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Research Article

IN THE FLOW: STUDY OF FLOW STATE AND COGNITION IN YOUNG ADULTS

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A R T I C L E I N F O

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A B S T R A C T

The study investigated the nature of the flow state among Young adults. Flow is defined as pleasurable experiential state that occurs during full-capacity engagement in which an individual is performing at a level that is matched with the demands of the task. The participant completed a scale assessing dimensions of flow in an activity selected by them. Results show more cognitively demanding activities elicited higher levels of flow for those with higher fluid ability, and lower levels of flow for those with lower fluid ability. The pattern was reversed for activities that were low in demand. The data highlight the potential importance of considering motivational states such as flow in understanding cognitive optimization in adulthood.

INTRODUCTION

Since Csikszentmihalyi (1975) first introduced the flow state as a general theory of the phenomenology of motivation, it has interested researchers from fields as diverse as education (Vollmeyer&Rheinberg, 2006), sports psychology (Jackson & Marsh, 1996), human factors (Choi, Kim & Kim, 2007), and neuroscience (Dietrich, 2004). Flow, which is defined as the experiential state that occurs as one approaches optimal engagement with a task, emerged from interest in describing the experience of optimal performance (Nakamura & Csikszentmihalyi, 2009). While the flow construct has been explored in various fields, neither the nature of flow in young adults nor its role in cognitive aging has been examined. This is surprising given the role of flow in subjective well-being (Myers & Diener, 1995) and the increased interest in the relationship between well-being and healthy aging (Ryff, Singer, & Love, 2004). While young participants have reported greater levels of flow when engaged in intellectually challenging activities than when participating in passive and easy activities (Csikszentmihalyi, 1990), the nature of such experiences has yet to be empirically assessed in a young sample. Furthermore, our review of the literature reveals little investigation of the mechanisms by which we derive pleasure from intellectual activities as we grow older.

To the extent that an intellectually engaging lifestyle may contribute to cognitive vitality (Hertzog, Kramer, Wilson, &Lindenberger, 2008; Crowe, Andel, Pedersen, Johansson, & Gatz, 2003; Wilson, Scherr *et al*., 2007; Parisi, Stine-Morrow, Noh & Morrow, 2009; Schooler &Mulatu, 2001; Schooler, Mulatu, & Oates, 1999), a full account of such enrichment effects will ultimately depend on understanding motivational states (such as flow) that may serve a self-regulatory function in engendering such choices in engagement. In the current study, we made a preliminary step toward addressing such issues by examining the nature of the flow state in young adults.

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Csikszentmihalyi (1990) defined flow in terms of nine dimensions which include challenge skill balance, the merging of actions with awareness, having clear task goals, unambiguous feedback, full concentration on the task at hand, a sense of control, a loss of self consciousness, a perception of the transformation of time, and an autotelic (or intrinsically rewarding) experience (see Csikszentmihalyi, 1990 for a comprehensive review of these dimensions). Flow is described as an exceptionally positive state and has been posited as the phenomenological experience that motivates people to perform difficult activities at a high level and to persevere in these activities across long periods of time (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2005). This state occurs when a person is completely absorbed in a task or situation and is characterized by entering a “channel” where task demands and skills are equivalent so that one is not below this channel in a state of boredom or above this channel where the challenges of the task overcome one’s skill set (Nakamura & Csikszentmihalyi, 2009). This suggests that the flow experience will be more likely if there is a match between the capacities afforded by ability and the demands of the activity, here called Match Hypothesis. Payne (2011), defined Match Hypothesis as the activities that are more cognitively demanding should elicit higher levels of flow for those with higher fluid ability, and lower levels of flow for those with lower fluid ability, as they would presumably be operating above their skill level, outside of the flow channel.

The Match Hypothesis was examined by Payne in adults but has yet to be examined in Indian context, in part because a generalized flow measure does not exist. However, a nine-factor measure of flow tailored to athletic performance has been validated. Jackson and Marsh (1996) used confirmatory factor analysis to establish construct validity of their Flow State Scale (FSS), demonstrating good fit to both a nine-factor model and a single global factor model of flow. Evidence for predictive validity included correlations between flow and other constructs theorized to relate to flow (i.e. perceived ability, anxiety, and motivation; Jackson, Kimiecik, Ford & Marsh, 1998). To our knowledge, flow has very limitedly been quantitatively assessed with this model for non-sports activities. Furthermore, the primary population for which the FSS measurement model has been explored has been elite athletes, most of whom have been relatively young. Thus, there is limited evidence that this measurement model of flow generalizes across tasks and populations.

The study aims to test the Match Hypothesis by examining the relationship between cognitive ability and the flow experience in activities of low and high demand. It was hypothesized that more cognitively demanding activities would elicit higher levels of flow for those with higher fluid ability, but lower levels of flow for those with lower fluid ability, and that the pattern would be reversed in low demanding activities.

METHOD

Participants

Participants included 127 community dwelling young adults from Rajasthan (3 districts). Participants ranged in age from 20 to 34 years (M = 24.1, SD = 7.7 years), and had an average of 15.5 years of education (SD = 2.7). All had at least completed the under-graduation studies.

Measures

Multiple instruments were used to assess fluid cognitive abilities. Processing speed was measured with letter comparison and pattern comparison tests (Salthouse & Babcock, 1991) and the identical pictures test (Ekstrom, French, & Harmon, 1976). Visual spatial processing was measured with the card rotation and hidden patterns tasks (Ekstrom *et al*., 1976).Working memory was measured with the N-Back test. Divergent thinking was measured with the different uses and opposites tests (Ekstrom *et al*., 1976). Inductive thinking was measured by the everyday problem-solving test (Marsiske& Willis, 1995). The composite for these tests of fluid ability showed high correlation. The Activity Flow State Scale (AFSS) contained 34 items representing each of the nine dimensions of flow, developed by Payne (2011). Participants rated items on a Likert scale ranging from (1) Strongly Disagree to (5) Strongly Agree. Instructions for our flow measure were as follows: Below you will read a number of statements that describe how people sometimes experience certain activities or events in their daily lives. Think about one activity that you performed or experience that you had during the last week, particularly one that you enjoyed and/or found satisfying. Try to remember how you experienced that activity as you read each statement below. Provide a rating for each statement to indicate how well it describes your experience by circling the appropriate number. In the AFSS, participants were free to report on any kind of activity that they had participated in recently.

In order to determine activity demand, we categorized participants' open-ended reports of their selected activity into groups representing activities of either high cognitive demand (HCD) or low cognitive demand (LCD). Estimates between independent raters that were blind to participants' flow ratings and cognitive abilities showed good interrater reliability (κ =.86). HCD activities included: working (14.3%), participating in art and music (12.5%), educational activities including taking classes and teaching (6.7%), reading and literacy activities (4.2%), completing puzzles and challenging games such as crosswords, cards, and Sudoku (3.6%), and searching for information in library settings or on computers (2.4%). LCD activities included: attending parties and social events (34.8%), physical exercise (10.2%), watching television (2.8%), cooking (2.4%) and vacation and resting (2.1%). Groups reporting HCD (N = 69) and LCD (N = 109) activities did not differ in age (MHC = 72.1, 60-92 years; MLC = 72.2, 60-94 years; t < 1), education (MHC= 15.8, 7-20 years; MLC=15.4, 12-21 years; t < 1), or fluid cognitive ability (MHC= .07, SE = .07; MLC= .04, SE = .07; t < 1). The global flow factor also maintained high reliability in both groups (αHC= . 89; αLC= .91).

In order to establish external validity coding scheme used in this study, participants were examined self perceptions of cognitive demand in a number of activities that were collected in a separate instrument. In this activity measure, participants were asked to rate the perceived levels of cognitive demand on a number of different everyday activities (see Salthouse, Berish, & Miles, 2002) All activity groupings listed above as HCD or LCD were included in this measure. HCD activities were rated by participants as significantly more demanding than LCD activities (MHCD= 3.73, SE = .07; MLCD= 2.86, SE = .06), t (176) = 12.65, p < .001, d = 1.00. Thus, even though any of these activities can likely vary in intellectual demand (e.g., "cooking" might constitute heating up leftovers or organizing a dinner party for 12), the participants who completed our AFSS shared our independent raters' perceptions that activities could be generally characterized in terms of cognitive demand.

Procedure

Participants completed the AFSS and the activity assessment as part of a larger set of measures that were mailed to their home. Participants were later administered the battery of cognitive measures in an individual laboratory session lasting approximately an hour. The time between completing the packet and completing the lab session was approximately one week.

RESULTS

The findings are in line with the nine proposed dimensions of flow (Csikszentmihalyi, 1990) and suggest that the multidimensional measurement model of flow (Jackson & Marsh, 1996) generalizes across general activities and to a previously unexamined population of young adults.

Because the Match Hypothesis includes no explicit predictions about what dimensions of flow would be related with specific or broad-based cognitive abilities, we aimed to operationalize flow as a single global construct (a global flow factor [Fg]; Jackson *et al*., 1998) and to examine relationships between Fg and cognition. Previous research has suggested that flow can be meaningfully examined at both a specific level of analysis (9 facets) or through a higher order global construct (Jackson *et al*., 1998; Jackson & Marsh, 1996; Jackson & Eklund, 2002). To do this, we formally tested the fit of the Fg model, which included all indicators loading on a single first-order latent factor. This model showed good fit to the data (χ 2=12.74, NNFI/TFI= .98, CFI = .98, RMSEA = .09, 90% CI = . 06, .12). Thus, we found evidence that the flow construct is multidimensional but can also be meaningfully assessed as a unitary construct (Jackson *et al*., 1998)

The Match Hypothesis posits that the experience of flow will vary as a function of the alignment between the person's cognitive ability and the cognitive demands of the task. Cognitive ability was modeled hierarchically with a latent factor representing general fluid ability (Gf) with lower order latent factors for processing speed, inductive reasoning, divergent thinking, and working memory. This model of cognitive ability showed good fit to the data (χ 2 = 111.80, NNFI/TFI= .93, CFI = .97, RMSEA = .06, 90% CI = .05, .08), suggesting that the measures of cognition among our young adults represented a general fluid ability factor (Carroll, 1993; Cattell, 1987). To test the Match Hypothesis, we used hierarchical regression to examine the joint effects of activity demand and cognitive ability on intensity of the flow state. Using the Fg composite as the criterion variable, we first entered the main effects of Gf and the dummy-coded activity demand (0 for LCD; 1 for HCD). We then entered the cross-product term of Gf and activity demand in Step 2. While neither the main effect of Gf nor of activity demand was predictive of the flow state (β= −.12, t (160) = −1.28, p > .05; β = −.04, t (160) = .08, p >. 05, respectively), the interaction term was significant (β= .30, t (160) = 3.45, p < .01). Consistent with the Match Hypothesis, this interaction suggests that the magnitude of the relationship between fluid ability and flow state varied as a function of the demand of the activity. We examined conditional effects of the interaction to determine if fluid ability was positively related to flow for cognitively demanding activities and negatively related to flow for non-cognitively demanding activities (i.e., testing if both slopes are significantly different from zero, rather than significantly different from each other). Using the simple slopes technique (Aiken & West, 1991; Preacher, Curran, & Bauer, 2006), we decomposed the interaction term into a simple regression of flow onto fluid abilities for both noncognitively demanding activities and cognitively demanding activities. Results indicate that both slopes were significant, with fluid ability positively related to flow for cognitively demanding activities (B = .25, SE = .11; t (93) = 2.26, p < .05), and fluid ability negatively related to flow for non-cognitively demanding activities (B = −.19, SE = .06; t (64) = −3.00, p < .01). The three-way interaction between age, fluid ability and activity demand was negligible (β = .04; t (160) = .05, p >.10). Collectively, these findings, along with the lack of correlation between age and flow (see Table 1 in online appendix), suggest that the ability to experience a flow state is not compromised with age.

Table 1 Correlation between Age, Education and Cognitive Flow

	Age	Ed	Sp	WM	VSP	DT	IR	Fluid
Age								
Ed	-.03							
Speed	-.46**	.23**						
WM	-.36**	.18*	.44**					
VSP	-.43**	.24**	.69**	.49**				
DT	-.33**	.38**	.47**	.38**	.57**			
IR	-.42**	.38**	.1**	.52**	.77**	.67**		
Fluid	-.48**	.35*	.78**	.63**	.86**	.73**	.92**	
C_Flow	-.01	.05	.20†	-.07	.31**	.21†	.24†	.27*
NC_Flow	.02	-.11	-.16	-.12	-.16	-.25*	-.38**	-.29**
G_Flow	.00	-.16	-.01	-.07	.02	-.03	-.13	-.08

Note. Ed = Education, Sp = Processing Speed, WM = Working Memory, VSP = Visual Spatial Processing, DT = Divergent Thinking, IR = Inductive Reasoning; Fluid = Fluid Composite; C_Flow = Flow for Cognitively Demanding Activities, NC_Flow = Flow for Low-Cognitively Demanding Activities; G_Flow = Global Flow Composite; **p* < .05, ***p* <. 01, †*p* < .10.

DISCUSSION

Our findings support the Match Hypothesis: participants with higher fluid abilities experienced higher levels of flow in cognitive activities, while those with lower fluid abilities experienced lower levels of flow. However, participants with lower fluid abilities experienced higher levels of flow in non-cognitive activities, while those with higher fluid abilities experienced lower levels of flow. These data are consistent with the resource-based selection view, in which resource scarcity arises when the "total demands required by multiple tasks exceed total available resources" (Riediger *et al*., 2006; p. 301) as well as the challenge-skill balance conception of flow. Among young adults, those who are generally resource-rich have the capacity to be more absorbed by activities of higher cognitive demand as opposed to resource-poor individuals who are more absorbed with activities of lower cognitive demand. To the extent that the flow state engenders persistence in an activity, this suggests that experiential states may contribute to the degree to which we gain from that activity, an account that is echoed in the educational literature with younger adults (cf. Engeser, Rheinberg, Vollmeyer, & Bischoff, 2005; Vollmeyer & Rheinberg, 2006).

With a population different from previous studies (including elders and non-experts) and across a broad range of self-selected activities, we showed similar model fit indices and factor loadings to previous measurement models of flow for both a 9-factor model (facets of flow) and a 1-factor (global flow) model (Jackson & Eklund, 2002; Jackson *et al*., 1998). Though our central test of the Match Hypothesis required only the global flow factor, we present evidence that the multidimensional model shows good fit as well, consistent with the previous validation of the scale and in line with flow theory. These different levels of analysis may prove important in future research. For example, it is often the case that lower order facets of personality traits predict outcomes above and beyond the broad trait (Paunonen & Ashton, 2001). Thus, while flow as a global construct is related to cognition during activity engagement, the facets of flow may be differentially associated with other outcome measures in young adulthood.

CONCLUSION

The finding that young adults have the capacity to experience flow when cognitive capacity and intellectual demands are in synch is potentially important for theories of cognitive optimization and translation into health recommendations and programs of life-long education. To the extent that educational experiences early in the life span engender more favorable trajectories of cognition in later life (e.g., Stern, 2009), flow offers a potential explanatory mechanism for such self-perpetuating effects: early development of cognitive capacities enables the experience of pleasure in the face of cognitive challenge, which fosters self-regulation of an intellectually stimulating lifestyle, which in turn, nurtures cognition through adulthood.

Certain limitations need to be addressed. Our coding scheme for the cognitive demand of activities was binary and based on open-ended responses. While there are likely some individual differences in the degree to which a particular activity is demanding, we set conservative estimates for what constitutes a highly demanding activity. Using independent ratings of the intellectual demand of activities is not an atypical approach (Arbuckle *et al*., 1992, Gold *et al*., 1995, Hultsch *et al*., 1999); in the current study, this categorization yielded good inter-rater reliability and external validity, and was consistent with perceived demand among participants. Future research is needed to examine a more fine-grained relationship between demands of the task and level of ability. Additionally, while the AFSS allows for participants to report flow on a wide range of activities, the retrospective nature of these reports is certainly a limitation.

Similar to a great deal of the literature on activity engagement and cognition, the current study is cross-sectional and correlational, limiting the ability to make causal claims. Longitudinal and experimental work is needed to chart the determinants of flow and the long-term effects on cognitive health and well-being. This research offers an instrument with good psychometric properties to address such questions. Future work that assesses the flow state as a function of activities as a manipulated variable would be valuable in isolating causal relationships. Nevertheless, our results offer preliminary evidence that young adults can find pleasure with intellectual pursuits within their capacity.

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