A Framework for Integrating Motivational Techniques in Technology Enhanced Learning

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Abstract. Motivation is a key factor in education. While there exist some learning system that consider techniques for motivating learners, these systems implement only one or few techniques and assume that the respective technique(s) work well for all learners. However, learners are motivated differently and what is motivating for one learner can be demotivating for another learner. In this paper, we introduce a framework of motivational techniques, which suggests motivational techniques that can be included in learning systems, discusses the relationships between these techniques, situations where the techniques might be demotivational for learners, and requirements of the techniques to be integrated into a course and learning system. This framework aims at providing guidelines on how to implement a set of motivational techniques into learning systems and is the basis for providing personalization based on motivational aspects in learning systems, presenting learners only with motivational techniques that work well for them.

Keywords: Motivation, personalized learning, personalized learning systems

1 Introduction

Motivation is the reason that someone engages in a certain behavior [1, 2] and therefore a key aspect to be considered in different domains such as business, health, and education. A lot of research has been conducted by educational psychological researchers on motivational aspects in the context of education, aiming at facilitating motivation in the educational domain and resulting in several theories and models [e.g., 1, 3]. Based on such theories and models, some learning systems have been developed that use particular techniques (e.g., rankings, avatars) to enhance learners' motivation [e.g., 4, 5]. However, most of these systems integrate only one or very few motivational techniques and assume that they can motivate each learner in a similar way. Only little research has been conducted on personalizing motivational techniques and enabling systems to recommend learners motivational techniques that enhance their motivation most.

The first step towards providing personalization based on motivational aspects in learning systems is to develop a framework of motivational techniques that can be

easily integrated into learning systems and online courses. In this paper, we introduce such a framework, which suggests a set of motivational techniques that facilitate the enhancement of motivation in an online course. These techniques are domain and course independent, making the framework easily applicable to different systems and courses. Requirements and characteristics of the techniques are discussed with respect to personalization issues.

In the next two sections, we provide an introduction into motivational models and theories for education as well as introduce related works on integrating motivational techniques into learning systems. Subsequently, our framework is presented and our conclusions and plans for future work are discussed.

2 Background on Motivation

For every behavior someone engages in there may be one or more influencing motivational factors, which can range from being motivational to being demotivational [1, 2]. Motivation is subjective and can be based on personal beliefs, feelings, and/or personal preferences. In education, motivation is a causal factor of learning [7] and it can be used to direct a student's behavior towards a particular goal, increase a student's applied effort and energy, increase a student's initiation and persistence in activities, enhance cognitive processing, and it can lead to improved student performance [8].

A student's level of motivation can be enhanced when the student exerts personal control for their learning and takes responsibility for it [6]. Students with an increased motivation to learn have a greater learning effectiveness [2] and those who are more persistent are more likely to achieve their goal [9]; however, too much control can lead to negative motivational effects [10]. Instructors and technology-enhanced instruction cannot control a student's motivation, but they can influence a student's motivation, either positively or negatively [11].

Intrinsic motivation is key to the success of a student since students with high intrinsic motivation have an increased curiosity and demonstrate behaviors that are explorative, self-regulated, and reflective, and typically outperform those students who are not intrinsically motivated [12, 13]. Furthermore, students in technology enhanced learning environments have been found to typically have a greater intrinsic motivation than those in face-to-face environments [14].

There exist numerous motivational theories which aim at explaining why people are motivated. From these theories, several motivational techniques can be derived to be used to enhance motivation in technology enhanced learning systems. In the realm of education, some of the popular theories include attribution theory, expectancy-value theory, and goal theory. Furthermore, motivational techniques can be based on theories from non-educational domains, such as reciprocation theory, consistency theory, social validation theory, persuasiveness of liking theory, and discrete emotions theory [17].

One of the main motivational models in education is Keller's ARCS model [3], which is used to design motivational strategies into instructional materials to improve the motivational appeal. The ARCS model consists of four conceptual categories (attention, relevance, confidence, and satisfaction) which are conditions that need to

be met for people to become and remain motivated. The attention category includes perceptual and inquiry arousal. The relevance category includes goal orientation, motive matching, and familiarity. The confidence category includes learning requirements, success opportunities, and personal control. The satisfaction category includes intrinsic reinforcement, extrinsic rewards, and equity.

3 Related Work

There are different motivational techniques implemented in technology enhanced learning environments; however, there is not a lot of information in regards to combining these techniques, as well as technique comparisons. The following are some examples of systems that include one or more motivational techniques.

Huett et al. [15] developed a mechanism for distributing ARCS-based e-mail communications as a motivational technique, consisting of supporting motivational techniques, such as an introduction, overviews of existing set goals, reminders, words of encouragement, and multiple points of contact to improve the motivation and retention of online students. The students who received the communications compared to those who did not, showed an increase in overall motivation; they also had a higher retention rate and a lower failure rate than the control group.

Code et al. [16] created a Goal setting kit (GSK) for gStudy, an e-learning tool that supports knowledge construction. The GSK is a motivational technique that allows students to set and manage their goals in an e-learning course and it records all of the activities of the students.

Comtella is a file and bookmark sharing system that enables researchers and students to share and exchange resources, such as links and research papers [4, 21]. The system includes motivational techniques, such as an online community, hierarchical memberships, rewards, top users, best papers of week list, personalized messages, ratings, community news, etc. [4, 21]. The system consists of a set of hierarchical memberships and rewards active users with better quality of service.

iHelp is a system that supports learners by providing asynchronous and synchronous facilities [17] as motivational techniques. The system includes supportive motivational techniques, such as emoticons, a marketplace, a top helper list, scored postings, etc. Smiley [19], an animated avatar with a human voice, was implemented on the system to respond to student performance. Vassileva [17] also implemented a marketplace for learning resources, where the helpees pay and the helpers earn system credits redeemable for prizes at the end of the term. In addition, the postings with the highest scores had a higher visibility.

Kim is an application-based interactive caring agent (displayed as an avatar) whose aim is to help students deal with negative emotions, and advise the students on overcoming English as Second Language obstacles [20]. The agent is a motivational technique that has a mentoring personality and also uses facial expressions, body gestures, and dialogue based on empathy, memory, and personality, to communicate with the student. Another agent-based system is eQuake, which is an electronic Question and Answer Knowledge Environment that includes motivational techniques such as multiple agents and a knowledge-base in the form of an online discussion forum [18]. The system also includes supportive motivational techniques, such as notifications, mes-

sage ratings, and an internal market. Students use the system to post questions, answers, comments, or ideas: when students ask a question, a knowledge agent intercepts question and searches the knowledge-base for any existing related questions that may satisfy the student.

4 Framework for Incorporating Motivational Techniques

The framework introduced in this section describes a set of motivational techniques which we identified as most suitable for the incorporation into learning systems. These techniques are based on motivational theories and models and most of them have been successfully implemented in particular learning environments. The techniques have been selected based on a comprehensive literature review and with respect to their capabilities to motivate learners. Furthermore, another selection criterion was that the techniques are domain independent and content independent, aiming at creating a generic framework that can be easily integrated in different systems and courses without rewriting or extending the content of these courses. Therefore, techniques that require learning material to be presented in a certain way (e.g., through videos, game-based learning, adaptive content presentation etc.) have not been considered in this framework.

In the following subsection, for each motivational technique a description is provided about the aim of the technique, why the technique is motivational, what has to be considered so that this technique is not demotivational, and the requirements for the course and system to integrate this technique.

4.1 Motivational Techniques

Progress Timeline. The *progress timeline* technique aims at (1) providing learners with information about their progress in the course based on predefined milestones such as assignments, quizzes, exams, projects or other graded components in the course, and (2) showing them their progress in relation to the progress of the class in anonymous as well as accumulated format.

This technique builds on the confidence and satisfaction categories of Keller's ARCS model [3]. This technique can motivate learners by providing them with a tool to assist with their personal time management and therefore can support a learner's belief that he/she can master the learning tasks. In addition, the technique allows learners to reflect on what they have successfully completed. Furthermore, this technique can provide learners with information on how they have progressed through the course in relation to their class mates and can motivate learners to work at the same or quicker pace. In addition, it can help to locate learners at the same milestone and facilitate communications between learners. Besides the motivational impact of this technique, it can also be demotivational for some learners if they feel as though they have fallen behind in the course and may not be able to catch up. Learners may also be demotivated if there appear to be too many milestones remaining for them to complete. Furthermore, learners may feel demotivated if they have a peer question but there are no active learners at the same milestone.

To implement the *progress timeline* technique into a learning system and course, the respective course has to have measurable milestones and the system must be able to track learners' completion of milestones and access the start and end dates of all learners for the course.

Progress Annotation. The *progress annotation* technique is used to display to the learner their progress through the course content. This technique allows learners to (1) tag their active position in the course content and (2) tag the completed content.

This technique builds on the confidence and satisfaction categories of Keller's ARCS model [3]. The *progress annotation* technique can motivate learners by allowing them to view and track their progress through the course and to reflect upon their progress. In addition, the technique empowers learners by displaying their exact position in the course content and it can be used to assist learners with their time management. Learners can be demotivated by this technique if they feel as though they are not progressing fast enough through the course, even though they are putting in a lot of effort.

To implement the *progress annotation* technique into a learning system and course, the respective course must have content and the system must be able to keep track of a learner's progress through the course content.

Rankings. The *ranking technique* is used to sort learners based on certain criteria. Learners can be ranked, for example, based on their performance, their participation, their interactions with others, and the amount of time that they spend online. For example, Comtella ranks learners based on the quality and quantity of their contributions [21] and iHelp displays a top helper list [17]. In addition, learners can be ranked based on multiple criteria, where a formula can be used to assign any weights and/or relationships.

This technique builds on the satisfaction category of Keller's ARCS model [3], as it allows learners to be rewarded or satisfied by displaying statistics, providing the learner with a scale to compare themselves to. Some learners will use this information to continually try to improve. Depending on the criteria, one learner may be satisfied being in the lower half of the course, while another learner is ranked second and is demotivated by the position, because he/she is not in first place. This technique can also be demotivational to some learners if they feel as though they should be doing better than they are or if they do not feel as though they have a sense of control. Since each ranking can be motivational to some and demotivational to others, personalization is an important issue for this technique.

To implement the *ranking* technique into a learning system and course, the course must have a minimum number of people enrolled; if there are too few people, the rankings may not be significant. The course must also have criteria that can be used to rank the learners. The learning system must be able to keep track of the learners' activities and achievements based on the ranking criteria.

Awards and Achievements. The *awards and achievements* technique supports learners by providing them with incentive and/or recognition. Awards and achievements are either achieved or not achieved, or they can be based on a scale or levels, such as different forum user types based on the number of posts a learner contributes. For

example, Comtella awards active users with better quality of service [21] and iHelp awards higher visibility to the postings with the highest scores [17]. The *awards and achievements* technique can be based on various course components, such as grades, participation, and the completed content.

This technique builds on the satisfaction category of Keller's ARCS model [3], as it rewards the learner. Awards and achievements are motivational as they provide recognition to a learner and a sense of accomplishment. Awards and achievements can be a demotivational if a learner does not have the time to allocate to additional learning or processing, if the learner finds flaws in the methodology, or if the learner does not get the recognition that he/she believes he/she deserves.

To implement the *awards and achievements* technique into a learning system and course, the course must have components that associate awards/achievements with them.

Discussion Forums. The *discussion forums* technique is a tool used for asynchronous communication between learners as well as between learners and their instructor. Discussion forums allows for learners to post questions, comments, and/or concerns and respond to existing posts and have been used, for example, in [17, 18, 21].

This technique builds on the confidence and attention categories of Keller's ARCS model [3], as it empowers and supports learners by facilitating peer assistance and they can be used to promote active participation of the learners. Discussion forums can be demotivational if the forum lacks content or if the amount of content is overwhelming. If the content is overwhelming, the learner may not be able to keep on top of all of the posts due to sheer volume. Also, some learners prefer to not communicate in a public forum.

Discussion forums are a standard component included in many technology enhanced learning environments. To implement the *discussion forum* technique, the learning system needs allow the integration of discussion forums into a course.

Communications. The *communications* technique is used to communicate course information to the learners, as demonstrated, for example, in [15]. These communications can be sent by various systems and protocols, such as e-mail, e-learning system message, SMS, and/or RSS. Communications provide learners with information from the instructor and/or the course environments, such as announcements, solutions to problems and exercises, updates on their goals, and/or advice if they are falling behind or if they are having problems in the course.

This technique builds on the confidence and satisfaction categories of Keller's ARCS model [3], as it promotes learner self-confidence and provides feedback and reinforcement to the learner. In general, communications are motivational as they keep learners informed and up-to-date on the course and any potential changes or additional information that is being provided. Communications can be demotivational if they contain too much content, if they are sent too frequently or not frequently enough, or if the learner finds the communications to be spam.

To implement the *communications* technique into a learning system and course, there must be content to communicate to the learners and means (the protocols) to send the communications.

Knowledge Agent. A knowledge agent is an agent on the system that is responsible for directing learners to the most appropriate information based on a request, as for example implemented in [18]. It acts as a broker between the learner and the information available on the system. A knowledge agent is asked a question by the learner and returns the most appropriate information to the learner in response to his/her question. A knowledge agent has access to all course information and documentation such as the course content, the forums, a knowledge-base and/or list of frequently asked questions, and any other manuals and documentation.

This technique builds on the confidence category of Keller's ARCS model [3], as it supports and empower learners. The knowledge agent is motivational as it allows the learner to easily navigate to the most appropriate information based on their query. The agent can be demotivating if the agent does not answer the questions appropriately.

To implement the *knowledge agent* technique into a learning system and course, the knowledge agent must have access to various course information and documentation to draw its responses from.

Caring Agent. A caring agent is an agent on the system that is responsible for emotionally supporting, identifying with, and assisting learners. The caring agent is displayed as an avatar on the system and it presents supporting information to the learner in an informal manner, as for example shown in [20]. The agent can advise learners on course deadlines and progress, any timelines that the learner is trying to meet, how the learner is progressing, or if additional learning materials have been uploaded. Also, the caring agent can interact with the knowledge agent to gather additional information to support the student. The caring agent can be used to support learners if they are doing poorly on practice materials by providing the learner with hints to assist the learner in successfully answering questions and by providing additional hints if they are not successfully answering a question.

This technique builds on the confidence and satisfaction categories of Keller's ARCS model [3], as it supports and empowers learners by coddling them. The agent can be demotivating if it does not properly support the needs of the learners or if the learners are distracted by the agent. It can also be demotivational if learners find that they are being overly coddled or if the agent is perceived as being annoying. The avatar can be demotivational to some learners based on its look and feel.

To implement the *caring agent* technique access to information about the learner and course needs to be available.

Posting Solutions. The *posting solutions* technique consists of posting the best solutions to problems or exercises in the course.

This technique builds on the satisfaction category of Keller's ARCS model [3], as posting solutions to problems and exercises is motivational when learners receive recognition for having the best answer and when learners are supported by being provided with a solution to a problem that they may not have been able to fully answer on their own. The *posting solutions* technique can be demotivational if a learner believes that his/her solution was better than the posted solution or if a learner never has the best solution.

To implement the *posting solutions* technique into a learning system and course, there must be graded activities and the course should be paced so the learners all have the same submission deadline.

Goal Setting. Goal setting encourages learners to set a plan to meet an objective, which causes learners to think about and understand various components of the course, as for example shown in [16]. Goals are set for personal gain and can be implemented for many facets, such as planning timelines for assignment submissions and exam write times; to achieve a certain grade, to beat a certain % of class, to get passing grade, etc.

This technique builds on the relevance category of Keller's ARCS model [3],as it allows leaners to establish a connection between the instructional environment and the learner's personal goals, which gives them a feeling of comfort and preparedness. Goal setting can be demotivational when the learner dislikes planning or is overwhelmed.

To implement the *goal setting* technique into a learning system and course, learners must have one or more course components to set goals based on.

Emoticons/Emotions. Emoticons are pictorial representations of facial expressions (such as pleased, happy, sad, surprised, angry, or neutral) and can be used to display extra meaning to the learner, as for example used in [17, 20]. For example, they can be used as an auto-response to a learner's interaction with the system or to add meaning to course content. Emoticons can be used in the course content, such as when a learner works on a practice exam. On the other hand, emotions can be displayed by avatars on the system when interacting with learners. Avatars can modify their facial expressions in response to a learner's interaction with it.

This technique builds on the satisfaction category of Keller's ARCS model [3], as it provides feedback and reinforcement to the learner. Emoticons can be demotivational if they are found to be annoying, unrelated, or insulting to the learner.

To implement the *emoticons/emotions* technique into a learning system and course, there needs to be content and/or activities for the emoticons to be integrated into or for the emotions to be related to.

4.2 Relationships between Motivational Techniques

Each of the introduced motivational techniques can be implemented as an individual technique. However, several optional dependencies exist, where one technique can support and enhance another technique, leading to more comprehensive capabilities of the respective technique. Furthermore, by combining motivational techniques and benefitting from their relationships, a technique that was previously demotivational to a learner may become more appealing. For example, the *ranking* technique can use inputs from the progress timeline, goal setting and others in order to provide more comprehensive rankings. While ranking based on only one aspect can be misleading and therefore demotivational for some learners, the consideration of multiple course facets can lead to more accurate ranking and therefore to an increased level of motivation. By implementing the proposed techniques and making use of the dependencies between techniques, a richer environment for motivating students can be provided.

Figure 1 shows the optional dependencies between each technique, using arrows to indicate the direction of dependency.

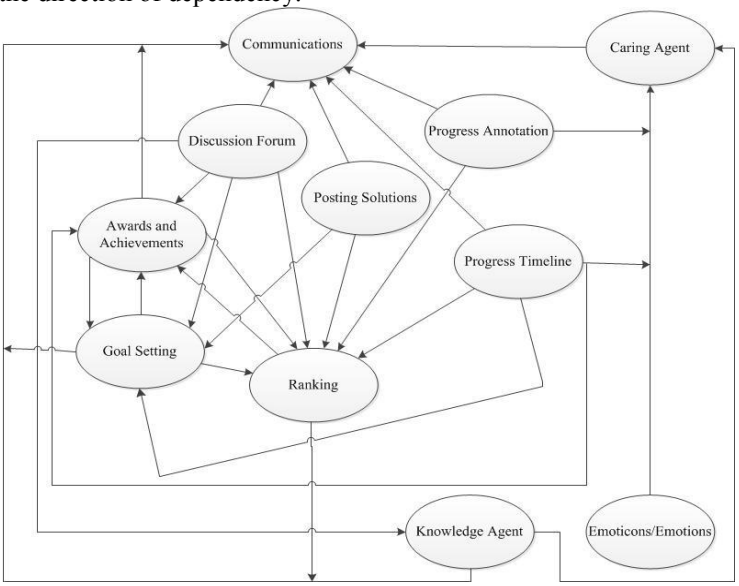

Fig 1. Optional dependencies between motivational techniques

5 Conclusions and Future Work

This paper proposes a framework of 11 motivational techniques to be integrated in learning systems in order to enhance learners' motivation. Each technique is described with respect to its aims, why it is motivational, possible demotivational effects, and the requirements for the system and course to integrate the respective technique.

This framework contributes to the area of technology enhanced learning in two ways: First, it proposes a domain independent and course independent set of techniques to be integrated in learning systems to enhance learners' motivation. By integrating the proposed set of techniques and considering their dependencies, learners can select between different motivational techniques that can increase their motivation at different stages and in different situations in the course. Second, the proposed framework is the basis for automatically providing learners with personalized motivational techniques that fit their motivational preferences and current situations.

Our future work will use this framework as basis for developing an adaptive mechanism that presents learners with motivational techniques that work best for them.

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