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Utilization of Flow Concept for Digital Service Requirements Prioritization

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Abstract
We argue that the concept of flow can be useful in investigating how requirements for digital services can be analyzed. We apply Novak et al's (2000) framework to analyze how flow can be utilized for requirements prioritization for digital services. Our findings indicate that the flow can be very useful for requirements development. Furthermore, the findings show that the flow can be potentially used for understanding experiential- and task-oriented user activities. Therefore, we conclude that the flow should be considered as a service requirements prioritization metric not only for digital services dominated by hedonic utility needs by users, but with all digital services. This calls for further research in service requirements method development and on how flow impacts user experience.

Keywords: digital service requirements, prioritization, flow, experiential- and task-oriented user activities, laddering interviews, IPTV.

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INTRODUCTION

Amazing business and technology successes such as Apple's iPhone and App Store are currently motivating more and more researchers to shift the focus of service design and development research towards understanding the development and design of such services. This emerging area of digital services brings up interesting problems that have not yet been fully studied. For example, traditional information systems development approaches most often focus on improving the efficiency and effectiveness of organizational processes, whereas the design of digital services for consumers may require more of an emphasis on the socio-psychological aspects of service use, such as hedonic utility (Kahneman et al., 2003) derived from the user experience.

User experience has been defined as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service" (ISO, 2008). In particular for interactive technologies to be successful, systems need to engage its users. In addition to being useful and usable, systems need to enhance the user's experience. This definition has been extended by human computer interaction researchers who have incorporated ideas of beauty, hedonism, and affection in relation to the product, system or service (Hassenzahl and Tractinsky, 2006, Law et al., 2009). The complexity of the quantifying user experience and the challenges this brings to design and development of digital services is manifested in the limited amount of academic literature available on the topic.

By using the concept of flow derived from the literature on optimal flow experiences, we propose to tackle the above issue of quantifying the user experience and of studying how it manifests itself in user requirements. The concept of flow provides a variety of components forming the human experience (Takatalo et al., 2008). In addition to this, several recent studies have explored this concept to gain further insights on positive user experiences (Chen et al., 1999, Davis and Wong, 2007, Finneran, 2005, Forlizzi and Battarbee, 2004, Ghani and Deshpande, 1994, Huang, 2006, Novak et al., 2000, Pilke, 2004, Steuer, 1991). Lastly, Pilke (2004) suggests that flow experiences occur during interaction with information technology, the concept of flow is suited for examining the quality of user experiences, and it is possible to build user interfaces that induce the experience of flow in users (Pilke, 2004).

For our study, Novak et al.'s (2000) theoretical model based on a comprehensive flow measurement procedure focused on user consumption behaviors is particularly interesting. Their study suggests specific constructs that are argued to be reliable indicators for measuring flow. Furthermore, they also suggest that the model of flow can be used to identify factors that facilitate the emergence of flow for users. As digital services are conducive to flow this may yield positive attitudes and outcomes for users (Finneran, 2005). Therefore, we consider the concept of flow to be an important element for gaining a better understanding of information systems for consumers. By understanding flow, products, systems and services can be designed to evoke positive user experiences, thereby increasing user satisfaction. Therefore, our research question is as follows: How can the flow concept be utilized for digital service requirements prioritization?

We proceed by first reviewing the literature on requirements prioritization and then continue with the concept of flow and its measurement. A research methodology section, the conducted interpretive study, and findings follow this. Finally, we present the findings of our study, along with a discussion of the limitation of the reported work and ideas for future research.

REQUIREMENTS PRIORITIZATION

Recently requirements prioritization has become even more important. Market-driven development often means that there are no easily identifiable customers and that requirements need to be co-created or discovered (Karlsson et al., 2007). Furthermore, there can easily be thousands of requirements to be considered after the requirements discovery process has been completed (Tuunanen et al., 2006). Therefore it is rather straightforward to conclude that requirements prioritization is important, or even vital, to the development of projects that deal with markets and consumers. It is not possible for any firm, small or large, to satisfy all desired requirements of their customers (Karlsson et al., 2007). Moreover, it is essential to find the "sweet spot" of requirements that would meet the target market's most important needs, after which the system or application can be varied to meet more specific needs. This has been done, e.g., with software product lines (Pohl et al., 2005).

Requirements prioritization itself has been defined in different ways in the literature. These are summarized in Table 1 below. Mathiassen et al. (2007) has taken a resource view to defining the objectives of requirements prioritization. According to them, requirements prioritization activities are resource-centric. They apply various types of analyses and decision-support techniques to help the analysts to decide how to use the firm's limited resources, e.g. technologies, skills, and time. Karlsson et al. (1998) have taken a more technical approach. They apply a requirements quality framework (Keller et al., 1990) for assessing the requirements prioritization methods. The framework is divided into three metrics categories: 1) performance, 2) design and 3) adaptation. These are then further elaborated by thirteen individual metrics.

Performance based metrics are related to the functionality of the system in terms of efficiency, integrity and reliability. Keller et al. (1990) also mention survivability of requirements that is defined as the capability of a system to fulfill its mission in a timely manner, in the presence of attacks, failures, or accidents (Ellison et al., 1999).

The usability as a requirements prioritization metric is more complicated to define (Jokela et al., 2003). In terms of requirements prioritization, Lauesen and Younessi (1998) identify five styles of usability. These are 1) Ease of learning, i.e. the system must be easy to learn for users with different skill levels, 2) Task efficiency, i.e. the system must be efficient, 3) Ease of remembering, i.e. the system must not be cognitively stressful to use, 4) Understandability, i.e. the user must understand what the system does, and finally 5) Subjective satisfaction. Berander et al. (2006) have proposed one further aspect; the attractiveness of requirements.

Design based metrics are more focused on the technical aspects of the requirements, such as maintainability, which is important for longer term architectural planning and future releases of the developed system or application. Correctness and verifiability, in turn, are closely linked issues for assuring that the requirements are ones that the users actually value and that they can be validated. Adaptation related metrics are similarly technical in nature, as these can be linked to object oriented development and modularization of code in application development (Rothenberger, 2003). Reusability of requirements is the backbone of these metrics and others build on this. Portability and interoperability relate to how code modules can be reused in different projects and how standardized the communication between objects and classes of objects is. Flexibility and expandability in turn illustrate how receptive to change the requirements are.

Resources	**Performance**	**Usability**	**Design**	**Adaptation**
Cost	Efficiency	Ease of Learning	Correctness	Expandability
Time	Integrity	Task efficiency	Maintainability	Flexibility

Technologies	Reliability	Ease of Remembering	Verifiability	Interoperability
Skills	Survivability	Understandability		Portability
		Subjective Satisfaction		Reusability
		Attractiveness		

Table 1. Requirements prioritization metrics, based on (Berander et al., 2006, Keller et al., 1990, Lauesen and Younessi, 1998, Mathiassen et al., 2007).

THE CONCEPT OF FLOW AND ITS MEASUREMENT

Flow has been studied in a wide range of disciplines such as psychology, education, information systems, and human-computer-interaction. The concept of flow was first pioneered by Csikszentmihalyi (1990). Flow represents a state of consciousness where a person is so absorbed in an activity that he or she excels in performance without being consciously aware of his or her every movement. It can be described as the sensation experienced when one is in the midst of an optimal experience. The optimal experience of flow can be defined as the mental state of an extremely rewarding concentration in an activity or task (Csikszentmihalyi, 1990). This form of concentration lies between frustration and boredom. Therefore, if that task or activity is challenging enough to be interesting, but not too difficult to cause frustration, then it offers the possibility for the experience of flow to occur (Csikszentmihalyi, 1990, Pilke, 2004).

The most commonly exhibited factors that contribute to flow as described by Csikszentmihalyi (1990) are as follows:

- For an activity to lead to flow, the activity must be done for the satisfaction of the activity itself,
- The person must be intrinsically motivated to do the activity, or autotelic, literally meaning self-goal,
- The activity must also be challenging and require skills, merge action and awareness, provide feedback, and require full concentration on the task at hand,
- The person experiencing flow must have clear goals, feel in control, lose their self-consciousness, and experience a distortion of time.

Flow has been studied in a broad range of contexts such as sports, work, shopping, games, website and computer use (Chen et al., 1999, Ghani and Deshpande, 1994, Novak et al., 2000). More specifically, Ghani (1995) has taken a human-computer interaction perspective to the matter. In his model, perceived tasks/challenges, skills, and cognitive spontaneity ("playfulness") were represented as antecedents of flow. Furthermore, the flow itself was measured through the constructs of enjoyment and concentration. The consequences resulting from flow included a focus on processes rather than on outcomes, increased learning, and increased creativity. Ghani's work illustrated the complexity of the balance between skills and challenges. Here, users with an excess of skills would feel more in control, and therefore experience flow. However, when users' skills greatly exceed their challenges, boredom is likely to occur, negatively influencing flow.

Hoffman and Novak (1996), in turn, have developed a theoretical model of flow for the web environment. They indicated the primary antecedents of flow as challenges, skills, and focused attention. They further added interactivity and tele-presence as secondary antecedents of flow. Tele-presence can be described as the extent to which one feels present in the mediated environment rather than in the immediate physical environment (Steuer, 1991). In his research, Steuer (1991) also identified vividness and interactivity as the two dimensions that determined tele-presence across communication technologies. These two dimensions were included in Hoffman and Novak's model as content characteristics that directly influenced tele-presence and focused attention. Hoffman and Novak (1996) further added involvement as a construct which encompassed intrinsic motivation and self-reliance. The construct of involvement was influenced by whether the activity was goal-directed or experiential. Furthermore, Hoffman and Novak labeled goal-directed and experiential behaviors as process characteristics in this model. Lastly, in this model the consequences of flow were increased learning, perceived control, having an exploratory mindset, and positive subjective experiences.

Later, Novak et al. (2000) created a revised theoretical model and tested it using structural equation modeling. In this new model, the control construct was moved from being a consequence to an antecedent of flow. The construct arousal, a dependent variable of challenge was added as an antecedent of flow. This revised model illustrated that the importance construct, i.e., how important the service, system or application is to the user, directly influenced focused attention, level of challenge, and skill. In addition to this, interactive speed influenced challenge. The findings from this research indicate that greater flow does not correspond to greater exploratory behavior, but rather exploratory behavior corresponded with tele-presence. Therefore, they argued that tele-presence contributes to both flow and exploratory behavior.

Finally, with a follow-up study Novak, Hoffman & Duhachek (2003) tested process characteristics (goal-directed and experiential consumption behaviors) to investigate whether flow experiences occur during both goal-directed and experiential activities. The findings of this study suggested that goal-directed processes would be more conducive to flow than experiential ones. Their findings contradicted previous research that suggested flow was more likely to occur during recreational activities than task-oriented activities. Furthermore, when examining the level of actual flow experience, the researchers found considerable evidence for flow occurring during both goal-directed and experiential types of activities (Novak et al., 2003). Moreover, the contradictory findings could be because their previous research study precluded a more precise investigation of flow during goal-directed versus experiential activities.

RESEARCH METHODOLOGY

The three main underlying research paradigms to guide qualitative research can be distinguished as positivist, interpretive, and critical (Orlikowski and Baroudi, 1991). In this study, we adopt an interpretive stance to research. Interpretive research has been said to be a feasible way to produce deep insights into information systems management and development issues by attempting to understand a phenomena through the meanings that people assign to them (Klein and Myers, 1999). We feel that adopting an interpretive approach in our research is appropriate, because the focus of this study is not to identify dependent and independent variables, but rather to make meaning out of the digital service requirements data that unfolds from the analysis process and to explore relationships as they emerge. By doing this, we can gain a better understanding of the idiosyncratic meanings that potential system features have for end-users. To do this, our study will utilize a case study design for exploring the role of *"flow"* driving features in the design of innovative technologies.

To discover service requirements, we applied a variation of the critical success chains method (Peffers et al., 2003) as part of the case study. It is a user-centered requirements development method for discovering and analyzing requirements data based on user preferences and reasoning for system applications and attributes from across broad user groups. This method does not require participants to have prior knowledge of the system, firm, or technology. The format of service feature – reasoning – value or goal of the requirements data also supports analysis of how the flow manifests itself in the user requirements. In this research, we focus on one particular digital service, namely an IPTV based e-learning service for tertiary education in New Zealand where students can participate in a classroom from campus, home, or office with live interaction. This research reports part of the development of Internet Protocol TV (IPTV) e-learning service at a premier research university in the Pacific region. IPTV is defined as a system delivering digital television services to users using Internet protocol technology. Television content is transmitted over a high speed broadband network (Dogra et al., 2006).

For this study, we recruited students from the business school of the university. The participants were undergraduate students in the information systems department. Selecting students from this department was considered appropriate for this study, as it allowed us to increase the chances of finding participants who were technologically savvy. All qualified participants were first sent an email giving them further information about online learning, as well as a description of "Flow" with examples. We invited 25 participants for the interviews. All but 4 participants could be reached. We then interviewed each of the participants individually and in person.

We then contacted participants by telephone to invite them to an individual face-to-face interview. At the end of each phone call, the participants were asked to give one idea of interest to them for a potential IPTV based e-learning service that they thought might also contribute towards providing a similar experience to flow. Some participants even contributed two or more ideas. We generated a list of stimuli ideas after the first nine invitations. In short, the stimuli were:

1) IPTV based e-learning system to use in own time for self-educated learning
2) IPTV based e-learning content
3) Usability of the IPTV based e-learning system or device
4) IPTV based e-learning system that can enhance the learning experience
5) IPTV based e-learning system just for you

The interviews were done using the laddering technique as outlined by Peffers et al. (2003). The participants were first given a description of flow with examples to read to get them thinking about innovative technologies that may result in enhancing their learning experience. The ideas compiled for the stimuli served as a starting point for our interviews. During the interview, participants were presented with a list of five special interest areas to get them thinking about potential features or ideas relative to an IPTV based e-learning system that they would like to see implemented. Also, for the interview, we had further elaborated each interest area from the list of stimuli to explain its potential application to the participants. Participants were then asked to rank order the interest areas in terms of their importance. Each interview lasted approximately 35 minutes on average. The interviews were digitally recorded in a MP3 format for subsequent analysis. During the interview, the researcher also took field notes on a spreadsheet in a structured format. The data collection provided us with 870 individual statements from the 21 laddering interviews. This amounts to about 41 statements per participant.

DATA ANALYSIS

The analysis is based on the critical success chains method (Peffers et al., 2003). As part of the interview process, the interviewees were first asked to reflect on their ideas and assign a numeric score to indicate how important the system ideas were to them. The researchers then carried out thematic analysis to identify distinct themes, and later grouped chains from the gathered data into the identified themes. For each theme, an interpretive clustering analysis process was carried out to further aggregate different expressions for similar ideas, consequences, and values. To provide a graphical representation of all chains within a theme, network maps were generated for each theme. Each network map was then re-formulated to determine or map the flow constructs and the various features of the e-learning system that may contribute to the user experience of flow.

To preserve the integrity of each chain, we first assigned them to a theme. Themes were determined by examining all chains and with the aim of finding common patterns among the chains. Three researchers independently examined the chains and came up with several themes. The researchers then discussed the themes to reach a consensus on the most appropriate themes or common patterns arising from all chains. Two researchers identified seven different themes and the other came up with six different themes. Eventually, the researchers reached a consensus to form seven themes. This was the result of combining and rearranging several concepts within different themes. For example, "puzzles and games to assist learning" was combined into the *"Interactive Learning"* theme and music related items joined the *"Personalized Learning Space"* theme.

The next step in the analysis involved sorting all individual statements into one of the seven themes. All three researchers independently sorted each statement into a theme. When comparing results from the coded statements, 80% of all individual statements were assigned to the same theme. Independently sorting chains increases the reliability of the thematic analysis process. Three researchers later discussed the conflicting statements until a consensus was reached. Overall, a few individual statements were assigned to two or more themes to retain the rich information within each chain. Once all the chains were sorted according to seven distinct themes, interpretive clustering analysis was carried out. As part of this process, the different expressions that participants had used were aggregated to describe similar ideas, consequences, and values. To achieve this, first, all chains were copied and sorted into a separate worksheet according to the themes they were assigned to. Three new columns for attributes, consequences, and value clusters were inserted into each new worksheet. For every worksheet (theme), first attribute clusters describing similar ideas or system features were aggregated. To identify the attribute clusters, we looked at the terminology participants had used to describe various system features important to them. In some instances, chains were multi-coded to two or more attribute clusters.

Next, we sorted chains by the attribute clusters. This step made the clustering process easier for allocating consequences to a particular cluster. That is, attributes within the same clusters were more easily visible and generally had similar consequences. The clustering process for consequences and values followed the same process as above. The final step in the analysis involved arranging the clustered codes into a graphical representation to create network maps for each theme. The network maps represent the features (attributes), the reasons for having or using those features as deemed by the interview participants (consequences), and the goals (values). Using the aggregated clusters of attributes, consequences, and values from our previous analysis, individual maps were constructed for each theme. In each network map, features or attributes were placed on the left, consequences in the middle, and values on the right. The associations between attributes and consequences and between consequences and values were captured using arrowed lines.

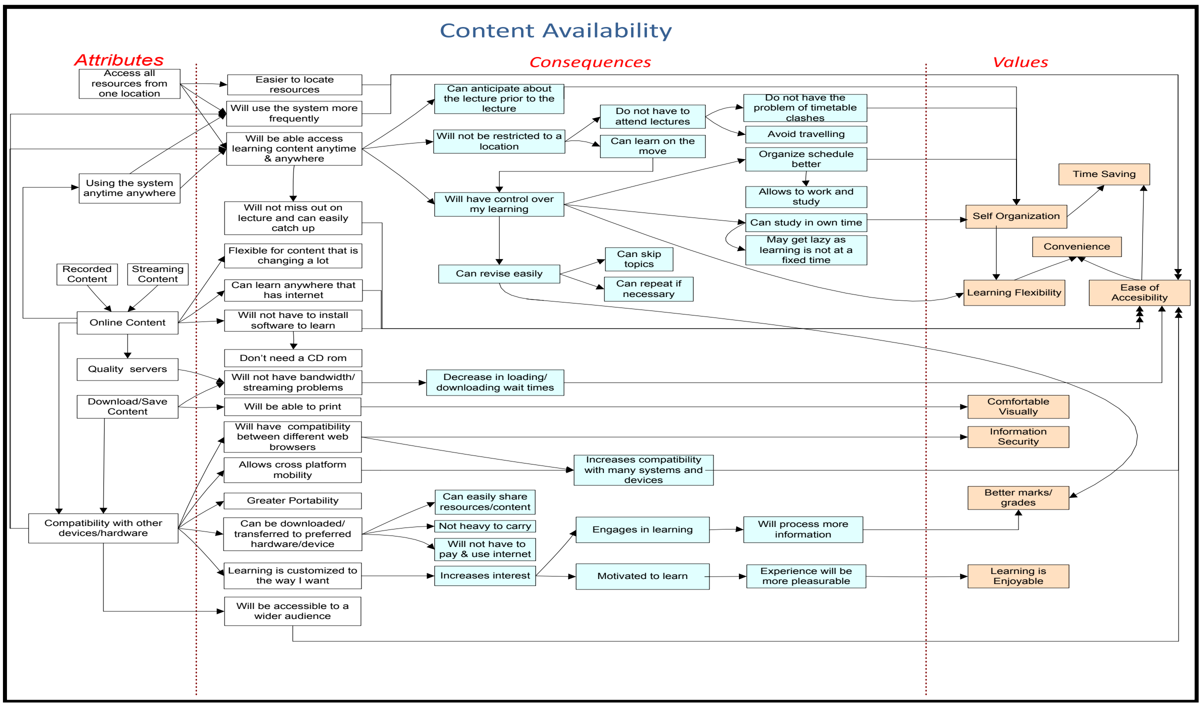

Figure 1. Network Map for theme "Content Availability".

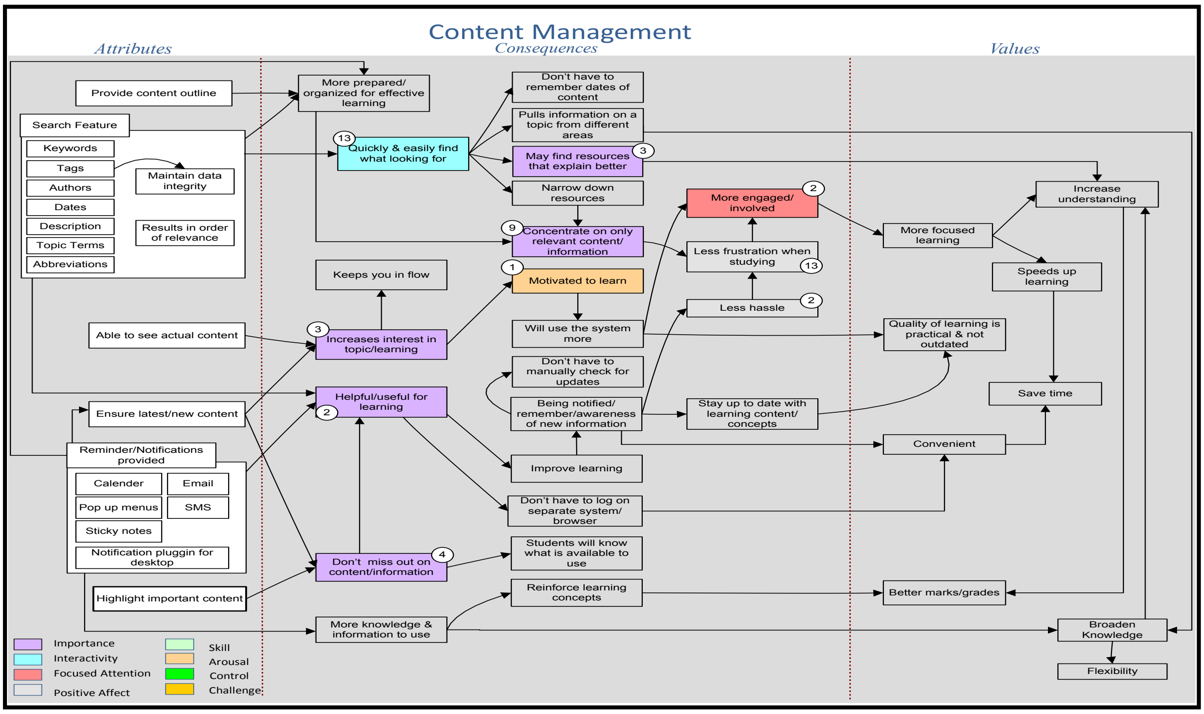

Figure 2. Network Map with highlighted antecedents of Flow for theme "Content Management".

Figure 1 in above illustrates the network map for the theme "Content Availability". At a glance, it can be seen that most system features (left) eventually lead to the value 'time saving' (right). The network map for this theme depicts the chains from the electronic spreadsheet at a higher level and in an easily understandable graphical format. Having created the network maps we proceeded to carry out further analysis to identify various features that may contribute to the user experience of flow. To do this, we needed to reflect over each of the seven network maps to identify if our results revealed any of the flow constructs as per our theoretical model.

Looking at the consequences within each of our network maps, we first identified consequences that could be represented by or mapped to any constructs from the theoretical model. To ensure we captured all consequences that corresponded to a construct in the model, we also looked at variables and variable descriptions that measured each construct. This ensured that we captured all conceptualizations that may contribute to the user experience of flow from our gathered data. On a separate spreadsheet we carried out further quantitative analysis to count the number of participants that had mentioned any of those conceptualizations resulting from the consequences data. In doing this, the intention was to provide indicators for the importance of each conceptualization. Furthermore, each conceptualization within the network maps were color-coded depending on the construct it mapped to within our theoretical model. By doing this, we could provide a clear graphical visualization of the emerging concepts that may contribute to the user experience of flow in e-learning systems. Figure 2 depicts the network map for the theme "Content Management". The conceptualizations that may contribute to the experience of flow within an e-learning environment can be identified in this map.

FINDINGS

In what follows, we present our findings from the data analysis. In particular, how we have been able to isolate the concept of flow from the end-user requirements data. The different antecedents of the user experience of flow emerging from each of the themes will be presented. All themes express the value of learning efficiently by speeding up the learning process to save time. This indicates that time is an important goal driving users of e-learning services. Therefore, for e-learning services to be successful, features that would enable users to save time will be highly valued and need to be considered. This may contribute towards the e-learning system being successfully accepted and used by its users. Also, based on our results, we consider an e-learning system that reflects the participants' value of making the process of learning enjoyable. This value was reported in all themes with the exception of the theme "Content Management", and also corresponds closely to the 'Positive affect' construct. However, concepts such as minimizing frustration during study was included as part of "Content Management". Therefore, the results reflect that e-learners will be motivated to learn more if the learning process can be made enjoyable.

We also found evidence of experiential and goal-directed consumption behaviors in all seven themes. However, overall the themes themselves can be categorized into two distinct categories. The themes that generally describe characteristics for experiential uses include "Collaborative Learning", "Interactive Learning", "Personalized Learning Space", and "User Interface Features". Moreover, the themes "Content availability", "Content Management", and "Content Delivery" generally describe uses for goal-directed consumption behaviors. The findings indicate that all seven themes include at least some conceptualization relating to the flow constructs that may contribute to the user experience of flow. Moreover, common in all seven themes are emerging concepts relating to 'Interactivity', 'Importance', and 'Focused attention'. Below, we illustrate one of the themes in detail; *Interactive Learning*.

The various concepts emerging from this theme are 'Importance', 'Interactivity', 'Control', 'Focused attention', and 'Arousal'. Also, evident in the results are concepts that correspond closely to 'Positive affect'. Table 2 provides an outline of the consequences that map to a particular construct or an antecedent of flow. As observed, most of the concepts map to the 'Importance' and 'Interactivity' constructs. A numeric score beside each consequence indicates the number of participants that reported a particular concept. A higher numeric score indicates that the particular conceptualization has a higher importance, as most participants value it. Particularly, the construct ‘Focused attention’ was reported by a high number of participants with a numeric score of 11. This indicates that most participants thought focused attention has a key role to play for interactive e-learning services and may contribute to enhancing their learning experience. Even though ‘Positive affect’ as a construct is not included in the theoretical model of flow, this construct emerged as part of our findings. This indicates that for interactive learning, this emerging construct plays a role in contributing to the user experience of flow.

Construct	**Consequences**
Importance (22)	Gives you an assessment of your weakness areas (8) Can highlight relevant points (3) Easily review key points for revision (9) Narrows down what to learn (2)
Interactivity (22)	Interaction feels natural and personalized (2) Resembles real time class room environment (3) Learning will be more interactive/active (9) Easily navigate for content & learn (8)
Control (4)	Control in learning (4)
Focused Attention (11)	Makes you engaged/immersed/involved with learning (11)
Arousal (12)	Will make learning interesting (7) Will make you motivated to learn (5)
Positive affect (3)	Less annoying (1) Enhances the learning experience (2)

Table 1. Consequences corresponding to antecedents of Flow for theme "Interactive Learning".

In Figure 3 below, the network map for theme "Interactive Learning" highlights the emerging concepts of flow. Based on our results, it can be seen that 'Importance' and 'Interactivity' are closely related to 'User control'. In addition to this, if users have more control, this will increase their arousal, which in turn drives users' focused attention during the interaction process. We found more concepts frequently corresponding to importance and interactivity within this theme. As part of the 'Interactivity' construct, the concepts correspond to interactive range (i.e. the number of possibilities for action at a given time), interactive mapping (i.e. how natural and intuitive the interaction is perceived to be by the user), and interactive speed dimensions. The consequences 'interaction feels natural and personalized' and 'resembles real time classroom environment' corresponds to the interactive mapping dimension. Whereas, the consequence 'learning will be more interactive and active' maps to the interactive range dimension. The consequence 'easily navigate for content and learn' corresponds to the interactive speed dimension. The concepts mapping to the 'Importance' construct corresponds to the self-relevance dimension.

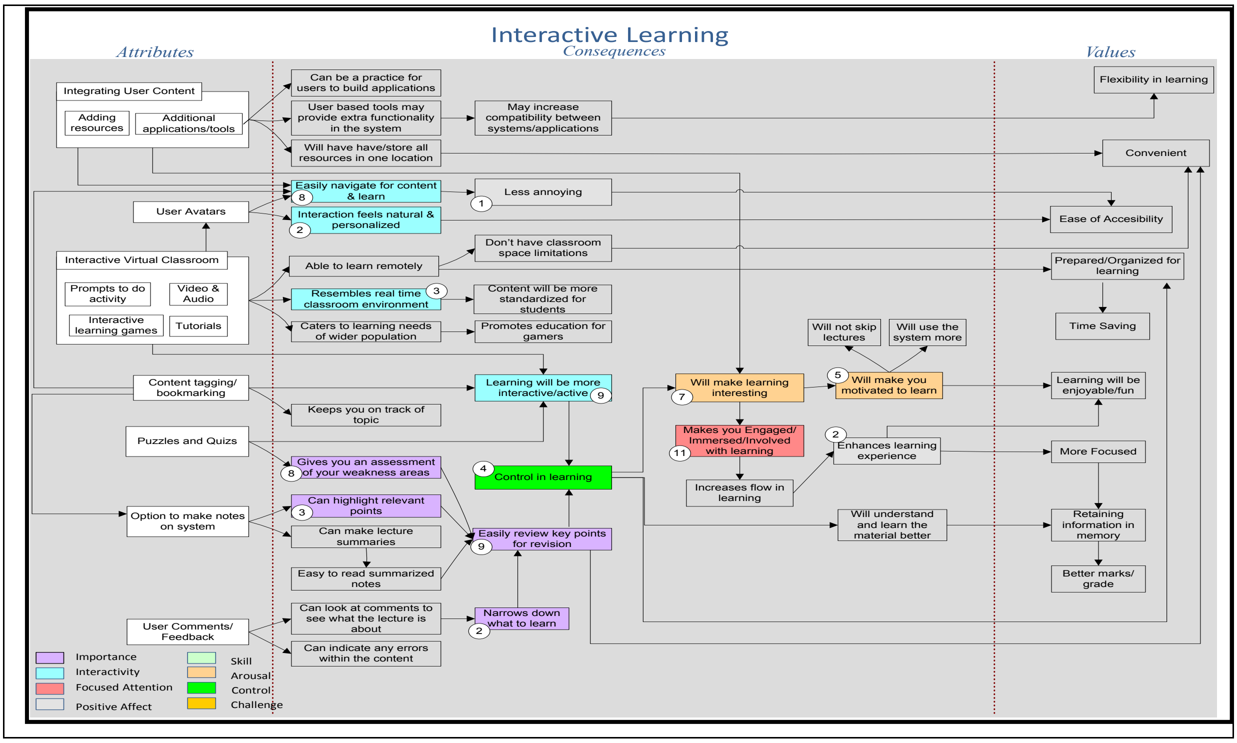

Figure 3. Network Map with highlighted antecedents of flow for theme "Interactive Learning".

In this theme, two concepts can be mapped to the 'Positive affect' construct. They are 'less annoying' and 'enhances the learning experience'. Based on the results, this indicates that participants value interactive speed. Moreover, interactive speed contributes to having a positive influence during the interaction process. That is, because participants will be able to navigate to content quickly, this will add towards creating a positive influence by minimizing annoyance when interacting with content. The second concept 'enhances the learning experience' also contributes towards having a positive influence when interacting with content. The results indicate that if students are more focused during their learning by being more involved or engaged, then eventually this will contribute in having a positive influence for learning, i.e. learning better.

The descriptive statistics of the cross-comparison of the themes is summarized in Table 3. The data summarizes the frequencies of the flow concepts in different themes, but also their relative weights. The weights are calculated by dividing the frequency in question with the total numbers of mapped requirements. This weight therefore gives a stantardized way of comparing the distribution of flow antecedents between themes. The table consists of the mappings of 558 requirements and all flow antecedents derived from (Novak et al., 2000). In addition, we have included a construct "Positive Affect". The original theoretical model of flow does not include the construct 'Positive affect'. However, this construct has been included in other studies (Davis and Wong, 2007, Hoffman and Novak, 1996). Within the network maps for all seven themes, we found evidence of concepts mapping to the 'Positive affect' construct. We found that all seven themes had at least four or more constructs present from the flow model (Novak et al., 2000). Particularly, the constructs 'Interactivity' (32.08%[1]), 'Importance' (28.14%[2]), were common in all seven themes regardless of whether the theme would be considered to be task or experiential oriented. This seems to be an overarching result that dominates this particular set of requirements with a little over sixty percent of requirements being mapped to these two constructs.

What's also interesting is how the themes could be differentiated. Our findings indicate that the themes related to more task-oriented activities are "Content Management" (CM), "Content Availability" (CA), and "Content Delivery" (CD). Furthemore, themes that generally describe more experiential uses are "Interactive Learning" (IL), "Collaborative Learning" (CL),"Personalized Learning Space" (PLS), and "User Interface Features" (UIF). Furthermore, we found that two of the task-oriented themes differed in an interesting way. The content management theme was the only one that had a relative weight above 0.10 for the 'Positive Affect' construct (0.29). Similarly, the content availability theme was the only one with a large relative weight for 'control' (0.53). The third theme in this group, content delivery, was dominated by 'Importance' (0.43), and 'Interactivity' (0.31) constructs that counted for 74% of the mapped requirements in this theme. This was also the largest theme in terms of the number of requirements (n=127 and 22.76% of all mapped requirements). This theme includes requirements that are mapped to six different constructs, namely 'Importance', and 'Interactivity', 'Arousal', 'Focused attention', 'Positive Affect', and 'Control'. From the relative weights we can see that it differs frm the two other task-oriented activities. However, based on the data it is difficult to analyze this further, beyond argueing that with this particular theme the requirements prioritization should be focused on two of the most important areas of flow, 'Importance' and 'Interactivity'.

[1] of all mapped requirements

Theme / Frequency / Relative weight	CM	CA	CD	IL	CL	PLS	UIF	Total	%
	Task-Oriented Activities			Experiential-Oriented Activities					
Importance	21 / 0.41	16 / 0.24	54 / 0.43	22 / 0.30	17 / 0.31	30 / 0.41	19 / 0.17	179 / 2.27	32.08%
Interactivity	12 / 0.24	11 / 0.16	40 / 0.31	22 / 0.30	35 / 0.64	7 / 0.09	30 / 0.28	157 / 2.02	28.14%
Arousal	1 / 0.02	3 / 0.04	12 / 0.09	**12 / 0.16**	0 / 0.00	**17 / 0.23**	**24 / 0.22**	69 / 0.76	12.37%
Focused Attention	2 / 0.04	2 / 0.03	10 / 0.08	**11 / 0.15**	0 / 0.00	**16 / 0.22**	**27 / 0.25**	68 / 0.77	12.19%
Control	0 / 0.00	**36 / 0.53**	9 / 0.07	4 / 0.05	0 / 0.00	4 / 0.05	4 / 0.04	57 / 0.74	10.22%
Positive Affect	**15 / 0.29**	0 / 0.00	2 / 0.02	3 / 0.04	0 / 0.00	0 / 0.00	5 / 0.05	25 / 0.40	4.48%
Challenge	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	2 / 0.04	0 / 0.00	0 / 0.00	2 / 0.04	0.36%
Skill	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	1 / 0.02	0 / 0.00	0 / 0.00	1 / 0.02	0.18%
Telepresence / Time distortion	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0 / 0.00	0.00 %
Total	51 / 1.00	68 / 1.00	127 / 1.00	74 / 1.00	55 / 1.00	74 / 1.00	109 / 1.00	558 / 7.00	100.00%
%	9.14 %	12.19 %	22.76 %	13.26 %	9.86 %	13.26 %	19.53 %	100.00%	

Table 3. Cross Comparison of Themes.

DISCUSSION

Based on our results, we propose that for digital service users, the relative importance of the antecedents of flow such as 'Interactivity', *and* 'Importance' are important in both experiential and task-oriented activities. Furthermore, when designing experiential-oriented activities as part of digital services, the 'Arousal' and 'Focused Attention' constructs, along with those mentioned above, should to be taken into account to create compelling online experiences for e-learners. In addition, when designing task-oriented activities, the common constructs mentioned above, along with 'Control' and 'Positive Affect', should be taken into account to create compelling online experiences for e-learners. However, from the findings we can see that task-oriented themes differ from each other more than the experiential activities. Therefore, more careful attention should be paid when prioritazing prioritizing requirements mapped to these themes. The cross-comparison of the themes reveal differences in how requirements should be prioritized if flow experience of the users is taken as basis for service requirements prioritization activities. What's more, it is interesting to see that all themes shared the dominance of two of the flow constructs, 'Importance' and 'Interactivity'. Thus, it can be argued that these constructs, and the requirements mapped to these, form the core requirements for enabling 'the flow' for this particular digital services. Furthermore, our results indicate that it is possible differentiate sets of requirements that form basis for system, service features based on the users' perceived flow experience. We see that his can potentially influence how we should analyze service requirements.

Past research argues that creating flow experiences for consumers is important in creating compelling online experiences (Novak et al., 2003). Our results indicate that digital service users (or e-learners in this case) do value the experience of flow in the online learning environment. The results also suggest that the experience of flow does play a role in the design of interactive technologies for consumers, in our case; IPTV based e-learning service. Furthermore, we see that this suggest that as part of users' cognitive thinking processes, users do value experiences that will engage them into their learning when carrying out activities or tasks using e-learning services. Therefore, in creating compelling experiences for the online learning environment, it is important that the experience of flow and flow driving features be incorporated into the design of such interactive technologies.

Comparing the results to each construct in the theoretical model of flow, we did not see any evidence of exploratory behavior within our results. The reason for this is due to the nature of our research study. We did not ask participants to report on their previous or current experiences relating to IPTV based e-leaning services, but rely on experiences with similar computer-mediated environments. We also did not find any evidence of the 'Tele-presence' or 'Time distortion' concepts within our requirements data. Past research indicates that 'Focused attention' corresponds to greater 'Tele-presence' and 'Time distortion'. We conclude that because the participants had not used an IPTV based e-learning system before, they were not able to think of experiences relative to the e-learning environment that could be characterized by an experiential time passing quality (Davis and Wong, 2007). For this reason, we think that time distortion and tele-presence concepts were not present in our user requirements data. However, past research also indicates that in an e-learning context, tele-presence and time distortion may be viewed as negative influences by e-learners. The reason for this is that e-learners will not be able to concentrate on their primary goal of learning if their mind becomes distracted and absorbed (Davis and Wong, 2007). Therefore, this may have played a role as part of the participants' (e-learners) cognitive thinking processes during our laddering interviews.

The theoretical model used to guide this research excludes 'Interactive mapping' and 'Interactive range' dimensions and only measures 'Interactive speed' dimension from the 'Interactivity' construct (Novak et al., 2000). However, in our study, we found evidence for requirements results of concepts corresponding to 'Interactive mapping', 'Interactive range', and 'Interactive speed' dimensions. Furthermore, Novak et al. (2000) have operationalized enduring involvement through the presence of situational, and or intrinsic self-relevance in their research. We found evidence of concepts mapping to 'Intrinsic interest' and 'Situational and or Intrinsic self-relevance'. Furthermore, the concepts were not present in all seven themes. Therefore, some antecedents of flow that were dropped in the theoretical model seem to be relevant for digital services and may need to be reconsidered, especially when designing IPTV based e-learning services.

CONCLUSIONS

This paper reports a study that investigated how flow manifests itself in digital service requirements. The focus of requirements development activity was an IPTV based e-learning service for a tertiary education in New Zealand. We applied an interpretive research approach and a variation of the laddering interview technique for data gathering (Peffers et al., 2003). The data collection provided us with 870 individual service requirement statements. The requirements data set was analyzed using a thematic clustering method. The results show that flow concept is useful in understanding how to prioritize service requirements, especially in the case of IPTV based e-learning services.

This study makes further contributions towards understanding the user experience of flow from both end-users' and analysts' perspective. We stipulate that our research provides a starting point in understanding the various constructs of flow that can be differentiated between experiential and task-oriented flow in service requirements prioritization. This is expected to be beneficial in conceptualizing flow for the different types of process activities. Although our study does not provide a method for enabling analysts to prioritize service requirements in an industry setting according to the flow user experience, our study does provide an argument for the need to develop such a method. This has the potential to fundamentally change the way digital services are developed for consumers who are not primarily driven by utilitarian needs, such as efficiency in work etc., but have a more hedonic emphasis for their user experience. What is more, this could potentially be a way to re-think how we conceptualize requirements prioritization in digital service development.

The reported study has some limitations. There may be missing features and mediators the participants may not be aware of that may contribute to the user experience of flow. This is because the participants relied on their experiences with similar technology-mediated environments and on the stimuli used in the study. Therefore, participants may have chosen a feature believing it may lead to an experience of flow, but may have missed out on moderators that they may not have been aware of. Also, a more careful phrasing of the stimuli provided may have revealed more or different ideas for the e-learning service. However, stimuli ideas were created based on what the participants had mentioned prior to the interviews. This increased the chances of using ideas during the interviews that were based on participants' interest areas.

For future research, the interactivity and involvement constructs from the concept of flow should be studied more carefully to find out if there are other dimensions that play a role in contributing towards compelling user experiences for interactive digital service innovations. Also, more research is needed to further elaborate on the relationships between the major constructs of flow in computer-mediated environments. This will help clarify and improve our methods for studying flow, and thereby, enable us to gain a better understanding of how to effectively design digital services that are conducive to compelling user experiences.

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