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Optimal Flow Experience in Web-Based Instruction

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The purpose of this study is to explore learner engagement and motivation related to *Flow* particularly in WBI settings. In the *Flow* state people are absorbed in their activities while irrelevant thoughts and perceptions are screened out. In this article, we attempted to identify some of the critical elements of learner feelings and WBI features which relate to the experience of *Flow*. Survey data were collected from 266 Korean cyber-university students and the data were subject to factor analyses and multiple regression to determine the best predictors of *Flow* in WBI environments. As a result, six factors, including G-factor for flow, were found. Based on these findings, a theoretical model for Learner Flow within WBI was proposed

Key Words: Flow experience, WBI flow, WBI feelings

Whether working with traditional instructional environments or those which use technology to support learning, teachers and instructional designers have the continual challenge to create what are called “motivating” or “engaging” learning activities. There is an implicit assumption that an engaged learner will engage in deeper and more complex types of learning, and will be more likely to become active in future learning activities. However, before beginning to build such motivating learning activities, it would be useful to have an idea of what it means for a learner to be *engaged* or *motivated*.

Certainly, motivation is an extremely multifaceted concept. However, one of the more interesting recent approaches to it relates to that peculiar mental state when learners become so engrossed in a task or activity that they can be said to ‘lose themselves’ and to ‘tune out’ the outside world. That is, the task itself so engages those involved that they enter what Csikszentmihalyi (1988; 1990) has called *Flow*.

The primary purpose of this study is to explore learner motivation from the perspective of *Flow*, focusing on a specific type of technology-supported learning environment, namely *Web-Based Instruction* (WBI). We are interested in certain relationships among three types of variables which operate in WBI: a) the specific feelings learners have during WBI activities which are said to be related to *Flow*; b) the types of experiences and opinions learners have had related to various aspects of WBI; and c) the learners’ reported degree of *Flow* during such WBI activities. Our conclusions help to clarify the relative importance of various component learner feelings experienced during WBI activities, together with certain WBI design elements, and to relate them to the learners’ reported degree of *Flow* during those activities.

The concept of Flow: Optimal experience

As articulated by Csikszentmihalyi and colleagues, *Flow* is the label adopted to describe a certain psychological state in which an individual feels cognitively efficient, motivated, and happy (Csikszentmihalyi, 1990). When in the *Flow* state, people become fully engrossed in their activities, while irrelevant thoughts and perceptions are screened out. This *Flow* state, also called a state of “peak experience ” or

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"optimal experience", is described by Donald Norman (1996) this way:

"Probably all of us have experienced this engaged state of focused attention, a form of trance. As all attention is focused upon the task at hand, the outside world fades away: Its noises and distractions subside. This trance world can be induced by many things, by books, plays, television. By games or music. By concentrated experiential cognition or by intense, focused reflection upon a problem. It is an enjoyable state, for when attention becomes so intensely focused upon the thing of interest everyday worries and fears are transcended and all else recedes. One lives for that task alone." (p. 38)

In school learning environments, *Flow* is considered desirable and highly functional, and has been linked to other factors of learner engagement, continual motivation, psychological health, and a sense of learner well-being (Hektner & Csikszentmihalyi, 1996; Hunter & Csikszentmihalyi, 2003; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2003).

There seems to be both a large and a small scopes for conceptualizing *Flow*. *Flow* can be thought of philosophically as an almost existential goal state (a la Maslow), applying to the "best feelings" in life (Csikszentmihalyi, 1975a, 1990) and the most enjoyable experiences possible in human lives at "the bottom line of existence" (Csikszentmihalyi, 1982, p. 13). However, this philosophical view of *Flow* describes mental states well beyond the scope of the current research framework.

Instead, in this paper, we will limit our conceptualization to the more modest 'micro' notion of *Flow* as being a situational motivational construct, related to a person's experience within a specific task or event. That is, we are interested in *Flow* states which might occur within specific circumstances or environments. In our case, we focus on *Flow* variables operating within a specific learning environment, namely during Web-Based Instructional activities.

Models of *Flow*

In general, the most basic elements common to all *Flow* models are aspects of task *challenge* and performer *skill* level (Csikszentmihalyi, 1975b; Csikszentmihalyi, 1990; Moneta & Csikszentmhalyi, 1996; Chen, Wigand, & Nilan, 1999). Various combinations of these two aspects will produce, so the theory goes, either *Flow* (in optimal combinations of challenge and skill), or alternatively *anxiety, boredom* or similar characteristics of the unmotivated performer (when challenge and skill are not well-matched). The early three-channel model (Csikszentmihalyi, 1975a) shown in Figure 1 indicate that the *Flow* state will emerge in a person who has skills which are congruent with the challenge of the task.

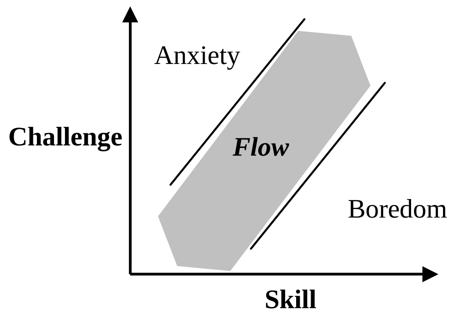

Figure 1. Three Channel Flow Model (Csikszentmihalyi, 1975a)

One characteristic of the three-channel model is that the "flow channel" encloses a diagonally banded region. What this suggests is that flow experiences are expected to occur under the optimal combination of skill and challenge level. When the levels of personal skill and task challenge are not matched, however, either anxiety (resulting from a high task challenge but low skill level) or boredom (a high level of skill but low task challenge) will result.

Greater empirical support, however, has been found for the reformulated four-channel model shown in Figure 2, where *Flow* results from high skills and high challenges, but apathy results from low skill and low challenges. Indeed, various studies have verified the clearly differentiated patterns reflected in the Four-Channel Model (Csikszentmihalyi, 1990).

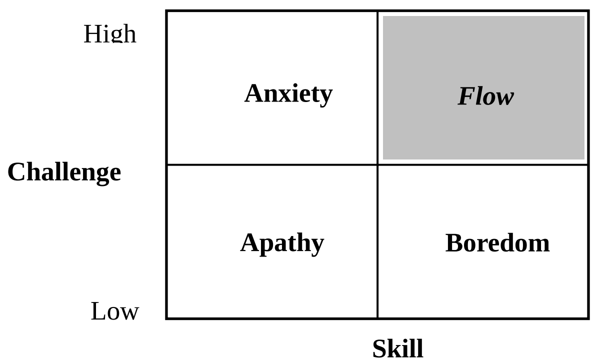

Figure 2. Four-Channel Flow Model (Csikszentmihalyi, 1990)

These original models have been subjected over time to testing and refinement (Privette & Bundrick, 1987; Massimini & Carli, 1988) gradually increasing and clarifying the psychological variables which are thought to relate to the general construct of *Flow*. Most of the current models are much more elaborate than earlier models, and conceptualize a person’s degree of *Flow* as a function of perceived challenges and skills, moderated by other intermediate factors such as control or arousal. Recently, some researchers (e.g., Novak, Hoffman, & Yung, 2000) have taken the study of *Flow* into computer-based environments, as well, and produced models specifically within those environments. This body of research is discussed in the next section.

Flow within computer-based environments

It is a common observation that in certain computer-based environments – gaming, for example, or Internet chat rooms – users might become so lost or engrossed in the activity, that they can be said to ‘tune out’ the outside world (Csikszentmihalyi, 1996). Such intense engagement by these computer users has begun to be studied by educational researchers keen on creating more motivating learning environments. Rotto (1994) for example, is interested in why computer games are so attractive and attempts to draw connections between the work of Csikszentmihalyi and other motivational theorists to make instructional games more motivating for the users. He suggests that designing computer-based learning activities to increase learner curiosity would also improve learner enjoyment and *Flow*. Similarly, Jones (1998) creates a set of multimedia guidelines for computer games and learning environments which are intended to enhance key *Flow* characteristics.

Empirical research in computer-based environments (Ghani & Deshpande,1994; Trevino & Webster, 1992; Webster, Trevino, & Ryan, 1993) has expanded and clarified many of the unique characteristics and variables of *Flow* operating there, and helped in the development of theoretical situational models of *Flow*. To date, most of the literature on *Flow* in web-based environments does not focus on learner motivation within educational settings, but instead comes from researchers in the field of business marketing who are primarily interested in the study of what makes for a positive consumer experience on the Web. Nonetheless, these investigators have provided useful foundation work which has relevance for educational research studying WBI environments and activities. In particular, the general conceptual model of *Flow* in an interactive computer-mediated environment (CME) described in detail in Hoffman and Novak (1996), serves as the basis for the current study. Their initial model served to reconcile inconsistencies in previous definitions and models and laid the groundwork for formal empirical testing.

The intention is that if current research can help to identify the related factors that make flow experiences possible in WBI, the instructional designers and instructors of WBI might greatly benefit from ideas on how to provide optimal *Flow* experiences to their students. We ask, “Can the learner experience *Flow* in Web-Based Instruction?” and “What are the factors involved in learners having an optimal *Flow* experience?”

For the current study we posited a simple model in which *Flow* might be predicable from two sets of variables (see Figure 3). One we call *Feelings During WBI*, comprised of previously researched aspects or constituent components of *Flow* (Playfulness, Importance, Exploratory Behavior, Time Distortion, Skill, Arousal, Challenge, and Focused Attention) which might arise in online environments (Chen, Wigand, & Nilan,1999; Novak & Hoffman, 1996; Novak, Hoffman, & Yung, 2000) but this time are applied specifically within online *instructional* environments. The second set of variables we call *WBI Experiences*, at the amount or degree that online learners have experienced various aspects common to most WBI environments (Contents, Design, Interactivity, and Navigation). Both of these domains are viewed here as

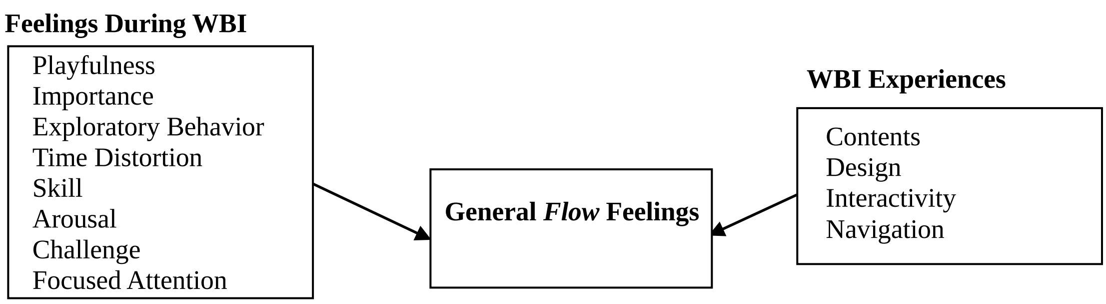

Figure 3. Initial Model for Learner Flow within WBI Environments and Activities

independent variables which predict of the dependent variable of *General Flow Feelings*.

To summarize, our interests in this study focus around an examination of what constitute the critical feelings of learners which are related to an optimal *Flow* experience, as well as which features of WBI environments and activities tend to be most closely associated with *Flow*.

The measurement of Flow

The measurement of *Flow* during computer- or web-based activities was pioneered with theoretical work by Hoffman and Novak (1996), followed by further psychometric work and continual revision of instrumentation by Novak and Hoffman (1997), Chen, Wigand, & Nilan (1998, 1999), Novak, Hoffman, & Duhachek (2003), and Novak, Hoffman, & Yung (2000).

The efforts of these researchers still have not settled on a stable instrumentation, however, and there remains much work to be done in both the conceptualization and the measurement of *Flow* in computer-based environments, especially online learning environments. The current study, thus, uses these previous papers as a foundation, but hopes to extend and clarify the instruments on those variables of especial interest in WBI environments.

A useful starting place for understanding psychometric issues related to *Flow* is a paper by Novak and Hoffman (1997) which examined a number of studies and identify and summarize three methods which have been used to measure the *Flow* phenomenon: *Experience Sampling Method*, *Narrative-Surveys*, and *Activity-Surveys.*

In the *Experience Sampling Method*, the method developed by Csikszentmihalyi, respondents are given pagers and are 'beeped' throughout each day for a period of days or weeks. At those moments, the respondents are to complete an instrument about the precise activity they are engaged in and their feelings at that time. The ESM is uniquely suited to yielding a general catalog of activities, events, or tasks from daily life which seem to produce feelings of *Flow*.

In the *Narrative-Survey Method*, respondents provide a narrative description of some *Flow* experience and then evaluate that experience using a survey instrument. This method was used by Privette and Bundrick (1987) to measure various constructs drawn from the theoretical and research literature. The objective of *Narrative-Surveys* is to understand the nature of the differences among the events related to these constructs. However, this methodology is not used to identify the extent to which flow occurs across different people for similar types of events.

Finally, the *Activity-Survey Method* asks respondents who have participated in a selected activity, task, or environment to retroactively evaluate their experience using a quantitative survey instrument. Webster, Trevino and Ryan (1993), for example, describe two studies which provide examples of this method. This technique is useful for either concurrently or retrospectively determining the experience of *Flow* for specific events.

As it is the intention of the current study to investigate learner perceptions and correlates of *Flow* experiences specifically within WBI activities and environments, we will also adopt the *Activity-Survey Method* as the most suitable data collection methodology. Certainly, though, there would be merit for investigators of other research questions to further explore the other data collection methodologies, as well.

Methods

Participants

The sample was drawn from a population of students attending any of the 16 cyber-universities authorized to award degrees by the Korean Ministry of Education and HRD. Invitations to participate in the online survey data collection were sent to the president's office in each cyber-university, of which 5 schools agreed. Each university was allowed to locate student volunteers in their own way: some posted general notices of the survey on a portal bulletin board; others were announced by online lecturers in their classes. 244 cyber university students from these 5 cyber-universities volunteered to participate and provided complete data. An additional 22 students scattered across several other cyber-universities also completed the survey.

In the final total of 266 participants (146 men and 120 women) all age categories were represented, from "younger than 16" to "older than 50". The median age category was 30-40 years old. Students were also asked to estimate the approximate time spent during a week on the Internet. The range of this variable was also very large, where the median category of time spent was 10-20 per week.

Instrument

This study builds upon instruments developed in previous works on *Flow* in web-based environments by Chen, Wigand, and Nilan (1999) and Novak, Hoffman, and Yung (2000). These papers provided the basic definitions of the subscales and items which would eventually be compiled into the current online survey. Since the current instrument was situated specifically in web-based instructional environments with Korean cyber-students, each original item from previous surveys needed to be either revised and translated, or new items needed to be added to be appropriate to the population and unique environment. Additional user demographic items were drawn from a general web survey instrument developed and validated by Graphics, Visualization, and Utilization Center (1998).

The instrument asked learners to think generally about their current experiences with WBI at their cyber-university. The development of the survey began with 50 initial items, including four user demographic questions and one open-ended narrative question asking learners to describe some *Flow* experience they may have had in their WBI experiences. The other 45 items were grouped into sections which reflected the overall initial *Flow* model being investigated here: 28 items reflected the learners' perceived feelings during WBI (called *Feelings During WBI*); 12 items measured the degree to which learners experienced various features of WBI during their online instruction (called *WBI Experiences*); and 5 items which ask them to self-report any *Flow* experiences they might have had during WBI (which we call *General Flow Feelings*). Each of these questions was assessed using a nine point Likert-type scale, with labeled anchor points at each end.

Questions were placed in an online survey format administered through a single independent website. Students were told the survey could be completed in 5-15 minutes. The invitation to the various schools to participate was sent on 13 May, 2002, with an initial data collection period of 15-31 May. This was extended to 16 June to allow for more responses, at which point the website was closed.

Following data collection, the 45 items related to the *Flow* model were subjected to item analysis (eliminating one item due to item invariance), and an independent validity check by five experts -- two of the current authors and three independent experts (thus eliminating three additional three items due to ambiguous or confusing wording).

Scale Reliabilities

Scale analyses were computed for the three sections of the questionnaire. For *Feelings During WBI* (26 items) the average item mean (on a 9-point scale) was 6.07 with an average item standard deviation of 2.21. The coefficient alpha reliability index for this section was .93.

For the 12 items in *WBI Experiences* the average item mean was 5.73 and the average standard deviation was 2.04. Coefficient alpha for *WBI Experiences* was .94

For the *General Flow Feeling* section (3 items) the average item mean was 6.35 with an average standard deviation of 2.52. Coefficient alpha for *General Flow Feeling* was .88.

Data Analysis

Analyses of the three major sections of the instrument were conducted in order to provide a picture of how the data operated with respect to the initial *Flow* model. Each of the sections (*Feelings During WBI*, *WBI Experiences*, and *General Flow Feelings*) was separately factor analyzed to reduce it to component factors. Factor scores were then created for *Feelings During WBI* and *WBI Experiences*, and were then separately regressed onto the *General Flow Feelings* factor scores.

All factor analysis employed the principal components extraction method subjected to a varimax rotation of those components. The eigenvalues used to determine the number of factors to be extracted was set to 1.0 for the *Feelings During WBI* and *General Flow Feelings* sections. However, in the *WBI Experiences* section an eigenvalue of 1.0 did not yield any useful factors and was thus adjusted downward to 0.5. In all cases, though, the cutoff for factor loadings to be included in a factor was set at .500.

Factor Analysis: *Feelings During WBI*.

Table 1 shows the six factors which were extracted in this section, the descriptive labels which seem to best apply to those items, the number of items included in each factor, and the percent of total variance explained (after rotation):

Factor Analysis: *WBI Experiences.*

Five factors were found and are presented in Table 2. (Note, the fifth factor only had one item in it which prevented interpretation, and thus was dropped in subsequent analyses.)

Factor Analysis: *Overall Flow Feelings.*

One factor was found containing all three of the items analyzed. The total variance explained (after rotation) was 60.0 percent.

During these factor analyses, factor scores were also computed and saved for each respondent. Following that, two separate multiple regression analyses were conducted, first by regressing factor scores from *Feelings During WBI* onto the

Table 1. *Feelings During WBI*

Factor	Factor description	Number of items	% Variance explained
1	**G-factor for *Flow*** component variables	14	30.1
2	**Exploratory behavior** in WBI environments and activities	3	9.1
3	**Importance** of WBI in life and future	2	8.8
4	Confidence in the **skills** needed in WBI environments	3	7.6
5	Feelings about the **challenge** of WBI compared with the challenge of favorite games or sports	2	7.1
6	Degree of **arousal**, excitement, expectancy during WBI	2	6.9

Table 2. *WBI Experiences*

Factor	Factor description	Number of items	% Variance explained
1	Degree of **interactivity** experienced during WBI	3	21.8
2	WBI lesson **contents** are rich and varied, interesting to me, and meaningful	3	20.4
3	**Usability**: design, structure, and attractiveness of the WBI	3	18.1
4	**Navigation**: ease of site map and movement to other pages and websites	2	16.4
5	*(System responsiveness to learner questions. DROPPED)*	*1*	*9.3*

Table 3. *Feelings During WBI* regressed onto *General Flow*

Factor	Standardized *Beta*	*t* (1, 259)	*p*
G-factor for Flow	.775	22.42	<.001
Importance	.234	6.77	<.001
Challenge	.130	3.75	<.001
Arousal	.093	2.69	.008
Exploratory Behavior	.078	2.25	.025
Skills	.053	1.54	.125

single *Overall Flow Feelings* factor score, and second by regressing factor scores from *WBI Experiences* also onto the *General Flow Feelings* factor score. Results are as follows:

1. Multiple Regression: *Feelings During WBI* onto *Overall Flow Feelings*. The regression of the set of all six factor score variables was significant at predicting *Overall Flow Feelings* (*MS*regression=30.48, *MS*residual=.317, *F*(6,259) =96.2, *p*<.001, overall adjusted *R*2=.68). Table 3 shows the regression coefficients:

The G-factor for *Flow* is a very strong contributor to the regression solution, which is not any particular surprise, since the included items are those which are typically said to describe *Flow* states. The factors of Importance, Arousal, Challenge, Exploratory Behavior, however, were of moderate strength. Skills, however, was a non-significant contributor.

2. Multiple Regression: *WBI Experiences* onto *Overall*

Table 4. *WBI Experiences regressed onto General Flow*

Factor	Standardized *Beta*	*t* (1, 259)	*p*
Interactivity	.465	9.92	<.001
Navigation	.311	6.65	<.001
Contents	.298	6.36	<.001
Usability	.162	3.45	.001

Flow Feelings. Factor scores from the first four factors were included in this regression. The set of all factor scores was significant at predicting *Overall Flow Feelings* (*MS*regression =28.33, *MS*residual=.581, $F(4,261)=48.76$, $p<.001$, overall adjusted $R2=.42$). Table 4 shows the regression coefficients:

Notice that all variables contributed in a moderately strong way to the regression solution, reflecting the overall moderate *R*2.

Discussion

In this study we were interested in the various underlying factors which seem to characterize learn feelings within WBI environments and activities, and the factors which can describe the learn WBI experiences and to use these factors as predictors of the learn optimal experience or *Flow*.

Results from the factor analyses of learners' *Feelings During WBI* showed a very dominant first factor, which we referred to as a *G-factor* for *Flow*. The items in that factor all seem to have in common the motivational aspects typically used to describe *Flow*, and this factor by far dominates the set of all factors. In fact, the *G-factor for Flow* weighed in at more than three times that of any of the other factors in the percent of variance it accounted for. What was a bit surprising was that the two factors most associated with the dominant *Flow* models by Csikszentmihalyi and colleagues (Challenge and Skill) had comparatively minor contributions to the final factor structure.

The results of the factor analysis of *WBI Experiences* produced factors which were much more evenly balanced in their relative contributions (after dropping the last single-item factor). These factors were also clearly described by terms very comprehensible to designers of WBI environments (Interaction, Navigation, etc.).

Finally, these two sets of independent variables were separately regressed onto the variable we call *Overall Flow Feelings* to establish any relationships which might exist. Nearly all regression coefficients in both regressions showed significantly relationships with *Overall Flow Feelings*, except (again, surprisingly) the Skill variable in the *Feelings During WBI set of variables.* Perhaps the items which were included in the Skill factor were not sensitive enough to completely measure the construct, or perhaps there were some translation difficulties in converting the items into Korean. However, one point which requires further investigation is whether the initial conceptual models of Csikszentmihalyi, which puts such emphasis on Skill might need modification. This may also highlight the potential measurement problem that in this and other *Flow* studies, skill and challenge are self-report measures, and are not objectively measured.

Since the rest of the variables showed statistical significance, the most fruitful approach to interpreting the findings is to examine the relative impact of each variable. For the set of independent variables called *Feelings During WBI*, the variable *G-factor for Flow* shows, not surprisingly, by far the strongest relationship with the *Overall Flow Feelings* factor. The items included in that factor have been traditionally used to define *Flow*, so it shouldn't be any surprise that they are highly correlated with a global measure of it. In this sense, the regression analysis helps to provide validation to those variables which have been seen as indirect components of *Flow*.

Far behind *G-factor for Flow* is the factor variable of Importance. This indicates that the degree of relevance or meaningfulness of WBI activities or environments is quite highly associated with a learner's reported level of *Flow* in those activities. Nearly as important a predictor, the variable Challenge also is predictable of consequent *Flow*. This variable measures the sense that there is something valuable to be gained by working the WBI activities, and does belong firmly in the conceptual *Flow* models of Csikszentmihalyi. The remaining variables of Exploratory Behavior and Arousal, while statistically related to *Flow*, are, in relative terms far behind in importance from the previously mentioned predictor variables.

For the measures of *WBI Experiences*, all variables are statistically significantly related to *Flow*, but the variable of Interactivity seems to have a stronger relationship than the rest. This makes sense, in that a measure of Interactivity can also be seen as a more direct index of learner engagement or involvement, more so than the other three variables. At the other end, the variable of Usability can be seen to have the weakest relationship with *Flow*. Usability reflects comparatively 'surface' features such as design attractiveness and structure, and would seem also to be logically less predictive of *Flow*.

Conclusion

It was tremendously exciting to see that a G-factor exists for flow in WBI settings. The G-factor explained about 30% of the total variance accounted for in the general flow, and for the purposes of this factor analytic study it can be considered a dominant and unified construct, with the other factors of exploratory behavior, importance, challenge, and arousal assuming a secondary level of contribution to the overall factor model. Additionally, the initial factors for WBI Experiences as stated in our *Initial Model for Learner Flow within WBI Environments and Activities* (see Figure 3) also changed their definitions and relative contribution. Figure 4 shows the revised model.

It is hoped that this revised model can aid future investigators to focus more specifically on the relevant characteristics of both *Flow* and web-based instruction, and to clarify some of the construct and measurement issues which come into play in such an investigation. The particular emphasis of this paper on WBI environments (as opposed to other environments where Flow might an important consideration) is unique, and should help bring a focus on those particular variables (found in Figure 4) which offer a high chance of impact.

Instructional designers, too, might wish to draw from this paper that, in terms of improving learner engagement anyway, they are on the right track if they focus their design efforts on the WBI environment's interactivity, contents, navigation, and usability features.

Much work remains to be done, of course, to more completely understand the interrelationships among personal motivational variables and WBI instructional design variables. This paper provides one such stepping stone of clarification.

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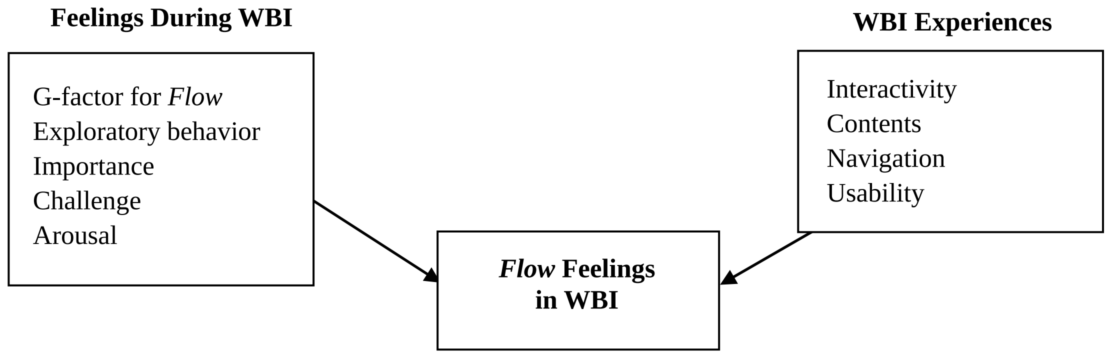

Figure 4. Revised Model for Learner Flow within WBI Environments and Activities

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