Master's thesis

NTNU
Norwegian University of Science and Technology
Faculty of Social and Educational Sciences
Department of Psychology

Aslak Bakke

Investigating type of enjoyment in flow and categorization of flow or non-flow experiences using mixture modeling

Master's thesis in Psychology
Supervisor: Hermundur Sigmundsson
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Preface

My time at NTNU is coming to an end after five years. I started studying psychology based on an interest in the field and writing a master's thesis has only grown this interest.

I would like to thank Hermundur Sigmundsson for being my supervisor and for giving valuable feedback throughout the process of writing this thesis. His enthusiasm and passion for learning and skill development is what initially made me want to write a thesis about Flow. By allowing me great amounts of freedom in what to write about and how to design the study Hermundur has made this a very enjoyable and educational experience.

I also want to thank my friends and family for supporting me. Being able to talk about what's on my mind and my ideas throughout the process has been very helpful. A special thanks goes out to my samboer Kelsey for encouraging me to make my thesis the best it can be and my cat Newton who doesn't understand much but still listens.

Abstract

Flow, a concept pioneered by Csikszentmihalyi in 1975, has garnered significant research attention, yet inquiries into the nature of enjoyment within flow experiences and methods for categorizing participants based on being or not being in flow remain limited. This thesis addresses these knowledge gaps by investigating four key research questions: 1) Are there gender differences in flow, autotelic personality and enjoyment? 2) What is the relationship between flow, autotelic personality and enjoyment? 3) What is the correlation between flow, enjoyment and the subscales of enjoyment: pleasure, relatedness, competence, challenge/ improvement and engagement? 4) Can groups of flowers and non-flowers be identified and if so, what are the differences between these groups?

A sample of 287 respondents, comprising 88 men and 197 women, was gathered from various faculties at NTNU through email. Participants completed a questionnaire including the general flow proneness scale, the Flow short scale, and the ENJOY scale, which measures overall enjoyment and its five subscales: pleasure, relatedness, competency, challenge/ improvement and engagement.

Gender differences were found in autotelic personality, with men exhibiting higher levels, while no differences were observed in flow or enjoyment. Correlation analyses revealed a positive relationship between flow, overall enjoyment and the five subscales. Competence, engagement, and pleasure had the strongest relationships. Hierarchical regression indicated that the association between autotelic personality and enjoyment was mediated by flow. Employing factor mixture modeling, 39% of the sample was classified as experiencing flow, with subsequent ANOVA analyses uncovering significant differences in autotelic personality, overall enjoyment, and the subscales of competence, engagement and pleasure among flower and non-flower groups.

Discussion of the findings, in light of existing literature and theory, alongside considerations of limitations and avenues for future research, concludes the thesis. This study represents a novel exploration of enjoyment types within flow and the second application of factor mixture modeling for classifying flowers and non-flowers.

Keywords: Flow, autotelic personality, enjoyment, pleasure, relatedness, competence, challenge/ improvement, engagement, classification

Sammendrag

Flow, et konsept som ble utviklet av Csikszentmihalyi i 1975, har fått betydelig forsknings oppmerksomhet, men spørsmål om typen av nytelse/glede forbundet med flytopplevelser og metoder for å kategorisere deltakere basert på om de har vært i flyt eller ikke er fortsatt begrenset. Denne oppgaven prøver å dekke disse kunnskapshullene ved å undersøke fire forskningsspørsmål: 1) Er det kjønnsforskjeller i flyt, autotelisk personlighet og nytelse/glede? 2) Hva er forholdet mellom flyt, autotelisk personlighet og nytelse? 3) Hva er sammenhengen mellom flyt, nytelse/glede og underskalaer: nytelse (pleasure), samvær (relatedness), mestringsfølelse (competence), utfordring/forbedring (challenge/ improvement) og engasjement (engagement)? 4) Kan grupper av deltakere i flyt og ikke i flyt identifiseres og i så fall, hva er forskjellene mellom disse gruppene?

Et utvalg på 287 respondenter, bestående av 88 menn og 197 kvinner, ble samlet inn fra ulike fakulteter ved NTNU via e-post. Deltakerne fullførte spørreskjema som inkluderte the general flow proneness scale, the Flow short scale og ENJOY-skalaen, som måler generell nytelse og fem underskalaer av nytelse/ glede: nytelse (pleasure), samvær (relatedness), mestringsfølelse (competence), utfordring/forbedring (challenge/ improvement) og engasjement (engagement).

Kjønnsforskjeller ble funnet i autotelisk personlighet, med menn som viste høyere nivåer, ingen kjønnsforskjeller ble observert i flyt eller nytelse. Korrelasjonsanalyser viste en positiv sammenheng mellom flyt, generell nytelse og de fem underskalaene. Mestringsfølelse, engasjement og nytelse hadde de sterkeste korrelasjonene. En hierarkisk regresjon indikerte at assosiasjonen mellom autotelisk personlighet og nytelse ble mediert av flyt. Ved å bruke factor mixture models ble 39 % av prøven klassifisert som å ha opplevd flyt. En videre ANOVA-analyse avdekket signifikante forskjeller i autotelisk personlighet, generell nytelse

og under skalaene for mestringsfølelse, engasjement og nytelse blant flyt og ikke-flyt gruppene.

Funn blir diskutert i lys av eksisterende litteratur og teori, sammen med betraktninger av begrensninger og forslag for fremtidig forskning. Denne studien representerer en ny utforskning av nytelse/glede typer innen flyt og den andre anvendelsen av factor mixture modeling for å klassifisere deltakere i flyt og ikke i flyt.

Nøkkelord: Flyt, autotelisk personlighet, nytelse, nytelse, slektskap, mestringsfølelse, utfordring/forbedring, engasjement, klassifisering

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Introduction

What makes life worth living? What drives an artist to forgo eating and sleeping to finish their work? What are the very best moments of life like? These were the questions Mihalyi Csikszentmihalyi set out to answer when researching optimal experiences. The answer he came to was Flow (Csikszentmihalyi, 1975). Flow is described as a highly enjoyable state where an individual is completely absorbed without reflective self-consciousness, and with a great sense of control (Csikszentmihalyi, 1990). Csikszentmihalyi also theorized the existence of an autotelic personality, that is, someone who is more likely to enter flow. Despite over four decades of research since its inception, several facets of Flow theory remain underexplored, particularly regarding the nature of enjoyment within Flow experiences and its categorical versus continuous characterization (Abuhamdeh, 2016). Although flow is consistently described as enjoyable, no research has looked into the type of enjoyment experienced in flow. Davidson et al. (2023) recently introduced a comprehensive scale for measuring enjoyment including five subscales of pleasure, relatedness, competence, challenge/ improvement and engagement.

Further, based on Csikszentmihalyi's descriptions, flow should be considered a categorical construct. Despite this, most research on flow measures it as a continuous construct (Abuhamdeh, 2016). Kawabata and Evans (2016) adopted an innovative approach, employing factor mixture modeling to classify individuals into distinct categories of "flowers" and "non-flowers," yet this method remains largely unreplicated.

Against this backdrop, the present study aims to address four key research questions that traverse the interplay of gender differences, autotelic personality, enjoyment, and the categorical versus continuous nature of Flow. Specifically, the current study aims to investigate four research questions: 1) Are there gender differences in flow, autotelic

personality and enjoyment? 2) What is the relationship between flow, autotelic personality and enjoyment? 3) What is the correlation between flow, enjoyment and the subscales of enjoyment: pleasure, relatedness, competence, challenge/ improvement and engagement? 4) Can groups of flowers and non-flowers be identified and if so, what are the differences between these groups?

Theoretical background

In this section I will first outline how flow has been described originally and how it is commonly described and characterized today. In doing this I will try to communicate what the essence of flow theory is. I will further highlight the different ways in which flow has been measured and two key issues in how it is commonly operationalized today. I will also review definitions for the term enjoyment and highlight how it relates to flow.

Flow

The concept of flow

"*The state in which people are so intensely involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it*". Csikszentmihalyi (1990)

Flow was first conceptualized by Mihály Csíkszentmihályi in 1975. He included six characteristics of flow in his first book titled "Beyond boredom and anxiety". The quotes are from Beyond boredom and anxiety (1975) and the original interviews he did with rock climbers, chess players, dancers and basketball players. The six characteristics given were:

1. Merging of action and awareness; Csíkszentmihályi describes this as "perhaps the clearest sign of flow"(p. 38). When action and awareness are merged to this extent there is no dualistic perspective; the person is aware of the action, but not of the awareness itself. "You

are so involved in what you are doing [that] you aren't thinking of yourself as separate from the immediate activity…" (p.39)

2. Centering of attention on a limited field; This facilitates action and awareness merging. When people are experiencing flow the rest of the world simply does not exist. Past and future are of no concern and "other people and things seem to have less significance" (p.40)

3. Loss of self-consciousness; Also described as "loss of ego", "self-forgetfulness" or "transcendence of individuality". The self in this context is taken to mean the part of humans that negotiate how base desires and wants should be represented so as to be acceptable in a larger society (Csíkszentmihályi, 1975). It is this social self that one is unconscious of during flow. Awareness of one's body can be very much present and even heightened. "... all the hangups that people have or I have as an individual person are momentarily obliterated" (p.43)

4. Feeling of control; Individuals in flow experience a sense of mastery and autonomy over their actions and environment, accompanied by a lack of concern or worry about potential failure. "I have no worries of failure… I feel enormous power to effect something of grace and beauty" (p.44)

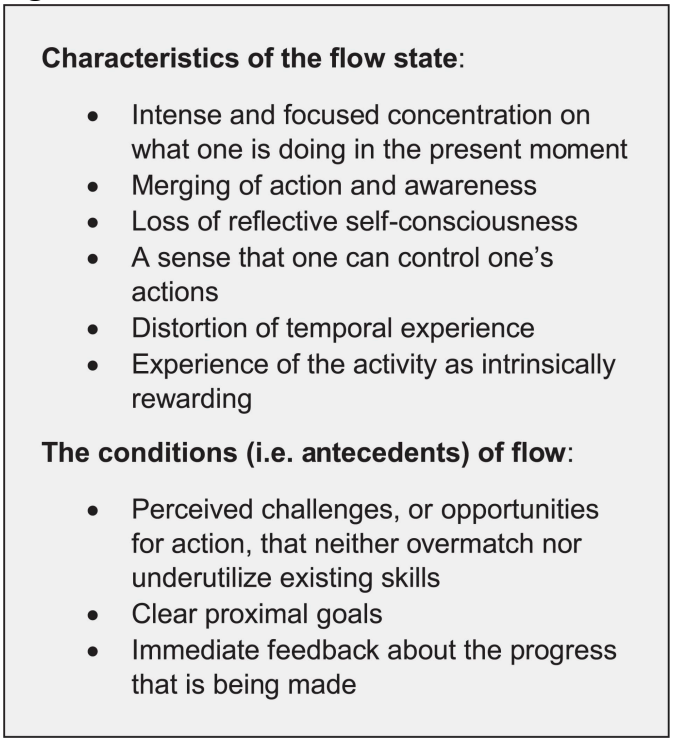
5. Coherent, non-contradictory demands for action and clear unambiguous feedback; One is acutely aware of what is good and what is bad and whether or not one is doing a good or bad job. However one does not stop to evaluate feedback. Rather, it is an automatic process that occurs. There are also no conflicting demands, every goal and action is aligned in a logical way. The results of possible action feel obvious and clear. "I think it's one of the few

sorts of activities in which you don't feel you have all sorts of different kinds of demands, often conflicting, upon you…" (p. 46)

6. Autotelic nature; The experience of flow is rewarding in and of itself. It does not require any exterior motives to be sought out. "The justification for climbing is climbing, like the justification of poetry is writing…" (p.47)

A component of temporal distortion was later added by both Csíkszentmihályi himself (Nakamura & Csikszentmihalyi, 2002; Csikszentmihalyi, 1988a, 1988b), Jackson and Marsh (1996) and Engeser and Rheinberg (2008), suggesting that time may seem to pass differently during flow, with hours feeling like mere moments (Csikszentmihalyi, 1975). Additional modifications were made to the descriptors of flow, including the breakdown of coherent demands into clear goals and immediate feedback(Jackson & Marsh, 1996; Csikszentmihalyi et al., 2014). Clear goals and immediate feedback have been labeled as conditions for, instead of characteristics of flow. In his original book Csíkszentmihályi briefly describes what can facilitate flow and draws attention to the balance of perceived skill and perceived challenge. All together the commonly accepted and used characteristics and conditions for flow today are shown in figure 1 (Nakamura & Csikszentmihalyi, 2002):

Figure 1



Note: The figure shows the characteristics and conditions for flow. Taken from Nakamura & Csikszentmihalyi, 2002

The characteristics of flow are much the same as how Csikszentmihalyi described them originally, with the addition of the three conditions for flow. They are described as:

a) Perceived match in challenge and skill that stretch existing skill,

b) clear goals

c) immediate feedback.

Balance of skill and challenge that stretches existing skill; This perceived balance of skill and challenge that neither overmatch or underutilize existing skill is important for gaining the characteristic sense of control. The sense of control stems from believing that no matter what happens in the situation one knows how to respond in an appropriate manner. While this perceived balance may not always align with objective reality, the subjective feeling of competence is essential. Moreover, the challenge should be such that it promotes the

development of existing skills. This also emphasizes that the activity needs to allow for actions to be made. Passive activities, such as watching tv, are thus less conducive to flow than activities that allow the person to be more actively engaged (Csikszentmihalyi 1975; Csikszentmihalyi et al., 2014).

Clear goals; Both the conditions of clear goals and immediate feedback are reliant on what the person perceives the goals to be. However, these goals are subjective and vary from person to person, even in situations where skill levels are similar. For instance, two rock climbers tackling the same route may have different objectives—one may focus on executing each move precisely, while the other aims to reach the summit (Csikszentmihalyi et al., 2014).

Immediate feedback; Making sense of the feedback one is getting is also reliant on the individual. Some tasks give more clear and structured feedback, such as playing an instrument where a false note is very noticeable. Regardless of whether the feedback is positive or negative, its usefulness to the individual is what is important. Negative feedback can be constructive, helping the individual improve and meet the challenges of the activity (Csikszentmihalyi et al., 2014). Even in situations where feedback is less structured, individuals capable of organizing chaotic stimuli can still attain a state of flow

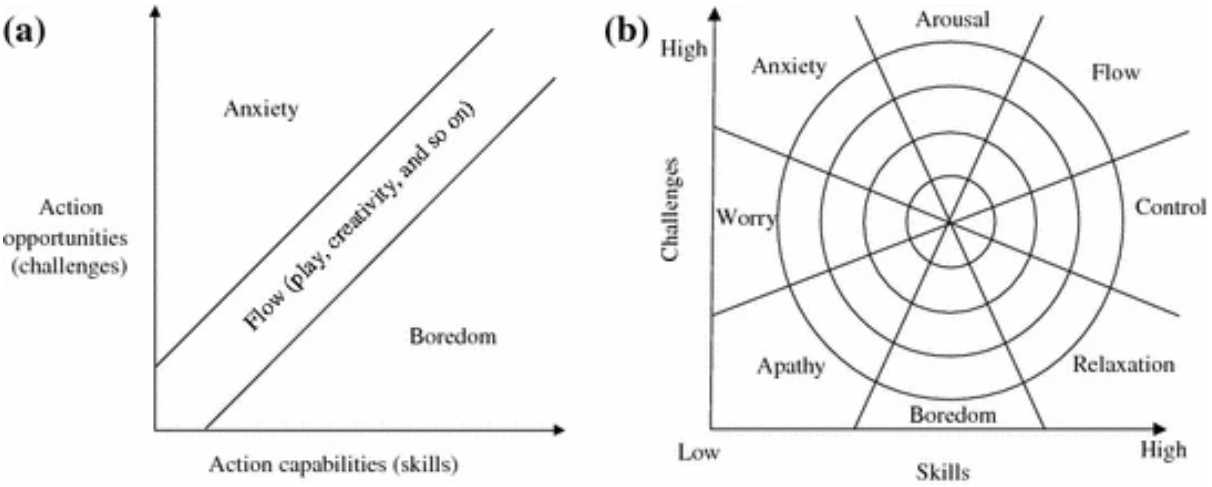
It's important to emphasize that these conditions for flow aren't objective criteria we can measure externally; rather, they hinge entirely on how an individual subjectively perceives them. Even if someone possesses the necessary skill to perform a task, if they lack confidence and view the task as more challenging than they can handle, they're unlikely to experience flow. These subjective assessments underscore that flow is an internal

phenomenon, heavily influenced by an individual's worldview and personality. This understanding led Csikszentmihalyi to propose the concept of an autotelic personality (Csikszentmihalyi, 1975). I will return to this topic of an autotelic personality after outlining how the definition of flow has led to models of the flow experience.

Models of Flow

There are several models for flow that aim to map out the subjective experiences of people in or around flow. I will show two of them here as they capture the essence of flow theory. The first model (Fig 1a) shows that balance of challenge and skill is what leads to flow (Csikszentmihalyi, 1975). When challenge is higher than skill anxiety is expected and when skill is higher than challenge a state of boredom arises. This is the simplest model for flow and captures the reliance on challenge and skill being balanced. However this model shows that flow should be achieved when skill and challenge are at the same level, which leaves little room for the stretching of existing skill. Additionally it has been argued that challenge and skill need to be of a higher than average level to enter flow (Csikszentmihalyi, 1997).

Figure 2



Note: Taken from Nakamura and Csikszentmihalyi (2002)

The second model (Fig 1b) highlights that challenge can exceed skill while still being in flow. This shows that flow can stretch existing skill if the level of challenge is just right (Csikszentmihalyi et al., 2014). Additionally this model indicates that challenge and skill above the average level for the person is required to enter flow (Csikszentmihalyi, 1997, p.31). The average level is the center of the graph where all the lines dissecting the different experiences meet. As a person moves further away from the center of the graph, in any direction, the experiences become more intense. The average level is determined both by the task and by how the person perceives the activities they engage in, meaning that different tasks have different criteria for entering flow (Massimini & Carli, 1988). Furthermore, this average level shifts as individuals grow and change over time, suggesting that the same task can either induce flow or a sense of control depending on changes in the challenge level due to increased experience (Csikszentmihalyi, 1997).

One critique worth mentioning for these models of flow is that they only include challenge and skill balance as a condition for flow. This is the condition that Csikszentmihalyi described as most important for flow (Csikszentmihalyi, 1975), but the other conditions of clear goals and immediate feedback are also continuously highlighted in his research

(Nakamura & Csikszentmihalyi, 2002). A question that quickly arises when looking at such models is how often do people inhabit the different zones? Whether or not one is prone to enter the flow zone can be determined by one's personality. What describes such a personality is the topic of the next section.

Autotelic personality

Flow theory has primarily focused on the phenomenological experience of being in flow (Baumann, 2021). However it has also been noted that there are individual differences in frequencies of flow experiences (Csikszentmihalyi, 1975). This implies that certain personality traits more readily predispose individuals to enter flow states. Csikszentmihalyi called this an autotelic personality. Autotelic originates from the Greek words auto (self) and telic (goal/purpose), meaning an intrinsic motivation where the activity itself is its own reward (Csikszentmihalyi, 1975). In contrast, activities pursued for external rewards like money or fame are termed exotelic.

In relation to personality, an autotelic person is someone who "generally does things for their own sake, rather than in order to achieve some later external goal" (Csikszentmihalyi 1997, p. 117). Autotelic people are open to and interested in new challenges while also being able to persist in high challenge situations (Baumann, 2021). This engagement and persistence is not a means to an end, but rather for the enjoyment of doing the activity. Additionally, they perceive highly challenging situations as less stressful and are inclined to seek situations where the challenge surpasses their perceived skill level, unlike those less autotelic who prefer the opposite (Asakawa, 2004).

In sum, autotelic people can be described as generally curious and interested in life, persistent and having low self-centeredness, resulting in an ability to be easily motivated by intrinsic rewards (Nakamura & Csikszentmihalyi, 2002; Tse, Nakamura & Csikszentmihalyi,

2021). With this description of an autotelic person in mind, it is worth mentioning that no one is completely autotelic. The demands and duties of life require that we sometimes do things that are not enjoyable to us. However, it should be possible to place people on a spectrum from those who generally feel like what they are doing is important and worth doing for its own sake, to those who almost never feel like what they are doing is worth it for its own sake (Csikszentmihalyi 1997). Several methods have been developed to measure autotelic personality as well as flow. It is these methods I now turn my attention to.

Measuring autotelic personality

Differences in how often and intensely individuals experience flow has long interested researchers. To better understand the autotelic personality two main ways of measuring it have been developed (Baumann, 2021). The first method is based on assessing time spent in flow and the intensity of these experiences and the second is based on finding personality traits associated with easily entering flow and then measuring autotelic personality by measuring these traits (Baumann, 2021).

Autotelic personality based on time spent in flow

This approach has been implemented using the event sampling method (ESM), which is discussed more extensively in the section on measuring flow. In studies utilizing ESM data, participants who reported spending more time in a state of flow are labeled as autotelic compared to those reporting less time in flow (Csikszentmihalyi, 1997). Time spent in flow does not only reflect autotelic personality but also the opportunities for flow available in the activities and environment participants experienced during sampling. Ullen et al. (2012)

measured flow proneness by assessing reported flow experiences in the domains of work, leisure and maintenance time. However, this method, which assesses the frequency and intensity of flow experiences, does not necessarily deepen the field's understanding of why some individuals report higher frequencies of flow experiences. To do so the underlying personality traits associated with more time in flow must be explored.

Autotelic personality as a collection of traits

Csikszentmihalyi et al. (1993) measured traits associated with concentration and openness to experience using the Personality Research Form (PRF; Jackson, 1984). More recently, Tse et al. (2018; 2020) developed the Autotelic Personality Questionnaire based on traits of curiosity, persistence, low self-centeredness, intrinsic motivation, enjoyment and transformation of challenge and boredom. Finally, Elnes and Sigmundsson (2023) developed the general flow proneness scale based on the importance of deep concentration ability, attentional control, perception and adjustment of challenge, in addition to the experience of reward and enjoyment. This scale measures flow proneness independent of the activity with 13 questions and is the scale used in the current study. Concentration and attentional control is needed for the characteristic of action and awareness merging, while perception and adjustment of challenge helps the individual engage in activities at the suited skill challenge level. Moreover, including measurements of the experience of reward and enjoyment highlights the intrinsically motivated part of flow experiences. This scale has been chosen based on its length and the fact that it assesses traits that lead to flow instead of measuring frequency and intensity of flow experiences. With an instrument for assessing autotelic personality now established, I will proceed to discuss the various methods employed for measuring flow and the specific measure selected for the present study

Measuring flow

Flow has been measured in a variety of ways that can be classified in three different types of measurements: interviews, questionnaires and the experience sampling method.

Interviews

Csíkszentmihályi initially conducted interviews with individuals who excelled in specific fields and exhibited a remarkable persistence in their chosen activities, even in the absence of external motivation (Csikszentmihalyi, 1975). These activities ranged from rock climbing and chess to basketball and dancing, among others. During these semi-structured interviews, Csíkszentmihályi asked participants to describe their most fulfilling moments while engaged in their respective activities. It was from these interviews that the concept of flow emerged (Nakamura & Csikszentmihalyi, 2002). Other researchers have also utilized interviews to gather detailed data about flow from specific experiences, leading to the development of some of the most widely-used questionnaires. For example, Jackson (1995) conducted interviews with elite athletes to investigate the factors contributing to their flow experiences. Subsequently, insights from these interviews were used to create the Flow State Scale (Jackson & Marsh, 1996). Similarly, the original interviews conducted by Csíkszentmihályi resulted in the development of the Flow Questionnaire (Csikszentmihalyi & Csikszentmihalyi, 1988b), which represents the second method of measuring flow: through questionnaires

Questionnaires

The Flow Questionnaire (Csikszentmihalyi & Csikszentmihalyi, 1988b) gives a description of the flow state, taken from interviews, and then asks the participants if they have

ever experienced something similar. If the respondent answered yes, the questionnaire proceeds with questions about the activities they perceive to fit the descriptions of flow and their subjective experiences in those situations (Csikszentmihalyi & Csikszentmihalyi 1988b). This gives a good overview of the types of activities respondents engage in when they experience flow and also groups them into flowers and non-flowers. Other questionnaires to measure flow have been developed. The revised flow state scale (FSS-2) by Jackson and Eklund (2002; 2004) is the most used one (Moneta, 2012). The Flow state scale (FSS) (Jackson & Marsh, 1996) and its revised version (FSS-2) (Jackson & Eklund, 2002; 2004) are based on the nine characteristics and conditions for flow to measure flow in sports situations. It consists of 36 items, four for each of the nine descriptors and conditions for flow. Similarly Engeser and Reinberg (2008) developed the Flow short scale which uses the same nine descriptors and conditions to measure flow in only 10 items and it is this scale that is used in the current study. The Flow short scale has been used in correlational, experimental and experience sampling studies (Engeser & Reinberg, 2008). It has been used to study flow in sports (Schüler & Brandstätter, 2013), esports (Schmidt et al., 2020), music (Spahn et al., 2021) and at work (Schermuly & Meyer, 2020) among other fields. Measuring flow in just 10 items makes it a good test for a questionnaire that includes other measures and is the main reason it was chosen for the current study.

With so many questionnaires existing it is worth highlighting the main ways in which they differ. Some questionnaires differ in if they include all the descriptors and conditions for flow or if they only focus on a few of them. The original questionnaire made by Csíkszentmihályi differs from virtually all other questionnaires in that it describes the flow state and then asks a yes/ no question about if the person has been in the state (Csikszentmihalyi & Csikszentmihalyi 1988b). In contrast, later questionnaires such as the FSS, FSS-2, and the Flow Short Scale all measure what degree the respondent agrees or

disagrees with items derived from some or all of the nine descriptors and conditions for flow. This difference results in either a continuous measure of flow or a categorical one. This issue is a key aspect of the current study and is something I will return to through this paper.

Experience sampling method

The third method is that of Experience sampling (Csíkszentmihályi & Larson, 1987). The experience sampling method was developed to overcome the retrospective nature of interviews and questionnaires. Participants would wear a pager or similar device that periodically pinged them and asked them several questions related to their current state of mind and what they were doing at the time they were pinged. Whether or not they were in flow would be ascertained by two factors a) the presence of flow inducing conditions (skill-challenge balance, clear feedback and clear goals) and b) the self-reported levels of involvement, concentration, and enjoyment, which served as proxies for the more complex state of flow (Nakamura & Csikszentmihalyi, 2002). While technically a repeated questionnaire, the Experience Sampling method distinguishes itself through its timing and ecological validity. By collecting multiple measurements throughout the day, researchers eliminate the need for participants to rely on memory. The experience sampling method has been used to study flow in different situations in daily life. Csikszentmihalyi and Larson (1984) used it to assess how high-school students' subjective experiences varied across different contexts, such as family life, social interactions, solitude, and classroom settings. The subjective experiences in these contexts were quite different and has stimulated other researchers in the field to continue using the experience sampling method.

While the Experience Sampling method offers unique advantages in studying flow experiences in daily life, questionnaires remain the most widely utilized method across the

field. However, this prevalence is accompanied by a concerning lack of consistency in how flow is defined and measured, as Abuhamdeh (2020) has underscored. Examining 42 publications on flow from 2015 to 2020, Abuhamdeh found that researchers operationalized flow in 24 different ways. From these different operationalizations he highlighted some areas of incongruence:

1. Flow as a discrete or continuous construct,
2. Including enjoyment in the measurement of flow

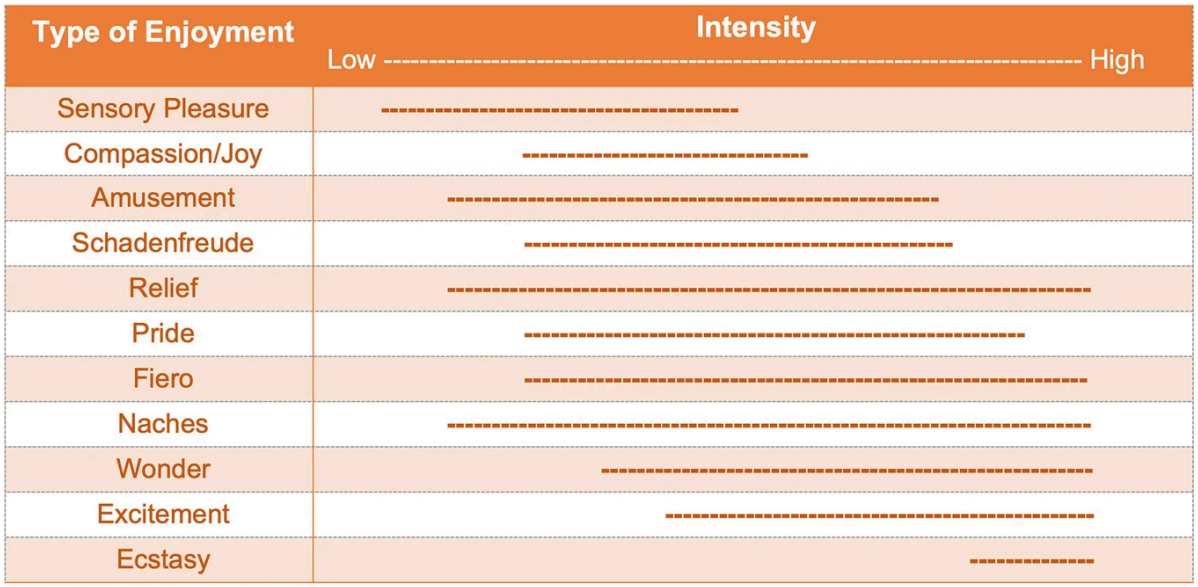
These issues will be elaborated on as they make the foundation for some of the research questions that motivated the current study.

Issues in measurement of flow

Flow as a discrete or continuous construct

Abuhamdeh (2020) suggests that certain psychological constructs can be effectively applied across a continuous spectrum of experiences, such as happiness and anxiety. These constructs allow for varying degrees of intensity, where individuals may experience low or high levels of happiness or anxiety at any given moment. However, there are other constructs, such as euphoria and fury, that cannot be meaningfully applied to a continuous spectrum. For instance, it doesn't make sense to experience a low amount of euphoria. While it's possible to locate these constructs on a continuum, they are not applicable to the entire range. Abuhamdeh (2020) extends this idea to flow, likening it to states like euphoria or fury that are not applicable to the whole spectrum. This concept is further illustrated by a figure created by Ekman and Ekman (as referenced by Abuhamdeh, 2021), which shows various types of enjoyment and their corresponding intensity levels:

Figure 3



Note: Different types of emotions and the intensity range they apply to. Taken from Abuhamdeh (2021 p.157).

The Flow Questionnaire (Csikszentmihalyi & Csikszentmihalyi, 1988b) categorizes respondents into flow and non-flow groups based on whether they recognize a description of flow as something they have experienced. In contrast, other questionnaires like the Flow State Scale 2 (Jackson & Marsh, 1996) ask respondents to rate to what extent items derived from the nine characteristics and conditions for flow align with an activity they remember, using a 1-5 scale ranging from strongly disagree to strongly agree. The average of these ratings is then calculated to determine a general flow score. These two approaches differ in their conceptualization of flow: one views it as a construct applicable to the entire spectrum of human experience, while the other considers it a relatively rare occurrence. So, which perspective is correct?

In Csikszentmihalyi's initial descriptions of flow in 'Beyond Boredom and Anxiety' (1975), flow appears to be conceived as a discrete construct:

"*From their accounts of what it felt like to do what they were doing, I developed a theory of optimal experience based on the concept of flow – the state in which people are so involved in an activity that nothing seems to matter; the experience itself is so enjoyable they will do it even at great cost, for the sheer sake of doing it.*" (p. iv)

This quote characterizes flow as an optimal experience that individuals either are or are not in, rather than something applicable to the entire spectrum of human experience. While it's recognized that individuals may have more or less intense flow experiences, it doesn't make sense to speak of experiencing a low amount of flow.

The challenge of measuring flow as a discrete construct remains a topic of debate within the field. One proposed approach is the use of factor mixture models to identify groups

of individuals experiencing (flowers) and those who are not (non-flowers) within the continuous measures obtained from questionnaires. Kawabata and Evans (2016) utilized this method with promising results, and their work partly informs the current study. In this framework, flow is likened to depression in clinical psychology: to be diagnosed with depression, one must surpass a certain threshold, making it a categorical construct. However, there are still varying degrees of depression. Similarly, Kawabata and Evans (2016) suggest that flow is a discrete construct, but once entered, one can experience varying levels of intensity within flow. This aligns well with the second model for flow depicted in Figure 2b.

In addition to being more in line with theory, categorical measurement of flow has several advantages. Studies looking at brain imaging of participants in flow to find neural correlates of flow and any research question aimed at differences in how humans think, feel and act while in flow vs not in flow benefit from a clear categorization.

Including enjoyment in the measurement of flow

The second source of incongruence Abuhamdeh (2020) identifies is that of flow being inherently enjoyable or not. This question hinges on how experiences of emotions are defined. One perspective suggests that for an emotion to be experienced, individuals must consciously recognize it, and since flow involves a loss of self-consciousness, enjoyment should be excluded from the flow experience (Seligman, 2011). However this is an incomplete view of how emotions are experienced. While it's true that individuals may not always be aware of or able to label the emotions experienced during flow, they are still undergoing emotional experiences (Moors, 2010). Additionally, the appraisal of emotions is believed to become quicker and more automatic with experience and practice (Moors et al., 2013), which is relevant to flow research since flow often occurs in activities individuals are

well-practiced in. Furthermore, the ability to experience emotions without a sense of self is evidenced by non-human mammals, which lack self-awareness yet are capable of experiencing emotions (Panksepp, 2005). The relationship between enjoyment and flow, as well as the nature of flow's enjoyment, will be further explored in the section on enjoyment

Enjoyment

Enjoyment is recognized as significant across various domains, including sports and exercise (Teixeira et al., 2022), positive psychology (Ryan et al., 2008), communication (Tamborini et al., 2011), work environments (Wade et al., 2008), and education (Gomez et al., 2010). It's commonly viewed as a favorable outcome associated with quality of life, happiness, and positive experiences (Davidson et al., 2023). However, examining the diverse definitions of enjoyment across different research fields reveals it as a vague and hard to pin down construct.

Defining enjoyment

In sport and exercise enjoyment is a subjective experience that depicts generalized feelings of pleasure and satisfaction (Teixeira et al., 2022). In positive psychology, more specifically self determination theory, enjoyment is a positive outcome based on fulfilling the basic psychological needs of autonomy, competence and relatedness (Ryan et al., 2008). Within communication studies, enjoyment is defined as the satisfaction of hedonic and non hedonic needs (Tamborini et al., 2011). When examining enjoyment in the context of the workplace, it refers to an individual's emotional evaluation of their job (Wade et al., 2008). In education, enjoyment is measured by the extent to which learners find the learning activity pleasant and satisfying (Gomez et al., 2010).

These varied definitions highlight the diverse nature of enjoyment, encompassing feelings of pleasure and satisfaction, the fulfillment of basic needs, and emotional appraisal. Additionally, the distinction between hedonic and non-hedonic (eudaimonic) needs adds another layer of complexity to understanding enjoyment. While both terms are often translated to happiness, they carry distinct meanings upon closer examination (Waterman, 1993).

Hedonic enjoyment

Hedonic enjoyment is derived from fulfilling basic needs, whether they are physical, psychological, or social (Waterman, 1993). Essentially, it refers to pleasure. Activities that typically evoke hedonic enjoyment are consistent across individuals. For instance, eating a satisfying meal or unwinding on the couch after a tiring day are common examples of experiences that bring hedonic enjoyment

Eudaimonic enjoyment

Eudaimonic enjoyment stems from recognizing and fulfilling one's true potential, often referred to as one's *daimon* (Waterman, 1990). The concept of *daimon* encompasses both the inherent potential shared by all individuals as part of the human species and the unique potential of each person. Living in alignment with one's *daimon*, or realizing one's potential, leads to eudaimonic enjoyment. What brings about eudaimonic enjoyment varies from person to person based on their values, talents, and other personal factors (Waterman, 1990).

In a broad sense, hedonic enjoyment can be seen as a shallower, passing form of enjoyment and eudaimonic enjoyment is a deeper and more fulfilling form of enjoyment (Waterman, 1990). It is evident that both need to be included in a universal definition of

enjoyment from the examples of relaxing on the couch and doing an activity one is passionate about, especially if the definition is to be used across a wide array of activities, cultures and contexts. Davidson et al. (2023) proposed the following definition:

A positive feeling, when engaged in a pleasurable and challenging activity, which allows for skill improvement, makes you feel connected to others, and makes you feel proficient in the activity.

This definition includes both hedonic enjoyment in the form of pleasure and eudaimonic enjoyment in the form of skill improvement and challenge. It is important to note that an activity can be enjoyable without hitting all the parts of the definition. In all, the definition represents five subscales of enjoyment, namely: pleasure, relatedness, competence, challenge/improvement and engagement. Davidson et al. (2023) developed a measure for enjoyment alongside their definition based on descriptions of enjoyment taken from 637 items on other scales for enjoyment. These items were then reduced by a panel of experts in enjoyment and questionnaire development. Finally, exploratory and confirmatory factor analysis was done to find the five underlying subscales and to validate the measure (Davidson et al., 2023). The resulting ENJOY scale is a universally applicable scale and is the measure for enjoyment used in the current study.

Enjoyment and flow

As mentioned previously, whether or not to include enjoyment in the measurement of flow has been the topic of some debate in flow research (Abuhamdeh, 2020; 2021). This is a somewhat surprising area of confusion since flow from the very beginning has been described

as extremely enjoyable by the rock climbers, chess players, dancers and basketball players Csikszentmihalyi interviewed to coin the term flow (Csikszentmihalyi, 1975). This confusion is in large part due to three issues as identified by Abuhamdeh (2021).

1. Failure to distinguish between experiencing emotions and being aware of experiencing them.
2. Incorrectly assuming that enjoyment experienced during flow is solely of the 'happy-smiley' type.
3. Ambiguity in Csikszentmihalyi's use of the term 'pleasure' in his work.

The first point, as discussed earlier, stems from the misconception that one must be able to label emotions to acknowledge their experience. The second and third points relate more to the nature of enjoyment experienced in flow.

An example that clearly shows that enjoyment during flow is not the “happy-smiley” type of enjoyment comes from Hetland et al. (2018) who captured facial expressions of long distance cross-country skiers during a skiing event with head mounted cameras and subsequently analyzed the facial expressions. The skiers showed less facial expressions of happiness during skiing than during breaks leading the researchers to conclude that “difficult activities are not pleasant” and that experiencing flow during the pursuit of difficult activities therefore is not enjoyable. However, according to the definition of enjoyment provided earlier, an activity doesn't necessarily have to be pleasurable to be enjoyable Of Course this becomes a question of definition of emotions and Hetland et al. (2018) would likely agree that the skiers were engaged in a challenging activity that allows for skill improvement and feelings of competence. This distinction between pleasure and enjoyment is something that

Csikszentmihalyi himself also made and brings me to the third source of confusion around enjoyment and flow.

Csikszentmihalyi writes in his book Flow (1990) that pleasure comes "whenever information in the consciousness says that expectations, set by biological programs or social conditions, have been met" (p.45). Sleep, food and sex all bring pleasure, but are not what give optimal experiences. Optimal experiences, flow experiences, are enjoyable in that they compel us to move forward, develop and grow in some way, they can be pleasurable as well, but what sets them apart is that they move us to go beyond what we previously were capable of (Csikszentmihalyi, 1990). A flow experience can be not "particularly pleasurable at the time they are taking place, but afterwards we think back on them and say "That really was fun" and wish it would happen again" (p. 46). Csikszentmihalyi argues that enjoyment cannot occur without intense attentional focus and that after an enjoyable event we have grown and become a more complex being. Again, this becomes a definition question of enjoyment, but it clearly underlines that enjoyment should be part of flow.

Aims and research questions of the current study

To summarize, flow is an enjoyable, highly engaged state of consciousness. However, the specific nature of enjoyment in flow has received little attention (Abuhamdeh, 2020, 2021). Questions regarding categorization of flowers and non-flowers are unresolved, but methods for such categorization have been suggested (Kawabata & Evans, 2016). The current study therefore aims to investigate what type of enjoyment occurs in flow and if groups of flowers and non-flowers can be identified based on continuous measurements. Additionally, the study investigates the relationship between flow, autotelic personality, and enjoyment, as

well as any gender differences across these variables. Subsequently, the paper will address these research questions in the order outlined here.

The study has four research questions:

- R1) Are there gender differences in flow, autotelic personality and enjoyment?
- R2) What is the relationship between the three factors of flow, autotelic personality and enjoyment?
- R3) What is the correlation between flow, enjoyment and the subscales of enjoyment: pleasure, relatedness, competence, challenge/ improvement and engagement?
- R4) Can flowers and non-flowers be categorized? And if so, how do the groups found differ in enjoyment and autotelic personality?

Methods

Participants

In all 287 participants responded to the questionnaire, 88 males, 194 females, four who reported other gender and one who did not wish to state their gender. Age ranged from 18 to 64 years (M = 25.54, SD = 7.59). Average age in the male sample was 25.12 years (SD = 5.88) and 25.80 years (SD = 8.32) in the female sample. 143 respondents indicated completed videregående or yrkesfaglig schooling as highest completed education, 140 indicated having completed higher education with a bachelors (99) a masters (32) or a Phd (9). Four participants did not wish to state their highest completed education.

Procedure

Participants were recruited via posters with qr codes that were hung up on the campuses of NTNU. Additionally emails with a link to the questionnaire were sent to the faculties at NTNU asking for participants. The questionnaire was made and hosted on https://nettskjema.no which is a data gathering tool developed by the University of Oslo. Ethical authorization from the Norwegian center for research data (NSD) was not needed because the questionnaire did not gather information capable of identifying participants, only age, gender and educational level were gathered. Prior to answering the questionnaire participants were given information about the nature and purpose of the questionnaire and that they consent to participating by clicking “send” on the last page. Datagathering started in September 2023 and concluded in February 2024. All data gathering was done by the author of this thesis.

Participants first answered questions about demographic variables and were then presented with the general flow proneness questionnaire (Elnes & Sigmundson, 2022). Further, participants were asked to think about an activity they do regularly and have completed in the last two weeks and answer the subsequent questions in relation to the last time they did that activity. Finally, they were asked to complete the short flow questionnaire (Engeser & Reinberg, 2008) and the ENJOY scale (Davidson et al., 2023). All questions were asked in english and norwegian, the norwegian translations were made by the author. The sample can be described as a convenience sample. See appendix B for the full questionnaire.

Measurements

Autotelic personality

Autotelic personality was measured using the general flow proneness scale (Elnes & Sigmundson, 2022). The scale consists of 13 items measuring participants' likelihood of entering flow in daily life. Items are assessed on a five point likert scale ranging from (1) totally disagree to (5) totally agree. Example items include “I enjoy challenging tasks/activities that require a lot of focus”, “I become stressed in the face of difficult/challenging tasks" (reverse scored) and “When I focus on something, I often forget to take a break”. The general flow proneness scale has shown to be reliable in test retest situations and has shown good internal consistency in earlier research with a Cronbach's alfa of .78 (Elnes & Sigmundsson, 2022). An overall autotelic personality score is calculated by averaging the answers on the 13 items.

Flow

Flow was measured using the Flow short scale (Engeser & Reinberg, 2008). It measures situational flow in 10 items that include all the characteristics and conditions for flow covered in the background section. The items are assessed on a seven point likert scale ranging from (1) strongly disagree to (7) strongly agree and can be averaged to get an overall flow score. Example items include “I don’t notice time passing”, “I feel that I have everything under control” and “I am totally absorbed in what I am doing”. The Flow short scale has been used in correlational, experimental and experience sampling studies (Engeser & Reinberg, 2008). It has been used to study flow in sports (Schüler & Brandstätter, 2013), esports (Schmidt et al., 2020), music (Spahn et al., 2021) and at work (Schermuly & Meyer, 2020) among other fields.

Enjoyment

Enjoyment was measured with the ENJOY scale (Davidson et al., 2023): This scale uses 25 items to measure overall enjoyment as well as five subscales of enjoyment. The subscales are pleasure, relatedness, competence, challenge/ improvement and engagement. There are five items relating to each subscale and the items are given in an order so that the items for the same subscale are not all in a row. The items are answered on a seven point likert scale ranging from (1) strongly disagree to (7) strongly agree. The answers from all the subscales can be averaged to get an overall score of enjoyment. Answers from the items are summed to give the level of enjoyment for each subscale and for the overall construct. Example items are “The activity was fun” (pleasure subscale), “The activity was a shared effort with others” (relatedness subscale), “I am good at the activity” (competence subscale), “The activity allowed me to develop new skills” (challenge/ improvement subscale) and “When I did the activity, I thought about nothing else” (engagement subscale).

Data analysis

To investigate the first research question, are there gender differences in flow, autotelic personality and enjoyment, an independent sample t-test was run.

The second research question on how the three variables of flow, autotelic personality and enjoyment relate to each other was investigated with correlation tests (Pearson's *r*) between flow, autotelic personality, overall enjoyment and the subscales of enjoyment. To further investigate the relationship between the three variables, specifically the predictive effects of flow and autotelic personality on enjoyment, a hierarchical linear regression was run. The first model included age and gender as control variables, autotelic personality was added in the second model and finally flow was added in the third model.

The third research question on what type of enjoyment, based on the five subscales: pleasure, relatedness, competence, challenge/ improvement and engagement, is found in flow, was investigated with correlation analysis between flow and the subscales of enjoyment.

Lastly, the fourth research question regarding categorization of flowers and non-flowers and how these groups differ was investigated by importing data to M*plus* (ver 7.3; Muthén & Muthén, 2013) and doing factor mixture modeling. Factor mixture modeling combines latent categorical and latent continuous variables to find unobserved groups in a population and to also give them a score on an unobserved variable (Clark, Muthén, Kaprio, D'Onofrio, Viken, & Rose, 2013; Muthén, 2006). This allows for modeling of constructs that are both categorical and continuous at the same time. For a more detailed overview of factor mixture modeling see appendix A. Finally, the differences in a) overall enjoyment, b) autotelic personality and c) the subscales of enjoyment in the groups identified in the factor mixture

modeling were further investigated using a one way ANOVA. All analysis other than the factor mixture modeling was done in SPSS (version 29).

Results

Alpha level of $p = .05$ for significant results are used in all analyses and only two tailed p results are reported.

Research question 1: Are there gender differences in flow, autotelic personality and enjoyment?

Table 1 shows the descriptive statistics for the measurements of autotelic personality, overall enjoyment and flow as well as results of an independent sample t-test investigating gender differences on the same three variables.

Table 1

Descriptives statistics for entire sample and results of independent sample t-test for gender differences in flow, autotelic personality, overall enjoyment and subscales of enjoyment(N = 287)

Descriptive statistics for entire sample								
Variables	Min score	Max score	Mean	SD				
Autotelic personality	1.85	4.45	3.30	0.56				
Overall enjoyment	2.86	6.92	5.05	0.91				
Flow	2.10	6.90	4.73	0.97				
t-test for gender differences								
	Means		SD		df	t	*p*	d
Variables	Male	Female	Male	Female				
Autotelic personality	3.40	3.30	0.55	0.56	172.62	2.17	.030	0.28
Overall enjoyment	5.05	5.03	0.95	0.89	159.36	0.16	.874	0.02
Flow	4.65	4.76	0.90	1.01	186.96	-.94	.347	-0.12
Pleasure	5.80	5.94	1.07	1.05	165.25	-1.02	.311	-.13
Relate	4.30	3.80	1.87	2.01	179.52	1.92	.057	.24
Comp	5.21	5.42	1.03	1.00	163.61	-1.56	.120	-.20
Chall/Improve	5.49	5.31	1.00	1.22	206.63	1.35	.179	.16
Engage	4.50	4.72	1.55	1.40	153.34	-1.12	.265	-.15

Note: Autotelic personality is measured on a 1-5 scale. Flow and enyomet are measured on a 1-7 scale.
df = degrees of freedom, d = cohen's d effect size.

There were no significant differences in overall enjoyment and flow between the genders. There was a significant difference in autotelic personality t(172.62) = 2.17, p = .030, between males (M = 3.40, SD = 0.55) and females (M = 3.30, SD = 0.56), indicating that

males reported higher levels of autotelic personality. The effect size of the difference was small d = 0,28.

Research question 2: What is the relationship between the three factors of flow, autotelic personality and enjoyment?

A correlation test for the three variables of autotelic personality, flow and overall enjoyment revealed a significant positive relationship between all of them. Autotelic personality and overall flow showed a moderate positive correlation r(285) = .40, $p < .001$. Autotelic personality and overall enjoyment had a small positive correlation r(285) = .22, $p < .001$. Finally, overall flow and overall enjoyment had a moderate positive correlation r(285) = .48, $p < .001$. Further correlations among the subscales of enjoyment and the three main variables were done to investigate the type of enjoyment experienced in flow (see research question three). The results are displayed in table 2.

Table 2

Pearson Bivariate Correlations between flow autotelic personality and overall enjoyment (N = 287)

Variables	Flow	AP	Enjoy tot
Flow	-		
AP	.40***	-	
Enjoy tot	.48**	.22***	-

Note: AP = autotelic personality, Enjoy tot = overall enjoyment.
* $p < .05$
** $p < .01$
*** $p < .001$

To further investigate the relationship between the three variables, specifically the predictive effects of flow and autotelic personality on enjoyment, a hierarchical linear regression was run. The first model included age and gender as control variables, autotelic personality was added in the second model and finally flow was added in the third model. Hierarchical regression allows the predictive role of age, gender, autotelic personality and flow to be investigated while controlling for each of the other variables and further elucidates the relationship between the variables.

Table 3

Hierarchical linear regression of autotelic personality and flow effects on overall enjoyment (N = 282)

Variables		*b*	SE*b*	β	R^2	R^2adj	ΔR^2
Model 1					.001	-.006	
	Gender	-.02	.12	-.01			
	Age	>-.01	.01	-.04			
Model 2					.06***	.05***	.05***
	Gender	.05	.12	.03			
	Age	-.01	.01	-.12			
	AP	.39***	.10	.24***			
Model 3					.25***	.23***	.19***
	Gender	-.05	.10	-.03			
	Age	-.01	.01	-.10			
	AP	.07	.10	.05			
	Flow	.45***	.05	.48***			

Note. *** $p < .001$,** $p < .01$, * $p < .05$. *(two-tailed)*
For gender, male coded 1, and female coded 2.

Results indicate that in the final model, only flow significantly predicts enjoyment, and any effect of autotelic personality on enjoyment disappears. Model 1 included age and gender, and was not significant, explaining 1% of the variance in enjoyment, $R^2 = .01$, $F(2,279) = .20$, $p = .82$. In model 2, autotelic personality was added, significantly improving the model $\Delta R^2 = .05$, $F(3,278) = 5.42$, $p = .001$. Model 2 explained 6% of the variance in overall enjoyment, $R^2 = .06$, $F(3,278) = 15.85$, $p < .001$. Model 3 added flow to the model and further significantly improved it $\Delta R^2 = .19$, $F(4,277) = 22.52$, $p < .001$. Model 3 explained 25% of the variance in overall enjoyment, $R^2 = .25$, $F(4,277) = 69.79$, $p < .001$ (see table 3). Flow was the only significant predictor of overall enjoyment in the completed model,$\beta = .48$, $p < .001$, indicating that increased flow predicts increased enjoyment when controlling for gender, age and autotelic personality. Autotelic personality going from significantly predicting enjoyment in mode 2, $\beta = .24$, $p < .001$, to no longer being significant in model 3, $\beta = .05$, $p = .443$, indicates that the effect of autotelic personality on flow is mediated by flow.

Research question 3: What is the correlation between flow, enjoyment and the subscales of enjoyment: pleasure, relatedness, competence, challenge/ improvement and engagement?

To investigate the third research question the same correlation analysis as in research question two was used (see table 4). Correlations show that Flow was significantly and positively correlated with overall enjoyment and all subscales of enjoyment. Flow had a medium correlation with overall enjoyment $r(285) = .48$, $p < .001$, a small correlation with relatedness $r(285) = .16$, $p < .05$, and challenge/ improvement $r(285) = .22$, $p < .001$, a

medium correlation with pleasure r(285) = .45, $p < .001$ and engagement r(285) = .45, $p < .001$ and a large correlation with competence r(285) = .54, $p < .001$. These results indicate that the type of enjoyment experienced in flow is derived from feelings of competence, engagement and pleasure more so than feeling connected to others and improving the skills required to do the activity.

Table 4

Pearson Bivariate Correlations between flow, overall enjoyment and the subscales of enjoyment: Pleasure, Relatedness, Competence, Challenge/ improvement and Engagement (N = 287)

Variables	Flow	Enjoy tot	Pleasure	Relate	Comp	Chall/ Improve	Engage
Flow	-						
Enjoy tot	.48***	-					
Pleasure	.45***	.73***	-				
Relate	.16*	.71***	.27**	-			
Comp	.54***	.60***	.53**	.18**	-		
Chall/ Improve	.22***	.68***	.49**	.34**	.33**	-	
Engage	.45***	.70***	.42**	.27**	.29**	.27**	-

Note: AP = autotelic personality, Enjoy tot = overall enjoyment, Relate = relatedness, Comp = competence, Chall/ Improve = challenge/ improvement, Engae = engagement
* $p < .05$
** $p < .01$
*** $p < .001$

Research question 4: Can flowers and non-flowers be categorized? And if so, how do the groups found differ in enjoyment and autotelic personality?

In addition to examining the type of enjoyment experienced in flow, this study investigated if grouping respondents in flow and non-flow groups based on continuous data using factor mixture modeling is possible. Analysis for building the model was done in M*plus* (ver 7.3; Muthén & Muthén, 2013) based on robust maximum likelihood estimation. A three class solution was found to have the best fit based on fit statistics and theoretical considerations. These classes represent unobserved groupings in the data based on responses to the flow short scale (Engeser & Reinberg, 2008). These latent classes can be interpreted as groups of flowers and non-flowers. For a more detailed description of model building see appendix A. The class average flow score is shown in figure 4. The x-axis shows the individual items in the flow short scale, while the y-axis shows the item average score for the items in each class. A higher score indicates stronger endorsement of flow characteristics. Class 1 is labeled as a flow class and class 2 and class 3 are non-flow classes.

Figure 4

Average flow scores for the classes identified in Factor mixture models (N = 287)

Note: x-axis lists the items on the Flow short scale (Engeser & Reinberg, 2008) and the y-axis shows the average scores on the item per class from the factor mixture model. Class sizes are Class 1 (n = 112, 39%) Class 2 (n = 132, 46%) Class 3 (n = 43, 15%)

The parallel scores suggest that there is an ordering of the classes from high/ in flow (class 1) to low/ no flow (class 3). The item average for all items in class 1 is above the midpoint (4) of the scale indicating that this class can be considered a flow class. Class 3 has the lowest scores on all items and is considered a non-flow class. Labeling class 1 as a flow class and class 2 and 3 as non flow classes means that 39% of the sample are identified as having been in flow and 61% of the sample are identified as not having been in flow.

A one way ANOVA was run to further investigate mean score differences in autotelic personality, overall enjoyment and the five subscales of enjoyment in the three classes. Results are shown in table 5.

Table 5

ANOVA investigating the differences in classes identified through Factor mixture models (N = 287)

Variables	df	F	*p*	η^2
AP	2, 284	17.94	<.001	.112
Enjoy tot	2, 284	27.25	<.001	.161
Pleasure	2, 284	27.42	<.001	.162
Relatedness	2, 284	2.66	.072	.018
Competence	2, 284	58.32	<.001	.291
Chall/ improve	2, 284	2.17	.116	.015
Engagement	2, 284	16.18	<.001	.102

Note: df (degrees of freedom) reported in: between groups, within group.
AP = autotelic personality, Enjoy tot = Overall enjoyment, Chall / improve = challenge improvement.

There were significant differences in the groups in all variables except the subscales for relatedness and challenge improvement. Effect size is reported as Eta squared (η^2) and can be interpreted as the percentage of variance that can be explained by the grouping variable (in this case the flow classes) on the outcome variable (autotelic personality, overall enjoyment and the subscales for enjoyment) (Lakens, 2013). Benchmarks for effect sizes are small = .01, medium = .06 and large = .14 (Choen, 1988). Meaning that nearly 30% of the variation in how much competence enjoyment respondents reported can be explained by which group they fall in. Further, there is a large effect for overall enjoyment, pleasure and competence and a medium effect for autotelic personality and engagement.

Further Tukey post-hoc tests revealed significant differences between all group pairs for autotelic personality, overall enjoyment, pleasure and competence with an ordering from high (class 1) to low (class 3). There was a significant difference in engagement between class 1 and the other two classes, but not a significant difference between class 2 and class 3.

Chi-square test was also done to examine gender differences in the flow and non-flow groups identified, but no significant results were found ($p = 0.175$).

Discussion

The main aims of the current study were to examine the type of enjoyment experienced in flow as well as the relationship between flow, autotelic personality and enjoyment. Further, gender differences in the variables of flow, autotelic personality and enjoyment were investigated. Finally, being able to categorize flowers and non-flowers is theoretically relevant (Csikszentmihalyi, 1975), but is something that is not commonly done in the field (Abuhamdeh, 2020; Kawabata & Evans, 2016). The aims of the study gave rise to the following four research questions:

- R1) Are there gender differences in flow, autotelic personality and enjoyment?
- R2) What is the relationship between the three factors of flow, autotelic personality and enjoyment?
- R3) What is the correlation between flow, enjoyment and the subscales of enjoyment: pleasure, relatedness, competence, challenge/ improvement and engagement?
- R4) Can flowers and non-flowers be categorized? And if so, how do the groups found differ in enjoyment and autotelic personality?

Results from the four questions will be discussed in order followed by limitations, future research and a conclusion.

Research question 1: Are there gender differences in flow, autotelic personality and enjoyment?

The results of an independent sample t-test suggest that there are gender differences in autotelic personality with males reporting more autotelic personality than females. However, there were no gender differences in amount of flow, overall enjoyment or any of the subscales of enjoyment in the activity reported from. Prior research has also failed to find gender differences in flow (Isham & Jackson, 2023). Previous research has not found any gender differences in autotelic personality (Elnes & Sigmundsson, 2023; Murica et al., 2008; Russell, 2001; Busch et al., 2012). The results from the current study could be due to skewed gender proportions in the sample (88 males, 194 females). Males tend to report higher levels of self estimated IQ and self esteem than females (Rielley et al., 2023) and so the observed differences could alternatively be due to male hubris or female humility. The inconsistent results between current and previous findings warrants further investigation of gender differences in autotelic personality.

Research question 2: What is the relationship between the three factors of flow, autotelic personality and enjoyment?

Results from the correlation analysis indicate that flow, autotelic personality and enjoyment are all positively correlated. Flow and autotelic personality had a moderate correlation (r = .40, p < .001), flow and overall enjoyment had a moderate correlation (r = .48, p < .001) and autotelic personality and enjoyment had a weak correlation (r = .22, p < .001). To further investigate the predictive effects of flow and autotelic personality on enjoyment, a hierarchical regression was run. Results show that the relationship between

autotelic personality and enjoyment is only significant when not controlling for flow, suggesting that the impact of autotelic personality on activity enjoyment is mediated by flow. Flow significantly predicted enjoyment and explained 19% unique variance above age, gender and autotelic personality. The results are in line with existing theory, suggesting that being an autotelic person does not lead directly to enjoyment, but can lead to enjoyment indirectly through flow (Csikszentmihalyi & Csikszentmihaly, 1988).

Research question 3: What is the correlation between flow, enjoyment and the subscales of enjoyment: pleasure, relatedness, competence, challenge/ improvement and engagement?

Flow is consistently described as enjoyable (Csikszentmihalyi, 1975; 1990; Peifer et al., 2022; Abuhamdeh, 2020; 2021), but empirical studies that explore what type of enjoyment flow brings are virtually nonexistent (Abuhamdeh, 2020, 2021). The second research question in the current study attempts to bridge this gap in the literature.

The results from the correlation analysis show that flow is moderately correlated with overall enjoyment ($r = .48$, $p < .01$), firmly confirming that flow is enjoyable in accordance with Csikszentmihalyi (1975) and contrasting Sigelmans view that flow is not enjoyable based on lacking awareness of enjoyment (Abuhamdeh, 2021). Further, the subscales of enjoyment revealed that flow is mostly enjoyable in the way of feeling competent, being engaged and feeling good about yourself (pleasure). The two remaining subscales, challenge/ improvement and relatedness, also had significant correlations with flow, but these were small. The results of each of the subscales and how they relate to flow theory will be discussed in order.

Engagement

Relating the findings to theory, there is no surprise that enjoyment based on engagement was correlated with flow (r = .45, p < .001) as total absorption in the task has been cited as one of the characteristics of flow from the very beginning (Csikszentmihalyi, 1975). “Merging of action and awareness” is what Csikszentmihalyi described as “perhaps the clearest sign of flow” (Csikszentmihalyi, 1975 p.38). However, as will become apparent with the subscale for challenge/ improvement, something being described as part of flow does not automatically mean that it is a part of flow that leads to enjoyment. Abuhamdeh and Csikszentmihalyi (2012) suggested that the deep engagement experienced during flow can be enjoyable based on making the features of the activity that initially captured the person's interest more salient. Further, Abuhamdeh (2021) suggested that being completely involved in a task can be evolutionarily beneficial based on enhancing performance and improving skill and thus should be enjoyable as an evolutionary adaptation. The current findings confirm these speculations that part of what makes flow so enjoyable is the deep engagement felt while in flow.

Pleasure

Pleasure had a moderate positive relationship with flow (r = .45, p < .001). Csikszentmihalyi has described flow as not necessarily pleasurable when defining pleasure as “whenever information in the consciousness says that expectationsons set by biological programs or social conditions have been met” (Csikszentmihalyi, 1990, p.45). This definition of pleasure is limited to fulfilling physical needs or socially dependent situations. The questions for the enjoyment subscale of pleasure used in the current study extend pleasure to broader concepts such as happiness and having fun with questions like “the activity was fun” and “the activity made me feel good”. Flow is an optimal experience and so it leading to

feeling good and having fun is no surprise. Additionally the respondents were remembering an activity they have done in the past and in the same book as Csikszentmihalyi's definition of pleasure is from, he writes: "None of these [flow] experiences may be particularly pleasurable at the time they are taking place, but afterward we think back on them and say, "That really was fun" and wish they would happen again." (Csikszentmihalyi, 1990). This is more in line with the Hetland et al. (2018) study that measured facial expressions of long distance skiers and found that less expressions of happiness were shown during skiing than during breaks leading them to conclude that doing hard things is not pleasurable. Similar results might have been found if facial expressions were measured during the activities participants in the current study reporter from. However, the retrospective nature of this study and the definition of pleasure used in the questionnaire means that the findings of flow being pleasurable is consistent with theory. If a similar design had been used by Hetland et al. (2018), they likely would have found much the same results.

Competence

The enjoyment subscale that was most strongly correlated with flow was competence ($r = .54$, $p < .001$). Flow is more likely to occur when the person doing the activity has practice doing it, as seen in the model of flow that assumes skill and challenge must be above average level for flow to occur (fig 1b, Nakamura & Csikszentmihalyi, 2002). Other conditions for flow, such as clear goals, necessitates that the person is familiar enough with the activity to have a framework for what the goals of the activity are. Further, the characteristic sense of control over one's actions experienced in flow would also benefit from feeling (and being) more competent at the activity.

The strong correlation between flow and competence can also explain a portion of the intrinsic motivation found in flow. Self determination theory describes competence, along

with autonomy and relatedness, as the three basic motivational needs humans possess, (Ryan et al., 2008). By fulfilling these needs a state of intrinsic motivation is achieved, which aligns well with flow as an autotelic experience.

One challenge associated with assessing competence within the context of flow lies in the requirement for a self-assertive evaluation, such as affirming, "I am good at this activity." While feelings of competence necessitate an explicit self-evaluation, a concept akin to competence, known as feelings of efficacy, offers a distinct perspective. White (1959) explained why human and non-human animals do things for seemingly no reason with feelings of efficacy, postulating that animals and humans derive pleasure from exercising their skill on the environment. From a dog feeling the joy of running to a baby's delight at kicking their legs, feelings of efficacy underscore the intrinsic motivation behind such behaviors. In the context of flow, where self-consciousness is diminished, evaluating feelings of competence becomes inherently challenging, but as with pleasure, the retrospective nature of this study allows competence to be measured. Competence and feelings of efficacy are very similar and for the purposes of this study the main difference is that one is simply felt without any need for a sense of self, while the other can be evaluated after the flow episode has concluded.

Challenge/ Improvement

The subscale of challenge/ improvement had a positive correlation ($r = .22$, $p < .001$), but was weaker than overall enjoyment, pleasure, competence and engagement. This result was surprising based on how Csikszentmihalyi has continuously highlighted the perceived match of skill and challenge and the allowance for skills to grow and stretch during flow as one of the main conditions for flow (Csikszentmihalyi, 1975, 1990; Nakamura & Csikszentmihalyi, 2002). This discrepancy in the current results and theoretical framework

can help further describe the relationship between flow, challenge and learning. I will first discuss flow and learning to show how flow can occur with or without learning. Further, the weak relationship between flow and challenge/ improvement enjoyment does not mean that flow does not lead to learning or having a balance of skill and challenge, but rather that these parts of the flow experience are not the most enjoyable parts.

The experience of flow stems from balancing skill and challenge, but engaging in an activity regularly should develop skill leading to higher amounts of challenge needed to enter flow. Csikszentmihalyi (1975) called this process *the cycle of challenge seeking and skill building.* This reasoning assumes time doing a skill is enough to improve at it, which is not always the case as seen with drivers not continually improving. In reality, drivers get to a comfortable skill level and then never improve further. To make improvement at something, purposeful practice is needed (Ericsson & Moxley, 2012), characterized by immediate feedback and repetition until a new goal or standard has been met (Ericsson, 2020). In contrast, naive practice is engaging in the activity as a means to improve at it, such as playing soccer matches to improve at soccer (Ericsson, 2020). Flow includes clear goals and immediate feedback and may resemble purposeful practice, though the repeatability of the activity and the goals set during the activity can vary substantially. Someone knitting a sweater can have a goal of finishing the sweater and in the process they repeat the individual actions in knitting over and over without improving at them. This person can still be in flow based on being completely absorbed, knitting at a pace that exactly matches their skill and having an enjoyable time. The same person can alternatively have a goal of knitting more complex patterns in a quicker or more uniform manner and so the flow of that knitting session becomes about improving skill.

Flow including both stretching and not stretching skills can be seen in the models of flow in figure 2 showing that flow is not only limited to situations where skill needs to stretch

to match challenge, but also when skill already matches or slightly exceeds challenge (Nakamura & Csikszentmihalyi, 2002). Csikszentmihalyi did not specify that skill should be stretched a great deal everytime flow experiences occur, but rather that flow *allows* for stretching of skill. Confirming Csikszentmihalyi's description, research on flow and learning finds a positive relationship (Pearce et al., 2005; Custodero, 2011; Bressler & Bodzin, 2016). The current results further indicate that flow and learning are related, but that this is not the most enjoyable part of flow. Moreover, it exemplifies that all aspects of flow need not be equally enjoyable. Finding the balance between challenge and skill is not where the main enjoyment of flow stems from. It is rather a feeling of competence when that balance has been achieved, feeling fully engaged with what you are doing and feeling pleasure from experiencing flow. Further, the relationship between flow and learning is such that being in flow will lead to learning over time (Custodero, 2011). Future research examining the type of enjoyment in flow over many sessions of an activity could find a stronger relationship between flow and enjoyment based on challenge/ improvement.

Relatedness

The subscale of relatedness was significantly correlated with flow, but had the smallest correlation ($r = .16$, $p < .05$).

Research on social flow indicates that flow can be achieved in social situations (Walker, 2021). The original conceptualization of flow relied on both interviews with practitioners of individual activities, rock climbers and chess players, and team activities,basketball. Csikszentmilalyi did not distinguish between social and individual flow in this early conceptualization of flow. Later research into social flow has distinguished co-active and interactive social flow (Walker, 2021). Co-active flow occurs when someone is in flow while in the presence of others, but not directly interacting with them. Such flow is experienced

individually. Interactive flow occurs when part of the activity necessitates cooperation and communication with others, such as in team games (Walker, 2021). The questionnaire for the current study only asked participants to state the activity they did, but not if they did it in the company of others or if it was a cooperative activity. Someone reporting having played soccer could be reporting a session of practicing free kicks on their own or playing a match. Because of this shortcoming in the construction of the questionnaire, the investigation of social flow is beyond this study. Interpretation of the relatedness subscale should be done with great caution as it is unknown how relevant it was to the activity being reported. Nevertheless, most activities humans do have something to do with other humans. A painter expressing themselves on the canvas is aware that the painting could be seen by others at a certain level. Similarly the source of inspiration for the painting could be a feeling of love and compassion for family members leading the painter to feel a great sense of relatedness even though they are painting alone. One conclusion that can be drawn from the positive correlation between flow and relatedness is that feelings of relatedness are not necessary to enter flow, but can facilitate it. To better assess the role of relatedness in flow further research is needed with better design. This is discussed further in the limitations and future research section.

Research question 4: Can flowers and non-flowers be categorized? And if so, how do the groups found differ in enjoyment and autotelic personality?

The vast majority of research on flow operationalises it as a continuous construct (Abuhamdeh, 2020). However the initial conceptualization of flow made by Csikszentmihalyi and how flow is talked about in the literature indicates that it is a categorical construct (Piefer & Engesser, 2021). People are either in flow or they are not (Csikszentmihalyi, 1975;

Abuhamdeh, 2020). The fourth research question of the current study is therefore to investigate if categorisation of participants in flow and non-flow groups with factor mixture models is appropriate based on continuous data.

Using factor mixture modeling, three distinct classes were identified. The factor mixture modeling method allows both latent continuous (global flow score) and latent categorical (flower and non-flower classes) variables to be found (Clark et al., 2013). A three class solution indicates that three distinct groups exist in the population based on flow scores. This is further supported by the ordered profiles on items from the Flow short scale, indicating that respondents in one group scored higher on all items than those in the next group, and so on (see Fig. 1).

To label these groups, insights from previous research and tests of mean differences in autotelic personality, overall enjoyment, and enjoyment subscales were considered. For instance, Kawabata and Evans (2016) employed similar factor mixture modeling methods and identified a four-class solution, labeling the two highest-scoring classes as flow classes. They based this division on the fact that the average flow scores of the two highest scoring classes exceeded 3 (the midpoint of a 5-point scale), leading to 54% of their sample being labeled as having experienced flow.

In the current study, class 1 had all items on the Flow short scale well above the midpoint of 4 (see fig 1) and had significantly higher scores on autotelic personality, overall enjoyment, and the enjoyment subscales of competence, engagement and pleasure than the other two classes. Class 2 also had all but one item on the Flow short scale above the midpoint of 4, but did not significantly differ in engagement enjoyment from Class 3. Class 3 had all but one of the Flow short scale items below the midpoint of 4.

Based on Class 1 scoring well above the midpoint of 4 on all Flow short scale items (all items were above 5) and its significantly higher scores on autotelic personality, overall enjoyment, and enjoyment subscales, it is labeled as a flow class. While Class 2 could also be argued as a flow class, it did not significantly differ from Class 3 in engagement enjoyment and had one item below the midpoint of the Flow short scale. This results in 39% of the sample being labeled as having experienced flow during the reported activity

The frequency of flow experiences remains somewhat uncertain, as individuals vary widely in how often they report experiencing flow (Nakamura & Csikszentmihalyi, 2002). Despite being extensively studied, whether flow is a rare or common occurrence remains a subject of ongoing research. Studies examining the frequency of flow often aim to demonstrate relationships between certain variables and increased levels of flow proneness, but they often fail to specify how often flow experiences actually occur (Vealey & Perritt, 2015; Koehn & Morris, 2014; Hirao et al, 2012;Sinnamon et al., 2012). In research that categorizes flowers and non-flowers the results do not give a clear picture of how frequent flow is. Asakawa (2010) found that Japanese college students on average experienced flow more than “few times a year” but less than “once a month” and Kawabata and Evans (2016) were criticized for concluding that 54% of their sample had been in flow (Abuhamdeh, 2020). These results indicate that flow is indeed a rare occurrence or that findings of high flow occurrence should be interpreted with much caution. On the other hand, Massimini and Carli (1988) found that teenagers reported being in flow states 19% of the time when reporting from daily experiences indicating that flow is much more common. These studies all use different measurements for flow which is a shortcoming in the field of flow research in general. How common an occurrence flow is remains unclear and will need further research and a standardized measure of flow to reach a consensus.

The large percentage of participants categorized as having experienced flow in the

current study can stem from the way the questionnaire asked respondents to select an activity: “something you do regularly and that you have done in the last two weeks. It can be a sport, a form of exercise, playing a game/board game, cooking, gardening, painting, writing, reading, playing an instrument or any other activity you do regularly”. The broad range of activities suggested lead participants to report from leisure activities they do based on intrinsic motivation with little to no external reward. Such activities are likely to be flow activities for the respondents leading to a high percentage of reported flow experiences (Csikszentmihalyi, 1990).

Furthermore, the high proportion of flow experiences in the current study can be attributed to the sample mainly consisting of students at a university in Norway. On a global scale, access to higher education is a privilege and financial policies that support students in Norway further reduces stressors for students. Students generally have ample free time to engage in activities they enjoy, making it easier to pursue autotelic activities compared to later in life when work and family demands may be more pressing. These factors taken together could suggest that the sample has a higher level of flow occurrence than would be expected in the general population.

Finally, directly answering the research question of if flowers and non-flowers can be categorized remains unclear. Based on theory flow should be a categorical construct (Csikszentmihalyi, 1975; Abuhamdeh, 2020). Factor mixture modeling does give classes, but to know if participants were correctly classified, class membership needs to be known beforehand. Suggestions for how to facilitate this knowledge is discussed in the future research section.

Limitations

The size of the current sample is both a strength and a weakness. 287 respondents is a good amount for a master thesis, but limits the types of factor mixture models that can be fitted to the data (Clark et al., 2013).

The way the questionnaire is constructed is intended to capture a wide variety of experiences. It has been suggested that there exists different types of flow for different types of activities (Peifer et al., 2022) and therefore having such a broad range of activities reported from can be viewed as a hindrance. Further, enjoyment based on relatedness could not fully be assessed due to the general nature of the activities.

Finally the sample being a convenience sample mainly consisting of students can limit the generalizability of the findings to the general population. The nature of the sample also led to a skewed gender distribution with more females than males participating in the study.

Future research

The results from the current study raise questions of the enjoyable nature of the challenge-skill balance and allowance for skill stretching in flow. Additional research investigating the relationship between learning, enjoyment and flow is warranted, preferably in a longitudinal manner.

Developing and validating tools for categorizing flowers and non-flowers from continuous data will allow the continuous measures for flow to better investigate questions related to flow frequency and further describe the characteristics present when participants are in flow. This is only the second study to employ factor mixture modeling in flow research after Kawabata and Evans (2016). More research is needed to validate the analysis method. Specifically, studies that use a mixture of the original flow questionnaire (Csikszentmihalyi &

Csikszentmihalyi 1988b) that describes flow and then asks a yes/no question to categorize participants and factor mixture modeling could further validate the analysis method. Establishing factor mixture models as a tool for categorizing flowers and non-flowers based on continuous data could allow older datasets that measured flow as a continuous construct to be reinvestigated and potentially provide a treasure trove of quantitative empirical backing for the characteristics of flow. Moreover, the relationship between the characteristics of flow and flow as a whole could be further investigated, proving insight into the question "are all of the characteristics of flow needed to enter flow?"

Other areas that can benefit from the explicit categorization of flowers and non-flowers are studies looking at brain imaging of participants in flow to find neural correlates of flow. Moreover, any research question aimed at differences in how humans think, feel and act while in flow vs not in flow benefit from a clear categorization. Factor mixture models can also be used to help guide development of unobtrusive observational measurements of flow by allowing a better understanding of the cutoff between flow and non flow. If unobtrusive measures of flow can be developed it could give clearer insight into the variance in different flow characteristics during a flow session.

Finally, more research on the exact nature of how flow is enjoyable is needed. The current study is the first to explore exactly how flow is enjoyable, but has limitations in the sample's applicability to a global population and so research on effects of socioeconomic status, culture, age groups and life experiences effect on the way in which flow is enjoyable will improve the certainty of the conclusions reached here.

Conclusion

The most important takeaway from the current study is that the type of enjoyments most correlated with flow are competence, engagement and pleasure. In all, four research

question were investigated: 1) are there gender differences in flow, autotelic personality and enjoyment, 2) how is flow enjoyable, 3) what is the relationship between flow, autotelic personality and enjoyment, and, 4) can flowers and non-flowers be categorized and if so how do these groups differ. Responses from 287 participants were collected and analyzed using correlation, regression and factor mixture modeling.

Males reported higher levels of autotelic personality than females. No other gender differences were found. Further, flow entails enjoyment derived from feelings of competence, engagement and pleasure. Support for enjoyment from challenge/ improvement was found, but warrants further investigation and could perhaps more fruitfully be investigated in longitudinal studies. Enjoyment based on relatedness was also found to have a weak positive relationship with flow, but different study design is needed to fully assess the role of relatedness in flow. Autotelic personality was shown to have an indirect effect on enjoyment through flow when controlling for age, gender and flow. Further, the results indicate that not all aspects of flow evoke enjoyment. The results from categorizing flowers and non-flowers indicate the 39% of the sample experienced flow in the activity reporting from. Flowers significantly differed from non-flowers in overall engagement, autotelic personality, and the enjoyment subscales of competence, engagement and pleasure. The subscale of challenge/ improvement was not different in the different classes highlighting the need for more research. Further research is needed to validate factor mixture modeling as a method for categorizing flowers and non-flowers, and can allow older datasets to provide invaluable insights.

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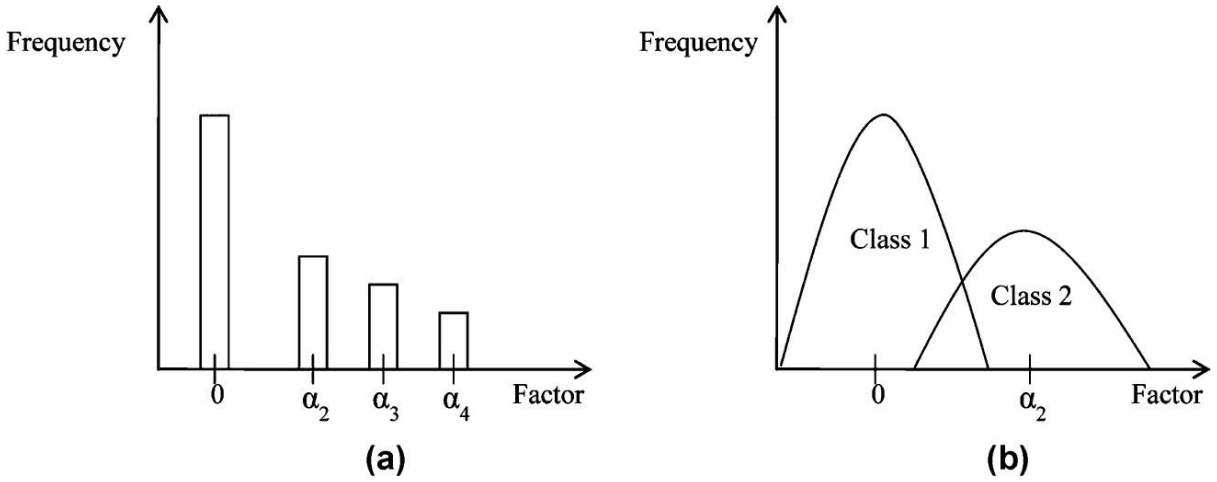
Appendix A

Factor mixture modeling

Factor mixture models (FMM) combine latent categorical and continuous variables to understand phenomena and situations that require the model to be simultaneously continuous and categorical (Clark, Muthén, Kaprio, D'Onofrio, Viken, & Rose, 2013; Muthén, 2006). Latent categorical variables, such as groups or subgroups in a population, are usually found by using latent class analysis (LCA) and latent continuous variables or groupings of items are found by factor analysis (FA). FMM's give a class variable that groups respondents and a factor variable that gives the difference in a continuous latent variable across and within the groups (Clark, 2013; Muthén, 2006). FMM's can vary depending on if the factor means, loadings, variance and intercepts are held constant or not across classes. The first model investigated in this study fixes everything but the factor means across the different classes. This type of FMM is often called Latent class factor analysis, but I will refer to the model as FMM1. FMM1 is the simplest model to make and interpret, but requires measurement invariance across the sample (Clark et al., 2013). The second model investigated in this study is a model where the factor means and variance are estimated separately for each class. This

model is often referred to as a mixture factor analysis, but I will call this model FMM2 to more easily distinguish between the two models. These two models can be represented graphically as shown in figure 5. Figure 5a represents a FMM1 model with four classes. The height of the bars show how many participants fall in that class and the further along the x-axis the bars are the higher the factor mean for that class is. Figure 5b represents a FMM2 with two classes. Because the factor variance is estimated separately for each class the classes are no longer represented by bars, but by distributions. The main difference between FMM1 and FMM2 is that FMM2 allows for heterogeneity within classes. Further relaxation of different parameters such as factor loadings and intercepts are possible, but make the model interpretation more difficult (Clark et al., 2013). Such models allow for different latent factors in different classes in the same sample and could be relevant for future research, however it is beyond the scope of this study.

Figure 5



Note: Taken from Clark et al. (2013)

When building the model recommendations from Clark et al. (2013) were followed. Clark et al. (2013) suggest first fitting a series of LAC's and FA's to the sample and then making a series of FMM's with first one factor and two classes, then one factor and three classes and so on until reaching the number of classes determined in the initial LCA's. Further FMM's with two factors and two classes are then made and remade with increasing the number of classes. This pattern of increasing the classes with a set number of factors, then starting over with one more factor and again increasing the number of classes is repeated until the number of classes and factors have both reached the highest number determined to be the best fit in the initial LCA's and FA's for all types of FMM's that are to be modeled. Clark et al. (2013) recommend starting with the most restricted model and then continuously relaxing criterion. The best fitting FMM often includes less classes or factors than the best fitting LCA's and FA's because including both in the model allows for more parsimonious explanation of the data (Clark et al., 2013).

Determining what model is the best is done by looking at fit statistics such as log likelihood (logL), Akaike's information criterion (AIC: Akaike, 1987), Bayesian information criterion (BIC; Schwartz, 1978), and sample-size adjusted BIC (ABIC; Sclove,1987) as well as considerations from theory (Nylund, Asparouhov, & Muthén, 2007; Clark et al., 2013; Muthén, 2006). LogL is used to assess the overall fit between the model and the data. Further AIC, BIC and ABIC are used because LogL can be made bigger by simply adding more parameters, which AIC and BIC take into account (Muthén, 2006). Finally a likelihood ratio test (LMR; Lo, Mendell, & Rubin, 2001) is used to check the model with *k* classes vs *k-1* classes, where a significant result means *k* classes is a better fit over *k-1* classes. LMR tests are only applicable to analysis that model classes, so not FA, and only between different numbers of classes within the same type of analysis (Clark et al., 2013). The other measures can be compared across different types of analysis. Higher LogL and lower AIC, BIC and

ABIC indicate a better model fit (Nylund et al., 2007; Clark et al., 2013; Muthén, 2006). Other statistics for the individual tests are also considered, such as eigenvalues, factor loadings and cross loadings for the FA's (Field, 2017), percentage of members is classes and general entropy for LCA's (Field, 2017) and FMM's (Muthén, 2006) and finally considerations from theory (Clark et al., 2013).

Model building

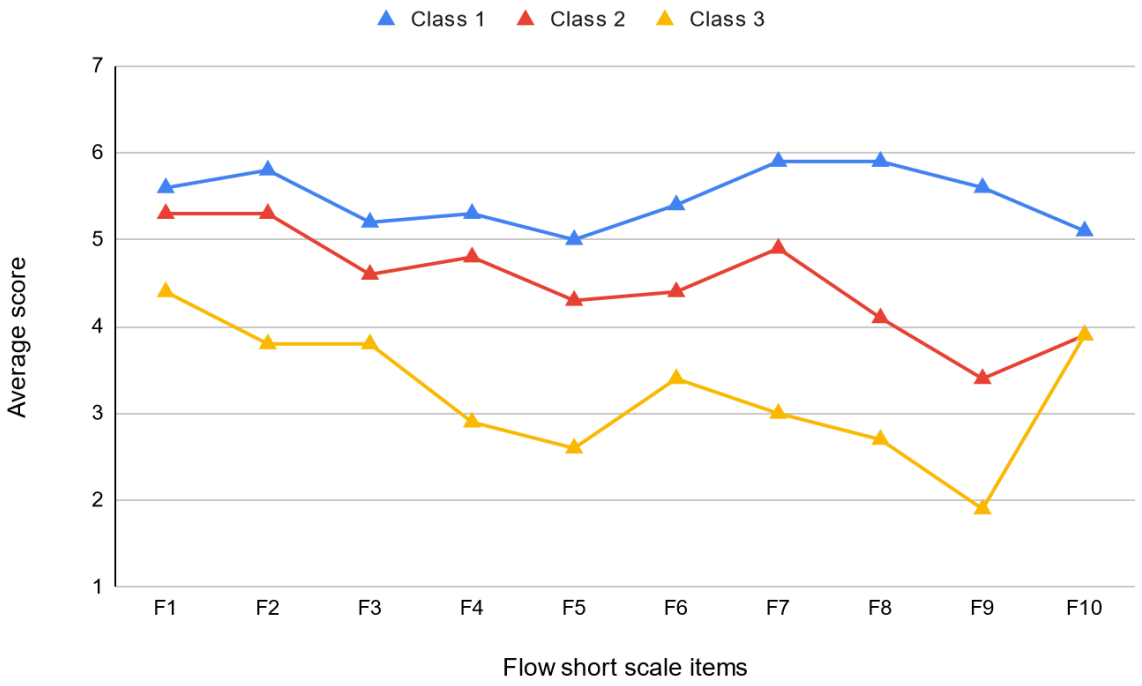
All analysis for building the model was done in M*plus* (ver 7.3; Muthén & Muthén, 2013) based on robust maximum likelihood estimation.

LCA results

A series of latent class analysis with classes ranging from two to four were done using the 10 items from the Flow short scale (Engeser & Reinberg, 2008). Fit statistics are presented in table 6. The three class solution was chosen as the best due to the LMR being significant. Adding more classes did improve other fit statistics such as AIC, BIC and ABIC, but the LMR test was not significant indicating that a preference for *k* versus *k-1* classes was not found. The estimated class percentages are, from highest to lowest flow scores are class 1 (n = 112, 39%), class 2 (n = 132, 46%) and class 3 (n = 43, 15%). As shown in figure 6 the item average scores of the ten flow items were parallel among classes suggesting an ordering of classes.

Figure 6

Latent class analysis profile ($N = 287$)



Note: x-axis lists the items on the Flow short scale (Engeser & Reinberg, 2008) and the y-axis shows the average scores on the item per class from the LCA. Estimated class sizes are Class 1 ($n = 112$, 39%) Class 2 ($n = 130$, 45%) Class 3 ($n = 45$, 16%)

FA results

An exploratory factor analysis revealed three factors with eigenvalues above one: 3.97, 1.31 and 1.23 respectively. However the two and three factor solutions all had significant cross loading on several items. Furthermore the one factor solution had acceptable loadings of above .3 on all items (Castello & Osborne, 2005). Finally the one factor solution for the Flow short scale has been established in other research (Engeser & Reinberg, 2008).

Based on this and the fact that LogL stays constant as more factors are added, the one factor solution was chosen as the best solution.

Factor mixture models

Based on LCA and FA results, models with one factor and two or three classes were fitted to the data. Fit statistics are shown in table 6. The model with the best BIC is a FMM1 model with two classes. The difference in the fit statistics across models is not large however, BIC only moves 19 points from the model with the best fit, FMM1 with two classes to the model with the worst fit, FMM2 with three classes. None of the models have a significant LMR indicating that there is no clear preference for either two or three class solutions.

Entropy was best for the FMM2 with two classes indicating that this model had the highest certainty when placing participants in classes. However, entropy has been shown to be a poor decision criterion for model selection (Sinha et al., 2021). Considerations from theory would favor the FMM2 with two classes. It assumes that flow has a bimodal distribution with two peaks representing flowers and non-flowers. The within class variation of the factor is assumed to show the difference in intensity of flow experience. The FMM1 model would group respondents in classes, but then assume that all participants in each class experienced the exact same amount of flow or in other words that there is complete homogeneity within classes (Clark et al., 2013). This clashes with the models of flow described in the background section (see figure 2) indicating that a FMM2 type model should be selected. However, factor mixture modeling requires quite large sample sizes to work properly (Sinha et al., 2021). Henson et al. (2007) recommends at least 300 participants and preferably 500 or more. The results from the FMM in the current study should therefore be interpreted with caution. More relaxed models also require even larger samples (Clark et al., 2013). While a FMM2 model would be most appropriate given theory, a FMM1 model is selected in the current study due

to sample size considerations. Interestingly the FMM1 with three classes and FMM2 with two classes both produce the same 44 respondents as a non flow group and the rest either in one big group (FMM2 two classes) or in two smaller groups (FMM1 three classes). In the FMM1 three classes solution the classes can be interpreted as two non-flow groups (n = 44 and n = 132) and a flow group (n = 112). The average scores on the flow short scale for each of the three classes are shown in figure 7.

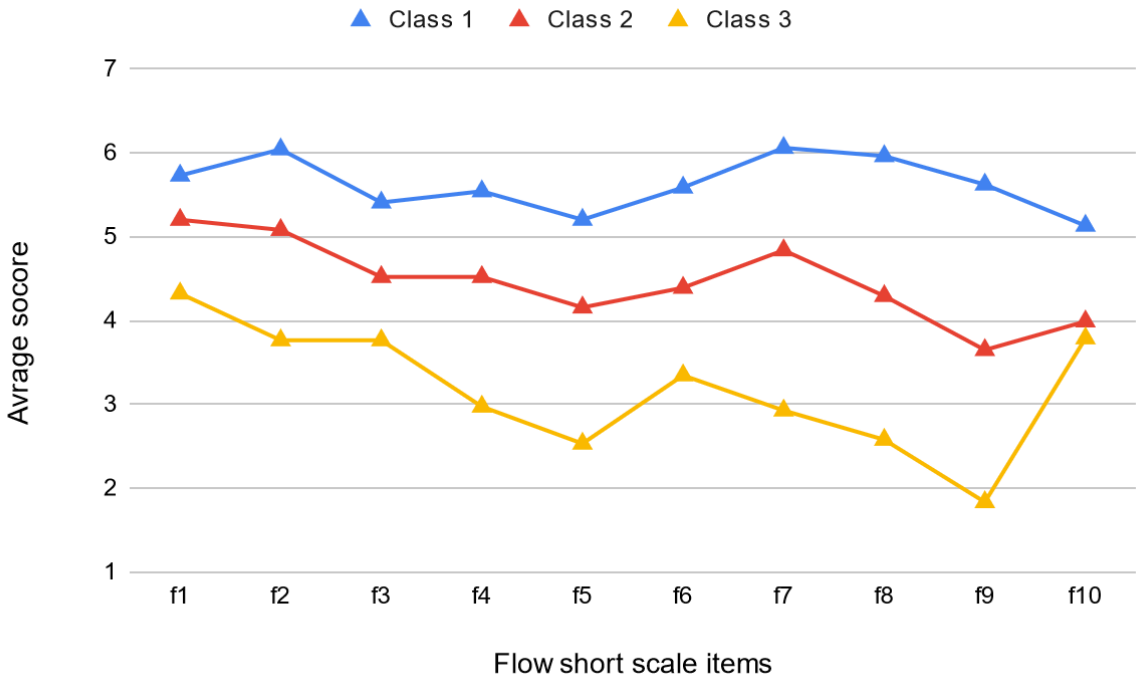
Table 6

Fit statistics for the different models (N = 287)

Model	LogL	Par.	Entropy	AIC	BIC	ABIC	*p*LMR
Latent Class analysis							
2c	-5051.911	31	.818	10165.822	10279.266	10180.962	0.0266
3c	**-4959.487**	**42**	**.852**	**10002.974**	**10156.672**	**10023.485**	**0.0103**
4c	-4881.415	53	.864	9868.829	10062.782	9894.713	0.1933
Factor analysis							
1f	**-4781.556**	**30**	**-**	**9998.740**	**10108.524**	**10013.391**	**-**
2f	-4781.556	39	-	9811.184	9953.903	9830.230	-
3f	-4781.556	47	-	9690.903	9862.898	9713.856	-
FMM 1							
1f 2c	-4963.109	32	.615	9990.218	10107.322	10005.846	0.3779
1f 3c	**-4961.318**	**34**	**.630**	**9990.636**	**10115.058**	**10007.241**	**0.6098**
FMM 2							
1f 2c	**-4963.043**	**33**	**.764**	**9992.086**	**10112.849**	**10008.202**	**0.6222**
1f 3c	-4961.191	36	.626	9994.382	10126.123	10011.963	0.2589

Note: N = 287. Par. = number of estimated parameters; AIC = Akaike's information criterion; BIC = Bayesian Information Criterion; ABIC = sample-size adjusted BIC; *p*LMR = Lo–Mendell–Rubin test.

Figure 7



Note: x-axis lists the items on the Flow short scale (Engeser & Reinberg, 2008) and the y-axis shows the average scores on the item per class from the FMM1 three class solution. Class sizes are Class 1 (n = 112, 39%) Class 2 (n = 132, 46%) Class 3 (n = 43, 15%).

In addition to classification, factor mixture modeling gives a factor mean for each class. These factors are based on the ten flow items from the Flow short scale (Engeser & Reinberg, 2008) and represent a global flow score. Table 7 shows the factor loading, intercepts, means and variance for each class. The top part shows factor loadings and item intercepts. The factor loading for F1 (the first item from the flow short scale) is fixed at 1 to set the scale for the model. Factor loading, intercepts and variance is held equal across classes. All items load significantly on the factor further validating a one factor model. The bottom part shows the factor mean and variance. The third class has its mean fixed at zero to give a reference for the other classes. The factor scores for the other two classes are 1.16 (Class 1) and 0.65 (Class 2). The factor scores are all significantly different from the factor score of the third class.

Table 7

Factor loading, intercepts, means and variance for each class in the FMM1 three class solution (N = 287)

	Factor loadings			Item intercepts		
Items	Class 1	Class 2	Class 3	Class 1	Class 2	Class 3
F1	1.00[a]	1.00[a]	1.00[a]	5.18*	5.18*	5.18*
F2	1.73*	1.73*	1.73*	5.09*	5.09*	5.09*
F3	1.34*	1.34*	1.34*	4.63*	4.63*	4.63*
F4	2.05*	2.05*	2.05*	4.49*	4.49*	4.49*
F5	2.06*	2.06*	2.06*	4.13*	4.13*	4.13*
F6	1.86*	1.86*	1.86*	4.52*	4.52*	4.52*
F7	2.43*	2.43*	2.43*	4.80*	4.80*	4.80*
F8	2.71*	2.71*	2.71*	4.43*	4.43*	4.43*
F9	3.00*	3.00*	3.00*	3.86*	3.86*	3.86*
F10	1.31*	1.31*	1.31*	4.28*	4.28*	4.28*
Factor mean	1.16*	.65*	0[a]			
Factor variance	.03	.03	.03			

Note: * $p<.001$, [a] fixed parameter.

Appendix B: Questionnaire

Information and consent sheet

Personlighet, glede og flyt

Side 1

Obligatoriske felter er merket med stjerne *

Hei!
Takk for at du deltar i dette forskningsporsjektet om personlighet, glede og flyt.
Undersøkelesen er annonym og tar 10-15 min. Det er ingen rette eller gale svar.

Du kan avbryte undersøkelsen når som helst om du ikke vil fortsette.
Du samtykker til å delta ved å trykke "send" på siste side.

Om du har spørsmål, kontakt: aslakoba@stud.ntnu.no

Hello!
Thank you for participating in this research project on personality, enjoyment and flow.
The survey is anonymous and takes 10-15 minutes. There are no right or wrong answers.

You can cancel the survey at any time if you do not want to continue.
You agree to participate by pressing "send" on the last page.

If you have any questions, contact: aslakoba@stud.ntnu.no

Demographic variables

*

Hvilket kjønn identifiserer du deg som?

Whan gender do you identify as?

- ◯ Kvinne / Female
- ◯ Mann / Male
- ◯ Annet / Other
- ◯ Ønsker ikke å oppgi / Do not wish to state

*

Hvor gammel er du? (skriv svar i antall år)

How old are you? (answer in number of years)

*

Hva er din høyest gjennomførte utdanning?

What is your highest completed education?

- ◯ Grunnskole / Elementary school
- ◯ Videregående skole eller yrkesfag / Highschool
- ◯ Bachelorgrad / Bachelor's degree
- ◯ Mastergrad / Masters
- ◯ Doktorgrad / Doctorate
- ◯ Annet / Other
- ◯ Ønsker ikke å oppgi / Do not wish to state

Flow proneness scale

Hvor enig eller uenig er du med følgende påstander?

How much do you agree or disagree with the following statements?

	Helt uenig / Completely disagree	Delvis uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or disagree	Delvis enig / Somewhat agree	Helt enig / Completely agree
Jeg liker utfordrende oppgaver/aktiviteter som krever mye fokus / I enjoy challenging tasks/activities that require a lot of focus *	○	○	○	○	○
Når jeg fokuserer på noe, glemmer jeg fort det som skjer og/eller er rundt meg (f.eks. andre personer, tid og sted) / When I am focused on a task/activity, I quickly tend to forget my surroundings (other people, time, and place) *	○	○	○	○	○
Jeg opplever som regel en god flyt i det jeg holder på med (ting er verken for lett eller for vanskelig for meg) / I usually experience a good flow when I do something (things are neither too easy nor too difficult for me) *	○	○	○	○	○
Jeg har flere ulike interesseområder / I have several different areas of interest *	○	○	○	○	○
Det er vanskelig for meg å gå ifra eller avslutte et prosjekt jeg holder på med / It is difficult for me to walk away from or quit a project I am currently working on *	○	○	○	○	○
Jeg blir stresset i møte med vanskelige/utfordrende oppgaver / I become stressed in the face of difficult/challenging tasks *	○	○	○	○	○

Det er vanskelig for meg å opprett-holde konsentrasjon over tid / It is difficult for me to maintain concen-tration over time *	○	○	○	○	○
Jeg blir fort lei av ting jeg holder på med / I quickly become tired of things I do *	○	○	○	○	○
Jeg blir som regel fornøyd med re-sultatet av innsatsen min på tvers av oppgaver (opplever mestringsfø-lelse) / I am usually satisfied with the results of my efforts across va-rious tasks (I experience feelings of mastery) *	○	○	○	○	○
Når jeg fokuserer på noe, glemmer jeg ofte å ta pause / When I focus on something, I often forget to take a break *	○	○	○	○	○
Jeg kjeder meg fort / I get bored easily *	○	○	○	○	○
Mine daglige gjøremål er utmatten-de fremfor stimulerende / My daily tasks are exhausting rather than stimulating *	○	○	○	○	○
Jeg utvikler interesse for det meste jeg holder på med i livet / I develop an interest for most of the things I do in life *	○	○	○	○	○

Side 4

Obligatoriske felter er merket med stjerne *

Tenk på en aktivitet du gjør ***jevnlig*** og som du har gjort ***i løpet av de siste to ukene***. Det kan være en sport, en form for trening, et spill/brettspill, matlagning, hagearbeid, maling, skriving, lesing, spille et instrument eller en annen aktivitet du gjør regelmessig. Vennligst svar på spørsmålene angående dem ***siste økten*** du hadde med aktiviteten.

Think of an activity that you do ***regularly*** and that you have done ***in the last two weeks***. It can be a sport, a form of exercise, playing a game/board game, cooking, gardening, painting, writing, reading, playing an instrument or any other activity you do regularly. Please answer the following questions in regard to ***the last session*** you had doing the activity

The ENJOY scale

Side 5

Obligatoriske felter er merket med stjerne *

Tenk på aktiviteten du gjorde og svar på hvor godt utsagnene passer med sist gang du gjorde aktiviteten.

Think about the activity you did and how well the statements fit with the last time you did the activity.

	Sterkt uenig / Strongly disagree	Uenig / Disagree	Litt uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or dis-agree	Litt enig / Somewhat agree	Enig / Agree	Sterkt enig / Strongly agree
Aktiviteten lot meg utvikle nye ferdigheter / The activity allowed me to develop new skills *	○	○	○	○	○	○	○
Aktiviteten gledet meg / The activity was pleasurable to me *	○	○	○	○	○	○	○
Jeg glemte hva som skjedde utenom aktiviteten / I lost track of what was going on outside of the activity *	○	○	○	○	○	○	○
Jeg følte meg tilknyttet andre under aktiviteten / I felt connected with others during the activity *	○	○	○	○	○	○	○
Aktiviteten gjorde meg lykkelig / The activity made me feel happy *	○	○	○	○	○	○	○

Obligatoriske felter er merket med stjerne *

Tenk på aktiviteten du gjorde og svar på hvor godt utsagnene passer med sist gang du gjorde aktiviteten.

Think about the activity you did and how well the statements fit with the last time you did the activity.

	Sterkt uenig / Strongly disagree	Uenig / Disagree	Litt uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or dis-agree	Litt enig / Somewhat agree	Enig / Agree	Sterkt enig / Strongly agree
Jeg følte meg veldig dyktig mens jeg holdt på med aktiviteten / I felt very capable during the activity *	○	○	○	○	○	○	○
Jeg følte meg utfordret, men ikke over-utfordret under aktiviteten / I felt challenged, but not over-challenged, during the activity *	○	○	○	○	○	○	○
Jeg likte å interagere med andre under aktiviteten / I liked interacting with others during the activity *	○	○	○	○	○	○	○
Aktiviteten var gøy / The activity was fun *	○	○	○	○	○	○	○
Jeg utviklet evnene mine sist jeg gjorde aktiviteten / I improved my skills the last time I did the activity *	○	○	○	○	○	○	○

Obligatoriske felter er merket med stjerne *

Tenk på aktiviteten du gjorde og svar på hvor godt utsagnene passer med sist gang du gjorde aktiviteten.

Think about the activity you did and how well the statements fit with the last time you did the activity.

	Sterkt uenig / Strongly disagree	Uenig / Disagree	Litt uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or disagree	Litt enig / Somewhat agree	Enig / Agree	Sterkt enig / Strongly agree
Jeg er god til å gjøre aktiviteten / I am good at the activity *	○	○	○	○	○	○	○
Jeg glemte hva som skjedde rundt meg mens jeg holdt på med aktiviteten / I forgot what was going on around me during the activity *	○	○	○	○	○	○	○
Jeg glemte tiden mens jeg holdt på med aktiviteten / I lost track of time during the activity *	○	○	○	○	○	○	○
Mens jeg holdt på med aktiviteten tenkte jeg ikke på noe annet / When I did the activity, I thought about nothing else *	○	○	○	○	○	○	○
Under aktiviteten kunne jeg bli flinkere til å gjøre den / During the activity I could get better at doing it *	○	○	○	○	○	○	○

Obligatoriske felter er merket med stjerne *

Tenk på aktiviteten du gjorde og svar på hvor godt utsagnene passer med sist gang du gjorde aktiviteten.

Think about the activity you did and how well the statements fit with the last time you did the activity.

	Sterkt uenig / Strongly disagree	Uenig / Disagree	Litt uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or disagree	Litt enig / Somewhat agree	Enig / Agree	Sterkt enig / Strongly agree
Jeg samarbeidet med andre under aktiviteten / I cooperated with others during the activity *	○	○	○	○	○	○	○
Jeg likte å holde på med aktiviteten / I liked doing the activity *	○	○	○	○	○	○	○
Jeg følte meg utfordret, men ikke under-utfordret under aktiviteten / I felt challenged, but not under-challenged, during the activity *	○	○	○	○	○	○	○
Aktiviteten var en delt innsats med andre / The activity was a shared effort with others *	○	○	○	○	○	○	○
Jeg fikk ikke med meg hva som skjedde rundt meg mens jeg holdt på med aktiviteten / I lost track of what was going on around me during the activity *	○	○	○	○	○	○	○

Obligatoriske felter er merket med stjerne *

Tenk på aktiviteten du gjorde og svar på hvor godt utsagnene passer med sist gang du gjorde aktiviteten.

Think about the activity you did and how well the statements fit with the last time you did the activity.

	Sterkt uenig / Strongly disagree	Uenig / Disagree	Litt uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or disagree	Litt enig / Somewhat agree	Enig / Agree	Sterkt enig / Strongly agree
Jeg følte meg nær andre når jeg gjorde aktiviteten / I felt close to others when I did the activity *	○	○	○	○	○	○	○
Sist jeg gjorde aktiviteten følte jeg at jeg gjorde en god jobb / I felt like I did a good job the last time I did the activity *	○	○	○	○	○	○	○
Jeg var dyktig i aktiviteten / I was proficient in the activity *	○	○	○	○	○	○	○
Jeg følte meg kompetent til å utføre aktiviteten / I felt competent at performing the activity *	○	○	○	○	○	○	○
Aktiviteten fikk meg til å føle meg bra / The activity made me feel good *	○	○	○	○	○	○	○

The Flow short scale

Obligatoriske felter er merket med stjerne *

Tenk på aktiviteten du gjorde og svar på hvor godt utsagnene passer med sist gang du gjorde aktiviteten.

Think about the activity you did and how well the statements fit with the last time you did the activity.

	Sterkt uenig / Strongly disagree	Uenig / Disagree	Litt uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or dis-agree	Litt enig / Somewhat agree	Enig / Agree	Sterkt enig / Strongly agree
Jeg opplever akkurat passe mye ut-fordring / I feel just the right amount of challenge *	○	○	○	○	○	○	○
Tankene og handlingene mine går jevnt/som av seg selv / My thoughts/activities run fluidly and smoothly *	○	○	○	○	○	○	○
Jeg merker ikke at tiden går / I don't notice time passing. *	○	○	○	○	○	○	○
Jeg har ingen vansker med å kon-sentrere meg / I have no difficulty concentrating *	○	○	○	○	○	○	○
Tankene mine er helt klare / My mind is completely clear *	○	○	○	○	○	○	○

Obligatoriske felter er merket med stjerne *

Tenk på aktiviteten du gjorde og svar på hvor godt utsagnene passer med sist gang du gjorde aktiviteten.

Think about the activity you did and how well the statements fit with the last time you did the activity.

	Sterkt uenig / Strongly disagree	Uenig / Disagree	Litt uenig / Somewhat disagree	Verken enig eller uenig / Neither agree or disagree	Litt enig / Somewhat agree	Enig / Agree	Sterkt enig / Strongly agree
Jeg er helt oppslukt av det jeg holder på med / I am totally absorbed in what I am doing *	○	○	○	○	○	○	○
De riktige tankene og bevegelsene skjer av seg selv / The right thoughts/movements occur of their own accord *	○	○	○	○	○	○	○
Jeg vet hva jeg må gjøre hele tiden / I know what I have to do each step of the way *	○	○	○	○	○	○	○
Det føles som om jeg har kontroll på alt / I feel that I have everything under control *	○	○	○	○	○	○	○
Jeg er helt i mine egne tanker / I am completely lost in thought *	○	○	○	○	○	○	○

Variables about the activity

Obligatoriske felter er merket med stjerne *

*

Hvilke aktivitet tenkte du på når du svarte?

What activity were you thinking of when you answered?

*

Hvor ofte driver du med aktiviteten?

How often do you do the activity?

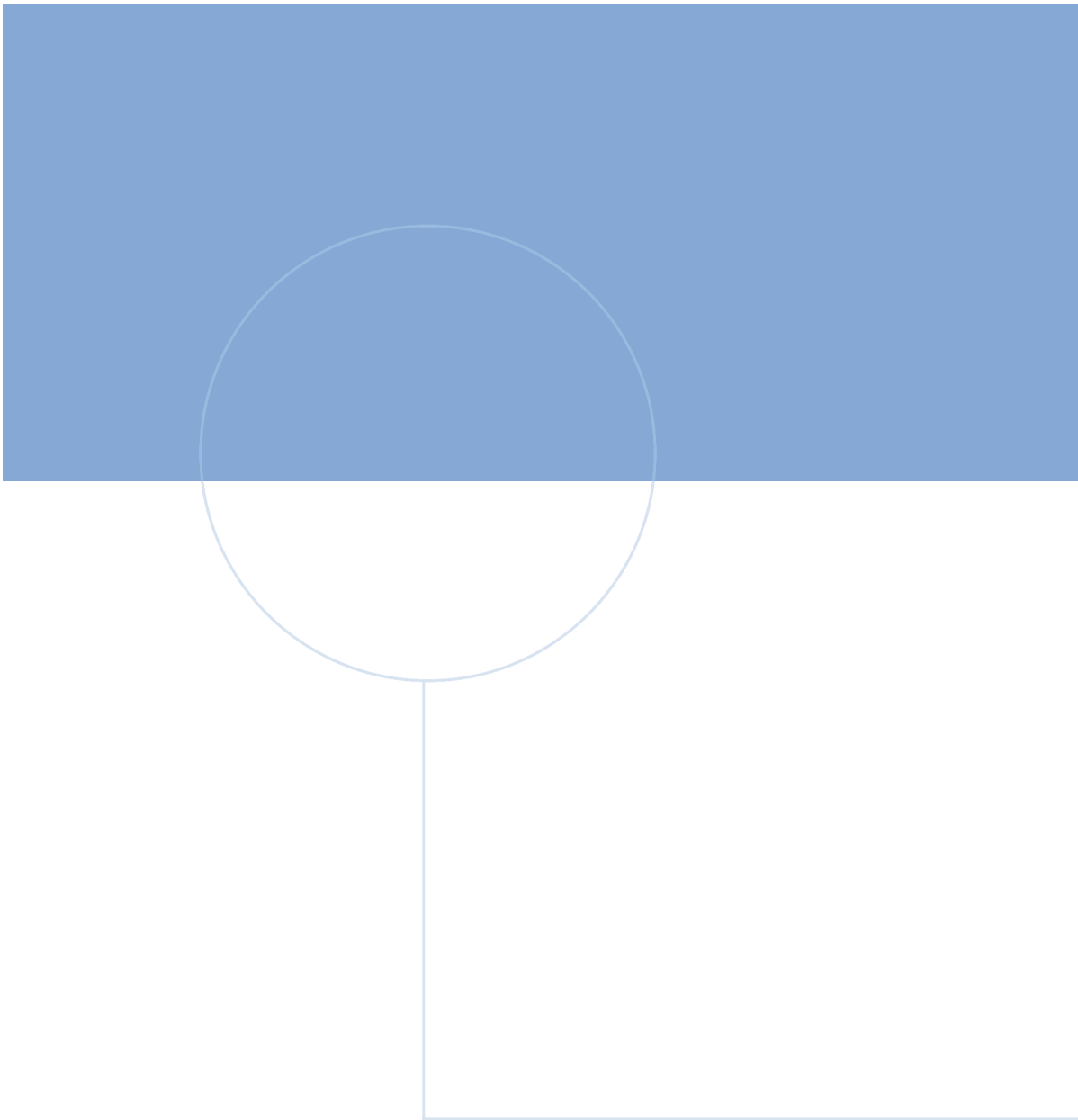
- ○ Daglig / Every day
- ○ 4 -6 ganger i uken / 4 -6 times a week
- ○ 2 -3 ganger i uken / 2 -3 times a week
- ○ Ukentlig / Every week
- ○ 2-3 ganger i måneden / 2-3 times a month
- ○ En gang i måneden / Once a month
- ○ Mindre enn en gang i måneden / Less than once a month

*

Hvor lenge har du holdt på med aktiviteten ?

How long have you been doing the activity?

- ○ Under 6 måneder / Less than six months
- ○ 6 måneder - 1 år / 6 months - 1 year
- ○ 1 - 2 år / 1 - 2 years
- ○ 2 - 4 år / 2 - 4 years
- ○ 4 - 8 år / 4 - 8 years
- ○ Mer enn 8 år / More than 8 years



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