Immersion in e-Learning

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ABSTRACT

Flow is a state of intense concentration and engagement, when a user is so *immersed* in her activity, that all other external influences cease. It is a well-known fact that flow is experienced in games, where we all had the 'just one more minute' request from our children. This paper analyses the notion of flow from two perspectives: the theoretical concepts and the practical reality. For the latter, game environments are compared to current e-learning environments. Finally, the extracted features are mapped back to the theoretical underpinning.

CCS CONCEPTS

• **Human-centred computing → Interaction paradigms →** *Hypertext / hypermedia*; *Web-based interaction*; **Applied computing → Education →** *e-learning*; **Information systems → Decision support systems →** *Data analytics*;

KEYWORDS

flow, e-learning, adaptation, social web, semantic web, gamification, learner analytics

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1 INTRODUCTION

In e-learning, immersion is a concept based on the psychological concept of flow: learners 'are so engaged in learning, that time and fatigue disappear' [1,2]. We mostly know this experience from online and offline games. The challenge is to create e-learning offers that can lead to a similar intense involvement. This seems to be an impossible challenge for educational software, and thus represents almost a 'holy grail' for online education. This is especially relevant now, with the rising of MOOCs, such as Corsera in the US and FutureLearn in Europe, backed up strongly, in a top-down fashion, by current politicians, but which suffer greatly from extremely high dropout rates.

1.1 Flow Components

The noted psychologist Csikszentmihalyi identified 4 key components of flow: **control** (learner's control over the experience); **attention** (learner's dedication to the task at hand); **intrinsic interest** (motivated by the desired outcome) and **curiosity** (leading them forward) [3]. Specifically, Csikszentmihalyi recommends as flow antecedents **clear goals & immediate feedback**, and a good **challenge & skills balance**.

3 IMMERSION FEATURES

An appropriate source for extracting immersion and flow-related features are games. It is easy, at first glance, to attribute the typically high level of immersion in game environments to advanced computer graphics (such as Halo 5[1]), or 3D interactivity (such as in EVE Online[2]); however, this is only part of the answer. It also represents the part that is more difficult to implement, requiring large teams of dedicated programmers. In the following I identify some tangible features of current game environments that are much more straightforward to implement, but that are currently missing in current e-learning environments (even in more advanced adaptive or personalised ones [4,5]), which may trigger immersion [6]. The focus here is mainly on feedback, which is considered an essential aspect to be supported in e-learning [7].

1) Game environments, unlike TEL environments, often have *multi-dimensional levels of interactivity and feedback*. Thus, unlike in a learning system, where feedback often relates to scores, marks, or percentage of progress, which all reflect, in principle, the single dimension of knowledge-increase, in game environments various parameters can be tracked, and the user can progress in various ways, as defined by these parameters.

2) Next, in game environments, the *feedback is frequent*. At each 'kill' or 'success', for instance, the popular first-player-shooter games immediately display on-screen the experience feedback. Opposed to that, most learning environments, adaptive or not, give delayed feedback, often significantly so, only, e.g., when a whole chapter is read, or an important concept is mastered.

3) Moreover, the *feedback is highly visible*. Games often place their feedback in the middle of the screen, as in the previous example, with perhaps strong colours, or even graphics. In learning environments, especially in adaptive settings, a lot of discussions have centred on the benefits of high level of feedback.

4) Furthermore, in game environments, the *feedback is fine-grained*. At each event, popular games immediately display experience feedback. A player feels at all times that she is making some progress. Opposed to that, most learning environments, adaptive or not, display quite a coarse-grained feedback.

5) Additionally, *feedback is volatile*. This means, feedback doesn't linger on the screen for very long.

[1] https://www.halopedia.org/Halo_5:_Guardians
[2] *https://www.eveonline.com/*

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6) Moreover, *feedback is traceable*. Whilst the information can flash quickly in front of the user, a user in a game environment can usually find, for instance, information about a certain achievement, when desired. Adaptive learning environments are more concerned with keeping track of the current state (e.g., the percentage of current knowledge) instead of storing minor achievements.
7) Adaptive educational environments may often track the *distance to achievement, instead of challenges conquered*. I.e., as in the above example, the percentage of knowledge as compared to the desired state of knowledge may be displayed. Instead, game environments display achievements, experience levels, ranking in a leader board etc.
8) Furthermore, *interactivity with other players* is often used in multi-player games as an extra dimension for exploration. Competition and collaboration are encouraged via reward systems. Whilst interactivity and collaboration have been explored in previous work on TEL environments (e.g., the ALS EU project[3] led by Warwick), its effect on the learning immersion is not yet fully explored and exploited.
9)*VAccess to information* (such as feedback) *can be obtained in multiple, redundant ways* in game environments. In such cases, redundancy is no undesirable feature, but the contrary: users can get to the information in whichever way they are more comfortable with. Contrary to this, educational environments rarely introduce redundancy in their paths.

4 DISCUSSION

Analysing how the features above map onto the theory provides the reassurance that these are indeed features which could be scaffolding flow and ultimately immersion in a learning environment, as follows.
1a) *multi-dimensional levels of interactivity*: in terms of flow antecedents, it maps onto 'challenge & skills balance'. In terms of the key components, it maps best onto 'control', although it allows also the learner to follow their 'intrinsic interest' and nurture 'curiosity', which could enhance 'attention'.
1b) *multi-dimensional feedback*: in terms of flow antecedents, it maps well onto the 'immediate feedback'. In terms of the key components, it maps onto 'attention' (as it keeps a learner's attention by the various type of feedback), gives a feeling of 'control', which could increase 'intrinsic interest' and 'curiosity'.
2) frequent feedback: directly maps to 'immediate feedback', and is generally related to 1b) above.
3) highly visible feedback: spurs 'attention', potentially increasing 'curiosity' and 'intrinsic interest', as well as giving a greater feeling of 'control'.
4) fine-grained feedback: allows clearly for 'control' - the learner is in charge and aware of most aspects of her learning. Importantly, in opposition to previous research, which was concerned about learning overhead [8], in fact, modern learners are well equipped to deal with a multitude of inputs online, without losing focus [9, 10].
5) volatile feedback: this feature supports 'immediate feedback' by still allowing for learner's 'attention' to the task at hand (instead of interrupting with interaction demands).
6) traceable feedback: this features supports 'immediate feedback' by helping, when 'interest' and 'attention' are caught, to easily be in 'control' and find the required information.
7) challenges conquered, not distance to achievement: this deals with the 'challenge & skills balance', in that, even harder problems, are presented in a manner in which they can be perceived as simpler and approachable, where skills and challenge are matched.
8) social aspects: interestingly, instead of detracting from a learner's attention', social interaction can actually help to improve the 'challenge & skills' balance, and lower achievement thresholds, by involving help from peers, tutors, etc. Such aspects, if well-implemented, can increase the level of perceived learner 'control', and thus increase the motivation and 'interest'.
9) redundant access to information: a less intuitive outcome, the availability of multiple paths to the same piece of information (be it feedback, or learning content, or social interaction) helps towards learner 'control', adjusting to the learner's mental model of the information organisation, and lowers the challenge from a system perspective, thus achieving a better 'challenge & skills balance'.

5 IMMERSION FRAMEWORK

Figure 1 represents these features in the form of an initial immersion features framework, including also the *flow dimensions*, directly mapped from the theory [1,2,3] (under features, on the right hand side of the image),
As can be seen in section 4, the majority of the features discussed there are centred around *feedback*. These involve points 1b- 7 from section 4. Others are concerned with *delivery* (Features->Delivery on right hand side of image), corresponding to 9 in section 4, and *interactivity* (Features-> multi-dimensional levels of interactivity), corresponding to feature 1a in section 4. Additionally, the framework describes the user *activities* (Features->Activities, right hand side of Figure 1) - the type of actions users are likely to perform when learning via a hypertext environment. Finally, the framework provides well as additional *metrics* and *measurement methods* (left hand side of the image), which can be involved in tracing and estimating the appropriateness of the specific implementation for this set of features.
This framework represents, to the best of the author's knowledge, the first attempt of systematically analysing and differentiating between flow parameters in games, and their counterpart in e-learning environments. Whilst some of these features have been studied separately, they have not been analysed in a systematic way, based on evidence from their source, as well as per their potential to inducing the flow state in the learners.

[3] http://www.academia.edu/12713425/Adaptive_Learning_Spaces

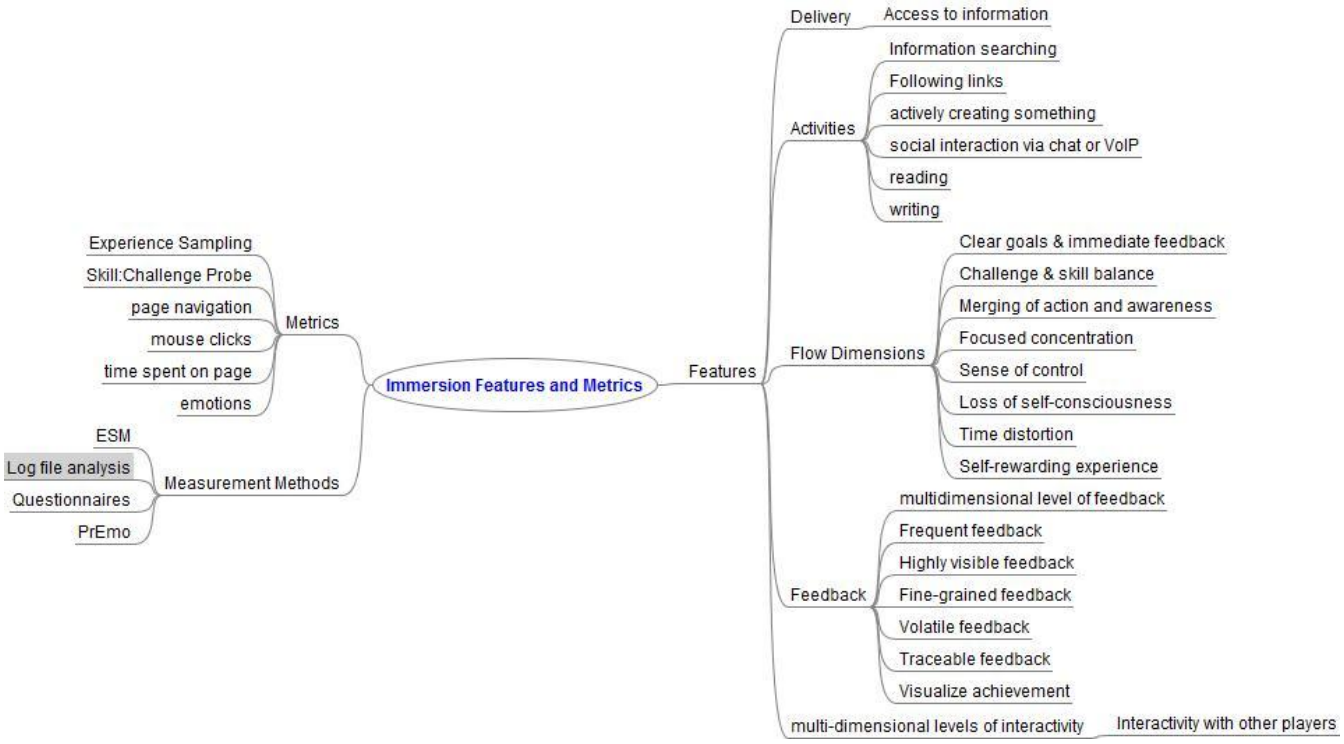

Figure 1: Immersion Features Framework.

6 CONCLUSIONS

In summary, this paper has proposed a new method of adding flow-related features to an e-learning environment, by extracting relevant flow-inducing features from games environments, which reflect the quintessence of user immersion, and creating an initial framework for researchers. However, instead of being stuck at a superficial level - such as assuming that e-learning has to be delivered via games, in order to induce flow, or that it has to include high resolution 2D or even 3D graphics, the focus was on the more often overlooked aspects of games. Still, the results are not comprehensive. Results mainly centre on 'feedback', and, for instance, 'goals' have not been studied at all. This study thus encourages researchers to further explore such features, to better reflect the intrinsic requirements of flow theory, and achieve the immersive environments for the learners of the future. Recently, a new generation of e-learning tools are incorporating such elements that are aimed at *flow* [11-20]. However, these researches are few and far between, and a broader effort of the research community in general is needed, to get closer to this 'holy grail' of online education.

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