9-2003

A Longitudinal Examination of Flow as a Predictor of Recreational Exercise

Brian Michael Chichester

LOMA LINDA UNIVERSITY
Graduate School

A Longitudinal Examination of Flow as a Predictor of Recreational Exercise

by

Brian Michael Chichester

A Doctoral Project submitted in partial satisfaction
of the requirements for the degree of
Doctor of Psychology

September 2003

Each person whose signature appears below certifies that this Doctoral Project in his or her opinion is adequate, in scope and quality, for the degree of Doctor of Psychology.

________________________________, Chairperson
Leslie R. Martin, Associate Professor of Psychology, La Sierra University

____
Kendal Boyd, Assistant Professor of Psychology

____
John Flora-Tostado, Associate Professor of Psychology

ACKNOWLEDGEMENTS

Sincere thanks and appreciation to my research chair, Leslie R. Martin, Ph.D., a role model and a mentor, whose professional support, guidance, and encouragement gave me vital inspiration and motivation when I needed it most. Acknowledgements to my committee members, John Flora-Tostado, Ph.D., and Kendal Boyd, Ph.D., for your support, insightful feedback, and critical inquiry. To Mihalyi Csikszentmihalyi, Ph.D.: Sincerest appreciation for meeting with me during the course of my research, and for your warmth, wisdom, and compassionate support when it most mattered. To Mr. Don Sease and Ms. Jennifer DeWitt at the Drayson Center: I am eternally grateful for your enthusiastic endorsement of my work and for the use of your fine facility. To Ms. Hsinya Lo for your unfailing logistical assistance and support. Finally, acknowledgements to the Drayson Center members who gave their time and feedback.

DEDICATION

To my first and best teachers: my parents, Michael and Margaret. To my first and best classmates: my sisters and brother, Nancy, Kathleen, and James. To my first and best classroom: the kitchen table.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

A Longitudinal Examination of Flow as a Predictor of Recreational Exercise

by

Brian Michael Chichester

Doctor of Psychology
Loma Linda University, September 2003
Dr. Leslie R. Martin, Chairperson

Flow state is a valued psychological state of enjoyment and well-being. It is characterized by feelings of intrinsic self-reward and marked by nine dimensions theorized to contribute to flow state. Flow has been studied mostly in elite athletes, whom report highly lucid flow experiences; to a much lesser extent it has been studied in recreational exercisers. Most prior research methodologies involve experience sampling or qualitative techniques, such as interviewing. Only one demonstrably valid and reliable flow instrument is widely available for efficient, quantitative measure of flow experiences. This study measures flow longitudinally in a recreational exercising population by comparing a new flow instrument with the established one. The new instrument's psychometric properties are analyzed, and measures of convergent and divergent validity are provided, as well as internal consistency and factor structure. This study also examines the predictive powers of the new instrument and the existing instrument in predicting exercise frequency at four-month follow-up.

Introduction

Flow is a valued psychological state of enjoyment and well-being. Characterized by feelings of intrinsic self-reward and optimal experience, flow is marked by the presence of nine dimensions believed to contribute to flow state (Jackson, 1996; Csikszentmihalyi, 1992; Csikszentmihalyi, 1985). Flow has been observed in exercising populations at the elite and recreational levels, (Jackson, 1996; Stein, Kimiecik, Daniels & Jackson, 1995; Jackson, 1995; Jackson, 1992) and in extremely diverse populations, including artists, dancers, surgeons, scientists, martial artists, musicians, chess players, rock climbers, men, women, adolescents, as well as blue-collar, white-collar, and clerical workers (Csikszentmihalyi, 1992; Csikszentmihalyi, 1985; Jacobs, 1994; Csikszentmihalyi & LeFevre, 1989; Massimini & Csikszentmihalyi, 1987). Flow research has been conducted in the United States of America, Canada, Germany, Italy, Australia, and Japan (Csikszentmihalyi, 1992; Jackson, 1996).

Flow is also referred to as optimal experience. Its utility as a measure lies in its function as a proxy for intrinsic motivation, happiness, and self-fulfilled engagement (Csikszentmihalyi & Patton, 1997; Csikszentmihalyi, 1992; Jackson, 1992; Parr, Montgomery and DeBell, 1998). A flow state, in this sense, is a self-sustaining, health-promoting, phenomenological, and psychological reinforcer. Better understanding flow and its dimensional components, especially flow's development over time and its utility as a predictor variable, will increase the utility of Flow Theory in applied settings. Thus far, practical adaptations of Flow Theory in applied settings have seen slower to progress than its theoretical development and refinement.

The Construct

The nine dimensions that comprise flow state as originally described by Csikszentmihalyi (1992) are:

Balance between challenge and skill. This dimension requires an appropriate balance between the challenge of an activity and the skill required to perform it. The overwhelming proportion of optimal experiences are reported to occur within sequences of activities that are goal-directed and bounded by rules—activities that require the investment of psychic energy and activities that could not be done without the appropriate skills. Skill and challenge need not be elaborate or elitist; reading, for example, is one of the most frequently mentioned flow activities world over. Regardless of the activity or skill involved, the balance between the challenge of the activity and the skill of the performer must be carefully matched to provide continual challenge, without leading to anxiety (low skill, high challenge), boredom (high skill, low challenge), or apathy (low skill, low challenge.)

Merging of action and awareness. Called one of the most universal and distinctive features of optimal experience, the merging of action and awareness is what happens when individuals become so involved in what they are doing that the activity becomes spontaneous, even automatic. Individuals experiencing flow stop being aware of themselves as separate entities from the actions they are performing.

Clear goals. Flow activities, by nature, tend to be structured, organized, and contain clear goals or objectives. Sporting events, surgery, rock climbing, dance, and chess playing are common examples. Other activities, such as artistic ventures, contain more abstract goals that depend on individuals possessing a strong personal sense of what they hope to accomplish; for example, a painter hoping to paint an abstract work that represents a particular emotional or social state. Unlike still-life paintings, where the painter replicates a scene or subject, an abstract painter, for example, must rely on an internal, intuitive sense of what he or she hopes to convey through the work, rather than merely hoping to emulate the design and appearance of an objective, external subject.

Unambiguous feedback. Clear, unambiguous feedback on performance is another dimension of flow experience. Feedback in athletic and sporting events is often obvious: Scoring a point, executing a difficult maneuver, completing an exercise set or repetition, or returning a tennis ball or badminton shuttle over the net. Other activities contain abstract feedback that nevertheless remains clear and unambiguous: Rock climbers witness their ascent inch by inch up a wall; chess players see their strategies directing them toward or away from mate, while carefully avoiding being mated by their opponents; individuals caring for plants or animals watch them flourish or sicken over time, depending on the quality and quantity of care given.

Concentration on the task at hand. Focusing concentration until only a small number of necessary stimuli are allowed to enter awareness is another frequently mentioned experience in flow. While concentration lasts, one is able to forget about irrelevant stimuli in order to accomplish the task at hand.

A paradox of control. Although flow experience requires an inherent element of skill-challenge balance, the sensation of control over the skill is paradoxically described as effortless. Flow experience is typically described as involving a sense of mastery or control—or, more precisely, as lacking worry about control. It is the *possibility* of being in control and the pursuit thereof, not necessarily the *actuality* of control that seems to define this flow dimension.

Loss of self-consciousness. During the process of concentration, as stimuli are selectively weeded out of conscious awareness, awareness of the self, too, fades in flow experiences. This loss of the sense of self from the external environment is sometimes accompanied by a feeling of unity with the environment, so much so that the individual in flow may report "being one" with the activity. Loss of self-consciousness does not involve a loss of self, and certainly does not a loss of consciousness. Rather, it's a loss of consciousness *of* the self. In other words, it refers to a lack of focus upon information we normally use to represent to ourselves who we are when experiencing a loss of self-consciousness.

Transformation of time. Time distortion is a commonly reported dimension of flow experience, though it has been reported to be one of the less universally endorsed dimensions by athletes in sport, possibly because some sporting activities require, by their nature, a high degree of time cognizance. In this dimension, the safest generalization to make is that the perception of time changes, so that it bears little resemblance to the actual passage of time as measured chronologically.

Autotelic experience. Chief amongst flow dimensions is the autotelic experience, or the feeling that the experience or activity is intrinsically rewarding. The term autotelic derives from two Greek words, *auto* meaning "self" and *tells* meaning "goal." It refers to a self-contained activity, one that is done not with the expectation of some future benefit, but simply because the doing itself is the reward.

Historical Context of the Construct

Research on Flow Theory began in the mid-1960s with exploratory work by Getzels and Csikszentmihalyi that examined creative thinking and discovery in art students. This work was expanded in 1970 with the publication of Csikszentmihalyi's doctoral thesis (Csiskzentmihalyi & Getzels, 1970), which closely examined the notions of creativity and the creative process in young, highly talented, art students. It was followed by a similar work in 1971 (Csikszentmihalyi & Getzels, 1971). Results of these two works were summarized and published in 1976 in a book by Getzels and Csikszentmihalyi entitled *The Creative Vision.* From this point, Csikszentmihalyi's interest in the attitudes and cognitive constructs of creative individuals and their motivations led to further research with more distinguishable flow-oriented themes (Csikszentmihalyi, 1975), including the first book to directly describe flow experience and one often quoted by flow researchers (Csikszentmihalyi & LeFevre, 1989; Jackson, 1996; Massimini & Csikszentmihalyi, 1987). A summary of flow research was published and later revised (Csikszentmihalyi, 1988; Csikszentmihalyi, 1992). The revised edition is what the author described as the first publication on flow for the general reader on educating individuals about flow-based self-improvement and the attainment of happiness.

As a theory, flow is a phenomenological description of optimal experience; it is a measure of engaged fulfilment. Flow Theory posits that a flow state occurs when an individual participates in a clearly defined, goal-oriented activity (usually an activity deemed enjoyable), whereby the individual's skill to meet the activity and the challenge of the activity, itself, are balanced. The phenomenological flow state is enhanced and deepened when the individual receives immediate feedback regarding performance, creating an inner-motivational "loop" such that attentional focus increases in a manner that is ordered and fully invested, resulting in a satisfying sense of total engagement and, consequently, a deeper flow state (Csikszentmihalyi, 1997; Csikszentmihalyi, 1992).

Flow Theory suggests that flow may be elicited with practice, and that some individuals may exhibit strong pro-flow personalities ("autotelic personalities"). Csikszentmihalyi describes such individuals as those who need "few material possessions and little entertainment, comfort, power or fame because so much of what he or she does is already rewarding" (1997). Autotelic personalities appear similar to the notion of temperaments and may remain steady through time without intervention or intentional cultivation of flow sate. The task of maintaining a sense of fulfilling engagement in life (flow) may be easier for an autotelic personality, for example, by their proclivity to strike the right balance between skill and challenge. (See Figure 1 for an illustrative example of flow in the perception of quality-of-experience as a function of perceived challenge and skill.)

Specific theoretical refinement of Flow Theory was conducted in a reflective essay on enjoyment, happiness, motivation, and satisfaction (Csikszentmihalyi, 1985). In that essay, Csikszentmihalyi concluded that previous investigations strongly suggest that the experience of flow (that is, optimal experience or enjoyment) remains a psychological constant, regardless of the activities that elicited the experience. The concepts of fun and enjoyment, from a flow perspective, are more related to the psychological construct of flow, rather than the external activity itself.

Following Csikszentmihalyi's initial theory development and refinement, subsequent flow research has focused, to some degree, less on theory and more on application. Massimini and Csikszentmihalyi (1987) explored flow as a tool in psychiatric rehabilitation. They reasoned that the discipline of psychology had failed to develop an adequate understanding of, and sufficient models for, normal, healthy behavior. Therefore, information on healthy populations could be beneficial in treating psychopathological disorders. The psychological study of normal, healthy behavior, they said, should be to psychology what physiology is to pathology. Their study observed 47 Italian students at the pre-university level, ages 16 to 18, with the Experience-Sampling Method (ESM), developed by Csikszentmihalyi in the 1970s as a measure to obtain subjective feeling states. The ESM method, described below, includes self-assessment forms that are completed when researchers randomly signal participants with electronic pagers. The participants were signalled 60 times in one week, five- to eight-times per day.

Analyses suggest that these healthy adolescent population experienced flow in accordance with Flow Theory; that is, flow states were most often reported when a perceived high-challenge situation matched the individual's perception of his or her skill in meeting that challenge. Psychiatric rehabilitation, the study concluded, could benefit from continued attention to understanding healthy populations and positive psychology. Moreover, rehabilitation should consider providing patients, in part, with high challenges that match their skill levels, in order to foster health-promoting flow experiences. This study's findings, however, must be tempered with the fact that it examined Italian adolescents. Therefore, extrapolation to other cultures and populations is somewhat limited (Massimini & Csikszentmihalyi, 1987).

Finally, an interesting and innovative discussion on flow comes from Maddux (1997). This contribution to the literature comes from an essay that Maddux published based on an adaptation from an address he gave to the North American Society for the Psychology of Sport and Physical Activity and the Canadian Society for Psychomotor Learning and Sport Psychology. Maddux makes a strong case by examining flow within the context of the Western notion of habit, health, and happiness. He contrasts this Western paradigm of habit as an automatic, future-oriented, mind*less* activity with the Eastern paradigm of habit as a deliberate, present-oriented, mind*ful* activity. The Eastern paradigm is one of enjoyment, active engagement, and present-oriented participation, Maddux suggests, whereas the Western paradigm is one of detached, future-oriented, delayed gratification. An Eastern paradigm of the notion of habit is conducive with several components of flow, as described by Csikszentmihalyi. For example, autotelic behavior, action-awareness merging, and skill-challenge balance are present-oriented and mindful, not future-oriented and mindless.

Measurement of the Construct

Flow has been measured in many settings and found to exist within many populations cross-culturally and across many activities (Csikszentmihalyi, 1992; Csikszentmihalyi, 1985; Jacobs, 1994; Csikszentmihalyi & LeFevre, 1989; Massimini & Csikszentmihalyi, 1987; Jackson, 1996; Stein, Kimiecik, Daniels & Jackson, 1995; Jackson, 1995; Jackson, 1992). Most flow research involves the use of experiential sampling, specifically Csikszentmihalyi's ESM method. As described earlier, ESM randomly samples experience with the aid of an electronic prompt, usually a beeper or wristwatch with multiple pre-set alarm times. The participant is interrupted at various points during a period of time, usually a week, by the beeper or watch alarm, which is activated without advance notice to the participant. The participant then typically records data about the activity in which he or she was engaging at the time of the prompt and the quality and characteristics of the experience. ESM as a method of data collection is thorough and effective, but can be cumbersome and time-consuming. Moreover, it does not tend to provide information specifically on all flow dimensions (Jackson, Kimiecik, Ford & Marsh, 1998).

In the realm of flow measurement in physical activity, the construct has largely been studied among elite athletes. Only recently has there been an interest in examining flow in recreational exercisers (Jackson, Kimiecik, Ford & Marsh, 1998). In the past few years alone have inroads been made toward making flow measurement more quantitative, time-efficient, and cost-effective with the development of psychometrically validated flow instruments. Only two published instruments are widely available for studying flow quantitatively and both are by Jackson. One instrument is designed to measure flow immediately after a sporting event (a state-based instrument), while the other measures flow more as an enduring trait or disposition (Jackson & Eklund, 2002).

One limitation of the existing flow instruments is that both are still relatively new and their reliability and validity are only beginning to become more established. While initial contributions to the literature regarding these instruments has been widely supportive (Jackson & Eklund, 2002; Vlachopoulos, Karageorghis & Terry, 1999; Tenenbaum & Jackson, 1999), rigorous and replicable reliability and validity testing are crucial components of reducing systematic error and both are vital in the collection of unbiased data (Rosenthal & Rosnow, 1991; McKenzie & Smeltzer, 2001). Another limitation is that alternate measures are not widely available. In fact, both of Jackson's measures are essentially the same measure, with minor adaptations to differentiate between state-based and dispositional responses. For example, changes were made in the wording of the original state-based instrument to reflect more temporally distal events, thereby getting more dispositional responses, rather than state-like responses linked more proximally to a recent sporting/athletic event. In other words, the verb tense from the state instrument was simply changed to past tense for the dispositional instrument, and minor modifications in the instructions were made. Several other items were tested and used to replace items appearing on the original versions of the state and dispositional measures (Jackson & Eklund, 2002). More information the Jackson scales is provided below.

Flow in Sport

Flow research in sport is largely credited to Jackson (Csikszentmihalyi, 1992). Jackson (1996) explored the conceptual understanding of flow in elite athletes by studying 28 athletes (14 men, 14 women) whom represented seven sports and a mix of individual and team-based activities. Each individual had achieved a top-10 placement in international competition. Included in the sample were seven World or Olympic medallists and 10 Commonwealth Games medallists. Participants were interviewed in a structured format under an operational definition that flow was a state of consciousness involving total absorption and intrinsic reward. Each was asked to describe a sporting experience (including competition or training) that was better than average. To facilitate the focus of the description, participants were read three quotes illustrating flow, in order to help them understand the types of experience they were being asked to recall. After sharing their experience, athletes were asked a series of questions about flow, in order to better identify the experience and its underlying factors. The interview questions were piloted on four elite-level athletes before the interviews were conducted. It is unclear if pilot athletes were excluded from the final sample (Jackson, 1996).

Jackson transcribed the interviews and examined them for prevailing themes, which were later compiled into a set of "raw data themes." Athlete quotes were used to depict the raw data themes, and quotes were written on one side of an index card, with a summary statement written on the opposite side. Raw data themes were then categorized into one of Csikszentmihalyi's flow dimensions or into a separate dimension, if no pre-existing dimension was deemed compatible. Raw data themes subsequently were organized thematically into "higher order themes," which represented several raw data themes expressing similar ideas or concepts. The raw data themes, higher order themes and general flow dimension themes were then independently examined by an external rater. Inter-rater reliability was calculated as a percent agreement between Jackson's initial categorization and the external rater's results. There was 99% agreement at the raw data level and 100% agreement at the higher order theme level. In the final analysis, Jackson determined that 97% of the raw data themes were consistent with Csikszentmihalyi's flow dimensions. Percent agreement is an attempt to represent an index of inter-rater reliability. While a common practice, it is a misleading index of agreement in that it fails to differentiate between accuracy and variability (Rosenthal & Rosnow, 1991).

Jackson showed strong support for the existence of flow within her sample. She found that 96% of the athletes interviewed expressed sentiments of an autotelic theme; 86% expressed themes of action-awareness merging; 82% expressed themes of both concentration on the task at hand and a paradox of control. Other themes existed, but were less prominent. Thus, Jackson's research toward a conceptual understanding of flow in elite athletes produced a wealth of explicit, rich, qualitative flow data, greatly contributing to the understanding of flow in exercise.

Jackson's work on the attitudes and psychological cognition of elite-level athletes also includes research on the overall mental strategies of Olympic wrestlers and champion figure skaters. The study involving elite figure skaters (Jackson, 1992) examined 16 former U.S. national champions. Each was interviewed about the factors they associated with achieving optimal experience during performance. Each athlete (nine women, seven men, age 18 to 33) was considered one of the best in the field, having earned medals in international competitions and the Olympics. Athletes were asked to recall their most satisfying skating experience—one that they would like to remember throughout their lives. Interviewing then consisted of exploring this experience by inquiring about flow dimensions, particularly skill-challenge balance, which the athletes were asked to rank on a 10-point scale. Specific inquiries were made as to what impeded or facilitated flow. A questionnaire was given to assess flow associations, using flow dimensions and a 10-point Likert-style scale. As with Jackson's 1996 study, the results of this investigation yielded rich flow descriptions. The 10-point self-ratings for skill and challenge-balance revealed almost identical ratings, each receiving a mean rating of 9.1 and 9.3 respectively. Among factors perceived as most important for achieving flow, 69% of the athletes cited a positive mental attitude. Other factors contributing to flow state included maintaining appropriate levels of arousal and relaxation, being well trained and physically ready to perform, and receiving a positive audience response. Factors that impeded flow, according to the athletes, were physical problems or making mistakes, losing focus, a negative mental attitude, and receiving a poor audience response.

In a similar study (1995), Jackson explored the perceived controllability of flow. Interview participants (28 elite athletes) were asked about flow experiences and their ability to control flow states. A large majority (79%) felt that flow was a controllable state, while 21% thought flow was not controllable. Some athletes felt flow states could be controlled only when none of the nine flow dimensions was missing. Others felt that none of the flow experiences were under direct control. Rather, they could only set the stage for a flow experience. Jackson concluded that confidence, or a positive mental attitude, as with the elite figure skaters, contributed to flow experience, suggesting that confidence is critical in achieving flow. Other flow-facilitating factors for the athletes included the athletes feeling good about their performance, as well as optimal environmental and situational conditions. Factors reported to impede or prevent flow included a lack of personal motivation, non-optimal arousal level, and problems with pre-competitive preparation. Interestingly, Jackson found that the majority of athletes felt that flow was a controllable state and that individuals had various ranges of ability in inducing a flow state, whereas the factors that disrupted flow were perceived to be completely beyond the control of the athlete.

Flow in Recreational Physical Activity

Another Jackson study (Stein, Kimiecik, Daniels & Jackson, 1995) investigated the psychological antecedents of flow in recreational sport. This comprehensive study was comprised of three separate analyses. It represents one of the earliest attempts to analyze flow in recreational athletes. The study examined flow experience in light of task- and ego-orientation, satisfaction, enjoyment, goal attainment, confidence, and competence. The results of the three studies are summarized as follows:

Study 1 examined 39 adults (26 men, 13 women, aged 18 to 55) participating in a recreational tennis tournament. The tennis players were given questionnaires inquiring about psychological states and flow state before and after their matches. Pre-match questionnaires examined state goals, competence, and confidence using Duda's Task and Ego Orientation in Sport Questionnaire. The post-match instrument measured flow and the quality of experience using a Likert-style, five-point-scale of eight known flow characteristics. Questionnaires were administered 10 to 20 minutes before competition and one to 10 minutes following competition. Results indicated that tennis players in flow experienced greater satisfaction than athletes not in flow. No differences were found between individuals in flow and nonflow with respect to task goals, ego goals, competence or confidence. A surprising result was that enjoyment was unrelated to flow.

Study 2 examined 31 of 70 randomly selected students enrolled in a basketball class at a major university. This sample used the ESM method, whereby participants completed self-assessments and questionnaires after being "beeped" by researchers, which, in this case, consisted of a research assistant who unexpectedly entered the class once a week and stopped all activities so that participants could complete their ESM forms. Two hundred eighteen of 228 ESM form responses were analysed using one-way analysis of variance. Students in flow reported more enjoyment, and less apathy and boredom. Flow states and, surprisingly, boredom states were found to be most satisfying. Students concentrated better in flow than in apathy or anxiety states, and found flow to be the state in which they perceived the greatest feelings of control and in which they experienced the most successes. Thus, flow provided the most positive context for recreational sport in a learning environment.

Study 3 investigated 17 regular male golfers, mean age 65, whom had played golf for 33 years on average, three to four days per week. An ESM approach was used in that golfers recorded their experiences at randomly pre-determined holes, which were signified by being highlighted on the score-card. The before-hole assessment contained an open-ended question inquiring about the golfer's goal for the hole and two five-point Likert-style questions rating confidence and competence. The after-hole assessment consisted of six Likert-style questions on a 10-point scale enquiring about the skill and challenge of the hole, enjoyment, satisfaction, concentration, and control. Analysis of 118 reported experiences revealed that golfers in flow and boredom states showed the most enjoyment, satisfaction, and concentration, while golfers in apathy and anxiety states had less enjoyment, satisfaction, and concentration. Golfers not in flow also felt less perceived control and performed worse than the golfers in flow.

In reviewing the results of all three studies, Stein, Kimiecik, Daniels and Jackson reached some interesting conclusions, some of which support flow, some of which do not. In relation to Study 1 and Study 2, they found that goals were unrelated to flow/nonflow experiences, and that participants in Study 2 who set ego-related goals (desire to impress others) reported the most enjoyment. This was surprising, since it was thought that task-oriented goals, where participants hope to improve their skill and not to impress others, were more conducive to flow states. Also surprising was that in Study 2 participants reported flow experiences as most optimal, whereas the golfers in Study 3 reported flow and boredom as most optimal. It is noted that flow associations in these studies seem to relate to the particular context of the activity. For example, in Study 3, bored golfers may consider their bored states as optimal as flow states, because feeling bored means they felt their skill exceeded the challenge of the hole, which in this context was good, since each golfer was a regular player and was accustomed to betting his cronies for bragging rights, drinks, lunch, and other small stakes. Whereas in Study 2, boredom states were not optimal; flow alone was most optimal. This may be because the basketball class was a learning environment and feelings of boredom might indicate a lack of learning. Flow, on the other hand, was optimal because it indicated that learning and enjoyment were, indeed, co-occurring. In other words, it might be preferable to be bored while playing cronies for small-stakes bets, but it is far less optimal to be bored while learning a new skill.

Examination of enjoyment, concentration, and competence also revealed interesting findings. Enjoyment, as noted above, was not related to flow in one of the studies. Moreover, enjoyment was not related to whether goals were task-oriented (a desire to improve technique or skill) or ego-oriented (a desire to beat others or appear talented), which defies some findings on this relationship. Likewise, feelings of confidence and competence did not seem to relate to flow experience. In conclusion, the results of the three studies indicate that flow occurs in recreational athletes, but that the underlying psychological mechanisms remain unknown and should be explored.

Finally, one of the most recent studies by Jackson addressing flow in recreational exercisers comes by way of the continued refinement and psychometric validation of her state and dispositional flow instruments. Jackson and Eklund (2002) present the Flow State Scale-2 (FSS-2) and the Dispositional Flow Scale-2 (DFS-2) as self-report measures designed to assess flow experience in physical activity. Item modifications were made to the original versions of these scales (the FSS and DFS) and confirmatory factor analyses of separate item identification and cross-validation samples demonstrated a good fit for the new scales. Jackson and Eklund's findings offered good support for a nine first-order factor model (the nine flow dimensions) and a higher order model (global flow factor). Two studies were conducted in this research:

Study 1 had a total of 597 participants, 391 provided FSS data, 386 provided DFS data, and 180 provided data for both the FSS and the DFS. Participants, recruited from university classes and sporting events and competitions, ranged in age from 17 to 72, with a mean age of 26 (SD = 10). Forty-nine percent were male, 51% were female. To be eligible to participate, respondents had to take part in physical activity at least twice per week. The vast majority ($n = 145$) participated in touch football; others participated in triathlon ($n = 105$), running ($n = 65$), and duathlon ($n = 56$). The sample was highly competitive. A full 50% participated at a state or local level, while 25% participated at a national or international level. The original DFS 36 items and 13 potential replacement test items were administered. Likewise, the administered FSS version was composed of the original 36 items with 13 potential replacement items. Analyses included structural

equation modelling with EQS 5.7b. Generated were statistics of chi-squares, non-normed fit indices, comparative fit indices, and root mean square error of approximation. Based on the results, five of the 13 potential replacement items were used in the newest versions of both scales, the FSS-2 and the DFS-2. Goodness of fit values for the final set of 36 items (31 original items and the five new additions) showed satisfactory fits. Loadings for items on first-order factors were all substantial, ranging from .59 to .86 for the DFS-2 (mean = .77). Correlations among the revised FSS-2 and DFS-2 first-order latent factors ranged from .24 to .78 (median *r* = .51) for the DFS-2. The values indicate that the nine flow factors, while sharing common variance, as expected, measure reasonably unique constructs and suggest adequate factorial validity.

Study 2 was designed to address weaknesses in Study 1 by providing cross-validation of the final 36-item scale. A total 897 respondents contributed data to Study 2, 449 of whom provided FSS-2 data, 584 of whom provided data for the DFS-2 (99 provided data for both instruments). Age of respondents ranged from 16 to 82 years, with a mean age of 26 (SD = 11). Forty-eight percent of the sample were male, 52% were female. To be eligible for Study 2, participants had to take part in physical activity at least twice per week. Participants were engaged in a variety of activities, more than 27 by category. Most (*n* = 255) were involved in running; others were involved in dance (*n* = 177), yoga (*n* = 99) and triathlon (*n* = 56). Participants participated in their activity at the international level (5%), national level (11%), college level (16%), state level (17%) or local level (23%). As before, participants were recruited predominantly from physical activity settings, as well as university-level psychology and exercise classes. Reliability estimates for the DFS-2 responses ranged from .81 to .90 with a mean of alpha of .85.

Structural equation modelling was again performed, as in Study 1, with minor changes made in regards to the treatment of missing data. Results show that overall fit values were reasonable and that a slightly better fit existed for first-order factor models on the DFS-2. Again, item loadings on the first-order factors were substantial for both instruments; for the DFS-2, item loadings ranged from .51 to .83 (mean = .73.) Correlations among the first-order factors ranged from .16 to .73 (mean $r = .48$) for the DFS-2. Reliability estimates for the DFS-2 ranged from .78 to .86 with a mean alpha of .82.

Overall, Jackson and Eklund's research demonstrates support for the DFS-2's utility in measuring dispositional flow experiences. Results suggest scale performance better to (and in some cases, no worse than) the original scales; the revised scales also performed well in cross-validation analyses. The authors recognize that a global flow assessment is useful and that their scales adequately provide an overall global flow score that appears psychometrically sound, however, they advocate using dimension scores, since dimensional contributions to overall flow may vary. Indeed, variations in pattern loadings existed in state versus dispositional measures on at least one dimension (Time Transformation.) Moreover, the dimensions of Time Transformation and Loss of Self-Consciousness consistently exhibited low loadings for both Jackson scales. In summary, overall results provide ample support for both scales' ability to measure the dimensional and global aspects of flow in a psychometrically sound manner across broad and diverse samples.

Limitations of these studies are worth noting. The samples were highly competitive and, in fact, all participants in both samples were self-selected in that they already regularly engaged in physical activity at least twice per week. Moreover, many were competitors at least at the local level. Therefore, samples do not generalize well to a more mainstream, sedentary population, especially for individuals who are complete newcomers to exercise. Another limitation more existential in nature is the overall difficulty in attempting to quantify an experiential state, which is never an easy task. Each methodology—including quantitative methods, such as the Jackson scales, qualitative methods, such as Csikszentmihalyi's early research, and mixed methods, such as EMS—has its strengths and limitations in regards to tapping into and measuring flow as a construct.

Purpose of the Present Study

The purpose of this study is three-fold: (1) to investigate a new flow instrument by examining its psychometric properties and by comparing it to the existing dispositional instrument; (2) to examine and compare both instruments' ability to predict exercise frequency; and (3) to use both instruments to demonstrate validly and reliably that flow exists in recreational exercisers.

As mentioned above, the most widely available and best researched quantitative instruments for measuring flow are from Jackson. One is the Flow State Scale-2 (FSS-2), the other is the Dispositional Flow Scale-2 (DFS-2). While both represent improvements in facilitating flow research at a quantitative level, they are not without limitation. For instance, neither instrument provides a means to assess response validity or consistency; there are no reverse-scored items to assess yea-saying responder bias. Yea-saying responder bias is a well-known identifiable bias that occurs when obliging participants feel inclined to answer positively to every item on a questionnaire due to social desirability. It is easily controlled for by varying the directionality of response alternatives (Rosenthal & Rosnow, 1991; Couch & Keniston, 1960). Additionally, the Jackson instruments are fairly lengthy at 36 items each. The other, unpublished scale, the Flowtivation Scale for Exercise (FSE), includes reverse-scored items and, at 25 items, is 31% shorter than the Jackson scale. The FSE's shorter overall length and reverse-scored items may reduce respondent burden and limit yea-saying response biases.

Finally, as noted before, the Jackson state and dispositional instruments are virtually the same. The wording has been changed to the past tense in the dispositional measure and the directions slightly modified. Instead of administering the instrument immediately after an athletic or exercising event, as is the case with the FSS-2, the dispositional instrument is given under non-exercising conditions regarding an overall specific activity, in order to elicit responses more general in nature (Jackson & Eklund, 2002; Jackson, 2001).

A final purpose for this project relates to the fact that flow research has remained methodologically mired at the qualitative level, mostly in Csikszentmihalyi's effective but burdensome ESM (experiential time-sampling) method. ESM, in particular, is not appropriate for some populations, nor it is suitable in many research circumstances when cost-effectiveness and expediency are at issue. Therefore, a need exists for the development of demonstrably valid and reliable flow instruments. Psychometrically validating the FSE and further examining the predictive powers of it and the DFS-2 will advance flow research and the construct's utility by providing more options for efficient, convenient data collection. Such quantitative developments in measuring flow experiences may help advance the theory and streamline its research. In time, this may help Flow Theory become incorporated more directly in applied and interventional settings.

Although flow has been studied increasingly thoroughly, albeit slowly, among exercisers, especially elite athletes, its role and utility in reinforcing or promoting physical activity is not well understood, particularly among recreational exercisers. As noted, the practical applications of Flow Theory, itself, have been limited. If, as the literature suggests and the theory posits, flow is, indeed, a measure of optimal experience and a state of intrinsically self-motivating, focused engagement, then it follows that examining flow dispositions in exercisers may increase understanding of exercise adherence. In other words, understanding flow as a potential reinforcer may advance the understanding of what helps some people exercise more than others. Promoting regular physical activity and understanding its psychological and behavioral substrates have become increasingly important with the advent of technology and the concomitant rise in a sedentary lifestyle. Engagement in physical activity is psychologically complex and involves, among other things, issues of external and internal motivation, self-image, self-efficacy, and social interaction (USDHHS, 1996; Ogden, 1997). Moreover, a lack of physical activity is attributable, at least in part, to a large portion of avoidable morbidity and mortality, especially in the Western world (Dubbert, 2002; Blumenthal, Sherwood, Gullette, Georgiades & Tweedy, 2002; USDHHS, 1996).

Examining the use of flow as a psychological construct in predicting exercise adherence may be important from a health-promotion/education perspective, since—despite the widely reported mental and physical benefits of regular physical activity—exercise dropout rates remain as high as 50% in the first six months (LaFontaine et al., 1992; Dishman, 1991). Being able to identify individuals at risk for dropout and at risk for impaired program adherence can aid in interventional efforts, particularly for populations engaging in exercise as an adjunct to treatment, as is sometimes seen with, for example, depressed patients who have been shown to improve clinically from regularly physical activity (Babyak et al., 2000). Exercise is also often utilized as an adjunct to medical and drug treatments for severe obesity and related conditions, such as diabetes, hypertension, and high cholesterol (Wadden, Brownell & Foster, 2002; Dubbert, 2002; Blumenthal, Sherwood, Gullette, Georgiades & Tweedy, 2002; Gonder-Frederick, Cox & Ritterband, 2002; USDHHS, 1996). Understanding internal motivations and enjoyment from exercise may help improve overall adherence for such populations, especially if they can be taught to enhance their intrinsic enjoyment of an activity from a flow-like perspective.

Finally, the mental and physical health benefits of regular physical activity are numerous and well-documented, including reduced risk for cardiovascular heart disease and diabetes; reduced risk for depression and anxiety; reduced hypertension and lowered cholesterol rates; increased positive affect and well-being; and increased self-confidence, self-efficacy and health-related quality-of-life (USDHHS, 1999; USDHHS, 1996; Ogden, 1997; Cox, 1998; Wadden, Brownell & Foster, 2002; Dubbert, 2002; Blumenthal, Sherwood, Gullette, Georgiades & Tweedy, 2002; Gonder-Frederick, Cox & Ritterband, 2002).

Key Hypotheses of this Study

Hypothesis 1: The FSE will prove to be psychometrically sound and demonstrably valid and reliable; it may thereby offer a viable alternative to and minor improvement over the existing dispositional measure.

Hypothesis 2: This study will replicate previous findings that flow exists in a sample of recreational exercisers and is quantitatively measurable in a valid and reliable manner.

Hypothesis 3: Flow, as measured by demonstrably valid and reliable instruments, is predictive of exercise frequency in a sample of recreational exercisers. Exercisers reporting lower initial flow will exhibit lowered exercise adherence and greater dropout. Exercisers reporting higher initial flow will show greater exercise frequency and a reduced drop-out rate.

Methods

Design

This study is a prospective longitudinal examination of flow as a predictor of exercise adherence. The study also analyzes the psychometric properties of the FSE using contemporaneous validity assessment, building upon previous validation research and pilot-testing.

Participants

Power analysis suggests that a minimum sample of 65 participants are needed to detect medium effects (*r* and *t*) at .05 (two-tailed) with a power of .70 (Rosenthal & Rosnow, 1991). For factor analysis of the FSE, as many participants as possible are desirable, especially since Flow Theory purports a large number of factors (nine) and the FSE contains 25 items. Therefore, a contingency plan was devised *a priori* whereby, in the event that a small sample is obtained in the present study, this study's sample would be combined with the sample from the FSE's developmental research, which is demographically similar, to help ensure a larger sample for factor analyses.

Participants in this study are recreational exercisers from a university fitness center. The sampling frame consists of members of the Drayson Center health and fitness facility at Loma Linda University. The sample consists of new Drayson members registering between July and October 2002. The Drayson Center is an eight-year-old, 100,000-square-foot, $16-million, state-of-the-art exercise and fitness facility serving the cosmopolitan Loma Linda University community, including faculty and staff, students, and limited members off campus members, including a contingent of senior citizens. Because of this, the sample is diverse in terms of age, ethnicity, gender, and SES.

Of a total of 350 questionnaires distributed over a three-month period, 63 were returned. One returned questionnaire was almost entirely incomplete and therefore eliminated. The final sample thus consists of 62 completed questionnaires, representing a response rate of 18%. A response rate of this nature falls within the typical response rate range of 5% to 30% for methodologically similar "cold-call" studies that employ no follow-up measures, such as telephone calls, post-cards, or letters (Salant & Dillman, 1994; Evans, 1991). Indeed, some researchers are observing a growing decline in research response rates due, in part, to the overall U.S. population being "oversurveyed" (Groves, Cialdini & Couper, 1992; Bickart & Schmittlein, 1999). Specific descriptive statistics on the Drayson Center's overall membership demographics are not available to compare with the characteristics of this sample due to limitations in the computer system the Center uses to collect, store, and analyze its membership data.

The sample consists of 30 men (48%) and 32 women (52%) with a mean age of 43 (SD=20). The youngest participant is 12, the oldest is 80. Thirty-nine participants (63%) are White/Caucasian; 11 (18%) are Latino/Hispanic; 10 (16%) are Asian; and 2 (3%) are African-American/Black (See Figure 2). In terms of income, the sample appears comparable to the average U.S. population. Twenty-one participants (35%) report earning more than $35,000. Thirteen (21%) report earning less than $10,000 annually, while another 13 participants (21%) report annual incomes exceeding $50,000. Most participants, however, 22 (36%) report earning between $20,001 and $35,000 (see Figure 3), which is somewhat lower than the national median income of $42,148 for a U.S. household (U.S. Census Bureau, 2001).

In terms of exercise habits, 44 participants (71%) engage in primarily aerobic-based activities, such as running. Twelve participants (19%) engage in primarily anaerobic activities, such as weight-lifting. The rest engage in activities that primarily emphasize flexibility and stretching, such as yoga (see Figure 4). The mode of exercise frequency for this sample is three sessions per week, self-reported by 15 (24%) respondents. However, the sample, as a whole, reports exercising quite regularly on average. Fifteen percent of respondents report exercising 4 times per week, while 10% report exercising 5 times per week. Five participants (8%) report no regular exercise prior to their completing their questionnaires. The mean self-reported exercise frequency for this sample is 3.3 times per week (SD=2.31) (see Figure 5).

Thirty-nine participants (63%) describe themselves as non-competitive, recreational exercisers. Sixteen (26%) describe themselves as regular or occasional amateur competitors, while the rest describe themselves as complete newcomers to exercise (See Figure 6). No participant describes him- or herself as an elite, masters, or professional athlete.

Finally, a 14-year lifetime history of exercise is reported by the average participant in this sample, ranging from a minimum reported lifetime history of 1 year of exercise to a maximum of 40 years of exercise. This item, however, was answered by only 22 respondents (35%) and therefore is of dubious value as a variable of interest. However, in terms of representing the overall sample demographically, these respondents appear adequate in representing a diversity of sample characteristics. Sixty-percent (13) are male. Their mean age is 45 years. Sixteen (72%) are White/Caucasian, 4 (18%) are

Asian and 2 (10%) are Hispanic/Latino. Nine (32%) describe themselves as occasional or regular amateur competitors.

The Follow-up Sample

The follow-up sample consists of respondents for whom prospective, longitudinal attendance data are available. Of the original 62 participants, 17 (27%) are unavailable for follow-up at this phase of data collection. About a half-dozen of those lost to follow up respondents are classified as short-term fitness center members, since they were attending the facility while associated with short-term proton cancer treatment. Other participants apparently did not complete their membership paperwork or, for some reason, are not on file in the Drayson Center's membership computer database.

The 45 study participants whose attendance data are available provide four consecutive months of follow-up data following the initiation of their membership. Demographics of this follow-up subset sample vary slightly from the original sample, but not considerably so. The follow-up sample consists of 21 men (47%) and 24 women (53%) with a mean age of 39 (SD=19). The youngest participant is 12, the oldest is 80. Twenty-seven participants (60%) are White/Caucasian; 8 (18%) are Latino/Hispanic; 8 (18%) are Asian; and 2 (4%) are African-American/Black (See Figure 2).

In terms of income, the subset of participants followed for four months is moderately less affluent than the full sample. Twelve participants (27%) report earning more than $35,000. Eleven (24%) report earning less than $10,000 annually, while another 7 (16%) report annual incomes exceeding $50,000. Most participants, however, 16 (36%) report earning between $20,001 and $35,000 (See Figure 3).

In terms of their exercise habits, 30 participants (67%) of the follow-up sample engage in primarily aerobic-based activities, such as running. Eleven participants (24%) engage in primarily anaerobic activities, such as weight-lifting. The rest engage in activities that primarily emphasize flexibility and stretching, such as yoga (see Figure 4). The modal distribution of exercise frequency for the follow-up sample, as actually recorded by attendance records, is 1 session per week versus a self-reported average of 3 times per week. The mean frequency is 1.1 sessions per week, versus 3.3 as self-reported (see Figure 5). Twenty-five participants (56%) describe themselves as non-competitive, recreational exercisers. Fifteen (33%) describe themselves as regular or occasional amateur competitors, while the remaining 5 respondents (11%) describe themselves as complete newcomers to exercise (See Figure 6). No participant in the follow-up subset describes him- or herself as an elite, masters, or professional athlete.

Instrumentation

Two self-report, pencil-and-paper instruments measuring flow are used in this study. Self-reports, such as questionnaires, are common research instruments, providing a fast, efficient means of collecting data on a particular construct (Stone, 1978). The first instrument is Jackson's Dispositional Flow Scale-2 (DFS-2) (Jackson & Eklund, 2002). The DFS-2 contains 36 items measuring the nine dimensions of flow as described by Csikszentmihalyi (1990, 1993). Each item is scored on a five-point scale, with 1 indicating the least dispositional flow and 5 indicating the most dispositional flow. Dimension scores are computed by totalling responses across each dimension's four items. A total scale score (global score) can also be obtained by adding scores across all dimensions, although Jackson recommends using dimension scores where possible. As noted, DFS-2 items are scored in one direction; there are no reverse-scored items.

Jackson and Eklund (2002) have reported good psychometric properties for the DFS-2 and good support for the nine flow dimensions, as indicated, among other things, by parameter estimates in their cross-validation study, which is detailed above. Loadings of items on the first-order factor are all substantial, ranging from .51 to .83, with a mean of .73. Correlations among first-order factors range from .16 to .73 (median $r = .48$). Reliability estimates obtained for the DFS-2 provide an alpha ranging from .78 to .86, with a mean alpha of .82. Jackson and Eklund also find evidence supporting a higher-order flow factor (global flow score), although the fit of the data is slightly better for the nine first-order factors. The higher-order factor loadings indicate that the nine flow dimensions may contribute unequally to a global flow factor.

The second instrument used in this study is the Flowtivation Scale for Exercise (FSE), a 25-item questionnaire measuring the same nine dimensions of flow. Each item is scored on a five-point scale ranging from the lowest response, a 1 (the least association to flow), to the highest response, a 5 (the highest association to flow.) Six items (24%) are scored in a reverse direction. Raw scores are computed by summing responses of the appropriate items of each corresponding dimension. A raw global score is computed by summing all item responses. Results are reported in mean responses, since not all dimensions have the same number of items. Dimension scores are computed by averaging each dimension's item scores. A global score is computed by averaging all item scores.

The unpublished FSE demonstrates adequate preliminary results in discriminating flow states among recreational exercisers and adequate preliminary psychometric properties (Chichester, 1998). In its developmental research, the FSE shows acceptable internal consistency with a Cronbach's alpha of .84. The instrument was pre-piloted on a sample of 20 and piloted on a sample of 114 university students (mean age 25; 56% female). Pilot research also demonstrates convergent and discriminant validity. For example, a convergence validity coefficient generated by correlating the instrument's global flow score with a flow dimension reported in the literature to be a strong contributor to flow state, Dimension 1 (Skill-Challenge Balance), shows a strong and significant correlation coefficient of $r = .52$ (one-tailed; $p < .001$ at .01 level). A discriminant validity coefficient generated by correlating the instrument's global flow score with age, a variable described in the literature as theoretically having no effect on flow state, results in $r = -.04$ (one-tailed; p=.35 at the .01 level). Correlations between instrument items and the global flow score in the FSE's developmental research are adequate, ranging from .08 to .63 (mean = .43). Item analysis shows an acceptable range of responses and an adequate Discrimination Index among instrument items. Consistent with the literature, flow dimensions correlate highly and significantly with a global flow score: Dimension 2: Action-Awareness Merging (.83); Dimension 6: Paradox of Control (.71); Dimension 4: Unambiguous Feedback (.67); Dimension 9: Autotelic Response; Dimension 3: Clear Goals (.62); Dimension 7: Loss of Self-Consciousness (.59); and Dimension 1: Skill-Challenge Balance (.52). Also consistent with the literature, Dimension 8 (Transformation of Time) is the least correlated with the total flow scores

(.09). Factor analytic results for the FSE in its developmental research are unavailable, since factor analysis was not performed during the FSE's initial development and testing.

The FSE was also evaluated using qualitative methods during its development. Participants from the developmental sample's highest and lowest 15% of the global flow scores were interviewed in a semi-structured interview and the transcripts were evaluated by a panel of judges who were given a description of flow based on the literature. Their task was to sort the transcripts (*n* = 6) into an appropriate "high flow score" or "low flow score" category. The judges, blinded to the participant's flow score and all identifying demographic information about the respondent, read transcripts that only contained the participants' verbal descriptions of their exercise experiences. Mean inter-rater reliability among all judges is adequate at *r* = .78. For all judges, the effective reliability coefficient is computed to be *r* = .91, based on Rosenthal and Rosnow's 1991 adaptation of the Spearman-Brown formula. Effective reliability is a measure of aggregate reliability—that is, it is a composite measure of all judges. Effective reliability is superior to percent agreement in that it accounts for both accuracy and variability. Finally, a binomial probability distribution shows more evidence for the qualitative results. The binomial probability distribution predicts what the judges' responses would have been if obtained solely by chance. Two judges correctly sorted 100% of the transcripts into the corresponding high-flow and low-flow categories. According to the binomial probability distribution, a match like that would be made by chance only 2% of the time. The third judge correctly sorted 66% of the transcripts; that same match rate would be obtained by chance 23% of the time.

Procedure

In this study, both the DFS-2 and the FSE are given to newly registering members of the Drayson Center at the membership desk. The questionnaires are packaged concisely in an easy-to-use, reader-friendly format and were distributed by Drayson staff at the membership desk. The surveys are prefaced with a brief introductory page soliciting demographic information. An informed consent/cover letter accompanied all questionnaires. Returning a completed or partially completed questionnaire constituted consent; this is explicated by the informed consent/cover letter. Respondents are offered the chance to win one of two incentive prizes for completing a questionnaire. Prizes are either a $25 gift certificate to a local sporting goods store or a $25 gift certificate to a nearby health spa. Winners of the two incentive prizes will be chosen at random from all respondents and mailed in late summer 2003.

Some participants completed their questionnaires at the membership desk. Many took their questionnaires with them, returning them at a later date, usually less than a week later. Questionnaires collected by Drayson staff were mailed every few weeks to the researcher, who was located off-site. Returned survey instruments were inspected for completion and, in the case of the FSE, checked for response bias by looking for inconsistent patterns on reverse-scored items.

Data in this study are also collected longitudinally from respondents' attendance records at the Drayson Center. Drayson members are admitted to the facility by a membership swipe card that records their identity, as well as date and time of entry. Attendance data were collected seven months after questionnaires were first distributed.

Coding

Data from the demographic cover sheet are coded as indicated on the FSE coding key included in the appropriate appendix. Ordinal data—that is to say, data that represent a natural ranking—are coded in a numerical order representing their ordinal structure. For example, the demographic variable "income" is coded on a six-point scale, whereby the smallest numerical coding category, a "1," indicates the least amount of gross annual income, while the largest numerical coding category, a "6," indicates the most gross income. Likewise, the variable "exercise category" ranks participants on a four-point scale from complete exercise newcomer to expert competitor. This variable is coded in a way that reflects this natural ordering: a "1" indicates the least amount of athletic prowess (that is a complete newcomer to exercise), while a "4" indicates the most prowess (an elite, masters or professional competitor.) Categorical data—data that do not represent a numbered order or ranking—are ordered subjectively on the coding key, but are "dummy coded" for statistical analyses. For example, demographic the variable "ethnicity" is coded on a five-point scale with the numerical rankings representing no particular order. In statistical analyses, however—correlations, for example—this variable is broken into its respective individual ethnic subcategories and is "dummy coded" using a binary system, so that a "1" equals a member of a particular ethnic group, while a "0" equals a non-member. Thus, for example, for the ethnic category "Asian," participants are coded as either Asian (coded as a "1") or non-Asian (coded as a "0".) Likewise, for the variable "exercise type," dummy coding is used so that each basic type of exercise (aerobic, anaerobic, flexibility-based) is broken down into its own subcategory and participants' preferences are coded as either a "1," indicating their physical activity falls into that specific category, or a "0" indicating their physical activity does not fall into that category. Response data from the FSE and DFS-2 instruments on items measuring flow associations are ordinal and scored on a five-point scale. They are coded in a manner that reflects their ordinal nature, so that a coding of a "1" equals a lesser association to flow, while a coding of a "5" equals a greater association to flow.

Analyses

Analyses in this study are conducted using SPSS version 8.0. Dimension and global flow scores are computed using averages to allow for comparisons between the DFS-2 and the FSE, since each instrument may use a different number of items to measure the same dimensions. Averaging item responses for dimension and global scores allows for appropriate comparisons across instruments.

In terms of missing data, only a few completed questionnaires contain missing data. The most missing items (8) are found on the demographic variable asking income range. Only nine respondents failed to complete all instrument items, with eight of those respondents missing just one item on both instruments. Five of the total missing instrument responses are from the FSE, while 4 are from the DFS-2. Missing item values in this study are replaced using an item-oriented mean substitution. That is, missing data points are replaced with the mean value for that item across the entire sample. Mean substitution is an often-used method of data grooming in cases of missing items up to 15% per case or variable (George & Mallery, 1999). Missing values across the data set, as a percentage of the sample total, range from a high of 13% (for example, 8 missing responses for the income question) to as low as 2% (1 missing response for eight instrument items on both the DFS-2 and FSE.) In no case did mean substitution account for more than 13% of any variable, safely within the generally accepted practice of a 15% cut-off (George & Mallery, 1999).

Analyses conducted for this study include the following:

1) Descriptive statistics, distributions, and sample characteristics, including:
    - Age, gender, ethnicity, and SES
    - Exercise frequency (workouts per week as self-reported and as recorded by actual attendance records)
    - Exercise/activity type (aerobic, anaerobic, and flexibility-based)
    - Exerciser category (elite/professional athlete, occasional or regular amateur competitor, recreational exerciser, and complete newcomer)
2) Analyses for psychometric validation of the FSE including:
    - Cronbach's alpha on the DFS-2 and FSE, and FSE subscales
    - Empirically supported discriminant and convergence validity coefficients on flow dimension scores and global flow scores for both the DFS-2 and FSE
    - Pearson correlational analyses between dimension scores and global scores on the DFS-2 and the FSE
    - Exploratory factor analysis of the FSE. This was not performed during the FSE's pilot research. An inadequate sample was obtained for factor analysis in this study. Therefore, data from this study is added to data from the FSE's developmental research for the purposes of factor analysis only. The 62 participants in this study's sample are

added to the 114 participants in the previous study's sample, making for a total factor analysis sample of 176

3) Analyses for replicating findings that support the existence of flow in recreational exercisers include:

    - *t* testing of dimensional and global scores on the DFS-2 and the FSE
    - Pearson correlational analyses between dimension scores and global flow scores on the DFS-2 and the FSE
    - Pearson correlational analyses between flow scores and sample variables (age, gender, ethnicity, SES, exercise frequency, exercise type, exerciser category, and self-reported attitudes toward and enjoyment from exercise)

4) Analyses testing flow's ability to predict exercise frequency:

    - Multiple regression on the DFS-2 and FSE. The independent variables (predictors) are the global flow scores of each instrument, as well as gender, age, ethnicity, SES, exercise type, and exerciser category. The dependent variable (criterion) is the prospective exercise frequency per week in a four-month period following the participant's initiation of membership. The method used for entering predictor variables into the model is the simultaneous method (SPSS "enter" method), whereby all variables in the block are entered into the regression analysis in a single step, as opposed to hierarchical entry based on theory.

- Multiple regression on DFS-2 and FSE dimension scores, as guided by correlation analyses. The independent variables (predictors) are the most highly, significantly correlated dimensions shared by both measures: Dimensions 1, 6 and 9. The dependent variable (criterion) is prospective exercise frequency per week in a four-month period following the participant's initiation of membership. The method used for entering predictor variables into the model is the same method described above.
- Simple regression modelling on global and dimension scores, guided by correlation analyses. The independent variables (predictors) are the most highly, significantly correlated dimensions shared by both measures: Dimensions 1, 6 and 9. The dependent variable (criterion) is prospective exercise frequency per week in a four-month period following the participant's initiation of membership. The method used for entering predictor variables into the model is the same method described above.

Results

First, distributions of all variables are examined. Histograms with normal curves are generated, as are normal probability plots, to assess the normality of the variables' distribution. This is done to ensure the data are normally distributed, in order to meet the assumptions of parametric testing, where indicated. Results show all data are normally distributed, therefore meeting the normality assumption for parametric testing.

Psychometric Analyses

Internal reliability is examined for both the DFS-2 and the FSE using Cronbach's alpha. Across all instrument items, an alpha of .95 is obtained for the DFS-2, with an alpha of .90 for the FSE. Subscale alphas for the FSE are: Dimension 1 (Skill-Challenge Balance): .70; Dimension 2 (Action-Awareness Merging): .73; Dimension 3 (Clear Goals): .57; Dimension 4 (Unambiguous Feedback): .57; Dimension 5 (Concentration): .36; Dimension 6 (Paradox of Control): .70; Dimension 7 (Loss of Self-Consciousness): .72; Dimension 8 (Time Transformation): .81; Dimension 9 (Autotelic Experience): .29. The mean alpha for all subscales is .61.

Convergence and discriminant coefficients are generated for both measures using appropriate theory-based variables. Attitude, enjoyability, and self-reported frequency of exercise are used to establish convergent validity with FSE and DFS-2 global scores, while age, gender, and ethnicity are used to establish discriminant validity. Convergence coefficients range from .27 to .42 for the FSE (mean = .37) and from .30 to .37 for the DFS-2 (mean = .35). Discriminant coefficients range from -.21 to .00 for the FSE (mean = -.13) and -.26 to .03 (mean = -.11) for the DFS-2. All convergence validity coefficients are significant at least below the .05 level; no discriminant validity coefficient is significant (see Table 1).

As described previously, exploratory factor analysis is performed on the data from this sample ($N = 62$) combined with data from the first sample in the FSE's developmental research ($N = 114$) (Chichester, 1998). This yields a total factor analysis sample of $N = 176$. The method of extraction used is principle axis factoring; the method of rotation is promax with a Kaiser normalization.

A scree plot of eigenvalues (see Figure 7) shows the pictorial results of factor analysis. While weak visual support exists for a nine-factor solution, as theoretically posited, stronger support exists after 36 iterations in this sample for a seven-factor structure (see Table 2). The majority of evidence based on the data suggests an underlying seven-factor structure. Evidence for this seven-factor structure is suggested by a scree plot of the data, as well as by an examination of eigenvalues. Eigenvalues run from a high of 7.27 for factor 1 to 1.04 for factor 7. Factor 8 and factor 9 have, respectively, eigenvalues of .94 and .93. Eigenvalues (and the scree plot) drop off markedly at that point; for example, the eigenvalue of factor 10 is .80.

A seven-factor solution accounts for 61% of the total cumulative variance versus 68% using nine factors. The first factor accounts for 29.12% of the variance. The second and third factors account for 7.38% and 5.99% of the variance, respectively, while the fourth factor accounts for 5.22%. The remaining three factors account for 4.75%, 4.41%, 4.15% of the variance. The first five factors combined account for 52% of the total cumulative variance explained.

In terms of simple structure, factorial cut-offs are chosen as follows: A minimum loading of .60 is required for an item to contribute substantially to a factor, with no items cross-loading greater than .40 on any other factor (see Table 3). Overall simple structure shows some cross-loading exists on four items in the seven-factor solution. Despite the fact that these variables didn't meet criteria, they are retained in the seven-factor solution based on theoretical grounds. Factorial structure for the seven principal components breaks down into renamed factors as depicted in Table 4, which also denotes individual item loadings. Two factors have only one instrument item loading. Most, however, are loaded on by more than one item in the exploratory seven-factor solution.

Flow Experiences Measured

Comparisons of both instruments by mean scores on the overall sample reveal an interesting pattern of similarities and differences (See Figure 8 and Figure 9). While patterns of dimensional differences exist across each instrument, overall global flow scores are almost exactly the same (see Figure 10). Each instrument's overall global score is highly correlated with the other and very significant ($r = .83$, $p < .001$). The difference of each instrument's global flow score is not significantly different from the other (M difference = -.02, SD -.27; $t\,(61) = -.61$, $p = .54$ (two-tailed)). The greatest statistically significant mean differences exist on Dimension 3 (Clear Goals) (M = -.52, SD = .73, $p < .001$); Dimension 5 (Concentration) (M = .27, SD = .53, p = < .000); and Dimension 1 (Skill-Challenge Balance) (M = .27, SD = .50, p = .000) (See Table 5).

Overall correlations of DFS-2 and FSE mean scores by dimension show moderate to high positive associations, ranging from $r = .13$ to .76 (see Table 6). All but two are significant and these two are the lowest overall correlations: Dimension 7 (Loss of Self-

Consciousness) (*r* = .23, p = .071) and Dimension 8 (Time Transformation) (*r* = .13, p = .304).

Correlations between global and dimension scores on both instruments are high and significant. Likewise, correlations between the global flow scores of one instrument and the dimension scores of the other instrument are high and significant in all but one case. The mean correlation between the FSE global flow score and all DFS-2 dimension scores is *r* = .61. The mean correlation between the DFS-2 global flow score and all FSE dimension scores is *r* = .60. For the FSE (see Table 7), correlations between the global score and dimension scores range between *r* = .29 and .84 (mean *r* = .72), with significance at the .01 level for all but one dimension (Dimension 8), which is significant at the .05 level. The greatest number of non-significant dimensional correlations on the FSE is on Dimension 8 (Time Transformation.) FSE Dimension 8 fails to correlate significantly with all FSE dimensions except Dimension 2 (Action-Awareness Merging). This correlation is moderate and significant at the .05 level (*r* = .27). For the DFS-2 (see Table 8), global and dimensional score correlations range between .57 and .88 (mean *r* = .73) and all are significant at the .01 level. The greatest number of non-significant dimension correlations on the DFS-2 is on Dimension 7 (Loss of Self-Consciousness). DFS-2 Dimension 7 fails to correlate significantly with four other DFS-2 dimensions. It correlates moderately highly and at the .01 level with the remaining DFS-2 dimensions.

Some salient sample characteristics correlate with global flow scores, while others do not (see Table 9). Self-reported exercise frequency per week in the overall sample exhibits a significant positive correlation with exercise category (*r* = .39, p < .001). Exercise category is whether a participant reports being an amateur competitor, a recreational exercisers, or a total newcomer to exercise. Self-reported frequency also correlates modestly and positively with FSE and DFS-2 global scores (*r* = .27, p < .05; *r* = .37, p < .001). Exercise type correlates with no variable to a significant degree.

Self-reported enjoyment and attitude show mixed correlative results with certain sample characteristics. Attitude and Enjoyment correlate highly and positively with each other (*r* = .59, p < .001), as well as with FSE and DFS-2 global scores. Self-rated attitude toward exercise correlates *r* = .42 with the FSE global flow score and *r* = .37 with the DFS-2 global flow score, both significant at the .01 level (two-tailed.) Self-rated enjoyment of exercise correlates slightly better with the FSE global score than with the DFS-2 global score (*r* = .43, p < .01, two-tailed, for the FSE versus *r* = .30, p < .05, two-tailed, for the DFS-2.) Variations in the instruments' global and dimension scores exist when correlated with sample characteristics (see Table 9). For example, overall self-reported enjoyment correlates in a positive direction most highly with the FSE global score (*r* = .43, p < .001), followed closely by Dimension 9 (Autotelic/Self-Motivating Experience) on both instruments (FSE *r* = .36, p < .05; DFS-2 *r* = .35, p < .05).

A participant's exercise category—whether they are an exercise newcomer, expert, or somewhere in between—correlates with several other sample characteristics. Exercise category correlates most strongly with exercise frequency per week (*r* = .39, p < .001). Other significant, positive correlations are found between exercise category and overall attitude (*r* = .27; p = .04) and exercise category and being of black ethnic type (*r* = .26; p = .04). Moderate, significant correlations are also seen on overall Attitude (*r* = -.27, p < .05), DFS-2 Dimension 1 (Skill-Challenge Balance) (*r* = -.25, p < .05), FSE Dimension 3 (Clear Goals) (*r* = -.35, p < .001), and FSE Dimension 6 (Paradox of

Control) (r = .-26, p = < .05) (see Table 9). Negative, significant correlations are found on exercise category and age (r = -.34, p = .006), exercise category and gender (r = -.31, p = .02), and exercise category and aerobic exercise type (r = -.26, p = .04).

Predictive Validity of both Instruments

To examine the utility of flow scores as predictors of exercising behavior over time, several multiple regression models are computed. To satisfy one of the *a priori* hypotheses of this research, two multiple regression models are generated to examine the contributions of global flow scores on both the FSE and the DFS-2 with the above-noted demographic variables. Ordinarily, this would not be done, since the demographic variables in question correlate low and non-significantly with the criterion and are otherwise not intended to be suppressor variables.

The first multiple regression model, which examines demographic variables and the FSE global score as predictors, shows that the overall amount of variance in four-month exercise frequency accounted for by the predictors is R^2 = .36. Standardized regression coefficients (beta weights), show a statistically significant positive beta of β = .31 for the global FSE score. A significant, negative beta (β = -.33) is found on the demographic variable of Asian ethnicity, while the demographic variable of Age is approaching significance with a negative beta weight (β = -.35) (see Table 10). The second multiple regression model examines the same demographic variables as predictors, except using the DFS-2 global score instead of the FSE global score. This model shows the overall amount of variance in the criterion accounted for by the predictors to be R^2 = .40. A significant positive beta weight appears for the DFS-2 global score (β = .40), while significant negative beta weights appear for the demographic variables of age (β = -.43) and Asian ethnicity (β = -.33) (see Table 11).

To assist in determining a more appropriate selection of predictor variables, correlations are generated on the outcome (dependent) variable of prospective exercise frequency over a four-month period (see Table 12). Both instruments show moderate and significant correlations. Total exercise frequency for the 45 follow-up participants over four months correlates significantly with the FSE global score ($r = .35$, $p < .05$) and the DFS-2 global score ($r = .38$, $p < .05$). Correlations are moderate at the dimension level, as well, with a mean correlation of $r = .24$ for the FSE across all nine dimensions and a mean correlation of $r = .27$ for the DFS-2 across all nine dimensions. These correlations range from a high of $r = .35$ on Dimension 2 (Action-Awareness Merging) on the FSE and $r = .43$ on Dimension 9 (Autotelic Experience) on the DFS-2, to a low of $r = .08$ on Dimension 5 (Concentration) on the FSE and r = .11 on Dimension 8 (Time Transformation) on the DFS-2. Longitudinal exercise frequency over four months also correlated significantly with one demographic variable in the longitudinal subset sample: Asian ethnicity negatively correlated with exercise frequency to a significant degree ($r = -.32$, $p = .04$). Other demographic variables, such as age, gender, income, exercise type, or exerciser category, did not correlate with exercise frequency at four-month follow-up.

When significant correlations inform the choice of independent variables, three flow dimensions emerge as ideal predictors based on correlations between four-month exercise frequency at follow-up and the dimension means on each instrument. These three dimensions are: Dimension 1 (Skill-Challenge Balance), which has a mean FSE and DFS-2 correlation of $r = .32$; Dimension 6 (Paradox of Control), which has a mean FSE and DFS-2 correlation of *r* = .34; and Dimension 9 (Autotelic Experience), which has a mean FSE and DFS-2 correlation of *r* = .37. All are significant at the .05 level. Using these dimensions for new multiple regression models, model 3 (see Table 13) and model 4 (see Table 14), show the overall amount of variance in prospective four-month exercise frequency accounted for by, respectively, the FSE and DFS-2 dimensions 3, 6, and 9. Variance is $R^2 = .13$ for the FSE and $R^2 = .20$ for the DFS-2, respectively; however, beta weights show no statistically significant coefficients on either analysis for either instrument.

To further explore the predictive power of flow—and to avoid the problem of having too many predictors for such a small sample in multiple regression modelling—simple regression models are generated using global flow and dimension scores (Table 15), which suggest that, among other things, the overall global flow scores of both instruments, as well as Dimensions 1, 6, and 9, are significant predictors of future exercising behavior at four-month follow-up. The DFS-2 Dimension 9 has the greatest predictive power among these predictors ($R^2 = .19$, $\beta = .43$, p = .00).

Discussion

Examining Flow Theory in recreational exercisers appears to have become an increasing focal point in the literature, and it has been identified as an area worthy of further examination (Jackson & Eklund, 2002; Jackson, Kimiecik, Ford & Marsh, 1998; Stein, Kimiecik, Daniels & Jackson, 1995.) This study advances the working knowledge of flow in recreational exercising populations. These results contribute to the theoretical development and the practical applications of flow as a phenomenological, psychological experience, first, by offering an additional instrument to measure the construct validly and reliably, and, second, by demonstrating the role of flow in predicting exercising behavior. Overall, analyses of flow in recreational exercisers have been under-examined, while analyses of flow's predictive power appear to be entirely unexamined until now.

The Psychometric Soundness of the FSE

In terms of developing an alternate instrument to measure flow, the results of this study suggest that adequate overall psychometric properties exist for the FSE. Internal consistency for all items and the global flow score, as measured by Cronbach's alpha, is, at .92, above the desirable cut-off of .85 advocated by some (Rosenthal & Rosnow, 1991.) Reliability coefficients may be interpreted directly in terms of the percentage of score variance attributable to different sources. For example, the FSE's overall .92 reliability coefficient signifies that 92% of the variance in test scores depends on true variance in the construct measured, and 8% depends on error variance. At the subscale level, alphas are reasonable for most subscales, ranging from .29 to .81, with a mean subscale alpha of .61.

Validity assessments for the FSE show appropriate levels of both convergent and discriminant validity. As Campbell (1960) so thoughtfully and eloquently argued decades ago, in order to establish construct validity, research must show that constructs correlate significantly with the variables they are theoretically supposed to correlate with, while not correlating with variables from which they are supposed to differ. The FSE shows good discriminant and convergent validity (Campbell & Fiske, 1959) when mean global scores are correlated with theoretically appropriate variables. For example, FSE global flow scores correlate highly and significantly with flow dimensions, as well as with overall self-reported enjoyment of exercise, positive attitudes toward exercise, and self-reported exercise frequency. This is consistent with what Flow Theory suggests, since flow, by theoretical definition, is a highly pleasurable and self-motivating state of psychic engagement. Perhaps one of the strongest indicators of convergent validity is the FSE's overall high and significant correlation with the DFS-2. In terms of discriminant validity, adequate psychometric evidence for the FSE exists as well, since no significant correlations are found between FSE global scores and demographic variables. Demographic variables, such as gender, age, or ethnicity, are repeatedly shown in the literature to be unimportant in determining flow experiences. These same results of convergent and discriminant validity held true in the four-month, follow-up subset. In all, the evidence suggests that the FSE has an adequate ability to correlate appropriately with variables it is theoretically expected to correlate with, while not correlating with variables it is theoretically not expected to correlate with.

The results of exploratory factor analysis in this study do not appear to establish satisfactory factorial validity due to excessive cross-loading. Moreover, factorial validity for the FSE in this study is hampered at present by a small sample size. Even when the sample of this study is bolstered by combining it with the sample from the FSE's developmental research, the overall factor analytic sample of $N = 176$ is still markedly limited in its ability to detect flow's nine-factor, theoretical structure in an instrument of 25 items. However, a seven-factor solution of this study offers noteworthy similarities with flow's nine theoretical dimensions. For example, there is an Automaticity factor in the seven-factor solution that appears congruent with Dimension 2 (Action-Awareness Merging) and Dimension 6 (Paradox of Control). Similarly, the seven-factor structure purports an Enjoyment factor that seems to mimic flow's Dimension 9 (Autotelic/Self-Motivating Experience). The seven-factor solution also has an Appropriate Challenge factor that appears similar to a combination of flow's Dimension 1 (Skill-Challenge Balance) and Dimension 7 (Loss of Self-Consciousness). Finally, there is in the seven-factor solution also an element regarding the subjective perception of the passage of time, although it appears to relate only with the experience of time passing faster than usual and not slower than usual, which has been, albeit tenuously, part of Flow Theory's Dimension 8 (Transformation of Time) theoretical construct.

Measurements of Flow in Recreational Exercisers

In terms of establishing the existence of flow in recreational exercisers, adequate evidence exists in this study to suggest that the sample is, indeed, experiencing varying flow experiences, as indicated by both FSE and DFS-2 data. Overall global scores between the two instruments are virtually identical and not statistically different from the other, either with the overall sample or with the four-month, follow-up subset.

Adding to the credibility of flow's existence in recreational exercisers are the correlations between flow dimensions and the FSE and DFS-2 global scores. FSE dimension scores correlate highly and significantly with the DFS-2 global score on all but one dimension (Time Transformation). Similarly, the FSE global score correlates highly and significantly with all DFS-2 dimensions.

It is satisfying that the dimensional loadings of both instruments on their respective global scores vary between the FSE and the DFS-2. This suggests that items on each instrument may be tapping into flow in an overall related yet somehow different manner. Consistent with the literature, the dimensional contributions to overall flow experience are likely to vary from individual to individual and from activity to activity. The FSE and the DFS-2 appear to have individual strengths in tapping into and uniquely measuring these dimensions in recreational exercisers. At the total sample level and the follow-up subset level, statistically significant mean differences between dimension scores exist on the FSE and DFS-2 for Dimension 1 (Skill-Challenge Balance), Dimension 3 (Clear Goals), and Dimension 5 (Concentration), with the greatest difference observed on Dimension 3. Correlations between the FSE and DFS-2 also provide evidence suggesting measurable flow experiences exist in recreational exercisers. The global score correlation between both instruments is high and significant. At the dimension level, mean scores on both instruments are also high and significantly correlated for the overall sample, as well as the follow-up subset, with the exception of Dimension 8 (Time Transformation).

Time Transformation has proven to be among the most unreliable dimensional contributor to flow. In Jackson's work on the refinement of the DFS, she discusses the overall low loadings this dimension contributes to the DFS-2 overall global score. Time transformation is a more ephemeral theme than, say, clear goals, she speculates, and clearly more contingent upon the activity in question (Jackson & Eklund, 2002.) It may also be a highly subjective experience dependent upon the specific activity and/or the individual exercise participant. For example, the psychological awareness of the passing of time (and its qualitative differences in passing either more slowly or more quickly than usual) is not as important in rock climbing or weight-lifting, for example, than it is in a more time-constricted or time-oriented activity, such as basketball or running, where participants are working, in some manner, against the clock. Basketball players, for example, must play the game within a pre-defined time period. Runners, for example, compete in terms of speed, a measurement of distance covered over time, and are often working simultaneously to beat the competition's time and their own personal best.

Another difference in the dimensional contributions to overall flow between the FSE and the DFS-2 lies with Dimension 7 (Loss of Self-Consciousness). Jackson's instrument shows overall low loadings between Dimension 7 and a global factor in the DFS original and the revised DFS-2. Interestingly, Dimension 7 also ranks among the lowest dimension loadings on the DFS-2 global score in this sample (second only to Dimension 8), as well as with the FSE global score. However, the FSE Dimension 7 score correlates significantly higher with the global factor on both the FSE and the DFS-2. Jackson (2002) has commented on the nature of her Dimension 7 at the item level, suggesting that the item wordings in her instruments may have a more self-presentational flavor than Csikszentmihalyi originally conceived. The wording on Jackson's four DFS-2 items that load on Dimension 7 may have a stronger emphasis on self-consciousness in relation to evaluation from others than the dimension theoretically intends. It is possible that the FSE item-level wording contains a lower self-presentational flavor and therefore taps more accurately into the nature of Dimension 7 as originally conceptualized.

Regardless of the dimensional differences between the FSE and the DFS-2, overall results suggest that flow, indeed, is measurable and quantifiable in this sample of recreational exercisers. That the dimensions load differently for both instruments is beneficial, in that it suggests each instrument has an ability to tap into flow experience somewhat uniquely. Moreover, individual dimensional contributions to flow remain largely unexamined and, therefore, not well understood, which is why examining flow at the dimensional level in diverse samples and across diverse activities has a utility beyond simply the ease of generating a global factor score.

Flow's Power to Predict Exercise

Flow's predictive validity proved interesting in this study, but certainly less than stellar in the statistical results for both the FSE and the DFS-2. Multiple regression modelling shows beta weights that are moderate and statistically significant for both the FSE and DFS-2 global scores as predictor variables. Significant, negative, beta weights exist also on certain demographic variables, suggesting they are negative predictors of exercise frequency, which is consistent with the literature. For example, older age, on average, is associated with less exercising behavior, thus representing an inverse relationship: as age goes up, exercise frequency tends to go down. In the first multiple regression model, which examines the FSE, global flow score is a significant predictor of prospective exercising behavior. Asian ethnicity is a significant inverse predictor of exercise frequency at four-month follow-up; that is Asian ethnicity is more predictive of lower levels of exercise at follow-up. This, too, is consistent with the overall literature, in that non-White ethnic groups are, on average, less likely to engage in regular physical activity. In this sample, possibly due to the more affluent, educated nature of the sample, this, however, did not hold true for Latino or Black participants; only Asians. Likewise, age also registers a moderately high, negative beta weight that approaches significance.

In the second regression model, which examines the DFS-2, the results show the DFS-2 global flow score is a significant, positive predictor of exercise frequency at four-month follow-up. In this regression model, Asian ethnicity and age are both significant, negative predictors of exercise frequency, as demonstrated by their beta weights. The results suggest that as age goes up in this subset sample regression model, the prediction is that exercise frequency is likely to go down. Similarly, a participant of Asian ethnicity in this analysis is predicted to less likely exercise as frequently as other ethnicities in the subset sample, based on regression analyses. These demographic variables were chosen *a priori* as predictors of exercising behavior in this study, because the literature suggests that age, income, and ethnicity are relevant predictors of exercise (USDHHS, 1996.) In general, the literature suggests that exercising behavior, on average, is, among other things, more closely associated with White ethnicity and more youthful populations, as well as educational attainment and socioeconomic status. However, as mentioned previously, these variables are theoretically irrelevant in predicting flow. This, too, is borne out in multiple regression analyses, which show that no demographic variable is predictive of global flow scores for either the FSE or DFS-2. It was originally hypothesized, therefore, that global flow scores would be better predictors than demographic variables in predicting prospective exercising frequency and indeed they are. In both models, however, the overall amount of variance in the outcome of prospective exercise frequency accounted for by the predictors is relatively small, ranging from an R^2 of .32 for the FSE to an R^2 of .35 for the DFS-2. Outside the sample, in a general population, the adjusted R^2 is estimated to range from .19 for the FSE to .23 for the DFS-2.

Using correlation analyses to determine more statistically appropriate predictor variables of exercise frequency does not improve overall predictive validity. Multiple regression modelling shows no significant beta weights for the either the FSE or DFS-2 when using the highly correlated dimensions of Dimension 1 (Skill-Challenge Balance), Dimension 6 (Paradox of Control), and Dimension 9 (Autotelic Experience) as predictor variables. Moreover, the overall amount of variance accounted for by these predictors is smaller, ranging from an R^2 of .13 for the FSE to an R^2 of .20 for the DFS-2. Outside this sample, in a general population, the adjusted R^2 ranges from .06 for the FSE to .14 for the DFS-2.

Limitations of these predictive analyses are noteworthy, since the prospective, follow-up sample, at 45 participants, is insufficient given the relatively large number of predictor variables, because the value of R gets worse as the number of predictors gets closer to the number of study participants (Cohen, 1996). Moreover, shrinkage, a natural, statistical phenomenon, occurs when regression equations are used to make predictions from one sample to another independent sample or to a general population. Shrinkage occurs because regression coefficients are tailored to fit the data of their original sample and because sample-specific chance fluctuations are not likely to appear again in other samples or in the population. To minimize this problem, Cohen (1996) advocates using at least 20 participants per predictor. This study's longitudinal follow-up of 45 participants fails that heuristic in multiple regression modelling due to its limited sample size.

To account for the overabundance of predictors and the under-abundance of participants, simple linear regression modelling is performed to examine which flow variables best predict exercise frequency at four months. In these models, the DFS-2 appears overall to be a moderately better predictor of exercising behavior during the four-month, longitudinal follow-up. The DFS-2 global score accounts for slightly more variance explained than the FSE global score (Table 15), in predicting four-month exercise frequency. Among the dimension scores, Dimensions 1, 6 and 9 appear to be the most strongly correlated with exercise frequency at follow-up. They account for modest amounts of the variance explained, with Dimension 9 on the DFS-2 appearing to be the most robust predictor.

Limitations of this Study

All studies have limitations and this one is certainly no exception. As indicated above, a serious limitation for this study concerns its lacking number of participants at the overall sample and at the follow-up sample levels. While adequate power exists for *t* and *r* analyses, the limitations of this study's small sample are seen most obviously in the exploratory factor analysis and in the multiple regression modelling. For comparison's sake, Jackson's confirmatory factor analyses are conducted on samples numbering close to 1,000, whereas the sample for exploratory factor analysis in this study—even when combined with the FSE's past research—is a mere 176 participants. Likewise, examining numerous predictor variables with multiple regression models in the follow-up subset of

45 participants fails the generally accepted practice of utilizing one predictor per 20 participants, as described above. This is why simple linear regression is also used to shed light on the predictive relationship of flow and exercise at four-month follow-up.

Another limitation concerns two constraints in the collection of data. First, the timeframe for obtaining follow-up exercise frequency is not ideal, in that data are from notably slow periods of physical activity in the fitness industry. During the periods of November and December, physical activity tends to decline due to the holiday season. This may be offset to a small degree by the tendency for people to resume exercise with gusto in January, when there is an attempt to achieve New Year resolutions of exercising more frequently. In this study, most follow-up attendance data, however, are from an interval of time between October and December, a busy holiday season when the exercise frequency of study participants may have been lower than usual. Moreover, the actual exercise frequency of this study's participants is likely adversely influenced by occasional malfunctions in the Drayson Center's scan-card system, which is used to record members entering the facility. The scan-card system malfunctioned for a brief period at least once during the overall seven-month data collection period. This means several participants could have been admitted to the facility to exercise without their admittance being recorded in the scan-card computer system.

Finally, this research relies heavily on global flow scores in making analyses and comparisons between the FSE and the DFS-2. While dimension scores are used in several instances, global scores are used more widely for the sake of convenience. Jackson (2002) has echoed Csikszentmihalyi's 1992 concerns that too much emphasis should not be placed on any empirical measure of flow, especially global scores.

Nonetheless, a contrary position of this research is that quantification of flow as a construct is necessary to advance Flow Theory's theoretical development and, even more importantly, to increase the theory's practical applications. Although it might be ideal to dwell on the dimensional level of flow in comparing the FSE and the DFS-2, it may not be the most convenient form of comparison, especially in practical application. Even Jackson, who advocates taking a multidimensional approach to analyzing and understanding flow experiences, recognizes the utility and relevance in using a global flow assessment (Jackson & Eklund, 2002).

Final Observations

Given the results of this study and the slowly growing empirical support in the literature, evidence exists that suggests flow does indeed exist in recreational exercising populations. Knowing more about the motivations and drives of recreational exercisers from a psychological perspective and knowing more about psychological predictors (and reinforcers) of exercising behavior—such as flow and other psychological states—may prove to be among the crucial contributions to the knowledge base that psychology can make on an applied level in transforming mental and physical health and in improving overall well-being and quality-of-life through physical activity. Transforming knowledge from theory to application is an important step in this process. Regular exercise is shown to be a potent variable in reducing overall morbidity and mortality associated with the ubiquitous sedentary lifestyle of the developed world. Moreover, exercise is demonstrated to be a powerful behavior for improving psychological functioning and overall mental and emotional well-being. Flow, as an intrinsic psychological motivator, may represent a significantly rewarding reinforcement to encourage healthy exercising behavior. Better understanding flow's role in promoting and reinforcing healthy behaviors may be among its most valuable contributions.

The results of this study are aimed at furthering the understanding of flow and the interplay of its constituent dimensional contributions, as well better understanding flow as a predictor of exercising behavior. Clearly, the results of this research suggest that flow is an observable and quantifiable phenomena in recreational exercisers and that at least three options exist for measuring it validly and reliably. While flow's predictive validity appears modest at best in the present study's findings, applying the methodology of this research (or a similar methodology) to larger samples will provide ample opportunity for further theoretical development and for improved practical application, both of Flow Theory and the FSE and DFS-2. Moreover, examining whether flow can be taught or at least developed in an interventional setting and cultivated as a form of intrinsic, psychological reinforcement to maintain exercising behavior is another practical focus for future examination.

References

Babyak, M., Blumenthal, J.A., Herman, S., Khatri, P., Doraiswamy, M., Moore, K. et al. Exercise treatment for depression: Maintenance of therapeutic benefit at 10 months. Psychosomatic Medicine, 62, 633-637.

Bickart, B. & Schmittlein, D. (1990). The distribution of survey contact and participation in the United States: constructing a survey-based climate. Journal of Marketing Research, Spring, 286-294.

Blumenthal, J.A., Sherwood, A., Gullette, E., Georgiades, A., Tweedy, D. (2002). Biobehavioral approaches to the treatment of essential hypertension. Journal of Consulting and Clinical Psychology, 70, 3, 569-589.

Campbell, D.T. & Fiske, D.W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. Psychological Bulletin, 56, 81-105.

Campbell, D.T. (1960). Recommendations for APA test standards regarding construct, trait, and discriminant validity. American Psychologist, 15, 546-553.

Chichester, B.M. (1998). A quantitative approach to investigating flow states in a recreational exercising population: A new method of measurement, a new direction for Health Promotion. Unpublished master's thesis, University of Glasgow, Glasgow, Scotland, United Kingdom.

Cohen, B. (1996). Explaining Psychological Statistics. Pacific Grove, CA: Brooks/Cole Publishing Company.

Couch, A. & Keniston, K. (1960). Yea-sayers and nay-sayers: Agreeing response set as a personality variable. Journal of Abnormal and Social Psychology, 60, 151-174.

Cox, R. (1998). Sports Psychology: Concepts and applications (fourth edition.) Boston: McGraw-Hill.

Csikszentmihalyi, M. & Getzels, J.W. (1970). Concern for discovery: An attitudinal component of creative production. Journal of Personality, 38, 91-105.

Csikszentmihalyi, M. & Getzels, J.W. (1971). Discovery-oriented behavior and the originality of creative products: A study with artists. Journal of Personality and Social Psychology, 19, 47-52.

Csikszentmihalyi, M. (1975) Beyond Boredom and Anxiety. San Francisco: Jossey-Bass.

Csikszentmihalyi, M. (1985). Reflections on enjoyment. Perspectives in Biology and Medicine, 28, 489-497.

Csikszentmihalyi, M. & Larson, R. (1987) Validity and reliability of the experience-sampling method. Journal of Nervous and Mental Disease, 175, 526-536.

Csikszentmihalyi, M. & LeFevre, J. (1989) Optimal experience in work and leisure. Journal of Personality and Social Psychology, 56, 815-822.

Csikszentmihalyi, M. (1992) Flow: The Psychology of Happiness. London: Rider.

Csikszentmihalyi, M. (1997) Finding Flow. New York: Basic Books.

Csikszentmihalyi, M. & Patton, J.D. (1997). Happiness, the optimal experience and spiritual values: An empirical study of adolescents. Revue Quebecoise de Psychologie, 18, 2, 167-190.

Dishman, R.K. (1991). Increasing and maintaining exercise and physical activity. Behavior Therapy, 22, 345-378.

Dubbert, P.M. (2002). Physical activity and exercise: Recent advances and current challenges. Journal of Consulting and Clinical Psychology, 70, 3, 526-536.

Evans SJ. (1991). Good surveys guide. British Medical Journal, 302, 302-303

George, D. & Mallery, P. (1999). SPSS for Windows Step by Step: A Simple Guide and Reference. Boston: Allyn & Bacon.

Gonder-Frederick, L.A., Cox, D.J., Ritterband, L.M. (2002). Diabetes and behavioral medicine: The second decade. Journal of Consulting and Clinical Psychology, 70, 3, 611-625.

Gould, D., Eklund, R.C., & Jackson, S.A. (1993). Coping strategies used by U.S. Olympic wrestlers. Research Quarterly for Exercise and Sport, 64, 83-97.

Gould, D., Finch, L.M., & Jackson, S.A. (1993). Coping strategies used by national champion figure skaters. Research Quarterly for Exercise and Sport, 64, 453-468.

Groves, R. M., Cialdini, R. B., & Courier, M. P. (1992). Understanding the decision to participate in a survey. Public Opinion Quarterly, 56, 475-95.

Hinkin, T.R. (1995). A review of scale development practices in the study of organizations. Journal of Management, 21, (5), 967-988.

Jackson, S.A. (1992) Athletes in flow: A qualitative investigation of flow states in elite figure skaters. Journal of Applied Sport Psychology, 4, 161-180.

Jackson, S.A. (1995). Factors influencing the occurrence of flow state in elite athletes. Journal of Applied Sport Psychology, 7, 138-166.

Jackson, S.A. (1996). Toward a conceptual understanding of the flow experience in elite athletes. Research Quarterly for Exercise & Sport, 67, 76-90.

Jackson, S.A. & Marsh, H.W. (1996). Development and validation of a scale to measure optimal experience: The Flow State Scale. Journal of Sport & Exercise Psychology, 18, 17-35.

Jackson, S.A., Kimiecik, J.C., Ford, S.K. and Marsh, H.W. (1998). Psychological correlates of flow in sport. Journal of Sport and Exercise Psychology, 20, 358-378.

Jackson, S.A. (2001). Dispositional Flow Scale-2 (DSF-2). Instructions for use and scoring. Unpublished manuscript.

Jackson, S.A. & Ecklund, R.C. (2002). Assessing flow in physical activity: The Flow State Scale-2 and the Dispositional Flow Scale-2. Journal of Sport and Exercise Psychology, 24, 133-150.

Jacobs, K. (1994). Flow and the occupational therapy practitioner. The American Journal of Occupational Therapy, 48, 989-996.

LaFontaine, T.P., DiLorenzo, T.M., Frensch, P.A., Stucky-Ropp, R.C., Bargman, E.P. & McDonald, D.G. (1992). Aerobic exercise and mood: A brief review, 1985-1990. Sports Medicine, 13, 3, 160-170.

Massimini, F., Csikszentmihalyi, M. & Carli M. (1987). The monitoring of optimal experience: A tool for psychiatric rehabilitation. Journal of Nervous and Mental Disease, 179, 545-549.

McKenzie, J.F. & Smeltzer, J.L. (2001). Planning, Implementing and Evaluating Health Promotion Programs. Boston: Allyn and Bacon.

Ogden, J. (1997). Health Psychology: A textbook. Buckingham, United Kingdom: Open University Press.

Parr, G., Montgomery, M. & DeBell, C. (1998). Flow theory as a model for enhancing student resilience. Professional School Counseling, 1, 5, 26-31.

Robinson, J.P. (1987). Microbehavioral approaches to monitoring human experience. Journal of Nervous and Mental Disease, 7, 514-518.

Rosenthal, R. & Rosnow, R. (1991). Essentials of Behavioral Research: Methods and data analysis (2nd edition). Boston: McGraw-Hill.

Salant, P. & Dillman, D.A. (1994). How to conduct your own survey. New York: Wiley.

Schriesheim, C.A., Powers, K.J., Scandura, T.A., Gardiner, C.C. & Lankau, M.J. (1993). Improving construct measurement in management research: Comments and a quantitative approach for assessing the theoretical content adequacy of the pencil-and-paper survey-type instruments. Journal of Management, 19, 385-417.

Stone, F. (1978). Research methods in organizational behavior. Glenview, IL: Scott, Foresman.

Stein, G.L., Kimiecik, J.C., Daniels, J., & Jackson, S.A. (1995). Psychological antecedents of flow in recreational sport. Personality and Social Psychology Bulletin, 21, 125-135.

Tenebaum, G., Fogarty, G.J., Jackson, S.A. (1999). The flow experience: A Rasch analysis of Jackson's Flow State Scale. Journal of Outcome Measures, 3, 3, 278-294.

U.S. Department of Health and Human Services. Physical Activity and Health: A report of the Surgeon General. (1996). Atlanta, GA: U.S. Department of Health and Human Services, Center for Disease Control and Prevention, National Center for

Chronic Disease Prevention and Health Promotion.

U.S. Department of Health and Human Services. Mental Health: A report of the Surgeon General. (1999). Rockville, MD: U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration, Center for Mental Health Services, National Institutes of Health, National Institute of Mental Health.

U.S. Census Bureau. (2001). U.S. Department of Commerce. Current Population Survey, Annual Demographic Supplements. Washington, DC: U.S. Department of Commerce, Housing & Household Economic Statistics Division.

Wadden, T.A., Brownell, K.D. & Foster, G.D. (2002.) Obesity: Responding to the global epidemic. Journal of Consulting and Clinical Psychology, 70, 3, 510-525.

Vlachopoulos, S.P., Karageorghis, C.I. & Terry, P.C. (1999). Communications to the annual conference of the British Association of Sport and Exercise Sciences. Journal of Sports Sciences, 17, 1.

Appendix A:

Cover Letter/Informed Consent

LOMA LINDA UNIVERSITY

Graduate School
Department of Psychology

11130 Anderson Street
Loma Linda, California 92350
(909) 558-8577
FAX: (909) 558-0171

Dear New Drayson Center Member:

You are invited to participate in a study on exercise attitudes. The purpose of this study is to gain additional knowledge on how new exercisers feel about their exercise routine. Participation in this study is expected to take about 15 minutes. Involvement in this study requires the completion of a questionnaire. Your exercise routine will also be examined by how often you use the Drayson Center. There is no risk associated with participating other than that normally associated with going about normal daily life.

Returning a completed or partially completed questionnaire will indicate consent for your participation. Your responses will be strictly confidential; your answers or participation in this study will not be revealed. Information from the study will only be available to the researcher and will be reported only in aggregate form. You will not be compensated for your participation, but participating will enter you into a prize drawing, making you eligible to receive incentive prizes for your time and effort. Incentive prizes will include a $25 gift certificate to a local day spa and a $25 gift certificate to a sporting goods store. You may also find the experience of participating in this study to be educational.

If you require assistance or information, please contact me, Brian Chichester at 909-799-3564, or my research supervisor, Dr. Leslie R. Martin at 909-785-2454. An impartial, independent third-party not associated with this study can be contacted at the Loma Linda Office of Patient Relations at 909-824-4647. During the study, you have the freedom to withdraw without consequence at any time. Your participation is completely voluntary and you may refuse to take part in this study without penalty.

Sincerely,

Brian Chichester

Brian Chichester, M.P.H., M.A.

909-799-3564 (phone) • 425-740-8789 (fax) • genericmail4me@aol.com

Appendix B:

Questionnaire (including demographic cover sheet, FSE, and DFS-2)

EXERCISE QUESTIONNAIRE

DIRECTIONS: Please provide the requested information in the spaces below and check [✓] the appropriate boxes (❑) where applicable. Some questions may seem repetitive. Just answer them all honestly and to the best of your ability. There are no "right" or "wrong" answers. Please answer every question.

My contact information...

My name:	
My address:	
My telephone:	
My e-mail:	

Some details about myself...

DO NOT write in the shaded area

My gender is... ❑ Male ❑ Female [ ]

My age is... __________ [ ]

The general ethnic category that best describes me is... (CHOOSE ONE): [ ]
- ❑ Asian/Pacific Islander
- ❑ Black/African-American
- ❑ Latino/Hispanic
- ❑ White/Caucasian
- ❑ Other: ______________

My approximate gross annual income is... [ ]
- ❑ Less than $10,000
- ❑ $10,000—$20,000
- ❑ $20,001—$35,000
- ❑ $35,001—$50,000
- ❑ $50,001—$75,000
- ❑ Greater than $75,001

When I exercise, I *most often* participate in... (CHOOSE ONE) [ ]
- ❑ Exercise that emphasizes aerobic capacity (Develops heart & lungs most; e.g. running)
- ❑ Exercise that emphasizes anaerobic capacity (Develops muscles most; e.g. weights)
- ❑ Exercise that emphasizes flexibility (Emphasizes stretching; e.g. yoga)

The best way to describe for how frequently I exercise is... [ ]
- Last six months: ❑ ________ time(s) per ❑ Day ❑ Week ❑ Other: ________ ❑ Never
- My adult lifetime: ❑ ________ year(s) ❑ Other: ________ ❑ Never

My attitude toward exercise can be *best* summarized as...
- Last six months: ❑ Very positive ❑ Positive ❑ Neutral ❑ Negative ❑ Very negative [ ]
- My adult lifetime: ❑ Very positive ❑ Positive ❑ Neutral ❑ Negative ❑ Very negative [ ]

I find exercise enjoyable...
- Last six months: ❑ Always ❑ Most times ❑ Sometimes ❑ Rarely ❑ Never [ ]
- My adult lifetime: ❑ Always ❑ Most times ❑ Sometimes ❑ Rarely ❑ Never [ ]

I consider myself a(n)... (CHOOSE ONE) [ ]
- ❑ Elite, masters or professional athlete
- ❑ Regular or occasional amateur competitor
- ❑ Non-competitor/recreational exerciser
- ❑ Complete newcomer to exercise

About my <u>most enjoyable</u> exercise experiences...

DO NOT write in the shaded area

1. I find the experience of exercising enjoyable, good fun, fantastic, or a "rush"...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

2. During exercise, I often fatigue to exhaustion, have no energy and feel weak...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

3. When I finish, I feel buzzed, on top of the world, strong, on a high...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

4. I do not enjoy the effort of exercising...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

5. I feel no pain during my workouts...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

6. My exercise workout flows and is falling into place...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

7. I am very absorbed in my exercise; I am "in the groove," totally involved...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

8. My mind wanders, and I am unable to shut out distractions...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

9. My exercise seems to happen automatically. It feels easy, comfortable, effortless...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

10. In spite of my physical and/or mental efforts, I feel relaxed, calm, collected, at ease...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

11. I feel confident during exercise, in control, unbeatable...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

12. I feel out of control during exercise, or feel I have little control over my performance...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

13. I am intently focused and concentrating on what I am doing...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

14. I am aware of my surroundings, see the "big picture" and know what is going on around me...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

15. I hear and/or see others around me, but they are of no influence to my performance...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

16. I am challenged by what I am doing, but I feel able to meet the challenge...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

17. I am performing my skills or techniques poorly...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

18. Time passes slowly during my workouts...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

38. I am aware of how well I am performing... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
39. It is no effort to keep my mind on what is happening... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
40. I feel like I can control what I am doing... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
41. I am not concerned with how others may be evaluating me... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
42. The way time passes seems to be different from normal... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
43. I love the feeling of the performance and want to capture it again... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
44. I feel I am competent enough to meet the high demands of the situation... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
45. I perform automatically, without thinking too much... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
46. I know what I want to achieve... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
47. I have a good idea while I am performing about how well I am doing... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
48. I have total concentration... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
49. I have a feeling of total control... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
50. I am not concerned with how I am presenting myself... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
51. It feels like time goes by quickly... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
52. The experience leaves me feeling great... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
53. The challenge and my skills are at an equally high level... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
54. I do things spontaneously and automatically without having to think... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
55. My goals are clearly defined... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]
56. I can tell by the way I am performing how well I am doing... ❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree	[___]

57. I am completely focused on the task at hand...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

58. I feel in total control of my body...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

59. I am not worried about what others may be thinking of me...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

60. I lose my normal awareness of time...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

61. The experience is extremely rewarding...
❑ I strongly agree ❑ I agree ❑ I'm neutral ❑ I disagree ❑ I strongly disagree [__]

Thank you for completing this questionnaire! Please ensure all questions are completed!

Good luck in the prize-drawing!

☺

Appendix C:

Flowtivation Scale for Exercise Scoring Key

COVER SHEET CODING KEY

DO NOT write in the shaded area

My gender is... ❑[1] Male ❑[2] Female [ ]

My age is... ___________ [ ]

The general ethnic category that best describes me is... (CHOOSE ONE):
❑[1] Asian/Pacific Islander ❑[2] Black/African-American [ ]
❑[3] Latino/Hispanic ❑[4] White/Caucasian
❑[5] Other:_____________

My approximate gross annual income is...
❑[1] Less than $10,000 ❑[2] $10,000—$20,000 [ ]
❑[3] $20,001—$35,000 ❑[4] $35,001—$50,000
❑[5] $50,001—$75,000 ❑[6] Greater than $75,001

When I exercise, I *most often* participate in... (CHOOSE ONE)
❑[1] Exercise that emphasizes aerobic capacity (Develops heart & lungs most; e.g. running) [ ]
❑[2] Exercise that emphasizes anaerobic capacity (Develops muscles most; e.g. weights)
❑[3] Exercise that emphasizes flexibility (Emphasizes stretching; e.g. yoga)

The best way to describe for how frequently I exercise is...
Last six months: ❑[1] ________ time(s) per ❑[2] Day ❑[3] Week ❑[4] Other:________ ❑[5] Never [/]
My adult lifetime: ❑[1] ________ year(s) ❑[2] Other:________ ❑[3] Never [/]

My attitude toward exercise can be *best* summarized as...
Last six months: ❑[5] Very positive ❑[4] Positive ❑[3] Neutral ❑[2] Negative ❑[1] Very negative [ ]
My adult lifetime: ❑[5] Very positive ❑[4] Positive ❑[3] Neutral ❑[2] Negative ❑[1] Very negative [ ]

I find exercise enjoyable...
Last six months: ❑[5] Always ❑[4] Most times ❑[3] Sometimes ❑[2] Rarely ❑[1] Never [ ]
My adult lifetime: ❑[5] Always ❑[4] Most times ❑[3] Sometimes ❑[2] Rarely ❑[1] Never [ ]

I consider myself a(n)... (CHOOSE ONE)
❑[1] Complete newcomer to exercise ❑[2] Non-competitor/recreational exerciser [ ]
❑[3] Regular or occasional amateur competitor ❑[4] Elite, masters or professional athlete

FLOWTIVATION SCALE FOR EXERCISE
SCORING KEY

DIMENSION 9: AUTOTELIC/SELF-MOTIVATING EXPERIENCE 5 questions (20% of total)—5 to 25 raw score points		Dimension 9 Score (raw/scaled)
Item 1 ____	I find the experience of exercising enjoyable, good fun, fantastic, or a "rush"… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	
Item 2 ® ____	During exercise, I often fatigue to exhaustion, have no energy and feel weak… ❑1 I strongly agree ❑2 I agree ❑3 I'm neutral ❑4 I disagree ❑5 I strongly disagree	
Item 3 ____	When I finish, I feel buzzed, on top of the world, strong, on a high… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	
Item 4 ® ____	I do not enjoy the effort of exercising… ❑1 I strongly agree ❑2 I agree ❑3 I'm neutral ❑4 I disagree ❑5 I strongly disagree	
Item 5 ____	I feel no pain during my workouts… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	

DIMENSION 2: ACTION-AWARENESS MERGING 4 questions (16% of total)—4 to 20 raw score points		Dimension 2 Score (raw/scaled)
Item 6 ____	My exercise workout flows and is falling into place… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	
Item 7 ____	I am very absorbed in my exercise, I am "in the groove," totally involved… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	
Item 8 ® ____	My mind wanders, and I am unable to shut out distractions… ❑1 I strongly agree ❑2 I agree ❑3 I'm neutral ❑4 I disagree ❑5 I strongly disagree	
Item 9 ____	My exercise seems to happen automatically. It feels easy, comfortable, effortless… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	

DIMENSION 6: PARADOX OF CONTROL 3 questions (12% of total)—3 to 15 raw score points		Dimension 6 Score (raw/scaled)
Item 10 ____	In spite of my physical and/or mental efforts, I feel relaxed, calm, collected, at ease… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	
Item 11 ____	I feel confident during exercise, in control, unbeatable… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	
Item 12 ® ____	I feel out of control during exercise, or feel I have little control over my performance… ❑1 I strongly agree ❑2 I agree ❑3 I'm neutral ❑4 I disagree ❑5 I strongly disagree	

DIMENSION 5: CONCENTRATION ON TASK AT HAND 3 questions (12% of total)—3 to 15 raw score points		Dimension 5 Score (raw/scaled)
Item 13 ____	I am intently focused and concentrating on what I am doing… ❑5 I strongly agree ❑4 I agree ❑3 I'm neutral ❑2 I disagree ❑1 I strongly disagree	

Item 14 ____ I am aware of my surroundings, see the "big picture," and know what is going on around me…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

Item 15 ____ I hear and/or see others around me, but they are of no influence to my performance…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

DIMENSION 1: CHALLENGE-SKILL BALANCE 2 questions (8% of total)—2 to 10 raw score points	Dimension 1 Score (raw/scaled)

Item 16 ____ I am challenged by what I am doing, but I feel able to meet the challenge…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

Item 17 ® ____ I am performing my skills or techniques poorly…
❑^{1} I strongly agree ❑^{2} I agree ❑^{3} I'm neutral ❑^{4} I disagree ❑^{5} I strongly disagree

DIMENSION 8: TRANSFORMATION OF TIME 2 questions (8% of total)—2 to 10 raw score points	Dimension 8 Score (raw/scaled)

Item 18 ® ____ I feel that time passes slowly during my workouts…
❑^{1} I strongly agree ❑^{2} I agree ❑^{3} I'm neutral ❑^{4} I disagree ❑^{5} I strongly disagree

Item 19 ____ I feel that time passes quickly during my workouts…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

DIMENSION 7: LOSS OF SELF-CONSCIOUSNESS 2 questions (8% of total)—2 to 10 raw score points	Dimension 7 Score (raw/scaled)

Item 20 ____ I feel as if I am "one" with the activity I'm doing…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

Item 21 ® ____ I am not functioning instinctively during my workouts…
❑^{1} I strongly agree ❑^{2} I agree ❑^{3} I'm neutral ❑^{4} I disagree ❑^{5} I strongly disagree

DIMENSION 3: CLEAR GOALS 2 questions (8% of total)—2 to 10 raw score points	Dimension 3 Score (raw/scaled)

Item 22 ____ I know exactly what I am going to do and how I am going to do it…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

Item 23 ____ I know in advance when it is going to be a productive workout or a successful technique…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

DIMENSION 4: UNAMBIGUOUS FEEDBACK 2 questions (8% of total)—2 to 10 raw score points	Dimension 4 Score (raw/scaled)

Item 24 ____ My exercise session is progressing perfectly, really well or like clockwork…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

Item 25 ____ I receive accurate feedback on my performance instinctively from within myself…
❑^{5} I strongly agree ❑^{4} I agree ❑^{3} I'm neutral ❑^{2} I disagree ❑^{1} I strongly disagree

Global Flow Dimension 25 questions (100% of total)—25 to 125 raw score raw score points	Total Flow Score (raw/scaled)
All items ____	

Validity Check Items: ® Reverse-scored items

Figures

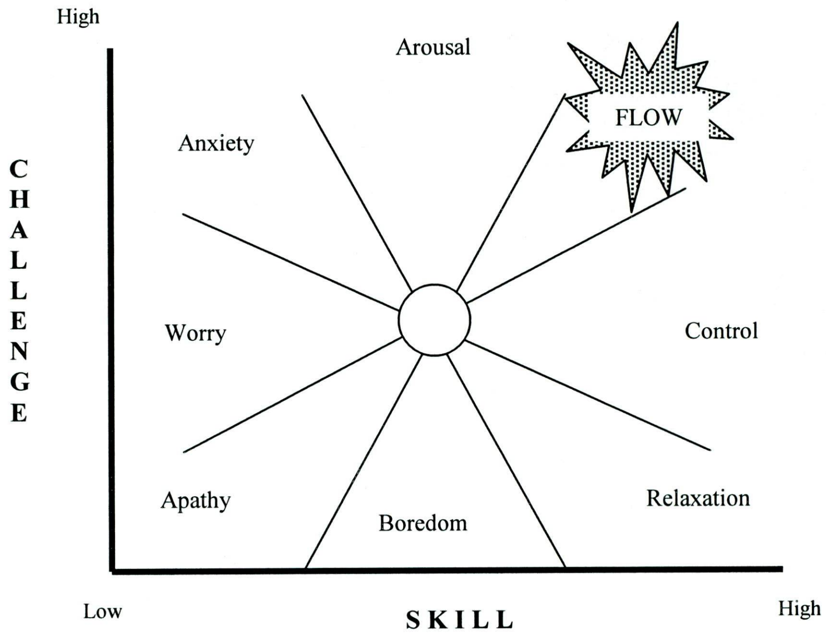
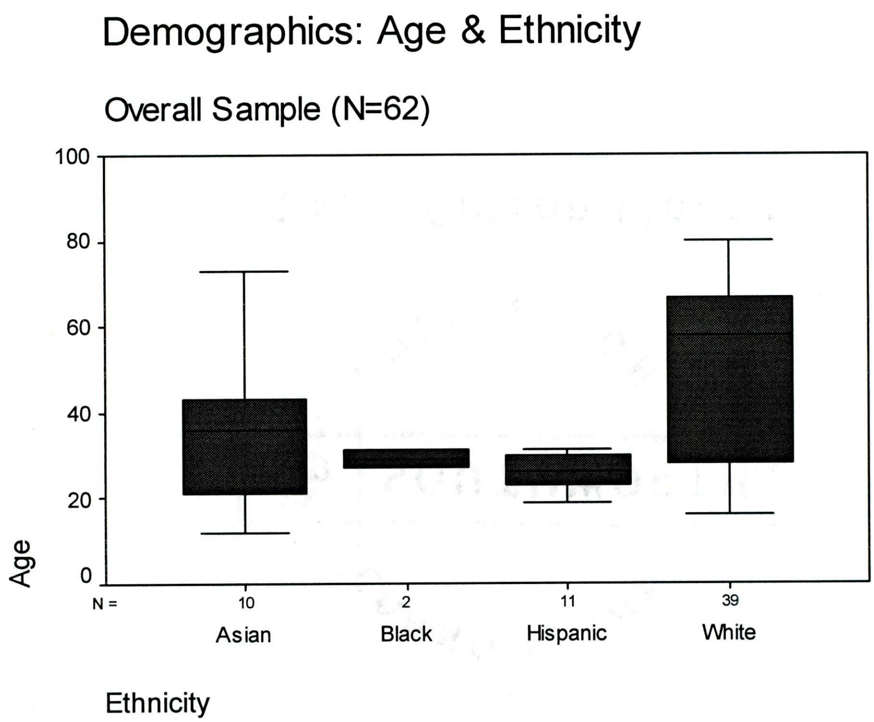


Figure 1. Quality of experience as a function of the relationship between challenge and skill. Flow state is high with skill-challenge balance. (Illustration not drawn to scale; adapted from Csikszentmihalyi, 1997, 1990; Massimini & Carli, 1988)



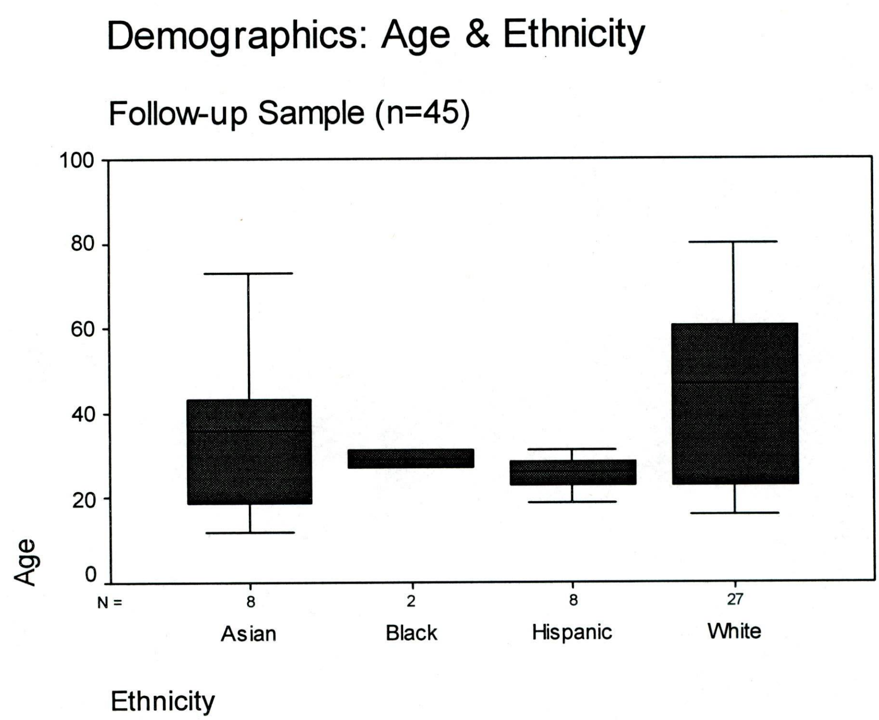
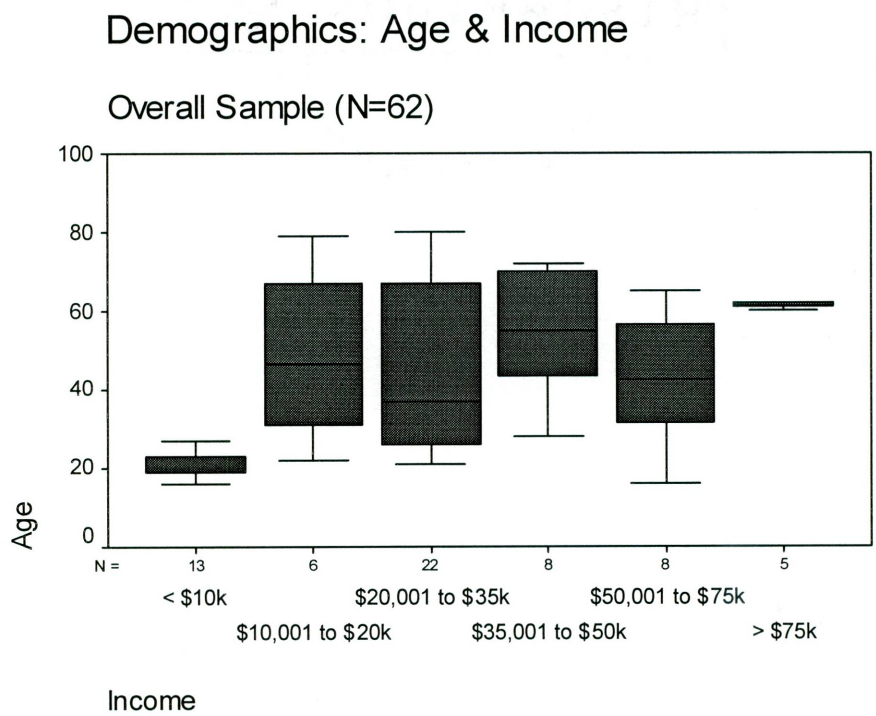


Figure 2. Comparative view of demographic variables Age and Ethnicity for overall sample and follow-up sample.



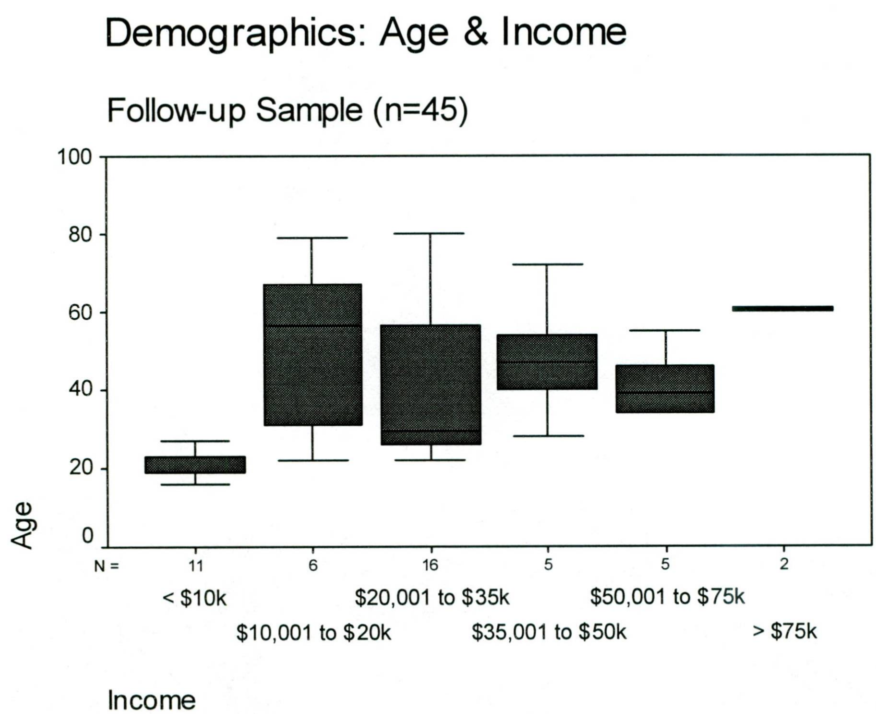
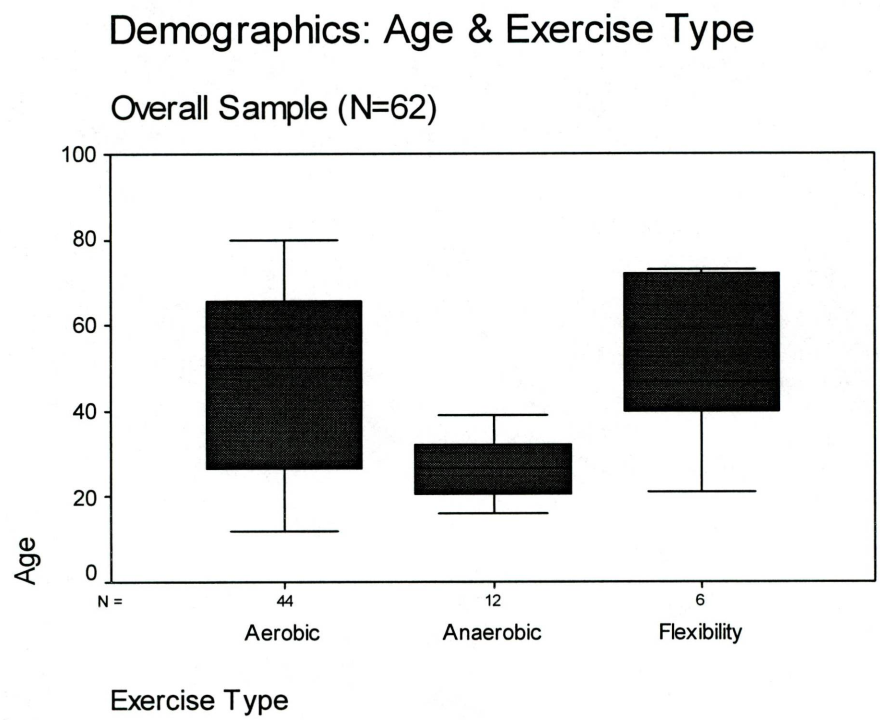


Figure 3. Comparative view of demographic variables Age and Income for overall sample and follow-up samples.



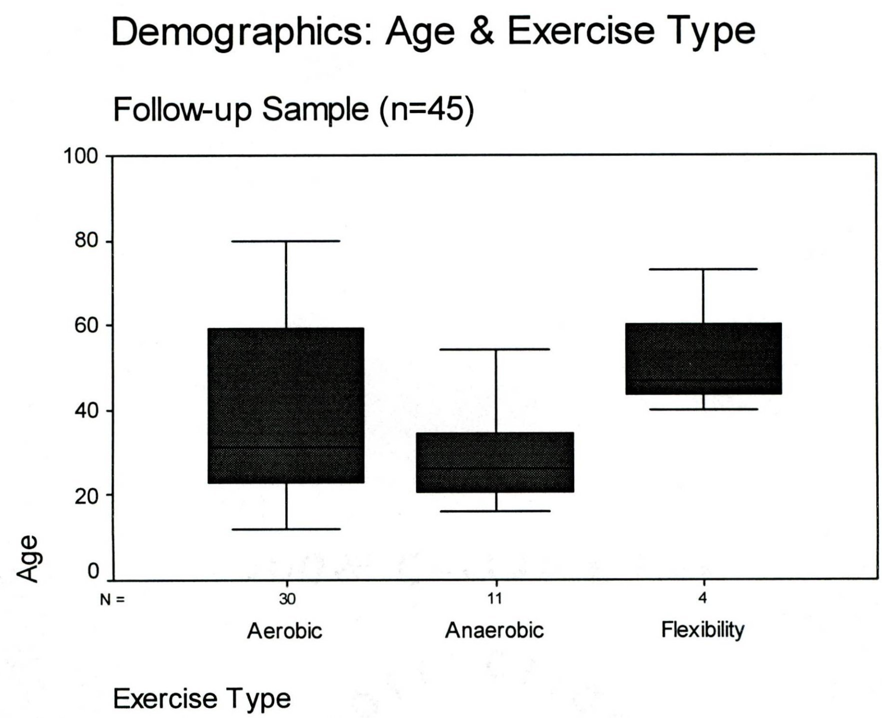
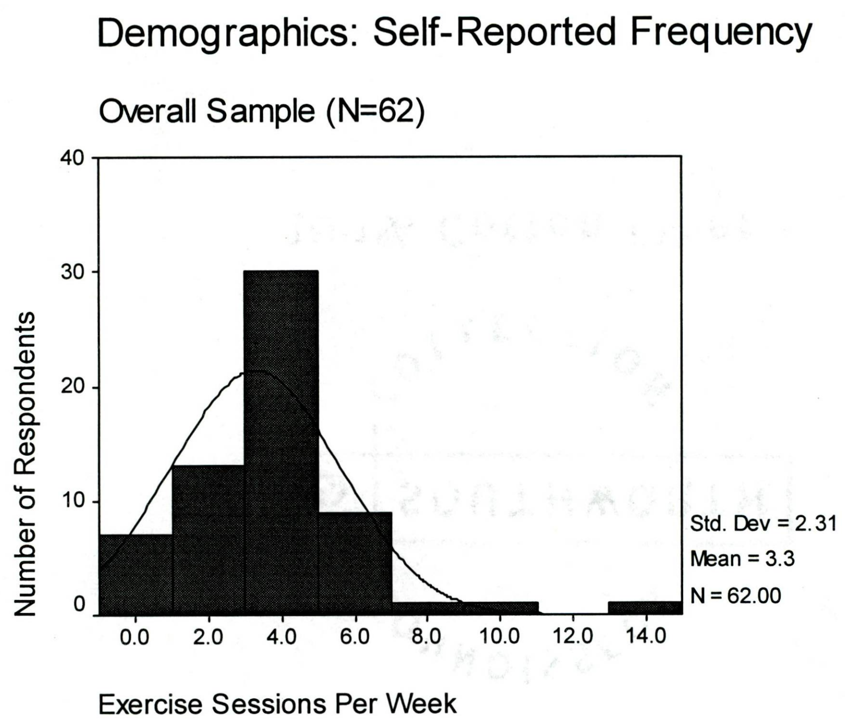


Figure 4. Comparative view of demographic variables Age and Exercise Type for overall sample and follow-up sample.



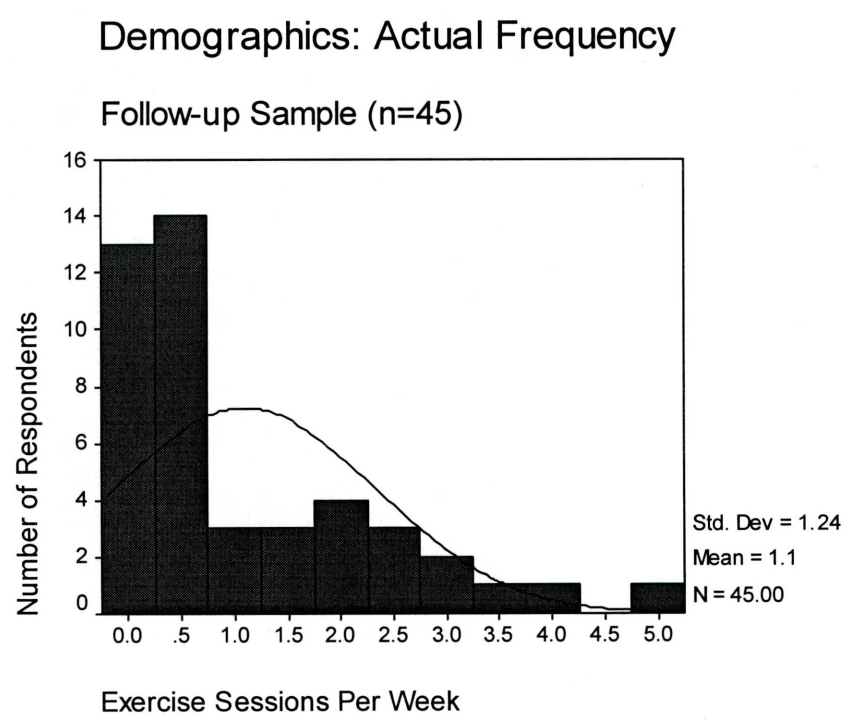
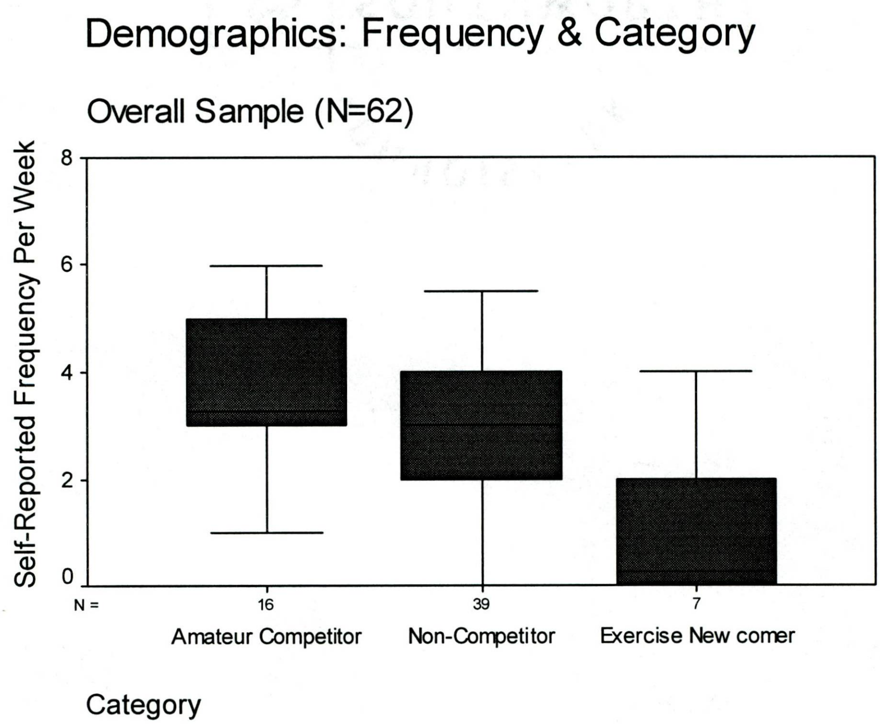


Figure 5. Self-reported exercise frequency of overall sample versus actual exercise frequency of four-month follow-up sample.



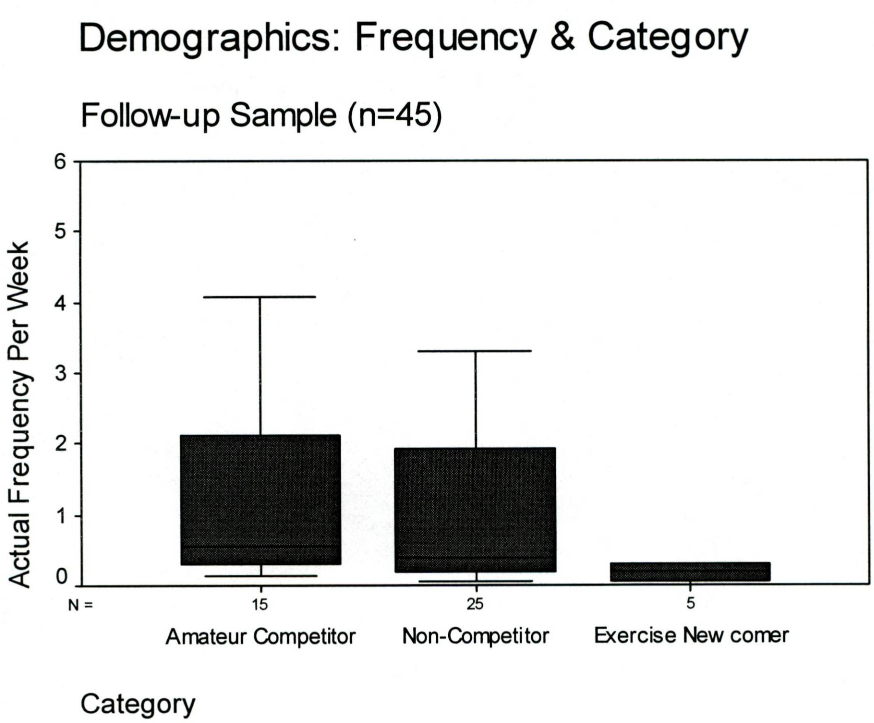


Figure 6. Self-reported exercise frequency per week by exerciser category for overall sample versus actual exercise frequency per week by exerciser category for follow-up sample.

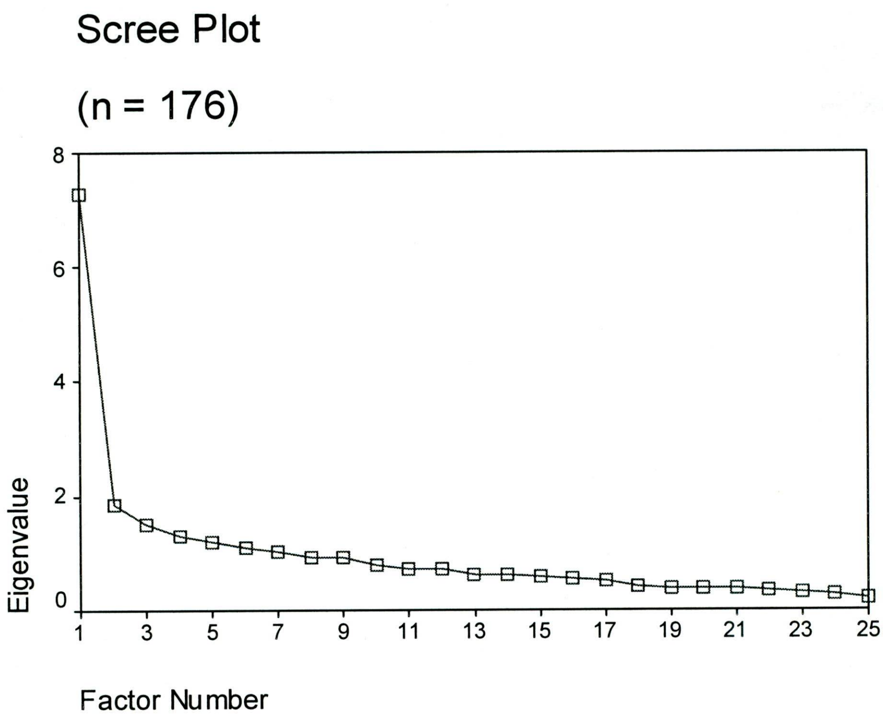
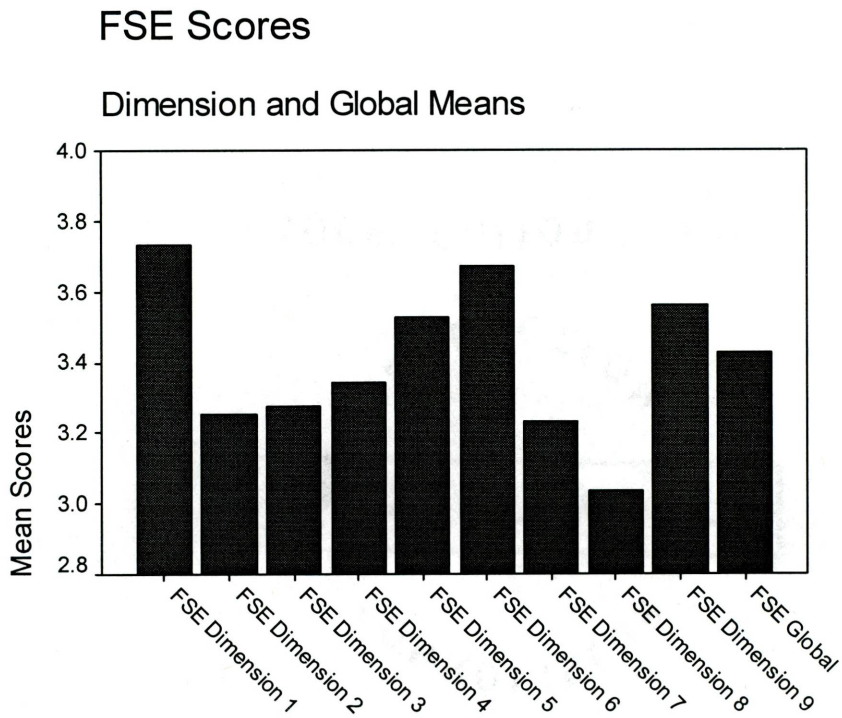


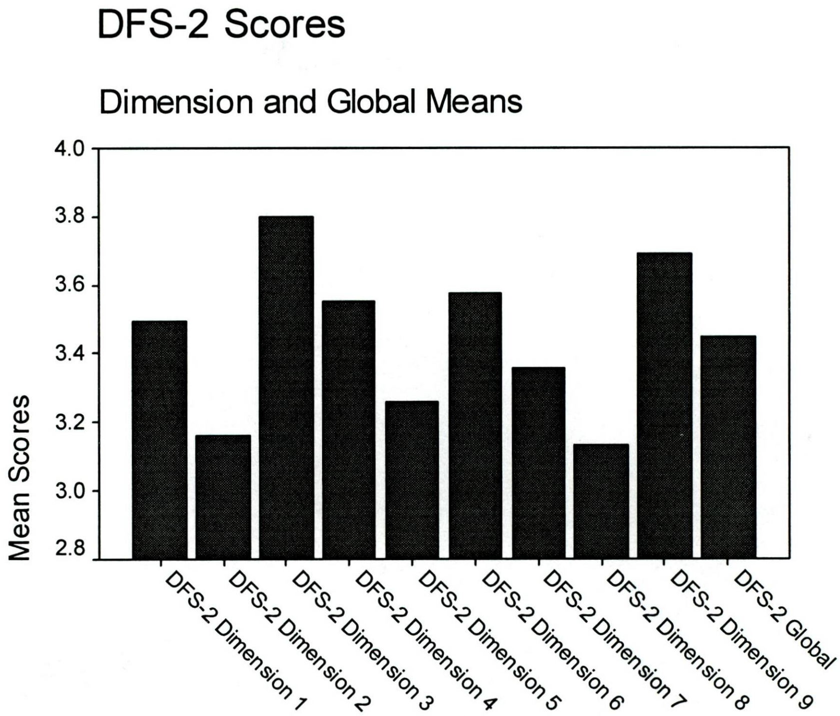
Figure 7. Scree plot of FSE factor structure.



Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

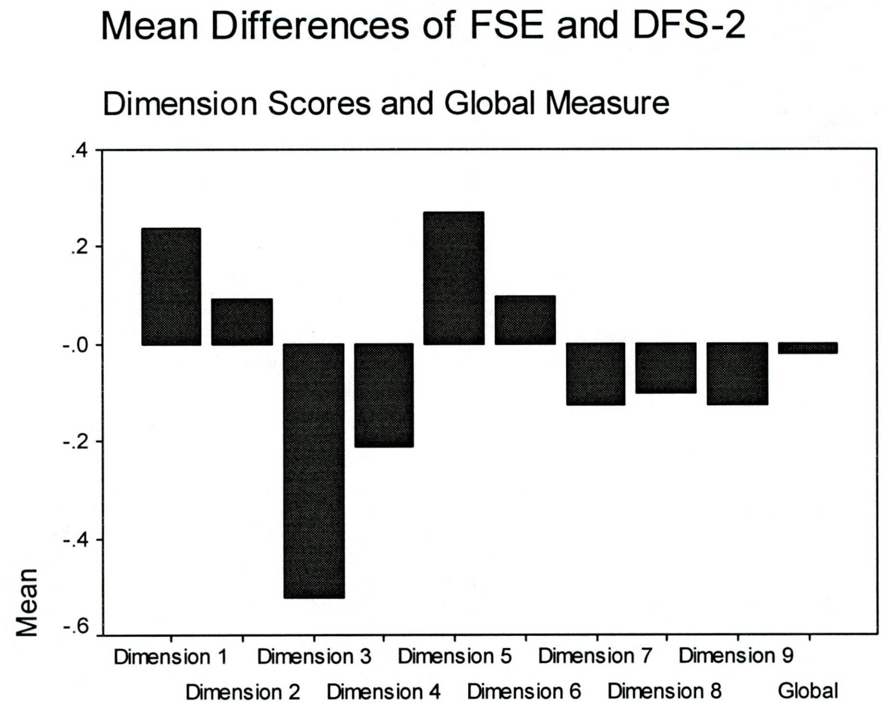
Figure 8. FSE mean scores by dimension and global score.

Figure 9



Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Figure 9. DFS-2 mean scores by dimension and global score.



Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Figure 10. Mean differences between FSE and DFS-2 by dimension and global score.

Table 1
Convergent and Discriminant Correlation Coefficients of Flow Instruments

	FSE Global mean	**DFS-2 Global mean**
Self-Reported Frequency Per Week	.27 *	.37 **
Attitude Overall	.42 **	.37 **
Enjoyable Overall	.43 **	.30 *
Gender	-.21	-.26
Age	-.17	-.03
Ethnicity	.00	.03

Note: N = 62

* Coefficient is significant at the .05 level (2-tailed)

** Coefficient is significant at the .01 level (2-tailed)

Table 2
Factor Analysis of the FSE

Total Variance Explained							
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation
Component	***Total***	***% of Variance***	***Cumulative %***	***Total***	***% of Variance***	***Cumulative %***	***Total***
1	7.28	29.12	29.12	6.80	27.18	27.18	5.10
2	1.85	7.38	36.50	1.32	5.29	32.47	5.10
3	1.50	5.99	42.49	1.03	4.10	36.57	2.76
4	1.31	5.22	47.71	.75	2.98	39.56	4.45
5	1.19	4.75	52.46	.68	2.73	42.28	2.78
6	1.10	4.41	56.87	.64	2.56	44.84	3.28
7	1.04	4.15	61.02	.54	2.17	47.02	2.77

Extraction Method: Principal Axis Factoring
Rotation: Promax with Kaiser Normalization

Table 3

Structure Matrix of FSE Factor Loadings by Item

	Factor						
	1	2	3	4	5	6	7
Question 25	.65	.37	.33	.38	.35	.22	.29
Question 6	.64	.59	.14	.42	.33	.41	.49
Question 24	.62	.44	.21	.35	.36	.34	.31
Question 9	.62	.50	.07	.33	.11	.41	.27
Question 10	.56	.49	.04	.29	.04	.35	.37
Question 22	.55	.47	.19	.39	.31	.38	.42
Question 23	.48	.24	.25	.16	.34	.14	.08
Question 14	.36	.12	.17	.21	.11	.21	.15
Question 15	.28	.16	-.10	.12	.25	.02	.11
Question 13	.34	.73	.33	.48	.33	.37	.32
Question 7	.50	.72	.32	.44	.24	.39	.32
Question 8	.39	.58	.42	.48	.24	.31	.30
Question 11	.55	.55	.16	.26	.23	.30	.34
Question 4	.33	.40	.67	.46	.23	.29	.25
Question 1	.37	.44	.67	.44	.23	.32	.32
Question 3	.43	.44	.51	.39	.25	.27	.34
Question 5	.10	.05	-.36	-.10	-.03	-.02	.27
Question 18	-.38	-.48	-.49	-.92	-.29	-.35	-.25
Question 19	.50	.55	.40	.83	.33	.44	.28
Question 17	.33	.38	.15	.30	.80	.35	.24
Question 16	.34	.22	.23	.28	.65	.33	.16
Question 20	.45	.44	.31	.39	.39	.86	.17
Question 21	.38	.47	.21	.42	.37	.62	.42
Question 2	.18	.20	.08	.09	.06	.08	.67
Question 12	.44	.44	.33	.50	.36	.23	.52

Extraction: Principal Axis Factoring. Rotation: Promax with Kaiser Normalization.

Table 4

A Seven-Factor Solution for the FSE with Item Loadings and Cross Loadings

Factor	Factor Name	FSE Items and Loadings	Items Cross-Loading
1	Automaticity	Item 25 (.65), Item 24 (.65), Item 9 (.62), Item 6 (.62)	Item 6 on Factor 2 (.59), Factor 4 (.42), Factor 6 (.41), Factor 7 (.49) Item 24 on Factor 2 (.44) Item 9 on Factor 2 (.50)
2	Absorbed Focus	Item 13 (.73), Item 7 (.72)	Item 3 on Factor 4 (.48), Item 7 on Factor 1 (.44) and Factor 4 (.50)
3	Exercise Enjoyment	Item 4 (.67), Item 1 (.67)	Item 4 on Factor 2 (.40) and Factor 4 (.46), Item 1 on Factor 2 (.44) and Factor 4 (.44)
4	Time Flies	Item 19 (.83)	Item 19 on Factor 1 (.50), Factor 2 (.55), Factor 3 (.40), Factor 6 (.44)
5	Appropriate Challenge	Item 17 (.80), Item 16 (.65)	None
6	Instinctive Integration	Item 20 (.86), Item 21 (.62)	Item 20 on Factor 1 (.45), Factor 2 (.44) Item 21 on Factor 2 (.47), Factor 3 (.42), Factor 7 (.42)
7	Fatigue	Item 2 (.67)	None

Table 5

Mean Differences between Global and Dimension Scores (FSE minus DFS-2)

	M	*SD*	*SEM*	*Lower 95% CI*	*Upper 95% CI*	*t*	*Df*	*Significance (2-tailed)*
Global	-.02	.28	.04	-.09	.05	-.61	61	.54
Dimension 1	.24	.50	.06	.11	.36	3.74	61	.00
Dimension 2	.09	.74	.09	-.10	.28	.96	61	.34
Dimension 3	-.52	.73	.09	-.71	-.34	-5.64	61	.00
Dimension 4	-.21	.67	.08	-.38	-.04	-2.53	61	.01
Dimension 5	.27	.53	.07	.14	.40	4.01	61	.00
Dimension 6	.10	.42	.05	-.01	.20	1.81	61	.08
Dimension 7	-.13	.99	.13	-.38	.13	-1.01	61	.32
Dimension 8	-.10	.67	.09	-.27	.07	-1.20	61	.24
Dimension 9	-.13	.54	.07	-.27	.01	-1.85	61	.07

Note: N = 62

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Table 6

Correlations of Mean DFS-2 and FSE Paired Scores

	N	Correlation	Significance (2-tailed)
Global	62	.83	.00
Dimension 1	62	.70	.00
Dimension 2	62	.44	.00
Dimension 3	62	.40	.00
Dimension 4	62	.50	.00
Dimension 5	62	.64	.00
Dimension 6	62	.76	.00
Dimension 7	62	.23	.07
Dimension 8	62	.13	.30
Dimension 9	62	.62	.00

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Table 7

Correlations Matrix of FSE and DFS-2 Global Scores and FSE Dimensions

	FSE Global	DFS-2 Global	FSE D1	FSE D2	FSE D3	FSE D4	FSE D5	FSE D6	FSE D7	FSE D8	FSE D9
FSE Global	**1.00**	.83 **	.78 **	.84 **	.71 **	.80 **	.71 **	.82 **	.78 **	.29 *	.78 **
DFS-2 Global	.83 **	**1.00**	.66 **	.63 **	.62 **	.67 **	.66 **	.75 **	.63 **	.14	.64 **
FSE D1	.78 **	.66 **	**1.00**	.58 **	.57 **	.57 **	.53 **	.69 **	.53 **	.16	.56 **
FSE D2	.84 **	.63 **	.58 **	**1.00**	.49 **	.67 **	.49 **	.61 **	.70 **	.27 *	.54 **
FSE D3	.71 **	.62 **	.57 **	.49 **	**1.00**	.58 **	.55 **	.54 **	.45 **	.10	.46 **
FSE D4	.80 **	.67 **	.57 **	.67 **	.58 **	**1.00**	.44 **	.64 **	.56 **	.24	.58 **
FSE D5	.71 **	.66 **	.53 **	.49 **	.55 **	.44 **	**1.00**	.50 **	.52 **	.15	.50 **
FSE D6	.82 **	.75 **	.69 **	.61 **	.54 **	.64 **	.50 **	**1.00**	.57 **	.15	.58 **
FSE D7	.78 **	.63 **	.53 **	.70 **	.45 **	.56 **	.52 **	.57 **	**1.00**	.19	.54 **
FSE D8	.29 *	.14	.16	.27 *	.10	.24	.15	.15	.19	**1.00**	.12
FSE D9	.78 **	.64 **	.56 **	.54 **	.46 **	.58 **	.50 **	.58 **	.54 **	.12	**1.00**

Note: N = 62

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Table 8

Correlations Matrix of FSE and DFS-2 Global Scores and DFS-2 Dimensions

	FSE Global	DFS-2 Global	DFS-2 D1	DFS-2 D2	DFS-2 D3	DFS-2 D4	DFS-2 D5	DFS-2 D6	DFS-2 D7	DFS-2 D8	DFS-2 D9
FSE Global	**1.00**	.83 **	.81 **	.60 **	.60 **	.59 **	.73 **	.80 **	.38 **	.31 *	.66 **
DFS-2 Global	.83 **	**1.00**	.87 **	.74 **	.71 **	.70 **	.78 **	.88 **	.59 **	.57 **	.74 **
DFS-2 D1	.81 **	.87 **	**1.00**	.63 **	.58 **	.49 **	.71 **	.84 **	.48 **	.35 **	.65 **
DFS-2 D2	.60 **	.74 **	.63 **	**1.00**	.44 **	.45 **	.55 **	.56 **	.48 **	.27 *	.38 **
DFS-2 D3	.60 **	.71 **	.58 **	.44 **	**1.00**	.58 **	.35 **	.60 **	.16	.48 **	.62 **
DFS-2 D4	.59 **	.70 **	.49 **	.45 **	.58 **	**1.00**	.53 **	.54 **	.17	.42 **	.52 **
DFS-2 D5	.73 **	.78 **	.71 **	.55 **	.35 **	.54 **	**1.00**	.65 **	.50 **	.32 *	.49 **
DFS-2 D6	.80 **	.88 **	.84 **	.56 **	.60 **	.54 **	.65 **	**1.00**	.46 **	.49 **	.70 **
DFS-2 D7	.38 **	.59 **	.48 **	.48 **	.16	.17	.50 **	.46 **	**1.00**	.16	.21
DFS-2 D8	.31 *	.57 **	.35 **	.27 *	.48 **	.42 **	.32 *	.49 **	.16	**1.00**	.42 **
DFS-2 D9	.67 **	.75 **	.66 **	.38 **	.63 **	.53 **	.49 **	.70 **	.21	.41 **	**1.00**

Note: N = 62

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Table 9

Correlations of Sample Characteristics and Mean Global and Dimensional Flow Scores

	Self-Reported Frequency Per Week	***Attitude Overall***	***Enjoyable Overall***	***Category***	***FSE Global***	***DFS-2 Global***
Frequency Per Week	**1.00**	.08	-.08	.39 **	.27 *	.37 **
Attitude Overall	.08	**1.00**	.59 **	.27 *	.42 **	.37 **
Enjoyable Overall	-.08	.59 **	**1.00**	.20	.43 **	.30 *
Category	.39 **	.27 *	.20	**1.00**	.22	.16
FSE Global	.27 *	.42 **	.43 **	.22	**1.00**	.83 **
DFS-2 Global	.37 **	.37 **	.30 *	.16	.83 **	**1.00**
FSE D1	.33 *	.34 **	.26 *	.24	.78 **	.66 **
DFS-2 D1	.32 *	.44 **	.31 *	.25 *	.81 **	.87 **
FSE D2	.21	.36 **	.39 **	.22	.84 **	.63 **
DFS-2 D2	.26 *	.17	.09	.12	.60 **	.74 **
FSE D3	.32 *	.45 **	.35 **	.35 **	.71 **	.62 **
DFS-2 D3	.48 **	.21	.19	.23	.60 **	.71 **
FSE D4	.25 *	.38 **	.43 **	.20	.80 **	.67 **
DFS-2 D4	.27 *	.31 *	.21	.14	.59 **	.70 **
FSE D5	.09	.30 *	.33	.01	.71 **	.66 **
DFS-2 D5	.12	.31 *	.31 *	.03	.73 **	.78 **
FSE D6	.29 *	.35 *	.33 *	.26 *	.82 **	.75 **
DFS-2 D6	.34 *	.35 *	.32 *	.18	.80 **	.88 **
FSE D7	.00	.25 *	.27 *	.04	.78 **	.63 **
DFS-2 D7	.16	.23	.19	.02	.38 **	.59 **
FSE D8	.00	.09	.07	.02	.29 *	.14
DFS-2 D8	.30 *	.05	.02	.02	.31 *	.57 **
FSE D9	.24	.24	.36 *	.11	.78 **	.64 **
DFS-2 D9	.22	.36 *	.35 *	.13	.67 **	.75 **

Note: N = 62

* Correlation is significant at the .05 level (2-tailed)

** Correlation is significant at the .01 level (2-tailed)

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Table 10

Multiple Regression Modeling of FSE Global Mean and Demographic Predictors for Total Exercise Frequency Over Four Months

Multiple Regression Model 1: Model Summary			
R	*R Squared*	*Adjusted R Squared*	*Standard Error of the Estimate*
.60	.36	.17	18.08

Predictors: FSE global mean score, age, gender, Asian ethnicity, black ethnicity, Hispanic ethnicity, white ethnicity, income, aerobic exercise type, anaerobic exercise type, flexibility exercise type, exerciser category.

Criterion: Total exercise frequency over four months

Model 1 Coefficients	Unstandardized Coefficients		Standardized Coefficients		
	B	*Standard Error*	*Beta*	*T*	*Significance*
Constant	-5.86	30.		-.19	.85
FSE global mean	13.89	6.56	.31	2.11	.04 *
Gender	-4.00	6.24	-.10	-.64	.52
Age	-.35	.18	-.35	-1.96	.06
Asian	-16.89	8.22	-.33	-.206	.04 *
Black	4.02	14.19	.04	.28	.77
Hispanic	-10.52	7.99	-.21	-1.32	.19
Income	2.94	2.10	.22	1.4	.16
Anaerobic	-6.20	6.84	-.14	-.91	.37
Flexibility	-7.78	10.63	-.11	-.73	.46
Category	-2.43	5.32	-.08	-.46	.65

Significant at the $p \leq .05$ level

Variables excluded through collinearity tolerance statistic: White, Aerobic

Table 11

Multiple Regression Modeling of DFS-2 Global Mean and Demographic Predictors for Total Exercise Frequency Over Four Months

Multiple Regression Model 2: Model Summary			
R	*R Squared*	*Adjusted R Squared*	*Standard Error of the Estimate*
.64	.40	.23	17.40

Predictors: DFS-2 global mean score, age, gender, Asian ethnicity, black ethnicity, Hispanic ethnicity, white ethnicity, income, aerobic exercise type, anaerobic exercise type, flexibility exercise type, exerciser category.

Criterion: Total exercise frequency over four months

Model 2 Coefficients	Unstandardized Coefficients		Standardized Coefficients		
	B	*Standard Error*	*Beta*	*T*	*Significance*
Constant	-18.39	28.94		-.64	.52
DFS-2 global mean	17.16	6.24	.40	2.74	.01 *
Gender	-2.19	6.09	-.06	-.36	.72
Age	-.43	.18	-.43	-2.48	.02 *
Asian	-16.69	7.88	-.33	-2.12	.04 *
Black	6.12	13.70	.06	.45	.66
Hispanic	-13.03	7.81	-.25	-1.67	.10
Income	3.05	2.02	.22	1.51	.14
Anaerobic	-4.79	6.52	-.11	-.74	.47
Flexibility	-7.51	10.22	-.11	-.74	.47
Category	-2.21	5.11	-.07	-.43	.67

Significant at the $p \leq .05$ level

Variables excluded through collinearity tolerance statistic: White, Aerobic

Table 12

Correlations of Four-Month Exercise Frequency with Mean Global and Dimensional Flow Scores

	Four-Month Exercise Frequency
Four-Month Exercise Frequency	1.00
FSE Global	.35 *
DFS-2 Global	.38 *
FSE D1	.29 *
DFS-2 D1	.35 *
FSE D2	.35 *
DFS-2 D2	.13
FSE D3	.28
DFS-2 D3	.12
FSE D4	.21
DFS-2 D4	.22
FSE D5	.08
DFS-2 D5	.42 **
FSE D6	.31 *
DFS-2 D6	.37 *
FSE D7	.28
DFS-2 D7	.23
FSE D8	.09
DFS-2 D8	.11
FSE D9	.31 *
DFS-2 D9	.43 **
Age	-.21
Gender	-.23
Asian Ethnicity	-32 *
Black Ethnicity	.17
Hispanic Ethnicity	.04
White Ethnicity	.14
Income	.01
Aerobic Exercise Type	.14
Anaerobic Exercise Type	.02
Flexibility Exercise Type	-.20
Exerciser Category	-.17

Note: N = 45

* Correlation is significant at ≤ .05 level (2-tailed)

** Correlation is significant at ≤ .01 level (2-tailed)

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 2	Action/Awareness Merging
Dimension 3	Clear Goals
Dimension 4	Unambiguous Feedback
Dimension 5	Concentration
Dimension 6	Paradox of Control
Dimension 7	Loss of Self-Consciousness
Dimension 8	Time Transformation
Dimension 9	Autotelic Experience

Table 13

Linear Regression Modeling of FSE Dimensions 1, 6, and 9 for Total Exercise Frequency Over Four Months

Multiple Regression Model 3: Model Summary			
R	***R Squared***	***Adjusted R Squared***	***Standard Error of the Estimate***
.36	.13	.06	19.18

Predictors: FSE Dimension 1, FSE Dimension 6, FSE Dimension 9
Criterion: Total exercise frequency over four months

Model 3 Coefficients	Unstandardized Coefficients		Standardized Coefficients		
	B	***Standard Error***	***Beta***	***T***	***Significance***
Constant	-35.51	22.08		-1.61	.12
FSE Dimension 1	3.30	6.28	.11	.60	.60
FSE Dimension 6	4.38	6.90	.13	.53	.53
FSE Dimension 9	6.62	7.16	.17	.36	.36

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 6	Paradox of Control
Dimension 9	Autotelic Experience

Table 14

Linear Regression Modeling of DFS-2 Dimensions 1, 6, and 9 for Total Exercise Frequency Over Four Months

Multiple Regression Model 4: Model Summary			
R	***R Squared***	***Adjusted R Squared***	***Standard Error of the Estimate***
.47	.20	.14	18.36

Predictors: DFS-2 Dimension 1, DFS-2 Dimension 6, DFS-2 Dimension 9

Criterion: Total exercise frequency over four months

Model 4 Coefficients	**Unstandardized Coefficients**		**Standardized Coefficients**		
	B	***Standard Error***	***Beta***	***T***	***Significance***
Constant	-41.14	19.33		-2.13	.04 *
DFS-2 Dimension 1	3.37	7.60	.10	.44	.66
DFS-2 Dimension 6	1.59	8.83	.15	.18	.86
DFS-2 Dimension 9	10.62	6.23	.34	1.70	.10

* Significant at the $p \leq .05$ level

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 6	Paradox of Control
Dimension 9	Autotelic Experience

Table 15

Linear Regression Modeling of FSE and DFS-2 Global and Dimensional Mean Flow Scores for Total Exercise Frequency Over Four Months

Simple Linear Regression Models Summary

	R	*R Squared*	*Adjusted R Squared*	*Standard Error of the Estimate*
Model 1	.35	.13	.11	18.74
Model 2	.38	.14	.12	18.55
Model 3	.29	.09	.06	19.17
Model 4	.35	.12	.10	18.80
Model 5	.29	.09	.06	19.17
Model 6	.37	.13	.11	18.64
Model 7	.31	.10	.08	19.04
Model 8	.43	.19	.17	18.05

Predictors: Model 1: FSE global flow; Model 2: DFS-2 global flow
Model 3: FSE D1; Model 4: DFS-2 D1
Model 5: FSE D6; Model 6: DFS-2 D6
Model 7: FSE D9; Model 8: DFS-2 D9

Criterion: Total exercise frequency over four months

Regression Coefficients for Simple Linear Regression Models

	Unstandardized Coefficients		**Standardized Coefficients**	**T**	**Significance**
	B	***Standard Error***	***Beta***		
Model 1	15.78	6.36	.35	2.48	.01 *
Model 2	16.22	6.05	.38	2.68	.01 *
Model 3	9.01	4.51	.29	2.00	.05 *
Model 4	11.50	4.76	.35	2.41	.02 *
Model 5	10.09	4.77	.31	2.12	.04 *
Model 6	12.64	4.90	.37	2.58	.01 *
Model 7	11.88	5.53	.31	2.15	.03 *
Model 8	13.57	4.30	.43	3.16	.00 *

* Significant at the $p \leq .05$ level

Flow Dimensions Legend	
Dimension 1	Skill-Challenge Balance
Dimension 6	Paradox of Control
Dimension 9	Autotelic Experience