conclusion

In summary, this PhD research has fulfilled its aims of confirming the presence and contributions of flow to ice hockey. This research has also taken this finding a step further identifying a new type of flow, known as distributed flow, which has been shown to be a good predictor of performance over and beyond other well-established predictors. In addition, five further factors have been identified, which all combined create the IHQ and positively contribute to performance. This research is an important contribution to the field of sport psychology as its pushing the preconceived boundaries. It shows dimensions such as distributed attention and strategic timing are important even though they have not previously been considered. Furthermore, this is the first research to eliminate the direct effect of MT on performance through strategic timing, showing even more promise for these findings and reason to further explore them. It has also highlighted how intertwined these dimensions are and the overlap the items making up the dimensions can have. Taking less linear and more inclusive perspectives in the future could not only shift the understanding of the knowledge base that already exists but also the trajectory of future research and findings. This research indicates that such a research endeavour is promising and provides the basis for pursuing it in future research aimed at fostering human performance in ice hockey, as well as other sports and domains of activity.

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**Appendix 1: Study 1 Consent Forms and Debriefing Sheet**

## PARTICIPANT BRIEFING - CONSENT FORM

Dear Participant,

You are being invited to take part in a research project. Before you decide to participate it is important that you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and ask if anything is unclear or if you would like further information.

The purpose of the project is to explore the presence of flow and metacognition when playing hockey for former NHL players. Flow is the idea of being fully immersed in the game and not noticing any distractions. It's frequently described as "being in the zone". Metacognition is being aware and in control of one's own thoughts and emotional responses. Both of these factors are important and play a role when it comes to sports. The study will examine the psychological processes at play for former NHL players to determine what similarities and differences are present compared to previous research of sports that are not as interactive and dependent on teammates.

You have been selected from the St. Louis Blues Alumni organisation. If you agree to participate in this one-off interview you will be asked to sign the consent form overleaf.

The researcher will go through the questions (which are attached to this letter), regarding performance and experiences of playing in the National Hockey League. This will take approximately 45 - 60 minutes of your time. With your prior consent, the interview will be recorded on a digital recorder or, alternatively, written notes will be taken. The anonymised interviews will subsequently be transcribed and analysed. Any reporting will only present anonymised and aggregated findings and individuals will not be identifiable in any way.

This study is exploratory in nature and you are only required to describe your personal experiences and opinions. There is, therefore, no right or wrong answers.

You will not be provided with individual feedback on the specific results of the individual interviews obtained but rather a summary of the results of the whole set of interviews.

If you decide to participate in this study, your participation and any information collected from you will be kept strictly confidential, and will only be available to the researcher and her academic supervisor of London Metropolitan University. The audio files and transcripts will be anonymised and encrypted. You have the right to withdraw confidentially by emailing me (email listed below) at any time until four weeks after the interview. At that time, all data will be totally anonymised.

If you agree to participate please read the attached consent statement and sign where indicated.
I would like to thank you in advance, for your participation.

Researcher: Melissa Reidelberger (MJR0097@my.londonmet.ac.uk)
Supervisor: Dr Giovanni Moneta (g.moneta@londonmet.ac.uk)

## PARTICIPANT'S CONSENT STATEMENT

I have been informed of and understand the purpose of this study and its procedures and I agree to take part in the research and to have my information used anonymously for the purposes of this study. I understand that there are no risks involved in the participation of this study.

I understand that any identifying information will be removed from the data, so my anonymity will be maintained. I also understand that the interview data collected during the project will remain confidential, but that anonymised data may be used in publications and/or conferences.

I understand that my participation is voluntary and that I may withdraw from the research at any time before the data is anonymised, without giving any reason and without prejudice to me.

My participation will remain confidential, whether I participate fully or withdraw from the study.

All questions that I have about the research have been satisfactorily answered and I understand that I will receive a debriefing form at the end of the interview, at which time I may ask additional questions. However, no individual feedback will be provided.

I agree to participate. (initials in box) ☐

I agree to the electronic recording of the interview. (initials in box) ☐

I do not agree to the electronic audio recording of the interview. (initials in box) ☐

Participant's signature: _____

Participant's name (please print): _____

Tick this box and provide your e-mail address if you would like to receive a summary of the aggregated results

E-mail: _____ ☐

Date: _____

**RESEARCHER'S STATEMENT**

I have informed the above named participants of the nature and purpose of this study and have sought to answer their questions to the best of my ability. I have read, understood, and agree to abide by the British Psychological Society's code of conduct, Ethical Principles and Guidelines for conducting research with human participants.

**Signed:** **Date:**

## PARTICIPANT DEBRIEFING SHEET

School of Psychology, London Metropolitan University

Thank you for your participation in this project.

***Aim of the study***
The aim of this study was to understand the psychological processes at play for former professional hockey players, in particular the presence and impact of flow and metacognition.

Flow is the idea of being fully immersed in the game and not noticing any distractions. It's frequently described as "being in the zone". Metacognition is being aware and in control of one's own thoughts and emotional responses. Both of these factors are important and play a role when it comes to sports. More information about flow and metacognition can be found below.
http://www.ted.com/talks/mihaly_csikszentmihalyi_on_flow (Describing Flow)
https://www.youtube.com/watch?v=P_b44JaBQ-Q (Describing Metacognition)

The purpose of the interviews was to obtain a basic understanding of these key issues that influence performance, both at the individual and team level. The data obtained will be subject to qualitative and quantitative analysis and will be used in this empirical study as an initial phase in building a taxonomy of strengths and virtues for ice hockey performance and ultimately lead to the development of a measurement instrument in this area.

***Why is this important?***
Previous research has explored the presence and importance of flow and metacognition with sports. These concepts have been studied both in team and individual sports, but no research has been devoted to ice hockey players. Since the ice hockey environment is completely different to any of the previous sporting contexts associated with flow, this environment needs to be studied to determine the existence of inter-connected and inter-dependent flow.

***What do we hope to find?***
Through this current research study, it is hoped to clarify presence and constraints of flow and metacognition for professional hockey players. The objective of this part of the study is to build a classification system of interactive flow and use the results of this phase for input in the development of a new scale. The new scale has implications for coaches and managers alike and could impact how coaches treat their teams and players and how teams go about scouting and recruiting players to fit within their organisation.

***Further information***
If you later decide that you no longer want your responses to be part of this study (and you don't need to give any reason), please contact me (details below) and your data will be removed from the analysis within 24 hours of the request. You must contact me within four weeks of the interview as all data will be anonymised after that point.

Thanks again for your participation. If you would like more information, or have any further questions about any aspect of this study, then please feel free to contact me, Melissa Reidelberger at mjr0097@my.londonmet.ac.uk or my supervisor Dr Giovanni Moneta at g.moneta@londonmet.ac.uk.

Please note that no individual feedback will be provided to participants. However a summary of results of the set of interviews will be provided if desired.

School of Psychology, London Metropolitan University

## Appendix 2: Semi-Structured Interview Guide

Interview Questions

**Performance Impacts with Teammates**:
-Did you play with the same players (keep the same line) frequently, or did it frequently get switched up? How do you think that contributed to your performance?
-Thinking back to championship teams you have participated on, is there anything that stands out as different than on regular teams you have played?

**Individual Flow:**
-Can you think of any times where you felt like you had the perfect game?

**Distributed Flow:**
-During a game, how was your attention divided between yourself, your teammates, and the opponent? Would that be different in games where you were ahead versus games you were behind, trying to catch up?

**Personal Metacognitions:**
-If you made a bad play or the other team scored, how did you bounce back from that and not let it affect you in your next shifts?
-Did you ever change positions during a game or your career? If so, did that ever alter your mind-set or focus?

**Team Metacognitions:**
-For the games that did not get off to the right start but turned around, what would you attribute that turnaround to?

**Game Phase (Attack and Defence):**
-Would you say your focus is different based on where you were on the ice (Defence zone, neutral zone, or offensive zone)?
-Did the situation of the game affect how much you paid attention at different parts of the ice (Defence zone, neutral zone, or offensive zone)?
-Were there times or locations on the ice where you were more focused on yourself rather than your teammates or opponents?
-Were there times or locations on the ice where you were more focused on your teammates than yourself?
-Were there times or locations on the ice where you were more focused on your opponents rather than yourself?

## Appendix 3: Questionnaires

Flow / Metacognition Questionnaire

### Flow Short Scale (FSS)

| | not at all | | | partly | | | very much |
|---|---|---|---|---|---|---|---|
| **I feel just the right amount of challenge.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **My thoughts/activities run fluidly and smoothly.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **I don't notice time passing.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **I have no difficulty concentrating.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **My mind is completely clear.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **I am totally absorbed in what I am doing.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **The right thoughts/movements occur of their own accord.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **I know what I have to do each step of the way.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **I feel that I have everything under control.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| **I am completely lost in thought.** | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

### Short Dispositional Flow Scale-2 (SDFS-2)

| | Never | Seldom | Sometimes | Often | Always |
|---|---|---|---|---|---|
| I feel I am competent enough to meet the high demands of the situation. | 1 | 2 | 3 | 4 | 5 |
| I do things spontaneously and automatically without having to think. | 1 | 2 | 3 | 4 | 5 |
| I have a strong sense of what I want to do. | 1 | 2 | 3 | 4 | 5 |
| I have a good idea while I am performing about how well I am doing. | 1 | 2 | 3 | 4 | 5 |
| I am completely focused on the task at hand. | 1 | 2 | 3 | 4 | 5 |
| I have a feeling of total control over what I am doing. | 1 | 2 | 3 | 4 | 5 |
| The way time passes seems to be different from normal. | 1 | 2 | 3 | 4 | 5 |
| The experience is extremely rewarding. | 1 | 2 | 3 | 4 | 5 |

**Short Flow in Work Scale (SFWS)**

Please rate each item in terms of how true it is for you. Please select one letter for each question according to the following scale:

N-Never or almost never true for you.

S-Sometimes true for you.

O-Often true for you.

A-Always or almost always true for you.

| Item | | | | |
|---|---|---|---|---|
| 1. When I get really involved with my work my concentration becomes like breathing…I never think of it. | N | S | O | A |
| 2. Sometimes when I am working I become so absorbed that I am less aware of myself and my problems. | N | S | O | A |
| 3. When I am working I am so involved in it that I don't see myself as separate from what I am doing. | N | S | O | A |

**Flow Metacognition Questionnaire (FMQ)**

| | Do not agree | Agree slightly | Agree moderately | Agree very much |
|---|---|---|---|---|
| (1) I become completely focused on the task when I am in flow. | 1 | 2 | 3 | 4 |
| (2) I know how I can re-create having flow if I want to. | 1 | 2 | 3 | 4 |
| (3) Flow has a positive effect on the activity. | 1 | 2 | 3 | 4 |
| (4) I am able to quickly re-enter flow if I need to. | 1 | 2 | 3 | 4 |
| (5) I am able to generate various ideas and options while being in flow. | 1 | 2 | 3 | 4 |
| (6) Once I start with the activity there is no stopping me getting into flow. | 1 | 2 | 3 | 4 |
| (7) I know that by being in flow I achieve more. | 1 | 2 | 3 | 4 |
| (8) I know what I need to do to get into flow. | 1 | 2 | 3 | 4 |
| (9) My thinking becomes clearer when I am in flow. | 1 | 2 | 3 | 4 |
| (10) It is in my power to control when I have flow. | 1 | 2 | 3 | 4 |
| (11) I am more creative when I am in flow. | 1 | 2 | 3 | 4 |
| (12) I am able to sustain flow for long periods. | 1 | 2 | 3 | 4 |

**Appendix 4: Coding Examples**

| Transcript | Theme |
|---|---|
| I guess you could answer this in a very hockey related sense in terms of who you are paying attention to on the other team and also kind of your responsibilities on that particular section on the ice, whether or not you are containing a player or whether or not you are fore-checking trying to win back possession. | Distributed attention |
| If you're in a great spot and you're playing well, I think the focus is still probably, you know, 60 per cent on you, probably 25-30 per cent on my opponent because I'm trying to figure out where can I beat that goaltender, which two of these defensemen do I want to go after next time I get a one on one, who do I want to challenge. | Distributed attention |
| Most of the time, I tried to focus on me the most because like if I'm doing my job properly, if I'm executing the plays properly, if I'm in the right spot, then you know good things are going to happen. So I tried not to focus too much on, like teammates. | Distributed attention |
| One of the worrying things is trying to do too much, trying to do other people's jobs. You've got to stick to your own job. If you see a player who has a potential weakness, I've possibly been guilty of trying to do too much, kind of doing more than my job. | Discipline |
| I think most teams practice doing whatever we need to do, our system. | Discipline |
| I called the goalie over and said 'calm down. We are all here for you. Just relax.' And then I told the rest of the team, in no uncertain terms, we need to support this goalie. And make things good for him. We are all in this together. | Team Support |
| Instead of separating defence and offense, we all talk together. We are in it together. | Team Support |
| You can show energy on the ice, try and get things going, try and have positive shifts when you're on the ice to get your team going, but you couldn't really impact the individuals too much. | Team Support |
| So changing the lines is just the deal where they try to get you back in the flow. | Adaptiveness |

| | |
|---|---|
| It's just such a mental deal because everybody, they know you can do the job, how do they get it out of you? | Adaptiveness |
| I mean I think after games, mostly it was just to relax and you know reflect on what had just happened, not worry about what was gonna happen you know the next day | Game Recovery |
| Forget all about it. Whether it was a good game, bad game, win or loss, I don't spend a lot of time on the previous game. I just move on." | Game Recovery |
| …my whole focus was on I wanted to do the same thing every single day so that I don't have something that bothers me or makes me panic because I'm running late or I hit traffic or whatever. | Routine |
| So you start to focus on making sure that you had a post-game protein shake, you're well hydrated, get a good stretch in. If you had to get ice on sore body parts, make sure you did that. If you needed to get a little bit of a rub down after, the masseuse would make sure that they got you ready. | Routine |
| The best guys just held everybody accountable, open line of communication. They had fun with the guys, but they didn't let anything you know slack off, like you knew if you screwed up, there was going to be some accountability there. | Accountability |
| But there were still moments where one of the teammates needed to get put in his place, and I was also kind of asked to do that job too, even if it was a superstar. | Accountability |
| It starts with leadership. You know, successful teams even going back to junior hockey, and if your people who were supposed to be our best players, your leader, if they did it the right way it seemed to follow suit. | Veteran Presence |
| There were some rookies, but there were a lot of older veteran players that have been through it before. So that provided that team with a lot of depth. When you have depth, you're going to be successful. | Veteran Presence |
| They were really good at knowing which guys to push, which guys to pull, which guys to lean on, which guys might need to get let off. | Coaching Impact |

| | |
|---|---|
| On a team level, the higher levels you get, it really comes down to the coach being able to allow his team to play the game at its highest level, have his players play with the utmost focus, and allowing each player to get the best out of himself. If you can accomplish that as a coach, it doesn't matter how good or how bad your x's and o's are, you're gonna have some success because you need to maximise every player's ability. Because your players' abilities are going to be similar to the team you're playing against ability. | Coaching Impact |
| I think if a coach can get in your head to make you believe in him, you'll go through the end of the rink for him. I think that makes a huge difference. If you're the coach and you're telling me things that I believe you, I'm your guy. | Coaching Impact |

| Transcript | Metacognition Theme |
|---|---|
| If we are a couple of goals behind and it's getting late in the game, you know, you start feeling the pressure more to catch up, and maybe the intensity rises a little bit. And your focus will be more attacking-minded, which might leave yourself a little more exposed. | Metacognition of Risk Taking |
| So you're not comfortable. So you might play a little bit more conservatively, which is never a good thing in hockey. | Metacognition of Risk Taking |
| I want to go back to the bench, refocus for a few minutes, a minute, and go 'okay, let's go get another one. | Metacognition of Resilience |
| It's really grinding. In fact, I tell people all the time, the superstars will tell you more than us, like it's hard to be a tough guy in hockey because of the mental grind you have to go through, knowing when someone is getting called upon, it's you getting the call but you're not getting the ice time. You're not getting that flow of being in the game. That's not enough of a deterrent, a bad start, to keep me out of a game, if that makes sense. | Metacognition of Resilience |
| But usually when I got off the ice, I'll just take a couple of seconds to take a breath, say 'it was never going to be a perfect game anyway, next shift. | Metacognition of Resilience |
| Particularly playing on strong teams, there seemed to be a sense of resiliency that I just knew we would get it back, so it just seemed like we needed to go back to work. | Metacognition of Resilience |
| I remember that the only thing I tried to focus on when bad plays happen was literally I can't bring it back so what I do next if I'm still thinking about that bad play, I'm gonna have another bad play and another bad play and another bad play. So I literally I used to call it park it. I just park it over to the side and then focus on like the next shift or the next play that I made. I always tried to make it simple and make it positive, so that I could start you know the momentum swing back into the good areas. | Metacognition of Resilience |
| So the next day in practice, I would go out, and I would give myself 30 or 50 repetitions of that exact shot. I would simulate it. I would take myself to the same spot in the ice. The same moment. And I would make the shot. I'd make the shot. I'd make the shot. I would just repeat it." | Metacognition of Resilience |
| When you're playing regular, you just kind of shrug it off. It's going to happen. I think if you're a rookie or you're not | Metacognition of Resilience |

| | |
|---|---|
| playing many games, you probably stew over it, worry about it more than if you're a regular player, you know you're going to go to the bench and you probably just get back on the ice again later. | |
| I think I've had shifts where I've thought 'I've done exactly what I needed to do on that shift'. | Role Metacognition |
| You know, if there was somebody you played with that you knew was a good fore checker, you'd let them go in first. If there was somebody that wasn't as good defensively, you'd be more defensive. And then depending on who you played with would determine where you fit in | Role Metacognition |
| I think the most important thing is that you have, well obviously you have to have right players for the right position. I mean you can't have all the same type of players. You have to have role players. You certainly need to have your scores but then you need your checkers. You need your defense when they are very you know good defensively and you need the guys that are good offensively. You are never going to have the perfect combination of player that is just as good offensively as he is defensively. The makeup of your team has to be very well thought-out. That's how you become a really, really good team when you've got all the bases covered where everybody has a role. Everybody is satisfied I guess maybe is the word in their role. That's usually when you have the best team that has a chance of winning." | Role Metacognition |

## Appendix 5: Study 2 & 3 Consent Forms and Debriefing Sheet

Participant Information Sheet

School of Social Sciences – Psychology

Study Title

Positive Self-Regulatory Structures and Processes Fostering Flow and Performance in Ice Hockey Players

Investigators

Melissa Reidelberger (MJR0097@my.londonmet.ac.uk)
Dr. Giovanni Moneta (g.moneta@londonmet.ac.uk) Senior Lecturer (Psychology)

Introduction

You are being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. If you are unclear of anything or if you would like more information, do not hesitate to ask. Please take your time to decide whether or not you wish to partake in this study.

What is the purpose of the study?

The purpose of this study is to create a tool to measure interactive[1] flow. My research thus far has identified new components of flow that have not been previously, so a new scale needs to be created to include these items.

Why have you been chosen?

You have been chosen to participate as you have played ice hockey. This study is only for current or former ice hockey players as all questions will be asked in the context of pregame preparation, during the game, and post-game recovery.

Do you have to take part?

It is up to you to decide whether or not to take part. If you do decide to take part, you will be asked to digitally sign a consent form. Your participation and any information collected from you will be kept strictly confidential and will only be available to the researcher and her academic supervisors. You will be free to withdraw at any time.

What will happen if you take part?

[1] When the second and third studies were conducted, distributed flow was referred to as interactive flow. After the studies were concluded, Walker (2021) was published referencing interactive flow, which was different than this finding and thus the name was changed to distributed flow.

For this part of the study, you will be asked to complete a 125 item questionnaire, measuring a range of factors around playing ice hockey from pregame preparation through thoughts during the game and finally post-game recovery.

What are the possible disadvantages and risks of taking part?

We do not foresee any risks of taking part in this study. You may find some questions asked are of a personal nature (for example, questions on ability and confidence during a game). All data collected will remain confidential and by analysed anonymously.

What are the possible benefits of taking part?

There are no direct benefits for you taking part in this study. However, your contribution to this study will help us to gain a better understanding of the personal factors that are related to ice hockey performance.

Will my participation in this study be kept confidential?

All information collected about you over the course of the research will be kept strictly confidential. All data collected that contains personally identifiable information will have these details removed before analysis is performed to keep your anonymity. You can request withdrawal of your data from this study up to 15 days after survey completion. After that time, all responses will be fully anonymised.

What will happen to the results of the research study?

We will store your data securely. Anonymised results of this study will be used for academic research, publications, presentations, and may also be used for teaching. Individual participants will never be identifiable in any results from this study. You may request a copy of the research optout using the researcher's contact information above.

Who is organising the research?

London Metropolitan University

Who has reviewed the study?

This study was approved by the Research Ethics Review Panel (RERP) of the University on 14/02/2020 and conforms to the British Psychological Society's Code of Ethics and Conduct (2009).

**Participant's Consent**

1. This agreement is of my own free will.

2. I have been given information regarding the aims of the research and have been given the researcher's name and contact details if I require more information.

3. I have had the opportunity to ask any questions about the study.

4. I realise that I may withdraw from the study within 15 days of survey completion without having to give a reason and without suffering having to give a reason and without suffering any adverse consequences.

5. I am aware that even after participating, I can decide to withdraw my data.

6. I understand that all personal information provided by myself will remain confidential and no information that identifies me will be made publicly available.

7. I consent for my data collected in this study to be linked to future data collected by the researchers and data held by the university for research purposes.

Participants where then forced to choose one of two options:

- Yes, I agree to participate in this research.
- No, I do not agree to participate in this research.

The rest of the survey would only continue if they selected the 'yes' option.

**Researcher's Statement**

I have informed the participant of the nature and purpose of this study and have sought to answer any questions to the best of my ability. I have read, understood, and agree to abide by the Ethical Principles for Conducting Research with Human Participants set out by the British Psychological Society in carrying out this study.

Melissa Reidelberger

**Appendix 6: Study 2 (125 Item) IHQ**

Please read each item and imagine yourself playing ice hockey and the experiences you have had while playing ice hockey games. The statements have been broken down into four sections: before the game, during the game, after the game, and generally while playing. Please circle the response per question which appears to be the most appropriate one for you while carrying out this activity.

1=Strongly disagree 2=Disagree 3=Agree 4=Strongly agree

Please read each item and answer in the context of preparing to play an ice hockey game. To help frame the question, imagine the phrase "before the game" to start each statement. Think of your experience and behaviour before the game to approach each statement.

| | | |
|---|---|---|
| 1 | I have a clear routine. [1] | 1 2 3 4 |
| 2 | I have a routine to keep me from thinking too much before the game.[1] | 1 2 3 4 |
| 3 | I have a routine so I can keep focused on my game. [1] | 1 2 3 4 |
| 4 | I try not to have a superstitious routine. [1] | 1 2 3 4 |
| 5 | My routine is consistent as long as I have been playing well in the previous matches. [1] | 1 2 3 4 |
| 6 | If I don't play well in a game, I change my pregame routine for the next one. [1] | 1 2 3 4 |

Please read each item and answer in the context of while playing an ice hockey game. To help frame the question, imagine the phrase "during the game" before each statement. Think of your experience and behaviour during the game to approach each statement.

| | | |
|---|---|---|
| 7 | When I play, I focus on getting the puck to one or two key players.[2] | 1 2 3 4 |
| 8 | It is difficult for me to change positions during a game. [2®] | 1 2 3 4 |
| 9 | I've had shifts where I've thought "I've done exactly what I needed to do." [2] | 1 2 3 4 |
| 10 | I play worse when I'm focused on myself. [3®] | 1 2 3 4 |
| 11 | I stick to my position. [2] | 1 2 3 4 |
| 12 | I do my own job(s). [2] | 1 2 3 4 |
| 13 | I don't let my line mates' playing style or skill dictate how I play my game. [2] | 1 2 3 4 |
| 14 | My focus depends on where I am on the ice and the responsibilities involved with that location. [3] | 1 2 3 4 |
| 15 | I'm more focused on myself than my team mates. [3] | 1 2 3 4 |
| 16 | I easily adjust to the players with whom I am playing. [5] | 1 2 3 4 |
| 17 | Getting lucky bounces can shift the momentum to my team. [6] | 1 2 3 4 |
| 18 | When my team has a comfortable lead, I sometimes find my mind wanders to thoughts outside of hockey. [6] | 1 2 3 4 |
| 19 | I adjust my style of play based upon the team I'm playing against. [6] | 1 2 3 4 |
| 20 | When my team is behind, I take more risks. [8] | 1 2 3 4 |
| 21 | I'm more focused on myself than the opponents. [3] | 1 2 3 4 |
| 22 | I can be mentally affected negatively by changing my line mates. [5] | 1 2 3 4 |
| 23 | I don't stew over my mistakes when I get regular ice time. [11] | 1 2 3 4 |

| | | |
|---|---|---|
| 24 | I feel more resilient because of my positivity. [11] | 1 2 3 4 |
| 25 | When my team is ahead, I play less aggressively. [8] | 1 2 3 4 |
| 26 | I usually play with the same line mates. [5] | 1 2 3 4 |
| 27 | I force opportunities. [6] | 1 2 3 4 |
| 28 | My team focuses on the opponent and counteracting their strategies. [12] | 1 2 3 4 |
| 29 | I'm not affected much by my teammates making a mistake. [11] | 1 2 3 4 |
| 30 | For the most part, I am able to recognise an opportunity and capitalise on it. [6] | 1 2 3 4 |
| 31 | When I get in trouble, I know where to go with the puck. [13] | 1 2 3 4 |
| 32 | There are a few people on my team who score most of the goals. [13] | 1 2 3 4 |
| 33 | I play my own game regardless of with whom I'm paired. [12] | 1 2 3 4 |
| 34 | I can feel easily defeated. [11®] | 1 2 3 4 |
| 35 | When my team is ahead, I do not take as many chances. [8] | 1 2 3 4 |
| 36 | I play better when I'm not focused on myself. [3] | 1 2 3 4 |
| 37 | If the other team scores during my shift, I take a few seconds when I get to the bench to reset and focus on the next shift. [11] | 1 2 3 4 |
| 38 | If I make a mistake, I stew over it for a while. [11®] | 1 2 3 4 |
| 39 | I trust my teammates to do their jobs. [12] | 1 2 3 4 |
| 40 | I expect my team mates to make the generous play rather than hogging the puck themselves. [13] | 1 2 3 4 |
| 41 | I watch as many players as possible. [15] | 1 2 3 4 |
| 42 | I feel strongly affected when the team morale is low.[11 ®] | 1 2 3 4 |
| 43 | I blur out my own team and just focus on the opposition. [3] | 1 2 3 4 |
| 44 | When I change line mates, I communicate more to find out their comfort zone for playing and then adjust my own. [5] | 1 2 3 4 |
| 45 | Playing frequently helps build my confidence. [11] | 1 2 3 4 |
| 46 | My team is stable, even if we are losing in a game. [11] | 1 2 3 4 |
| 47 | When I come back to the bench after my shift, I think "I've done my job." [12] | 1 2 3 4 |
| 48 | My decisions are often guided by what the opposition is doing. [3] | 1 2 3 4 |
| 49 | I am mostly focused on my objectives on the ice. [3] | 1 2 3 4 |
| 50 | I need to play with players who I can feed the puck. [13] | 1 2 3 4 |
| 51 | I feel like I play smart hockey. [8] | 1 2 3 4 |
| 52 | I try to cover for my team mates when they make a mistake. [13] | 1 2 3 4 |
| 53 | I communicate with my team mates to learn their tendencies. [13] | 1 2 3 4 |
| 54 | My team plans specific plays. [6] | 1 2 3 4 |
| 55 | My team executes specific plays we have planned. [6] | 1 2 3 4 |
| 56 | Playing with the same person(s) allows me to play better. [5] | 1 2 3 4 |
| 57 | I feel like I need to compensate for my team mates. [12] | 1 2 3 4 |
| 58 | I am constantly adjusting to what is happening in the game.[3] | 1 2 3 4 |
| 59 | My team has a balance of having fun but being serious when we need to be.[6] | 1 2 3 4 |
| 60 | I leave myself exposed when chasing an offensive opportunity. [8] | 1 2 3 4 |

| | | | | | |
|---|---|---|---|---|---|
| 61 | I focus on the opponents to find a weakness to exploit. [3] | 1 | 2 | 3 | 4 |
| 62 | Part of my strategy is to make the opponent make a mistake before I make one. [6] | 1 | 2 | 3 | 4 |
| 63 | I tend to view things positively. [11] | 1 | 2 | 3 | 4 |
| 64 | My team mostly focuses on ourselves, our own systems and what needs to be done. [12] | 1 | 2 | 3 | 4 |
| 65 | If I'm not playing well, I mostly focus on myself.[3] | 1 | 2 | 3 | 4 |
| 66 | I tend to do exactly what I need to do for the team. [2] | 1 | 2 | 3 | 4 |
| 67 | When I'm asked to play with a new partner or line, I view it as an opportunity to make something new and productive for the team. [5] | 1 | 2 | 3 | 4 |
| 68 | I don't feel discouraged if my team gets off to a bad start. [11] | 1 | 2 | 3 | 4 |
| 69 | I feel like I can learn from watching other players.[15] | 1 | 2 | 3 | 4 |
| 70 | I feel a sense of resiliency with my team when we get behind in a game. [11] | 1 | 2 | 3 | 4 |
| 71 | If I'm not getting a regular shift, I find it difficult to keep focused. [11] | 1 | 2 | 3 | 4 |
| 72 | I play better when there is open communication with everyone on the same page. [13] | 1 | 2 | 3 | 4 |
| 73 | A big physical play by my team can often give my team momentum in the game. [6] | 1 | 2 | 3 | 4 |
| 74 | When I make a mistake, my team mates cover for me. [13] | 1 | 2 | 3 | 4 |
| 75 | My confidence can be affected with whom I'm on the ice. [13] | 1 | 2 | 3 | 4 |
| 76 | I am able to set aside a mistake I've made and continue playing without it affecting me. [11] | 1 | 2 | 3 | 4 |
| 77 | I work harder after my team has let in a goal to get the momentum back on our side. [6] | 1 | 2 | 3 | 4 |
| 78 | I focus more on my team mates than myself. [3] | 1 | 2 | 3 | 4 |
| 79 | After I score, I want to get off the ice to have a reset before my next shift. [15] | 1 | 2 | 3 | 4 |
| 80 | My team as a whole feels resilient even we are behind in a game. [11] | 1 | 2 | 3 | 4 |
| 81 | I start to chase the game when I am getting chances to score but not capitalising on them. [15]® | 1 | 2 | 3 | 4 |
| 82 | I don't feel phased if the game starts off badly for my team. [11] | 1 | 2 | 3 | 4 |
| 83 | If my team mates are struggling, I don't feel like I can directly impact them. [13] | 1 | 2 | 3 | 4 |
| 84 | When my team is behind, I focus more on the attack, which can leave the team a little exposed. [8] | 1 | 2 | 3 | 4 |
| 85 | If I make a bad play, I set it aside immediately and move on. [11.] | 1 | 2 | 3 | 4 |
| 86 | I get bothered by negative things less than my team mates do. [11] | 1 | 2 | 3 | 4 |
| 87 | I feel more confident when certain team mates are on the ice. [13] | 1 | 2 | 3 | 4 |
| 88 | If we go down against a strong team, part of me doesn't believe we can come back. [11] | 1 | 2 | 3 | 4 |
| 89 | I break the game into segments with specific goals for each segment. [11] | 1 | 2 | 3 | 4 |

Please read each item and answer in the context of while playing an ice hockey game. To help frame the question, imagine the phrase "after the game" before each statement. Think of your experience and behaviour after the game to approach each statement.

| | | | | | |
|---|---|---|---|---|---|
| 90 | I talk with my teammates and reflect upon what just happened. [9] | 1 | 2 | 3 | 4 |
| 91 | I unwind from my previous game before I begin to prepare for the next one. [9] | 1 | 2 | 3 | 4 |

| | | | | | |
|---|---|---|---|---|---|
| 92 | I am focused on replenishing nutrition. [1] | 1 | 2 | 3 | 4 |
| 93 | If I missed a shot or play in the game I think I should have made, I work on it at the next practice to make sure the skill is honed in. [11] | 1 | 2 | 3 | 4 |
| 94 | I focus on relaxing. [9] | 1 | 2 | 3 | 4 |
| 95 | I forget about everything and move on. [9] | 1 | 2 | 3 | 4 |

Please read each item and answer in the context of while playing an ice hockey game. These questions are in the general context of playing hockey during a game or throughout the season. Think of your experience and behaviour in general to approach each statement.

| | | | | | |
|---|---|---|---|---|---|
| 96 | I know where I am in the pecking order of the changing room and the ice and accept that. [2] | 1 | 2 | 3 | 4 |
| 97 | I play better on teams that feel close and have a strong sense of camaraderie. [13] | 1 | 2 | 3 | 4 |
| 98 | Veterans provide depth to a team. [7] | 1 | 2 | 3 | 4 |
| 99 | I play with the same line mates for most of the season. [5] | 1 | 2 | 3 | 4 |
| 100 | The hockey season feels like a roller coaster to me with many ups and downs. [14] | 1 | 2 | 3 | 4 |
| 101 | The more depth my team has, the more I know we will be successful. [7] | 1 | 2 | 3 | 4 |
| 102 | My belief in my coach pushes me to play better. [4] | 1 | 2 | 3 | 4 |
| 103 | I feel consistent throughout the hockey season. [14] | 1 | 2 | 3 | 4 |
| 104 | The best players on my team are the team leaders. [7] | 1 | 2 | 3 | 4 |
| 105 | I would watch professionals play and study their tendencies.[15] | 1 | 2 | 3 | 4 |
| 106 | I can accept having a different role on my team. [2] | 1 | 2 | 3 | 4 |
| 107 | Sometimes I need to put a team mate in his or her place within a team. [10] | 1 | 2 | 3 | 4 |
| 108 | I can easily take different roles in a team. [2] | 1 | 2 | 3 | 4 |
| 109 | I build chemistry from playing with the same person. [5] | 1 | 2 | 3 | 4 |
| 110 | I recognise what my individual role is on a team. [2] | 1 | 2 | 3 | 4 |
| 111 | We have leaders on my team and the rest of us follow suit. [7] | 1 | 2 | 3 | 4 |
| 112 | Playing with the same person often benefits my performance on the ice. [5] | 1 | 2 | 3 | 4 |
| 113 | It feels like everybody is held accountable on my team. [10] | 1 | 2 | 3 | 4 |
| 114 | Good leadership on a team makes everybody play better. [7] | 1 | 2 | 3 | 4 |
| 115 | I make an effort to surround myself with smart hockey players. [15] | 1 | 2 | 3 | 4 |
| 116 | I watch my team mate's tendencies to I know if I need to adjust my play accordingly.[2] | 1 | 2 | 3 | 4 |
| 117 | I often crave positive reinforcement from my coach. [4] | 1 | 2 | 3 | 4 |
| 118 | I have never had an altercation with a team mate or coach that lasted longer than a day. [10] | 1 | 2 | 3 | 4 |
| 119 | I am a consistent player for at least ¾ of the season. [14] | 1 | 2 | 3 | 4 |
| 120 | When I'm not playing hockey, I think about scoring goals.[9] | 1 | 2 | 3 | 4 |
| 121 | I play better on a team where everybody is held accountable. [10] | 1 | 2 | 3 | 4 |
| 122 | I play better when I like my coach and my coach likes me. [4] | 1 | 2 | 3 | 4 |
| 123 | There are players with whom I play exceptionally well from years of playing together. [5] | 1 | 2 | 3 | 4 |
| 124 | I believe close-knit teams can be more successful than the best skilled teams. [13] | 1 | 2 | 3 | 4 |

| | | |
|---|---|---|
| 125 | I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. [4] | 1 2 3 4 |

Key:

1) Routine
2) Role Metacognition
3) Distributed Attention
4) Coaching Impact
5) Adaptiveness
6) Strategic Timing
7) Veteran Presence
8) Metacognition of Risk-Taking
9) Game Recovery
10) Accountability
11) Metacognition of Resilience
12) Discipline
13) Team Support
14) Staying Even
15) Role Model Metacognition

**Appendix 7: Exploratory Factor Analysis and Correlations on Pilot IHQ (125 Items) – 12 Factor Solution**

| Questionnaire Item | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor7 | Factor 8 | Factor 9 | Factor 10 | Factor 11 | Factor 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31. When I get in trouble, I know where to go with the puck. | 0.660 | -0.104 | 0.129 | 0.033 | -0.084 | 0.058 | 0.228 | -0.049 | -0.149 | 0.057 | 0.125 | 0.025 |
| 27. I force opportunities. | 0.647 | -0.075 | -0.177 | 0.108 | 0.111 | 0.067 | 0.254 | 0.009 | 0.052 | -0.113 | -0.037 | 0.142 |
| 16. I easily adjust to the players with whom I am playing. | 0.646 | -0.105 | 0.006 | -0.034 | 0.003 | -0.093 | -0.027 | -0.154 | -0.043 | 0.188 | 0.125 | 0.056 |
| 51. I feel like I play smart hockey. | 0.630 | 0.101 | 0.092 | -0.122 | 0.063 | 0.108 | 0.040 | 0.030 | -0.174 | 0.094 | 0.117 | -0.138 |
| 30. For the most part, I am able to recognise an opportunity and capitalise on it. | 0.628 | -0.098 | 0.087 | 0.043 | 0.033 | 0.275 | 0.170 | 0.088 | -0.078 | 0.020 | 0.027 | -0.003 |
| 108. I can easily take different roles in a team. | 0.554 | 0.158 | 0.131 | -0.137 | 0.023 | -0.126 | -0.139 | 0.057 | 0.079 | -0.119 | -0.141 | 0.131 |
| 66. I tend to do exactly what I need to do for the team. | 0.549 | 0.138 | 0.107 | 0.056 | -0.044 | 0.158 | 0.054 | -0.087 | -0.019 | 0.049 | -0.011 | -0.071 |
| 8(R). It's difficult for me to change positions during a game. | 0.517 | 0.160 | 0.131 | -0.085 | 0.135 | -0.107 | -0.125 | -0.105 | -0.069 | -0.144 | 0.037 | -0.120 |
| 119. I am a consistent player for at least 75% of the season. | 0.498 | 0.119 | 0.287 | 0.070 | -0.145 | 0.106 | 0.020 | -0.030 | -0.138 | -0.012 | -0.109 | 0.015 |
| 52. I try to cover for my team mates when they make a mistake. | 0.472 | 0.106 | -0.223 | 0.007 | 0.150 | -0.322 | 0.039 | -0.021 | 0.189 | -0.026 | 0.059 | -0.094 |
| 107. Sometimes I need to put a team mate in his or her place within a team. | 0.465 | -0.005 | 0.025 | -0.302 | -0.159 | 0.030 | -0.188 | 0.100 | 0.054 | 0.328 | 0.178 | 0.201 |
| 19. I adjust my style of play based upon the team I'm playing against. | 0.427 | -0.089 | -0.025 | 0.193 | 0.070 | -0.104 | 0.021 | -0.102 | 0.089 | -0.023 | 0.401 | -0.221 |
| 123. There are players with whom I play exceptionally well from years of playing together. | 0.410 | -0.001 | 0.171 | -0.135 | 0.050 | 0.318 | -0.093 | 0.310 | -0.081 | -0.133 | 0.139 | -0.078 |

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|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7. When I play, I focus on getting the puck to one or two key players. | -0.368 | -0.137 | -0.251 | 0.032 | 0.285 | 0.251 | 0.018 | 0.092 | 0.347 | -0.129 | 0.336 | -0.018 |
| 11. I stick to my position. | -0.361 | 0.173 | 0.137 | -0.163 | -0.092 | 0.225 | 0.054 | -0.144 | 0.059 | 0.123 | 0.071 | 0.062 |
| 53. I communicate with my team mates to learn their tendencies. | 0.358 | 0.251 | -0.050 | 0.060 | 0.237 | 0.087 | -0.058 | 0.124 | -0.104 | 0.180 | 0.328 | -0.060 |
| 116. I watch my team mate's tendencies to know if I need to adjust my play accordingly. | 0.354 | 0.201 | 0.044 | 0.052 | 0.158 | 0.049 | -0.020 | 0.139 | -0.042 | -0.016 | 0.198 | -0.328 |
| 103. I feel consistent throughout the hockey season. | 0.336 | -0.016 | 0.310 | 0.197 | 0.007 | 0.062 | 0.118 | 0.033 | 0.087 | -0.054 | 0.013 | 0.027 |
| 67. When I'm asked to play with a new partner or line, I view it as an opportunity to make something new and productive for the team. | 0.285 | 0.080 | 0.108 | 0.103 | 0.136 | -0.172 | 0.050 | 0.182 | 0.034 | 0.205 | -0.137 | 0.226 |
| 58. I am constantly adjusting to what is happening in the game. | 0.238 | 0.146 | 0.147 | 0.050 | 0.165 | 0.040 | 0.021 | 0.178 | 0.040 | 0.082 | 0.182 | -0.080 |
| 97. I play better on teams that feel close and have a strong sense of camaraderie. | -0.081 | 0.607 | -0.018 | 0.156 | -0.198 | -0.032 | -0.184 | 0.135 | -0.017 | -0.210 | -0.140 | -0.171 |
| 87. I feel more confident when certain team mates are on the ice. | 0.068 | 0.576 | -0.206 | -0.061 | 0.014 | 0.174 | -0.059 | -0.045 | -0.142 | -0.328 | -0.071 | -0.162 |
| 45. Playing frequently helps build my confidence. | 0.198 | 0.571 | -0.129 | 0.018 | -0.009 | -0.104 | 0.227 | -0.015 | -0.201 | -0.101 | -0.070 | 0.068 |
| 114. Good leadership on a team makes everybody play better. | -0.031 | 0.550 | 0.008 | 0.022 | 0.212 | 0.086 | -0.039 | 0.158 | 0.056 | -0.169 | -0.206 | -0.028 |
| 109. I build chemistry from playing with the same person. | 0.048 | 0.548 | -0.061 | -0.023 | -0.116 | 0.391 | -0.024 | 0.234 | -0.183 | -0.031 | -0.007 | 0.105 |

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| 72. I play better when there is open communication with everyone on the same page. | -0.049 | 0.529 | -0.067 | -0.061 | 0.094 | -0.028 | 0.167 | 0.064 | -0.105 | 0.101 | 0.056 | -0.076 |
| 124. I believe close-knit teams can be more successful than the best skilled teams. | 0.052 | 0.498 | 0.207 | -0.013 | -0.064 | 0.029 | -0.206 | -0.034 | 0.023 | 0.064 | 0.033 | -0.096 |
| 43. I blur out my own team and just focus on the opposition. | 0.016 | -0.484 | 0.016 | -0.016 | -0.054 | 0.125 | 0.046 | -0.058 | 0.244 | -0.140 | 0.248 | 0.182 |
| 110. I recognise what my individual role is on a team. | 0.207 | 0.471 | 0.057 | -0.083 | 0.029 | 0.322 | 0.110 | -0.073 | -0.018 | 0.062 | -0.093 | 0.075 |
| 101. The more depth my team has, the more I know we will be successful. | 0.316 | 0.465 | -0.100 | 0.134 | -0.090 | 0.038 | 0.040 | -0.044 | -0.098 | 0.097 | 0.073 | -0.066 |
| 69. I feel like I can learn from watching other players. | -0.143 | 0.456 | 0.002 | -0.018 | 0.419 | -0.075 | 0.202 | 0.242 | -0.020 | 0.012 | -0.055 | 0.022 |
| 56. Playing with the same person(s) allows me to play better. | -0.174 | 0.454 | 0.037 | -0.090 | 0.178 | 0.327 | 0.140 | 0.117 | 0.062 | 0.033 | 0.000 | 0.061 |
| 106. I can accept having a different role on my team. | 0.098 | 0.437 | 0.031 | -0.003 | 0.174 | -0.141 | -0.024 | -0.018 | 0.101 | -0.103 | 0.059 | 0.222 |
| 9. I've had shifts where I've thought "I've done exactly what I needed to do." | 0.219 | 0.431 | 0.147 | -0.046 | -0.174 | -0.167 | 0.175 | 0.057 | 0.054 | -0.189 | 0.033 | 0.021 |
| 98. Veterans provide depth to a team. | 0.131 | 0.430 | -0.082 | 0.243 | 0.148 | 0.035 | -0.076 | -0.249 | 0.104 | -0.078 | 0.171 | 0.135 |
| 73. A big physical play by my team can often give my team momentum in the game. | 0.084 | 0.422 | -0.192 | 0.060 | -0.174 | 0.070 | -0.059 | -0.051 | 0.163 | 0.171 | 0.163 | 0.180 |
| 50. I need to play with players who I can feed the puck. | -0.242 | 0.389 | -0.075 | 0.010 | -0.332 | 0.171 | 0.056 | 0.016 | -0.033 | 0.015 | 0.002 | -0.224 |

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| 37. If the other team scores during my shift, I take a few seconds when I get to the bench to reset and focus on the next shift. | -0.075 | 0.359 | -0.054 | 0.010 | -0.100 | -0.146 | 0.309 | 0.158 | -0.074 | 0.186 | 0.263 | 0.082 |
| 14. My focus depends on where I am on the ice and the responsibilities involved with that location. | -0.060 | 0.356 | 0.044 | 0.007 | -0.046 | -0.094 | 0.218 | -0.104 | 0.251 | -0.031 | -0.014 | 0.091 |
| 77. I work harder after my team has let in a goal to get the momentum back on our side. | -0.200 | 0.290 | 0.164 | 0.212 | 0.037 | -0.072 | -0.030 | 0.187 | 0.158 | -0.092 | 0.205 | 0.121 |
| 38(R). If I make a mistake, I stew over it for a while. | 0.165 | -0.028 | 0.709 | -0.055 | -0.054 | -0.015 | 0.017 | -0.154 | 0.042 | -0.056 | -0.134 | -0.075 |
| 85. If I make a bad play, I set it aside immediately and move on. | 0.011 | -0.137 | 0.703 | -0.083 | -0.182 | 0.032 | 0.114 | 0.049 | 0.256 | -0.003 | -0.086 | 0.160 |
| 42. I feel strongly affected when the team morale is low. | -0.099 | 0.061 | -0.594 | 0.061 | 0.057 | 0.223 | -0.008 | -0.038 | 0.058 | 0.110 | 0.126 | 0.119 |
| 76. I am able to set aside a mistake I've made and continue playing without it affecting me. | 0.116 | 0.064 | 0.578 | 0.105 | 0.038 | 0.049 | 0.062 | -0.135 | 0.213 | -0.115 | 0.085 | 0.034 |
| 23. I don't stew over my mistakes when I get regular ice time. | 0.047 | 0.090 | 0.546 | -0.110 | -0.127 | 0.179 | 0.071 | -0.147 | 0.208 | 0.167 | -0.104 | 0.119 |
| 88(R). If we go down against a strong team, part of me doesn’t' believe we can come back. | 0.042 | 0.006 | 0.541 | 0.258 | -0.004 | -0.093 | -0.062 | -0.045 | -0.237 | 0.023 | -0.025 | 0.006 |
| 34(R). I can feel easily defeated. | 0.276 | 0.159 | 0.537 | 0.036 | 0.059 | -0.045 | -0.102 | -0.120 | -0.103 | 0.066 | -0.068 | -0.193 |
| 10. I play worse when I am focused on myself. | 0.086 | 0.008 | -0.509 | -0.034 | 0.458 | 0.157 | -0.023 | -0.121 | 0.192 | 0.040 | -0.112 | -0.111 |
| 100(R).The hockey season feels like a roller coaster to me with many ups and downs. | -0.119 | -0.278 | 0.496 | 0.237 | 0.133 | -0.052 | -0.199 | -0.007 | -0.061 | -0.154 | -0.140 | -0.156 |

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| 75(R).My confidence can be affected by those with whom I'm on the ice. | 0.077 | -0.168 | 0.495 | -0.014 | 0.021 | -0.275 | -0.098 | -0.004 | 0.182 | 0.260 | 0.029 | 0.008 |
| 63. I tend to view things positively. | 0.139 | 0.117 | 0.444 | 0.310 | -0.077 | 0.129 | -0.060 | -0.171 | 0.125 | -0.500 | 0.089 | -0.231 |
| 24. I feel more resilient because of my positivity. | 0.187 | -0.002 | 0.379 | 0.120 | 0.077 | 0.076 | 0.242 | -0.003 | 0.267 | 0.025 | -0.087 | -0.155 |
| 18(R). When my team has a comfortable lead, I sometimes find my mind wander to thoughts outside of hockey. | -0.255 | 0.206 | 0.351 | 0.100 | 0.156 | -0.168 | 0.058 | 0.154 | -0.080 | -0.162 | -0.173 | 0.134 |
| 22(R).I can be mentally affected negatively by changing my line mates. | 0.113 | -0.100 | 0.348 | 0.198 | 0.046 | -0.060 | -0.076 | -0.065 | -0.248 | 0.100 | -0.098 | 0.289 |
| 71. If I'm not getting a regular shift, I find it difficult to keep focused. | 0.125 | 0.093 | -0.324 | -0.144 | -0.111 | 0.141 | 0.079 | 0.004 | 0.063 | -0.084 | -0.219 | -0.245 |
| 68. I don't feel discouraged if my team gets off to a bad start. | -0.081 | 0.201 | 0.312 | 0.224 | 0.188 | -0.078 | -0.040 | -0.088 | 0.279 | 0.026 | -0.091 | 0.188 |
| 80. My team as a whole feels resilient even when we are behind in a game. | -0.055 | 0.067 | -0.067 | 0.746 | -0.017 | 0.051 | -0.114 | -0.004 | 0.083 | -0.069 | 0.244 | 0.083 |
| 39. I trust my team mates to do their jobs. | -0.086 | 0.085 | 0.034 | 0.635 | 0.029 | 0.088 | 0.053 | -0.366 | 0.009 | 0.173 | -0.014 | -0.001 |
| 113. It feels like everybody is held accountable on my team. | -0.028 | -0.072 | 0.072 | 631.000 | 0.081 | 0.183 | 0.022 | 0.181 | 0.035 | 0.013 | 0.041 | -0.128 |
| 59. My team has a balance of having fun but being serious when we need to be. | 0.067 | 0.173 | 0.025 | 0.602 | -0.132 | -0.002 | 0.108 | -0.084 | -0.130 | -0.003 | 0.084 | -0.032 |
| 46. My team is stable, even if we are losing in a game. | 0.106 | -0.242 | 0.196 | 0.501 | 0.005 | 0.149 | 0.016 | 0.024 | -0.063 | 0.089 | -0.113 | 0.220 |

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| 70. I feel a sense of resiliency with my team when we get behind in a game. | 0.105 | 0.161 | 0.096 | 0.500 | -0.054 | -0.089 | -0.187 | 0.045 | 0.175 | 0.025 | 0.168 | 0.054 |
| 57(R). I feel like I need to compensate for my team mates. | -0.287 | 0.196 | -0.021 | 0.390 | 0.037 | -0.107 | -0.050 | -0.366 | -0.019 | 0.193 | -0.059 | -0.209 |
| 74. When I make a mistake, my team mates cover for me. | 0.135 | 0.036 | 0.181 | 0.381 | 0.078 | 0.002 | 0.039 | 0.042 | 0.288 | 0.007 | -0.366 | -0.078 |
| 28. My team focuses on the opponent and counteracting their strategies. | -0.318 | -0.111 | -0.087 | 0.370 | 0.057 | 0.159 | 0.264 | 0.037 | -0.058 | 0.355 | 0.309 | 0.007 |
| 20. When my team is behind, I take more risks. | 0.228 | -0.191 | -0.077 | 0.290 | -0.258 | -0.284 | 0.287 | 0.124 | 0.057 | -0.252 | 0.081 | 0.054 |
| 12. I do my own job(s). | 0.164 | 0.169 | 0.183 | -0.270 | -0.256 | 0.121 | -0.008 | -0.252 | 0.179 | 0.146 | 0.060 | -0.023 |
| 91. I unwind from my previous game before I begin to prepare for the next one. | -0.060 | 0.179 | 0.053 | 0.205 | -0.105 | -0.035 | 0.067 | 0.132 | -0.039 | 0.005 | 0.089 | -0.151 |
| 15. I'm more focused on myself than my team mates. | -0.071 | -0.028 | 0.087 | -0.077 | -0.779 | -0.251 | 0.022 | 0.006 | 0.093 | 0.067 | -0.084 | 0.081 |
| 36. I play better when I'm not focused on myself. | 0.126 | 0.082 | -0.476 | 0.015 | 0.701 | 0.221 | 0.009 | -0.089 | 0.215 | 0.128 | -0.226 | -0.038 |
| 78. I focus more on my team mates than myself. | 0.082 | -0.164 | 0.011 | -0.016 | 0.684 | 0.512 | -0.116 | -0.003 | 0.058 | -0.128 | 0.100 | -0.054 |
| 21. I'm more focused on myself than the opponents. | 0.018 | 0.014 | 0.013 | 0.056 | -0.639 | -0.021 | 0.078 | 0.306 | 0.030 | 0.047 | -0.157 | 0.136 |
| 65. If I'm not playing well, I mostly focus on myself. | 0.029 | 0.154 | -0.319 | 0.283 | -0.449 | -0.088 | -0.063 | 0.186 | 0.087 | -0.023 | -0.199 | 0.153 |
| 64. My team mostly focuses on ourselves, our own systems and what needs to be done. | 0.195 | -0.199 | -0.004 | 0.420 | -0.427 | 0.203 | -0.149 | 0.126 | -0.053 | 0.168 | -0.044 | 0.037 |
| 41. I watch as many players as | 0.278 | 0.078 | 0.068 | 0.009 | 0.387 | 0.003 | 0.068 | 0.114 | 0.005 | -0.150 | 0.253 | 0.047 |

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| possible. | | | | | | | | | | | | |
| 99. I play with the same line mates for most of the season. | 0.158 | -0.011 | -0.098 | 0.051 | 0.293 | 0.863 | -0.085 | -0.027 | -0.176 | 0.205 | 0.104 | 0.055 |
| 26. I usually play with the same line mates. | 0.139 | -0.054 | -0.179 | 0.052 | 0.109 | 0.792 | -0.214 | 0.047 | -0.045 | 0.216 | 0.165 | -0.046 |
| 104. The best players on my team are the team leaders. | -0.060 | -0.009 | -0.033 | 0.147 | 0.313 | 0.610 | -0.001 | 0.171 | 0.035 | 0.061 | -0.032 | -0.124 |
| 112. Playing with the same person often benefits my performance on the ice. | -0.074 | 0.370 | 0.069 | -0.009 | -0.026 | 0.524 | -0.265 | 0.161 | -0.018 | -0.220 | 0.021 | 0.066 |
| 111. We have leaders on my team and the rest of us follow suit. | -0.186 | 0.150 | -0.148 | 0.293 | -0.034 | 0.506 | -0.029 | 0.037 | -0.117 | 0.109 | -0.065 | 0.318 |
| 40. I expect my team mates to make the generous play rather than hogging the puck themselves. | 0.238 | -0.019 | 0.087 | 0.143 | -0.111 | 0.339 | 0.104 | -0.133 | 0.166 | 0.225 | -0.218 | 0.127 |
| 90. I talk with my team mates and reflect upon what just happened. | 0.027 | 0.054 | 0.009 | 0.189 | 0.296 | 0.321 | -0.094 | 0.270 | -0.089 | 0.049 | 0.086 | -0.013 |
| 3. I have a routine so I can keep focused on my game. | 0.111 | 0.000 | 0.039 | -0.037 | -0.022 | -0.142 | 0.728 | 0.145 | -0.111 | 0.105 | -0.131 | 0.181 |
| 1. I have a clear routine. | 0.225 | 0.051 | 0.012 | 0.032 | 0.133 | -0.098 | 0.632 | 0.018 | -0.113 | -0.083 | -0.032 | 0.068 |
| 2. I have a routine to keep me from thinking too much before the game. | -0.094 | 0.016 | -0.011 | -0.050 | -0.089 | -0.102 | 0.545 | 0.081 | 0.093 | 0.160 | 0.059 | 0.212 |
| 5. My routine is consistent as long as I have been playing well in the previous matches. | 0.040 | -0.008 | 0.087 | -0.071 | -0.161 | -0.101 | 0.526 | 0.113 | 0.284 | -0.051 | 0.052 | -0.035 |
| 49. I am mostly focused on my objectives on the ice. | 0.179 | 0.259 | -0.181 | 0.080 | 0.018 | -0.080 | 0.466 | -0.166 | -0.026 | -0.001 | 0.130 | -0.094 |
| 105. I watch professionals play and study their tendencies. | 0.124 | 0.119 | 0.072 | -0.183 | 0.277 | -0.003 | 0.424 | 0.363 | -0.019 | -0.053 | -0.023 | -0.005 |

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| 17. Getting lucky bounces can shift the momentum to my team. | 0.087 | 0.378 | -0.215 | 0.080 | -0.026 | -0.043 | 0.398 | 0.014 | -0.019 | -0.240 | -0.050 | 0.162 |
| 6. If I don't play well in a game, I change my pregame routine for the next one. | -0.234 | -0.066 | -0.058 | -0.024 | -0.129 | 0.033 | 0.376 | 0.325 | 0.336 | 0.082 | 0.064 | -0.037 |
| 47. When I come back to the bench after my shift, I think "I've done my job." | 0.272 | 0.205 | 0.225 | -0.045 | -0.126 | 0.069 | 0.282 | -0.026 | 0.021 | -0.017 | 0.072 | 0.170 |
| 4. I try not to have a superstitious routine. | -0.005 | -0.086 | -0.160 | 0.143 | -0.150 | -0.041 | -0.258 | 0.091 | 0.128 | 0.126 | 0.167 | -0.144 |
| 122. I play better when I like my coach and my coach likes me. | -0.149 | 0.173 | -0.061 | -0.018 | -0.331 | 0.183 | -0.089 | 0.629 | 0.081 | 0.077 | -0.195 | -0.048 |
| 93. If I missed a shot or play during the game I think I should have made, I work on it at the next practice to make sure the skill is honed in. | 0.017 | 0.133 | -0.040 | 0.053 | 0.110 | -0.141 | 0.340 | 0.541 | 0.002 | 0.105 | 0.106 | -0.162 |
| 120. When I'm not playing hockey, I think about scoring goals. | -0.095 | -0.162 | -0.083 | -0.042 | -0.099 | 0.009 | 0.280 | 0.512 | -0.040 | -0.008 | 0.094 | 0.144 |
| 125. I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. | -0.143 | 0.314 | -0.004 | -0.089 | -0.300 | -0.104 | -0.074 | 0.510 | 0.158 | 0.309 | -0.019 | -0.181 |
| 115. I make an effort to surround myself with smart hockey players. | 0.088 | 0.108 | 0.059 | 0.201 | -0.012 | 0.164 | -0.028 | 0.495 | -0.098 | 0.080 | 0.063 | -0.191 |
| 102. My belief in my coach pushes me to play better. | 0.031 | 0.151 | -0.133 | -0.004 | 0.132 | 0.129 | 0.083 | 0.467 | 0.024 | 0.368 | -0.179 | 0.050 |
| 117. I often crave positive reinforcement from my coach. | 0.092 | 0.002 | -0.314 | -0.113 | -0.072 | 0.080 | -0.060 | 0.451 | 0.181 | 0.388 | -0.309 | -0.031 |

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| 81(R). I start to chase the game when I am getting chances to score but not capitalising on them. | -0.091 | -0.110 | 0.260 | 0.083 | 0.079 | -0.028 | 0.098 | -0.383 | -0.192 | 0.168 | -0.164 | 0.007 |
| 95. I forget about everything and move on. | 0.072 | -0.096 | 0.261 | 0.147 | -0.016 | 0.029 | -0.027 | -0.380 | 0.186 | -0.161 | 0.179 | 0.110 |
| 121. I play better on a team where everybody is held accountable. | 0.103 | 0.311 | 0.061 | 0.197 | -0.298 | -0.142 | -0.005 | 0.360 | -0.089 | 0.135 | -0.078 | -0.281 |
| 35. When my team is ahead, I do not take as many chances. | 0.003 | -0.250 | -0.006 | -0.120 | 0.042 | -0.050 | 0.156 | -0.004 | 0.660 | 0.130 | -0.129 | -0.207 |
| 25. When my team is ahead, I play less aggressively. | 0.060 | -0.335 | -0.044 | 0.009 | -0.166 | -0.140 | -0.090 | 0.222 | 0.580 | -0.106 | 0.039 | -0.166 |
| 79. After I score, I want to get off the ice to reset before my next shift. | -0.223 | -0.034 | 0.073 | 0.037 | 0.005 | -0.019 | -0.054 | 0.046 | 0.502 | 0.010 | 0.005 | 0.082 |
| 60. I leave myself exposed when chasing an offensive opportunity. | -0.067 | 0.082 | -0.208 | 0.303 | -0.238 | -0.254 | -0.042 | -0.008 | 0.481 | -0.020 | 0.011 | 0.130 |
| 29. I'm not affected much by my team mates making a mistake. | -0.110 | 0.006 | 0.302 | 0.198 | 0.152 | 0.120 | 0.018 | -0.080 | 0.408 | 0.031 | -0.099 | 0.059 |
| 82. I don't feel phased if the game starts off badly for my team. | 0.004 | 0.068 | 0.224 | 0.342 | 0.103 | -0.069 | -0.089 | -0.033 | 0.406 | -0.025 | 0.101 | 0.029 |
| 86. I get bothered by negative things less than my team mates do. | 0.057 | 0.158 | 0.069 | -0.081 | 0.062 | -0.138 | -0.017 | -0.149 | 0.375 | -0.106 | 0.089 | -0.036 |
| 54. My team plans specific plays. | 0.052 | -0.041 | -0.064 | 0.085 | -0.163 | 0.223 | 0.061 | 0.116 | -0.101 | 0.794 | -0.015 | 0.028 |
| 55. My team executes specific plays we have planned. | -0.010 | -0.254 | -0.054 | 0.177 | -0.096 | 0.238 | 0.097 | 0.152 | 0.019 | 0.732 | 0.107 | 0.063 |
| 44. When I change line mates, I communicate more to find out their comfort zone for playing and then adjust my own. | 0.241 | 0.101 | -0.014 | -0.120 | 0.069 | -0.047 | -0.018 | 0.057 | 0.140 | 0.399 | 0.245 | -0.127 |

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| 84. When my team is behind, I focus more on the attack, which can leave the team a little exposed. | 0.190 | -0.101 | -0.201 | 0.185 | -0.233 | 0.022 | 0.054 | 0.206 | 0.063 | -0.374 | 0.088 | -0.440 |
| 32. There are a few people on my team who score most of the goals. | -0.079 | 0.089 | -0.219 | 0.069 | 0.037 | 0.024 | 0.152 | -0.147 | -0.039 | -0.221 | 0.121 | 0.196 |
| 48. My decisions are often guided by what the opposition is doing. | -0.010 | -0.029 | -0.223 | 0.220 | 0.221 | 0.066 | -0.056 | -0.129 | 0.089 | 0.005 | 0.637 | -0.165 |
| 62. Part of my strategy is to make the opponent make a mistake before I make one. | 0.310 | 0.004 | -0.060 | 0.153 | -0.029 | 0.228 | 0.025 | 0.013 | -0.045 | 0.054 | 0.488 | 0.056 |
| 61. I focus on the opponents to find a weakness to exploit. | 0.273 | -0.103 | 0.137 | -0.052 | 0.058 | 0.133 | 0.052 | 0.145 | 0.041 | -0.004 | 0.485 | -0.074 |
| 118. I have never had an altercation with a team mate or coach that lasted longer than a day. | -0.213 | 0.021 | 0.216 | 0.208 | 0.082 | 0.096 | 0.067 | 0.119 | 0.080 | -0.025 | -0.364 | -0.198 |
| 89. I break the game into segments with specific goals for each segment. | 0.078 | -0.138 | -0.004 | 0.259 | -0.113 | 0.057 | 0.231 | 0.117 | -0.125 | 0.225 | 0.296 | 0.071 |
| 83(R). If my team mates are struggling, I don't feel like I can directly impact them. | 0.102 | 0.068 | 0.211 | -0.062 | 0.180 | 0.044 | -0.015 | 0.258 | -0.080 | 0.167 | 0.287 | 0.127 |
| 13. I don't let my line mates' playing style or skill dictate how I play my game. | -0.119 | -0.003 | 0.101 | -0.002 | -0.189 | 0.043 | 0.206 | -0.048 | 0.024 | 0.018 | 0.008 | 0.630 |
| 33. I play my own game regardless of with whom I'm paired. | 0.156 | -0.036 | 0.087 | 0.036 | -0.087 | -0.056 | 0.397 | -0.096 | -0.011 | 0.044 | -0.104 | 0.507 |
| 96. I know where I am in the pecking order of the changing room and the ice and accept that. | 0.038 | 0.273 | -0.170 | 0.035 | -0.004 | 0.392 | 0.017 | 0.027 | -0.025 | -0.142 | -0.070 | 0.436 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 94. I focus on relaxing. | -0.040 | 0.160 | 0.284 | -0.014 | -0.061 | 0.121 | 0.044 | 0.053 | 0.153 | -0.082 | 0.091 | -0.380 |
| 92. I am focused on replenishing nutrition. | 0.088 | 0.095 | 0.148 | 0.016 | 0.033 | -0.181 | 0.263 | 0.237 | 0.045 | 0.157 | -0.038 | -0.313 |

Table 73: Pattern matrix for the 125-iten pilot IHQ (12-factor solution; promax rotation, N=147)

| Factors | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor7 | Factor 8 | Factor 9 | Factor 10 | Factor 11 | Factor 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Factor 1 | 0.264 | 0.260 | 0.132 | 0.074 | 0.027 | 0.129 | 0.128 | 0.123 | 0.025 | 0.092 | 0.121 |
| Factor 2 | | 0.194 | 0.113 | 0.063 | 0.019 | 0.081 | 0.152 | 0.074 | 0.113 | 0.080 | 0.060 |
| Factor 3 | | | 0.141 | 0.283 | -0.038 | 0.017 | -0.024 | -0.005 | 0.127 | 0.147 | 0.167 |
| Factor 4 | | | | 0.220 | -0.050 | 0.168 | 0.109 | 0.107 | 0.122 | -0.032 | 0.079 |
| Factor 5 | | | | | -0.349 | -0.123 | 0.115 | -0.11 | 0.159 | 0.038 | 0.224 |
| Factor 6 | | | | | | 0.285 | -0.038 | 0.211 | -0.179 | 0.022 | -0.214 |
| Factor 7 | | | | | | | -0.006 | 0.140 | 0.043 | 0.083 | -0.207 |
| Factor 8 | | | | | | | | -0.025 | -0.056 | 0.142 | 0.086 |
| Factor 9 | | | | | | | | | 0.029 | 0.076 | 0.048 |
| Factor 10 | | | | | | | | | | -0.028 | 0.056 |
| Factor 11 | | | | | | | | | | | 0.096 |

Table 74: Correlations for the 125-iten pilot IHQ

**Appendix 8: Exploratory Factor Analysis and Correlations on Pilot IHQ (68 Items) – 11 Factor Solution**

| Questionnaire Item | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 | Factor 9 | Factor 10 | Factor 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23. I don't stew over my mistakes when I get regular ice time. | 0.769 | 0.02 | -0.066 | 0.065 | -0.065 | 0.099 | 0.126 | 0 | 0.054 | -0.013 | 0.092 |
| 85. If I make a bad play, I set it aside immediately and move on. | 0.728 | 0.084 | 0.036 | -0.197 | -0.085 | 0.017 | 0.04 | 0.1 | 0.194 | -0.125 | -0.046 |
| 38R. If I make a mistake, I stew over it for a while. | 0.673 | 0.166 | -0.115 | -0.045 | -0.114 | -0.057 | -0.061 | 0.313 | 0.007 | -0.002 | 0.005 |
| 24. I feel more resilient because of my positivity. | 0.612 | 0.251 | 0.003 | -0.034 | 0.084 | -0.113 | 0.185 | -0.048 | 0.167 | 0.14 | 0.091 |
| 76. I am able to set aside a mistake I've made and continue playing without it affecting me. | 0.589 | 0.072 | 0.194 | 0.018 | 0.109 | 0.079 | -0.179 | 0.074 | 0.137 | -0.032 | -0.096 |
| 63. I tend to view things positively. | 0.495 | 0.078 | 0.08 | 0.077 | 0.207 | 0.084 | -0.082 | 0.081 | -0.029 | -0.071 | 0.004 |
| 29. I'm not affected much by my team mates making a mistake. | 0.389 | -0.079 | 0.353 | -0.213 | 0.018 | 0.072 | 0.099 | 0.039 | -0.059 | 0.063 | 0.04 |
| 86. I get bothered by negative things less than my team mates do. | 0.353 | 0.034 | 0.024 | 0.277 | 0.105 | -0.154 | -0.061 | -0.295 | 0.058 | 0.088 | -0.187 |
| 66. I tend to do exactly what I need to do for the team. | 0.105 | 0.682 | 0.146 | 0.084 | -0.071 | 0.009 | 0.032 | -0.027 | -0.088 | 0.037 | 0.051 |
| 30. For the most part, I am able to recognise an opportunity and capitalise on it. | 0.21 | 0.667 | -0.029 | -0.134 | 0.112 | 0.061 | 0.036 | -0.043 | 0.209 | 0.044 | 0.023 |
| 27. I force opportunities. | 0.012 | 0.652 | 0.028 | -0.058 | 0.199 | -0.089 | 0.022 | -0.077 | 0.19 | 0.03 | -0.066 |
| 31. When I get in trouble, I know where to go with the puck. | 0.131 | 0.593 | -0.042 | 0.078 | 0.122 | -0.039 | -0.21 | 0.071 | 0.215 | -0.09 | 0.149 |
| 108. I can easily take different roles in a team. | 0.082 | 0.478 | 0.043 | 0.165 | -0.131 | -0.006 | 0 | 0.181 | -0.126 | 0.033 | -0.212 |
| 8R. It's difficult for me to change positions during a game. | 0.099 | 0.347 | -0.146 | 0.217 | 0.077 | -0.087 | -0.024 | 0.336 | -0.221 | 0.09 | -0.16 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80. My team as a whole feels resilient even when we are behind in a game. | -0.187 | -0.009 | 0.842 | -0.03 | 0.122 | 0.059 | -0.135 | -0.115 | -0.084 | -0.084 | 0.12 |
| 70. I feel a sense of resiliency with my team when we get behind in a game. | -0.022 | 0.065 | 0.73 | 0.007 | 0.059 | -0.053 | 0.109 | 0.141 | -0.128 | -0.107 | 0.06 |
| 82. I don't feel phased if the game starts off badly for my team. | 0.215 | 0.067 | 0.651 | -0.004 | 0.03 | -0.081 | -0.027 | -0.12 | -0.052 | 0.074 | 0.037 |
| 68. I don't feel discouraged if my team gets off to a bad start. | 0.232 | -0.005 | 0.612 | 0.068 | -0.246 | 0.004 | -0.066 | 0.043 | -0.043 | 0.159 | -0.011 |
| 46. My team is stable, even if we are losing in a game. | 0.05 | 0.285 | 0.533 | -0.395 | -0.061 | -0.082 | -0.02 | 0.125 | 0.024 | -0.068 | 0.173 |
| 59. My team has a balance of having fun but being serious when we need to be. | -0.114 | 0.179 | 0.512 | 0.145 | -0.028 | 0.037 | -0.11 | -0.027 | 0.07 | -0.147 | 0.159 |
| 77. I work harder after my team has let in a goal to get the momentum back on our side. | 0.078 | -0.166 | 0.475 | 0.204 | 0.112 | 0.084 | 0.071 | -0.059 | -0.086 | 0.036 | -0.098 |
| 45. Playing frequently helps build my confidence. | -0.126 | 0.234 | -0.019 | 0.639 | -0.15 | 0.061 | -0.052 | -0.065 | 0.156 | 0.002 | -0.026 |
| 72. I play better when there is open communication with everyone on the same page. | -0.054 | -0.112 | -0.111 | 0.599 | -0.058 | 0.123 | 0.024 | -0.009 | 0.193 | 0.088 | 0.031 |
| 37. If the other team scores during my shift, I take a few seconds when I get to the bench to reset and focus on the next shift. | 0.077 | -0.269 | -0.034 | 0.525 | 0.262 | -0.051 | 0.131 | -0.046 | 0.256 | 0.085 | 0.211 |
| 73. A big physical play by my team can often give my team momentum in the game. | -0.018 | 0.092 | 0.238 | 0.504 | 0.066 | 0.137 | 0.008 | -0.382 | -0.074 | -0.084 | 0.1 |
| 124. I believe close-knit teams can be more successful than the best skilled teams. | 0.222 | 0.001 | -0.002 | 0.466 | 0.004 | 0.088 | 0.103 | 0.184 | -0.326 | -0.049 | 0.122 |
| 9. I've had shifts where I've thought "I've done exactly what I needed to do." | 0.088 | 0.298 | 0.135 | 0.39 | -0.039 | 0.141 | 0.049 | -0.047 | 0.051 | -0.192 | -0.246 |
| 17. Getting lucky bounces can shift the momentum to my team. | -0.041 | 0.181 | 0.07 | 0.352 | -0.007 | 0.149 | -0.008 | -0.302 | 0.27 | -0.062 | -0.173 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| 106. I can accept having a different role on my team. | -0.086 | 0.074 | 0.28 | 0.348 | -0.061 | 0.064 | -0.064 | 0.144 | -0.085 | 0.089 | -0.151 |
| 48. My decisions are often guided by what the opposition is doing. | -0.031 | -0.167 | 0.111 | -0.019 | 0.692 | -0.093 | -0.089 | -0.196 | 0.022 | 0.181 | -0.054 |
| 61. I focus on the opponents to find a weakness to exploit. | 0.096 | 0.034 | -0.124 | -0.073 | 0.624 | 0.153 | -0.034 | 0.231 | 0.053 | -0.046 | -0.028 |
| 62. Part of my strategy is to make the opponent make a mistake before I make one. | 0.043 | 0.159 | 0.037 | -0.05 | 0.615 | 0.114 | 0.023 | 0.068 | -0.033 | -0.074 | 0.042 |
| 19. I adjust my style of play based upon the team I'm playing against. | -0.08 | 0.277 | 0.058 | 0.001 | 0.607 | -0.293 | 0.056 | -0.068 | 0.001 | -0.002 | -0.054 |
| 116. I watch my team mate's tendencies to know if I need to adjust my play accordingly. | -0.056 | 0.17 | 0 | 0.108 | 0.319 | 0.115 | 0.074 | 0.268 | 0.023 | -0.031 | -0.014 |
| 41. I watch as many players as possible. | -0.057 | 0.161 | 0.08 | -0.053 | 0.31 | -0.05 | 0.004 | 0.306 | 0.075 | 0.263 | -0.233 |
| 112. Playing with the same person often benefits my performance on the ice. | 0.041 | -0.127 | 0.025 | 0.07 | 0.001 | 0.843 | -0.016 | -0.054 | -0.16 | -0.06 | -0.175 |
| 109. I build chemistry from playing with the same person. | -0.125 | 0.065 | 0.031 | 0.303 | -0.119 | 0.697 | 0.092 | -0.005 | -0.008 | -0.143 | -0.024 |
| 56. Playing with the same person(s) allows me to play better. | 0.05 | -0.191 | 0.096 | 0.171 | -0.105 | 0.634 | 0.001 | -0.029 | 0.219 | 0.033 | -0.082 |
| 123. There are players with whom I play exceptionally well from years of playing together. | 0.059 | 0.268 | -0.137 | -0.029 | 0.179 | 0.456 | -0.016 | 0.171 | -0.036 | -0.005 | -0.082 |
| 99. I play with the same line mates for most of the season. | 0.039 | 0.22 | -0.066 | -0.104 | 0.091 | 0.447 | 0.003 | -0.132 | -0.131 | 0.346 | 0.313 |
| 26. I usually play with the same line mates. | 0.003 | 0.135 | -0.071 | -0.079 | 0.234 | 0.43 | 0.036 | -0.282 | -0.159 | 0.152 | 0.327 |
| 110. I recognise what my individual role is on a team. | 0.186 | 0.175 | -0.109 | 0.329 | -0.055 | 0.389 | 0.019 | 0.012 | 0.079 | 0.005 | 0.087 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 52. I try to cover for my team mates when they make a mistake. Team Support. Forward. | -0.106 | 0.321 | 0.037 | 0.259 | 0.241 | -0.337 | 0.102 | 0.041 | -0.01 | -0.003 | -0.062 |
| 122. I play better when I like my coach and my coach likes me. | 0.143 | -0.129 | -0.121 | -0.047 | 0.065 | 0.236 | 0.759 | -0.097 | -0.056 | -0.203 | 0.014 |
| 125. I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. | 0.115 | -0.206 | -0.081 | 0.202 | 0.117 | -0.042 | 0.741 | 0.1 | -0.039 | -0.197 | 0.175 |
| 117. I often crave positive reinforcement from my coach. | -0.04 | 0.193 | 0.022 | -0.074 | -0.173 | -0.087 | 0.736 | -0.192 | -0.125 | 0.054 | 0.24 |
| 102. My belief in my coach pushes me to play better. | -0.055 | 0.029 | 0.032 | 0.115 | -0.112 | -0.038 | 0.593 | 0.13 | 0.003 | 0.178 | 0.33 |
| 81. I start to chase the game when I am getting chances to score but not capitalising on them. | -0.063 | 0.12 | 0.007 | 0.005 | 0.331 | 0.014 | 0.438 | -0.237 | -0.105 | -0.079 | -0.257 |
| 93. If I missed a shot or play during the game I think I should have made, I work on it at the next practice to make sure the skill is honed in. | -0.144 | 0.072 | 0.136 | -0.028 | 0.1 | -0.05 | 0.384 | 0.175 | 0.37 | -0.003 | 0.032 |
| 42R. I feel strongly affected when the team morale is low. | -0.238 | -0.059 | 0.032 | 0.215 | 0.058 | 0.121 | -0.047 | -0.642 | 0.058 | 0.141 | 0.067 |
| 88R. If we go down against a strong team, part of me doesn't believe we can come back. | 0.116 | -0.075 | 0.229 | 0.019 | -0.072 | 0.066 | -0.246 | 0.569 | -0.109 | -0.05 | 0.155 |
| 34R. I can feel easily defeated. | 0.368 | 0.148 | -0.036 | 0.173 | -0.043 | -0.096 | -0.037 | 0.512 | -0.159 | 0.039 | 0.097 |
| 83R. If my team mates are struggling, I don't feel like I can directly impact them. | 0.069 | -0.135 | 0.009 | -0.04 | 0.335 | 0.072 | 0.189 | 0.509 | -0.002 | 0.042 | 0.015 |
| 79. After I score, I want to get off the ice to reset before my next shift. | 0.307 | -0.097 | 0.315 | -0.065 | 0.03 | -0.021 | 0.122 | -0.476 | -0.004 | 0.056 | -0.184 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 71. If I'm not getting a regular shift, I find it difficult to keep focused. | -0.108 | 0.33 | -0.211 | 0.045 | -0.155 | 0.055 | 0.197 | -0.398 | -0.01 | -0.029 | -0.101 |
| 53. I communicate with my team mates to learn their tendencies. | -0.183 | 0.151 | 0.141 | 0.239 | 0.272 | 0.099 | 0.032 | 0.347 | -0.084 | 0.095 | 0.118 |
| 3. I have a routine so I can keep focused on my game. | 0.126 | 0.147 | -0.166 | 0.148 | -0.059 | -0.134 | -0.046 | -0.02 | 0.808 | -0.061 | 0.24 |
| 1. I have a clear routine. | 0.05 | 0.27 | -0.069 | 0.189 | -0.011 | -0.002 | -0.274 | -0.143 | 0.725 | 0.031 | 0.068 |
| 2. I have a routine to keep me from thinking too much before the game. | 0.214 | -0.095 | -0.081 | 0.058 | 0.092 | -0.025 | -0.001 | -0.159 | 0.718 | -0.147 | 0.128 |
| 105. I watch professionals play and study their tendencies. | -0.083 | 0.159 | -0.022 | -0.107 | -0.035 | 0.187 | 0.161 | 0.298 | 0.373 | 0.096 | -0.166 |
| 15R. I'm more focused on myself than my team mates. | -0.11 | 0.028 | 0.012 | 0.019 | 0.051 | -0.024 | -0.054 | 0.152 | -0.091 | 0.761 | 0.047 |
| 36. I play better when I'm not focused on myself. | -0.09 | 0.16 | 0.033 | 0.116 | -0.128 | -0.105 | 0.111 | -0.38 | -0.048 | 0.719 | 0.101 |
| 21R. I'm more focused on myself than the opponents. | 0.107 | -0.167 | -0.2 | 0.147 | 0.118 | -0.203 | -0.224 | 0.006 | -0.043 | 0.702 | -0.022 |
| 78. I focus more on my team mates than myself. | 0.074 | 0.052 | -0.014 | -0.245 | 0.074 | 0.253 | -0.133 | -0.056 | -0.04 | 0.635 | -0.11 |
| 69. I feel like I can learn from watching other players. | -0.005 | -0.175 | 0.118 | 0.27 | -0.231 | 0.159 | 0.156 | 0.11 | 0.28 | 0.41 | -0.088 |
| 54. My team plans specific plays. | 0.052 | -0.014 | 0.033 | 0.122 | -0.135 | -0.091 | 0.232 | 0.068 | 0.144 | -0.008 | 0.888 |
| 55. My team executes specific plays we have planned. | 0.028 | -0.035 | 0.175 | -0.103 | 0.007 | -0.137 | 0.226 | 0.055 | 0.15 | 0.019 | 0.84 |
| 89. I break the game into segments with specific goals for each segment. | -0.151 | -0.054 | 0.147 | 0.061 | 0.212 | 0.065 | -0.229 | 0.135 | 0.317 | -0.105 | 0.415 |

Table 75: Pattern matrix for the 68-item pilot IHQ (11-factor solution; promax rotation, N=147)

| Factors | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 | Factor 9 | Factor 10 | Factor 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| Factor 1 | 0.124 | 0.190 | 0.114 | 0.073 | 0.035 | -0.205 | 0.158 | -0.084 | 0.035 | 0.054 |
| Factor 2 | | 0.107 | 0.201 | 0.226 | 0.260 | 0.039 | 0.250 | 0.148 | 0.107 | 0.024 |
| Factor 3 | | | 0.242 | 0.169 | 0.101 | 0.078 | 0.290 | 0.302 | 0.277 | -0.079 |
| Factor 4 | | | | 0.147 | 0.108 | 0.213 | 0.322 | 0.151 | 0.074 | -0.127 |
| Factor 5 | | | | | 0.208 | 0.055 | 0.096 | 0.140 | 0.142 | 0.109 |
| Factor 6 | | | | | | 0.190 | 0.098 | 0.119 | 0.107 | 0.125 |
| Factor 7 | | | | | | | 0.026 | 0.261 | 0.032 | -0.105 |
| Factor 8 | | | | | | | | 0.233 | 0.250 | -0.173 |
| Factor 9 | | | | | | | | | 0.150 | -0.070 |
| Factor 10 | | | | | | | | | | -0.058 |

Table 76: Correlations for the 68-item pilot IHQ

**Appendix 9: Exploratory Factor Analysis and Correlations on Pilot IHQ (40 Items) – 8 Factor Solution**

| Questionnaire Item | Factor 1 | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 |
|---|---|---|---|---|---|---|---|---|
| 38R. If I make a mistake, I stew over it for a while. | 0.839 | 0.124 | -0.16 | -0.099 | -0.112 | -0.064 | 0.015 | -0.077 |
| 23. I don't stew over my mistakes when I get regular ice time. | 0.806 | -0.027 | -0.102 | 0.215 | -0.028 | 0.009 | -0.047 | 0.001 |
| 85. If I make a bad play, I set it aside immediately and move on. | 0.719 | 0.022 | -0.024 | -0.029 | -0.052 | -0.078 | -0.18 | 0.066 |
| 34R. I can feel easily defeated. | 0.634 | 0.139 | 0.057 | -0.014 | -0.05 | -0.044 | 0.098 | -0.113 |
| 63. I tend to view things positively. | 0.573 | 0.007 | 0.059 | 0.005 | 0.176 | 0.045 | 0.001 | 0.015 |
| 76. I am able to set aside a mistake I've made and continue playing without it affecting me. | 0.563 | 0.077 | 0.185 | -0.202 | 0.093 | 0.032 | -0.068 | 0.059 |
| 24. I feel more resilient because of my positivity. | 0.527 | 0.151 | 0.029 | 0.256 | 0.058 | -0.171 | 0.118 | 0.203 |
| 88R. If we go down against a strong team, part of me doesn't believe we can come back. | 0.4 | 0.026 | 0.263 | -0.162 | -0.134 | 0.092 | 0.095 | -0.108 |
| 30. For the most part, I am able to recognise an opportunity and capitalise on it. | 0.123 | 0.691 | -0.037 | -0.041 | 0.169 | -0.027 | -0.075 | 0.055 |
| 66. I tend to do exactly what I need to do for the team. | 0.084 | 0.685 | 0.085 | 0.015 | 0.01 | 0.025 | 0.011 | -0.093 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 31. When I get in trouble, I know where to go with the puck. | 0.131 | 0.654 | -0.047 | -0.21 | 0.209 | -0.032 | -0.123 | 0.072 |
| 108. I can easily take different roles in a team. | 0.117 | 0.616 | 0.114 | -0.025 | -0.251 | 0.099 | 0.047 | -0.102 |
| 27. I force opportunities. | -0.081 | 0.609 | -0.018 | 0.032 | 0.204 | -0.065 | 0.047 | 0.203 |
| 71R. If I'm not getting a regular shift, I find it difficult to keep focused. | 0.244 | -0.368 | 0.33 | -0.16 | 0.094 | -0.032 | 0.074 | 0.141 |
| 70. I feel a sense of resiliency with my team when we get behind in a game. | 0.011 | 0.067 | 0.788 | 0.138 | 0.059 | -0.038 | -0.146 | -0.045 |
| 80. My team as a whole feels resilient even when we are behind in a game. | -0.266 | 0.019 | 0.772 | -0.087 | 0.147 | 0.025 | -0.136 | -0.023 |
| 82. I don't feel phased if the game starts off badly for my team. | 0.035 | 0.092 | 0.759 | 0.001 | -0.057 | -0.112 | -0.043 | 0.055 |
| 68. I don't feel discouraged if my team gets off to a bad start. | 0.17 | 0.027 | 0.668 | -0.006 | -0.313 | 0.038 | 0.12 | 0.067 |
| 77. I work harder after my team has let in a goal to get the momentum back on our side. | 0.072 | -0.066 | 0.503 | 0.103 | 0.11 | 0.073 | 0.004 | -0.172 |
| 117. I often crave positive reinforcement from my coach. | -0.139 | 0.136 | -0.02 | 0.743 | -0.096 | -0.117 | 0.063 | -0.064 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 125. I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. | 0.146 | -0.212 | 0.046 | 0.739 | 0.142 | 0.03 | -0.168 | 0.027 |
| 102. My belief in my coach pushes me to play better. | 0.019 | -0.008 | 0.121 | 0.711 | -0.024 | 0.01 | 0.247 | 0.062 |
| 122. I play better when I like my coach and my coach likes me. | 0.045 | -0.12 | -0.062 | 0.709 | 0.041 | 0.179 | -0.199 | -0.032 |
| 48. My decisions are often guided by what the opposition is doing. | -0.211 | -0.182 | 0.149 | -0.108 | 0.691 | -0.077 | 0.115 | 0.046 |
| 62. Part of my strategy is to make the opponent make a mistake before I make one. | 0.039 | 0.21 | -0.028 | 0.066 | 0.674 | 0.055 | -0.015 | -0.094 |
| 61. I focus on the opponents to find a weakness to exploit. | 0.115 | 0.083 | -0.148 | -0.06 | 0.667 | 0.11 | 0.066 | -0.044 |
| 19. I adjust my style of play based upon the team I'm playing against. | -0.114 | 0.208 | 0.059 | 0.096 | 0.604 | -0.252 | 0.014 | 0.033 |
| 83R. If my team mates are struggling, I don't feel like I can directly impact them. | 0.317 | -0.125 | 0.102 | 0.16 | 0.4 | 0.093 | 0.097 | -0.066 |
| 53. I communicate with my team mates to learn their tendencies. | -0.056 | 0.221 | 0.256 | 0.067 | 0.285 | 0.228 | 0.162 | -0.003 |
| 112. Playing with the same person often benefits my performance on the ice. | -0.046 | -0.066 | -0.045 | -0.035 | 0.009 | 0.844 | 0.027 | -0.08 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 109. I build chemistry from playing with the same person. | -0.13 | 0.187 | 0.029 | 0.088 | -0.042 | 0.758 | -0.128 | -0.025 |
| 56. Playing with the same person(s) allows me to play better. | -0.064 | -0.149 | 0.063 | -0.034 | -0.053 | 0.758 | 0.082 | 0.236 |
| 110. I recognise what my individual role is on a team. | 0.184 | 0.204 | -0.149 | 0.09 | 0.004 | 0.528 | 0.057 | 0.127 |
| 21R. I'm more focused on myself than the opponents. | 0.166 | -0.257 | -0.185 | -0.085 | 0.094 | -0.091 | 0.776 | 0.043 |
| 15R. I'm more focused on myself than my team mates. | -0.024 | 0.049 | 0.023 | 0.013 | 0.096 | 0.006 | 0.775 | -0.084 |
| 36. I play better when I'm not focused on myself. | -0.261 | 0.115 | 0.02 | 0.247 | -0.121 | -0.038 | 0.704 | 0.059 |
| 78. I focus more on my team mates than myself. | -0.004 | 0.024 | -0.121 | -0.153 | 0.153 | 0.171 | 0.6 | -0.121 |
| 3. I have a routine so I can keep focused on my game. | 0.026 | 0.063 | -0.074 | 0.076 | -0.095 | 0.013 | 0.012 | 0.851 |
| 2. I have a routine to keep me from thinking too much before the game. | 0.028 | -0.176 | -0.011 | 0.042 | 0.035 | 0.071 | -0.157 | 0.765 |
| 1. I have a clear routine. | -0.101 | 0.204 | 0.012 | -0.162 | -0.027 | 0.093 | 0.047 | 0.751 |

Table 77: Pattern matrix for the 40-item pilot IHQ (8-factor solution; promax rotation, N=147)

| Factors | Factor 2 | Factor 3 | Factor 4 | Factor 5 | Factor 6 | Factor 7 | Factor 8 |
|---|---|---|---|---|---|---|---|
| Factor 1 | 0.280 | 0.331 | -0.154 | 0.178 | 0.174 | 0.125 | 0.186 |
| Factor 2 | | 0.155 | 0.066 | 0.204 | 0.178 | 0.146 | 0.277 |
| Factor 3 | | | -0.100 | 0.180 | 0.155 | 0.289 | 0.149 |
| Factor 4 | | | | 0.020 | 0.202 | -0.156 | 0.070 |
| Factor 5 | | | | | 0.166 | 0.089 | 0.197 |
| Factor 6 | | | | | | -0.008 | 0.034 |
| Factor 7 | | | | | | | 0.043 |

Table 78: Correlations for the 40-item pilot IHQ

**Appendix 10: Correlations Between Measured Variables and Psychometric Measures for Females v Males; Defence v Forwards**

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .490** | .308* | .293* | .359** | .327** |
| Metacognition of Resilience: Team | .379** | .454** | .323** | 0.118 | .263* |
| Strategic Timing | .683** | .391** | .461** | .413** | .681** |
| Coaching Impact | -0.147 | 0.012 | -0.021 | -0.027 | -0.045 |
| Distributed Attention | .367** | 0.216 | .283* | .404** | .416** |
| Routine | .256* | 0.128 | 0.227 | 0.178 | .441** |
| Adaptiveness | .258* | 0.143 | .342** | 0.084 | 0.169 |
| External Focus | 0.235 | .244* | .296* | 0.184 | 0.006 |

Table 79: Correlations Between Measured Variables and Psychometric Measures for Females (n=65; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .354** | .318** | .265* | .350** | .311** |
| Metacognition of Resilience: Team | .311** | .463** | .426** | .359** | .382** |
| Strategic Timing | .599** | .288** | .381** | .396** | .496** |
| Coaching Impact | .275* | 0.155 | .276* | 0.040 | .366** |
| Distributed Attention | .249* | .315** | 0.146 | .301** | 0.212 |
| Routine | 0.175 | 0.062 | 0.172 | .291** | .251* |
| Adaptiveness | .369** | .286* | .291** | .224* | .303** |
| External Focus | -0.050 | 0.188 | 0.138 | 0.141 | -0.117 |

Table 80: Correlations Between Measured Variables and Psychometric Measures for Males (n=80; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | 0.195 | .333* | 0.246 | .415** | 0.284 |
| Metacognition of Resilience: Team | .396** | .468** | .414** | .481** | .400** |
| Strategic Timing | .615** | 0.177 | .457** | .460** | .504** |
| Coaching Impact | .343* | 0.208 | 0.249 | 0.209 | .345* |
| Distributed Attention | .415** | 0.239 | .375** | .423** | .391** |
| Routine | .352* | 0.131 | .350* | .545** | .473** |
| Adaptiveness | 0.277 | 0.031 | 0.162 | 0.214 | 0.266 |
| External Focus | 0.201 | 0.184 | .323* | 0.256 | 0.064 |

Table 81: Correlations Between Measured Variables and Psychometric Measures for Defence (n=48; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .513** | .323** | .310** | .355** | .359** |
| Metacognition of Resilience: Team | .324** | .454** | .370** | 0.149 | .301** |
| Strategic Timing | .678** | .401** | .408** | .395** | .658** |
| Coaching Impact | -0.093 | -0.014 | 0.023 | -0.115 | 0.033 |
| Distributed Attention | .272** | .302** | 0.140 | .317** | .284** |
| Routine | 0.102 | 0.051 | 0.071 | 0.069 | .215* |
| Adaptiveness | .359** | .347** | .431** | 0.152 | .239* |
| External Focus | 0.003 | .227* | 0.140 | 0.100 | -0.129 |

Table 82: Correlations Between Measured Variables and Psychometric Measures for Forwards (n=99; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

**Appendix 11: Study 3 (36 Item) IHQ**

Please read each item and imagine yourself playing ice hockey and the experiences you have had while playing ice hockey games. The statements have been broken down into four sections: before the game, during the game, after the game, and generally while playing. Please circle the response per question which appears to be the most appropriate one for you while carrying out this activity.

1=Strongly disagree 2=Disagree 3=Agree
4=Strongly agree

Please read each item and answer in the context of preparing to play an ice hockey game. To help frame the question, imagine the phrase "before the game" to start each statement. Think of your experience and behaviour before the game to approach each statement.

| | | |
|---|---|---|
| 1 | I have a clear routine. [1] | 1 2 3 4 |
| 2 | I have a routine to keep me from thinking too much before the game.[1] | 1 2 3 4 |
| 3 | I have a routine so I can keep focused on my game. [1] | 1 2 3 4 |

Please read each item and answer in the context of while playing an ice hockey game. To help frame the question, imagine the phrase "during the game" before each statement. Think of your experience and behaviour during the game to approach each statement.

| | | |
|---|---|---|
| 4 | I'm more focused on myself than my team mates. [2]® | 1 2 3 4 |
| 5 | I adjust my style of play based upon the team I'm playing against. [3] | 1 2 3 4 |
| 6 | If I make a bad play, I set it aside immediately and move on. [7] | 1 2 3 4 |
| 7 | For the most part, I am able to recognise an opportunity and capitalise on it. [6] | 1 2 3 4 |
| 8 | When I get in trouble, I know where to go with the puck. [6] | 1 2 3 4 |
| 9 | I can feel easily defeated. [7]® | 1 2 3 4 |
| 10 | I'm more focused on myself than the opponents. [2]® | 1 2 3 4 |
| 11 | I tend to do exactly what I need to do for the team. [6] | 1 2 3 4 |
| 12 | I don't stew over my mistakes when I get regular ice time. [7] | 1 2 3 4 |
| 13 | I feel more resilient because of my positivity. [7] | 1 2 3 4 |
| 14 | I force opportunities. [6] | 1 2 3 4 |
| 15 | I focus on the opponents to find a weakness to exploit. [3] | 1 2 3 4 |
| 16 | Part of my strategy is to make the opponent make a mistake before I make one. [3] | 1 2 3 4 |
| 17 | I am able to set aside a mistake I've made and continue playing without it affecting me. [7] | 1 2 3 4 |
| 18 | I tend to view things positively. [7] | 1 2 3 4 |
| 19 | I play better when I'm not focused on myself. [2] | 1 2 3 4 |
| 20 | If I make a mistake, I stew over it for a while. [7]® | 1 2 3 4 |
| 21 | My decisions are often guided by what the opposition is doing. [3] | 1 2 3 4 |
| 22 | Playing with the same person(s) allows me to play better. [5] | 1 2 3 4 |
| 23 | I don't feel discouraged if my team gets off to a bad start. [8] | 1 2 3 4 |

| | | | | | |
|---|---|---|---|---|---|
| 24 | I feel a sense of resiliency with my team when we get behind in a game. [8] | 1 | 2 | 3 | 4 |
| 25 | I work harder after my team has let in a goal to get the momentum back on our side. [8] | 1 | 2 | 3 | 4 |
| 26 | I focus more on my team mates than myself. [2] | 1 | 2 | 3 | 4 |
| 27 | My team as a whole feels resilient even we are behind in a game. [8] | 1 | 2 | 3 | 4 |
| 28 | I don't feel phased if the game starts off badly for my team. [8] | 1 | 2 | 3 | 4 |
| 29 | If my team mates are struggling, I don't feel like I can directly impact them. [3®] | 1 | 2 | 3 | 4 |

Please read each item and answer in the context of while playing an ice hockey game. These questions are in the general context of playing hockey during a game or throughout the season. Think of your experience and behaviour in general to approach each statement.

| | | | | | |
|---|---|---|---|---|---|
| 30 | My belief in my coach pushes me to play better. [4] | 1 | 2 | 3 | 4 |
| 31 | I build chemistry from playing with the same person. [5] | 1 | 2 | 3 | 4 |
| 32 | I recognise what my individual role is on a team. [5] | 1 | 2 | 3 | 4 |
| 33 | Playing with the same person often benefits my performance on the ice. [5] | 1 | 2 | 3 | 4 |
| 34 | I often crave positive reinforcement from my coach. [4] | 1 | 2 | 3 | 4 |
| 35 | I play better when I like my coach and my coach likes me. [4] | 1 | 2 | 3 | 4 |
| 36 | I play better when the coach is able to recognise the strengths of his/her players and make matches accordingly. [4] | 1 | 2 | 3 | 4 |

Key:

1) Routine
2) External Focus
3) Distributed Attention
4) Coaching Impact
5) Adaptiveness
6) Strategic Timing
7) Metacognition of Resilience: Individual
8) Metacognition of Resilience: Team

**Appendix 12: Final Coding for Full IHQ in Lisrel and Distributed Flow in Lisrel**

Final Coding for Full IHQ

```
Raw Data from file 2Final.psf
Latent Variables rout disatt resind mettime exfocus adapt resteam coachim
Relationships
Method = Unweighted Least-Squares
Routine1 = 1*rout
Routine2 Routine3 = rout
DisAtt1 = 1*disatt
DisAtt2 DisAtt3 DisAtt4 = disatt
ResInd1 = 1*resind
ResInd2 ResInd3 ResInd4 ResInd5 ResInd6 ResInd7 = resind
MetTime1 = 1*mettime
MetTime2 MetTime3 MetTime4 = mettime
ExFocus1 = 1*exfocus
ExFocus2 ExFocus3 ExFocus4 = exfocus
Adapt1 = 1*adapt
Adapt2 Adapt3 = adapt
ResTeam1 = 1*resteam
ResTeam2 ResTeam3 ResTeam4 = resteam
CoachIm1 = 1*coachim
CoachIm2 CoachIm3 CoachIm4 = coachim
LISREL Output: ME=ML
```

Final Code for Distributed Flow in Lisrel

```
Raw Data from file Round2F.psf
Latent Variables  disatt mettime exfocus
Relationships
Method = Unweighted Least-Squares
DisAtt1 = 1*disatt
DisAtt2 DisAtt3 DisAtt4 = disatt
MetTime1 = 1*mettime
MetTime2 MetTime3 MetTime4 = mettime
ExFocus1 = 1*exfocus
ExFocus2 ExFocus3 ExFocus4 = exfocus
LISREL Output: ME=ML
Path Diagram
End of Problem
```

**Appendix 13: Correlations Between Measured Variables and Psychometric Measures for Females v Males; Defence v Forwards**

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .307** | 0.173 | 0.150 | .347** | .207* |
| Metacognition of Resilience: Team | .279** | .193* | .254** | 0.172 | .244** |
| Strategic Timing | .609** | .375** | .434** | .513** | .631** |
| Coaching Impact | 0.127 | .236** | .220* | -0.034 | 0.102 |
| Distributed Attention | .331** | .219* | .204* | 0.174 | .240** |
| Routine | .329** | .181* | .271** | .332** | .434** |
| Adaptiveness | .341** | 0.175 | .295** | 0.156 | .177* |
| External Focus | -0.006 | -0.025 | -0.083 | -0.079 | 0.034 |

Table 83: Correlations Between Measured Variables and Psychometric Measures for Females (n=126; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .360** | .159* | .251** | .379** | .308** |
| Metacognition of Resilience: Team | .213** | 0.085 | .184** | .340** | .291** |
| Strategic Timing | .643** | .224** | .367** | .401** | .519** |
| Coaching Impact | 0.062 | -0.008 | .158* | -0.011 | .168* |
| Distributed Attention | .333** | 0.059 | .292** | .327** | .292** |
| Routine | .206** | 0.097 | .197** | .242** | .351** |
| Adaptiveness | .205** | 0.054 | .286** | 0.019 | 0.132 |
| External Focus | 0.022 | 0.052 | 0.096 | 0.111 | 0.032 |

Table 84: Correlations Between Measured Variables and Psychometric Measures for Males (n=214; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .371** | 0.181 | .248** | .397** | 0.177 |
| Metacognition of Resilience: Team | .244* | .227* | 0.185 | .237* | .274** |
| Strategic Timing | .555** | .259** | .402** | .411** | .479** |
| Coaching Impact | -0.042 | 0.042 | 0.047 | -0.096 | 0.175 |
| Distributed Attention | .205* | 0.050 | .190* | .309** | .253** |
| Routine | .333** | 0.106 | .248** | .272** | .338** |
| Adaptiveness | .255** | 0.085 | .267** | 0.101 | .235* |
| External Focus | -0.048 | -0.032 | -0.108 | -0.038 | 0.061 |

Table 85: Correlations Between Measured Variables and Psychometric Measures for Defence (n=110; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)

| Measured Variable | Psychometric Measures | | | | |
|---|---|---|---|---|---|
| | SDFS-2 | SWFS | FMQ-1 | FMQ-2 | MTS |
| Metacognition of Resilience: Individual | .339** | .151* | .192** | .339** | .306** |
| Metacognition of Resilience: Team | .224** | 0.075 | .229** | .309** | .280** |
| Strategic Timing | .654** | .276** | .382** | .461** | .592** |
| Coaching Impact | 0.088 | 0.070 | .209** | 0.036 | .138* |
| Distributed Attention | .373** | 0.125 | .273** | .252** | .276** |
| Routine | .178** | .132* | .214** | .291** | .402** |
| Adaptiveness | .242** | 0.100 | .297** | 0.068 | 0.112 |
| External Focus | 0.015 | 0.040 | 0.078 | 0.090 | 0.022 |

Table 86: Correlations Between Measured Variables and Psychometric Measures for Forwards (n=232; ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed)) SDFS-2 = Short Dispositional Flow Scale-2 (Jackson, Martin, & Eklund, 2008), SWFS = Short Flow in Work Scale (Moneta, 2017), FMQ- 1 = Flow Usefulness FMQ-2 = Flow Self-regulation (Wilson & Moneta, 2016), and MTS = Mental Toughness Scale (Madrigal, Hamill, & Gill,2013)