Sustaining and Enhancing a Learner's Motivation within a Web-Based Intelligent Tutoring System (WITS)

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Highlights: This project focuses on finding a way to sustain and enhance the learners’ motivation during the learning process within a Web-Based Intelligent Tutoring System (WITS) environment. To achieve this, we extracted, validated, and evaluated a set of motivational tactics rules. These rules are represented as event-condition-action rules. Therefore with this way of representing the rules it is easy to comprehend, implement and to incorporate this rules into any web based e-learning system in order to sustain and enhance the motivation of the learners dynamically during the learning process.

Key words: Motivation, motivational tactics, web based e-learning, ITS, interactive WBEL, intelligent agent.

Introduction
One of the biggest challenges in an asynchronous e-learning environment (e.g. Web based e-learning, Web-Based Tutoring System, and MOOC) is keeping the learners motivated for the entire learning period since they often feel isolated and the levels of learning interactivity are often considered trivial (Ghergulescu &
Thus, our project focuses on finding a way to sustain and enhance the learners’ motivation during the learning process within a Web-Based Intelligent Tutoring System (WITS) environment. For this research we extracted, validated, and evaluated a set of motivational tactics rules to sustain and enhance the motivation of the learners’ during the learning process. These rules were represented as event-condition-action rules. The representation of those rules in a symbolic manner makes it easy to understand, implement and incorporate it into any computer software. Thus, the rules should be considered as essential in the development of an Intelligent Tutoring System (ITS) environment to help sustain and enhance the learners’ motivational state during the learning process. This research project has resulted in a prototype to evaluate the suggested rules. We believe that the proposed model and prototype will be of value by providing e-learning environments’ designers with an example of detecting, sustaining and enhancing the learners’ motivation dynamically during the learning process.

Description of the innovation
The major outcome of our project is a set of motivational tactics rules. These rules can be easily integrated to any Web-Based e-Learning (WBEL) in order to be able to sustain and enhance the motivation of the learners’ dynamically during the learning process, without direct intervention from the teacher. The elicitation of the knowledge to sustain and enhance the learners’ motivation in real time within WBEL environment were carried on four stages based on the knowledge engineering processes of Turban, Sharda, Delen, and Efraim (2007):
1. Motivational tactics extraction: This stage involved the extraction of expert teachers' knowledge regarding how to sustain and enhance the learner's motivation during the e-learning process. Then, the extracted knowledge was represented in the form of condition-action rules, those rules called “motivational tactics rules”.

2. Motivational tactics validation: In this stage, the extracted motivational tactics rules from the previous stage were validated by expert teachers.

3. A prototype called WITS was designed and developed as a test-bed for the evaluation of the extracted motivational tactics rules.

4. Motivational tactics evaluation: This stage involved the evaluation and application of the extracted motivational tactics rules. This stage involved two groups of learners (control and experimental group) used the system for three weeks, and then the values for that the motivation differences between them were collected and compared.

The component structuring process of the proposed WITS (which can be used as a guide in the development of a WBEL system with the ability to sustain and enhance the motivation of the learners’ during the learning process) illustrated in Figure 1. This process is presented into three parts:

i) Browser: presents the learner who surf the Internet/intranet using the WITS system.

ii) Application Server: presents the main components of the system and the data flow between these components. It also presents the work cycle between browser request and database contents.

iii) Database Server: presents the place for storing the data and the knowledge based rules.
As shown in Figure 1, the WITS has two main components to interact with the learners to detect, sustain, and enhance their motivation. These components are:

i) Learner Module: The main role of this module is to interact with the learners and to gather the information about the learners’ cognitive and motivational states (logs data) while they interact with the tutoring system. Examples of learners’ cognitive information are their success or failures doing the exercise, giving up, and asking for help. Meanwhile, data log examples are the time spent on performing the exercise, exercise results, whether the learner has received a feedback or otherwise, and learner's hesitation. The “Learner Module” will save this information in the WITS database. This module is also responsible for sending this information to the “Motivational modeller”.

ii) The intelligent agent: This component of the system has two main roles: (i) to detect learner’s motivational state depending on the information gathered by the “Learner Module” and (ii) to sustain and enhance the learner’s motivation by applying the appropriate motivational tactics rule.

The intelligent agent has two sub-components:
- Motivational Modeller: The main role of this modeller is to diagnose the learner’s motivational state by analyzing the learner’s cognitive and logs information coming from the “Learner Module”.
- Tutor Module: This module receives input from the “Motivational Modeller” and makes decisions regarding what and when to apply the motivational tactics. The purpose of these motivational tactics is to sustain or enhance the learner’s motivation.
Table 1 presents samples from the elicited motivational tactics rules to sustain/enhance the motivation of learner who finished the given task successfully. The columns represent: the name of the rule, the input (a set of presumptive motivational state of the learner) of the rule which are classified as attention, confidence, satisfaction, effort, and the output (motivational tactics).
Table 1: Motivational tactics rules to sustain/enhance the motivation of learner who finished the given task successfully

<table>
<thead>
<tr>
<th>Rule</th>
<th>Attention</th>
<th>Confidence</th>
<th>Satisfaction</th>
<th>Effort</th>
<th>Motivational tactics</th>
</tr>
</thead>
<tbody>
<tr>
<td>S2</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>- Reward the learner's performance and provide him/her performance feedback.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Require more effort from the learner.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Provide him/her with another more difficult task.</td>
</tr>
</tbody>
</table>

S3   | High      | High       | Low          | High   | - Reward the learner's performance and praise him/her effort. |
|      |           |            |              |        | - Provide the learner with performance feedback. |
|      |           |            |              |        | - Suggest to the learner another more difficult task (if he/she reject, provide him/her with a similar difficulty task). |

The background of the innovation
The use of Artificial Intelligence techniques with WBEL systems brought the hope of developing systems that would become personalized to each learner and thus be of more benefit to him/her (Kose, 2014). Although with added complexity, intelligent systems (such as Intelligent Tutoring System (ITS), Intelligent Learning Environments (ILE), and Intelligent Computer Assisted Language Learning (ICALL)) did not always succeed in engaging the learner. However, the question still remains as to how the system should behave in order to sustain and enhance the learners’ motivational state (du Boulay & del Soldato, 2016). Therefore, the main objective in this project was to develop motivational tactics rules to sustain and enhance the learners’ motivation in real time within a WBEL environment.

The importance to the community:
Currently there is a big trend towards the use of asynchronous e-learning environments such as WBEL and MOOC to support or as an important component of the traditional learning process such as in a blended learning environment. The aim of these different online
modalities is to enhance the learning process which will support the development of the community. However one of the biggest challenges of these trends is keeping the learners motivated throughout the entire learning process. Therefore, we believe that our project outcome will support this trend and hence support the development of the community.

**The advantages of the innovation towards computing future:**
The developed motivational tactics rules are intended to be of value to the designers and developers of interactive and intelligent WBEL environments. As it is hoped that the designers and developers can easily incorporate the suggested rules into their systems as a way to sustain and enhance the learners’ motivation during the learning process. Thus, the suggested rules should be considered as a stepping-stone in the development of WBEL environment that can sustain and enhance learners’ motivation during the learning process.

**References**