

## ENHANCING TRUST IN E-LEARNING THROUGH SECURITY MECHANISMS IMPROVEMENT

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**Abstract:** *Trust is an important issue in establishment of any service. Researchers usually discussed trust in contexts of online banking, but other services are prone to trust problems too. We researched models of trust in e-learning and potential role of security in development of trust. Security was improved through usage of additional learning environment module that communicate with user. An adapted trust model was tested and the results are presented with appropriate conclusions and suggestions for future research.*

**Keywords:** *e-learning, trust, security*

### 1. INTRODUCTION

Trust is a general term. According to the Webster's dictionary, it is "belief that someone or something is reliable, good, honest, effective, etc." [1]. Oxford dictionary offers similar explanation: "Firm belief in the reliability, truth, or ability of someone or something" [2]. Belief is a subjective category, so is the trust. Not having trust in someone or something -in some person, organization or web-service, might have strong influence on how we approach it, if we approach it at all. We could limit sharing confident information with the person or stop using a service qualified as non-trustworthy. Also, we may require additional check and measures of control, since there is not enough evidence of reliability to just close our eye and believe everything will be fine.

Trust is an important issue in online services operation. Its definition is more specific in this context: "a psychological state that allows a person to accept vulnerability based upon positive expectations of the intentions or behavior of others" [3]. It is even stated as key factor of online business success [4]. Further, information security is stated as one of factors influencing trust [5], with various classification of elements that compose the security itself. In [5] author defines three elements - access control, transparency of identity and surveillance, while other may have different taxonomy, as it will be stated in next section.

Matter of trust in online services is mostly researched in context of e-commerce and e-banking, which is reasonable, since these services bring risks that may put users (clients) in possibility of heavy loss. However, any online service, even a plain web site is accompanied with certain level of trust. Therefore it is justified to assume trust as important issue in e-learning.

The paper deals with relation of security and trust and how we may enhance the trust through improvement of security mechanisms. The problem tackled in this paper is how could we improve trust in e-learning that is facilitated in official education. Other approaches, dealing with open education options, that may require full anonymity are not discussed, but one may find interesting results in [6].

The rest of paper is structured as it follows: current research in area of trust in online services (including e-learning) is given, then the foundations of security architecture and model of research are presented and the results are discussed and conclusions are made.

### 2. BACKGROUND

Researchers tended to classify factors influencing trust in various ways. Wang defined trust framework with four complex factors: credibility, design, instructor socio-communicative style, privacy and security [7]. Similar approach was taken by Hsu [8], who analyzed e-commerce service trust. The security elements he defined are "perceived security" and "perceived privacy".

In [9] authors conveyed a wide-scale research in which they concluded that security is an important factor, but dealing with possible accident and ensuring users that it would be mitigated and fixed showed up to be more important than evident existence of security controls.

Wright et. al. argued that both privacy and trust were highly context-dependent issues and that policy makers were supposed to clarify statements regarding privacy and trust and to adapt them to new needs [10].

A comprehensive literature review is given in [11], in order to bring a model for web-site trust evaluation. Among other things, there is an interesting debate stated - about how users' technology proficiency affects their

trust. In short: it is still unclear whether higher proficiency leads to greater trust or it is the opposite. The final model is made consisting of many factors, which are not of same importance for different kind of web-service, i.e. for e-banking and e-commerce.

Trust model used in this paper is based on [7] and [11].

### 3. SECURITY MODULE

Model of enhanced security is based on usage of seLTSA architecture given in [12] (Image 1). The security module is developed as key part of LTSA (Learning Technology System Architecture) upgrade. It is an element that orchestrates security measures integrated in the learning environment. It presumes improvement of conventional security mechanisms built into learning environment, by using advanced monitoring and enhanced communication with users.

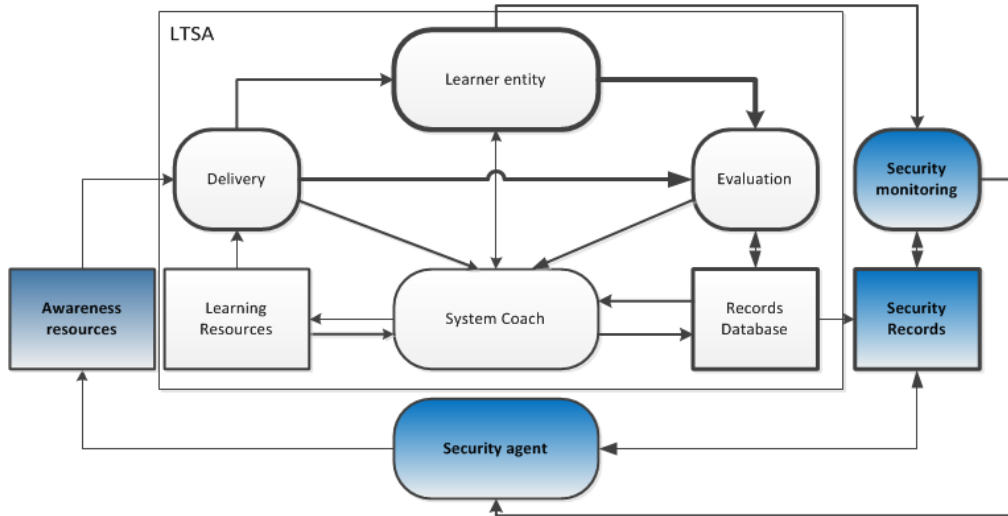


Image 1: seLTSA architecture (taken from [12])

Module's role in brief is to monitor events related to security, act proactively and correspond with users, disseminating security recommendations. Communication is "light": it is integrated in courses that users visit and users are not forced to interact, i.e. they are not forced to read some text or to take e-test related to security issues.

The module is implemented as a software agent - a plugin for the popular learning environment - Moodle [13]. Moodle is chosen mostly because it is open source and because students of the faculty where it was planned to assess the module, are already familiar with it.

Users (students) are exposed to the relatively small block of text taken from awareness resources (which are further derived from terms of system usage). The resources are dependent on user's profile and the profile is built upon user's behavior. The behavior includes password management, malicious file handling and security awareness test results. The test is not obligatory. Module also may send mails and private messages with required information.

### 4. RESEARCH

We established an online course, placed on Moodle platform with installed security module. A group of 35 students was enrolled for two months. No additional information regarding the module or the research was

disclosed, in order to get unbiased results.

After the course was over, we conducted a survey related to trust, based on model given in section "Background". Factors comprising trust were categorized in three groups: security, reputation and content. Security was articulated through module functions. The survey utilized Likert's scale (1-5) (Appendix). The results are presented on Image 2.

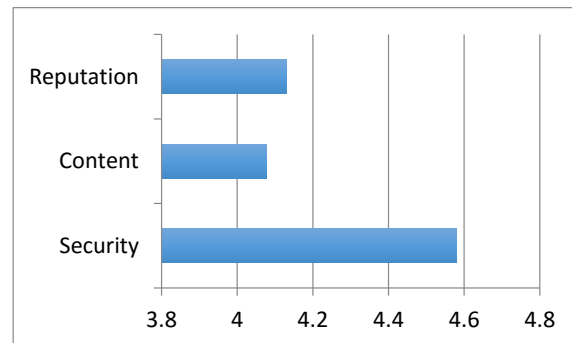


Image 2: Survey results

The results have unambiguously shown that security is important building block of trust. Module's functions turned out to be valuable, even more important than other trust "ingredients".

Although the results are somewhat satisfying in matter of hypothesis that security is important and that we may improve the trust in whole by enhancing the security features through module, we further analyzed how component of "security" factor correlate in order to check if there were some internal components interconnections. Therefore we used SPSS package to make automatic refactoring of the factors standing inside each category. We found strong relationship between reputation and security factors. Most factors belonging to "security" category were factored in same group as reputation. Therefore we concluded that security is tightly related to reputation and these two categories may even be merged into one.

## 5. CONCLUSION

Trust in e-learning is established through interaction of various factors. Security is one of them. By enhancing security, trust may be improved too. In order to boost trust, it is important that users get feeling that they are cared about and that they won't be let to themselves to solve problems. Security module developed as part of seLTSa architecture is user-oriented. Even it is not too proactive, users got they way of getting information and automatic support.

Research showed that factors related to security are important for trust, but also suggested seeking for new models of trust, since not just every kind of e-business got its own oddities, but even different scenarios and sub-scenarios of learning may bring some novel moments in model of trust, revealing factors affecting it. It is up to further research to enlighten these models.

## APPENDIX - SURVEY ITEMS

### Reputation

1. For trusting this system, it is important that the e-learning site is on university domain.
2. For trusting this system it is important if other colleagues are using it.

### Course content and communication

3. Accuracy of e-learning content influence my trust in e-learning.
4. Site availability influences my trust.
5. Availability of technical support influences my trust.
6. Quality of teaching material affects the trust.
7. Communication with other users on course affects my trust.
8. System design (look, colors) influences my trust in e-learning system.
9. Feel of community affects my trust

### Security

10. It is important for trust in e-learning to be well introduced with terms of usage.
11. It is important for trust to get assistance with login problems.
12. It is important for trust to have uploaded files checked.
13. It is important for trust to have potential attackers banned.
14. Preserving privacy of my data is important for trust.

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