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ΔΙΠΛΩΜΑΤΙΚΗ ΕΡΓΑΣΙΑ:

Using Social Annotation Tool to Enhance Learning: A Literature Review

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Abstract

Social annotation tools are used more often in contemporary learning processes in order to boost learning. Nowadays, plenty models, types and applications have been created that facilitate annotation to online documents, web pages, even multimedia. The primary purpose of all these twenty-four applications, that are analyzed herein, is to stimulate reading comprehension and offer a more interesting virtual learning environment, that can benefit both tutors and learners. The main criteria that have been selected for comparing the reviewed annotation tools are effectiveness, usability and knowledge dissemination. Finally, it is believed that there are many opportunities to improve the existing models, as well as to create brand new models.

Key Words: E-learning, annotation tools, information technology

1. Introduction

Nowadays, there is a significant shift from traditional forms of learning to more virtual ones, where there is no need of physical presence in a specific geographical place with the classic books. The rapid emerge of new e-learning methods across the educational community created more needs for the development of new tools that can facilitate both students and tutors. Annotation tools are a vast category that is useful for educational purposes and for efficient and effective knowledge dissemination. The present paper briefly describes some existing annotation tools that have been tested and reviewed. Then, regarding three selected criteria, a comparison follows in order to be able to compare and contrast the different properties and abilities of them. Finally, the analysis concludes with the outcome regarding the usefulness of the existing models and the possible potentials for improvements.

2. Literature Review

In recent literature, there is are different types of online annotation systems that have been developed by academics that facilitate the same purpose: the e-learning methods. The vast majority selected reviewed systems are used in educational context, whereas there as some for more broad uses, such as libraries or just for social tagging data.

2.1 Annotation Tools for Educational Purposes

The first main category of annotation tools is related with educational purposes. In the first paper (Bonifazi et al., 2002), there is a discussion on design and implementation of a web-based User-Centered Annotation Tool (UCAT), which is based on Amaya (a web browser and annotation tool that complies with World Wide Web Consortium (W3C) standards. The basic features of the abovementioned tool are the readability of the annotation area, the ability to insert links, different icons for each annotation type and author, the icon choice and the search function. The benefits of this program, which has been implemented on windows platform, are the clear input structure for making annotations, the ability to insert not only textual annotations but also hyperlinks, the ability to choose among a variety of annotation tools in regard to the

communicative functions, the usage of different iconic displays within the original document and individualized preferred icons.

Another system, ASIFA (annotation-sharing and intelligent formative assessment system), combines the techniques of collaborative annotating and data mining by using artificial intellectual techniques on formative assessments to increase learning efficiency (Lin, et al., 2011). The aim of formative assessment is to provide effective feedback by taking online collaborative annotations by identifying learning weaknesses that most students suffered from. Multimedia annotations (audio, text) are more beneficial than inexplicit (highlight) and enhances learner's knowledge and motivation. The phases of the system are: a. the Test phase which includes a question bank and b. the review phase for each incorrectly answered question. Data mining facilitates the possible correlation between the questions with the same concept. The ASIFA System has two main parts, the web application and the access database. The comparison with paper and pencil formative assessment has showed that ASIFA system enhances learning achievement but student's behavior on annotation does not have an important correlation with the learning achievements.

Semantic annotation tools for e-learning can be categorized into different viewpoints, regarding specific requirements and the aims that usually fulfill (Azouaou, et al., 2004). The basic requirements for such tools how useful they are in terms of teaching, how easily can be shared between the teaching actors and how usable they are in facilitating teaching methods. Depending on three key factors, the annotator, the user of annotation and the fact that the annotation is semantic or not, the authors (2004) presented four properties of annotations: automatic versus manual, cognitive versus non-cognitive, computational versus non-computational and semantic versus non-semantic. Furthermore, there are some research annotation tools, such as MemoNote and AnnForum that need improvements in order to be more automatic and more semantic.

HyLighter (Samuel, et al., 2011), is, also, a Social Annotation Modeling Learning System (SAM-LS) that can offer learners benefits and improve effectiveness. The main properties of this social software are the ability to annotate an electronic document and the peer assessment of the document. In comparison with other annotation systems, HyLighter brings together cognitive constructivist and socio-cultural theoretical frameworks and therefore allows students to organize their learning effectively, check and compare their performance

and have valuable feedback. Despite the fact that the system is technically usable, it is not fully appreciated in terms of educational gains since it has no serious impact on student's motivation.

A learning process SQAR steps into a web-based annotation tool called WebAnnot, a prototype of SQAR as an extension for the Firefox browser (Mostefai, et al., 2012). This specific model includes the following main entities: the learner who is user and annotator, the document (online) and the annotation interface which contains Assisted Annotation and Annotation Management, and finally the local and distant database. The modeling of SQAR process includes survey, question, annotation and review. The tests' results indicate that this interactive system has an impact on learning effectiveness since it is seemed that this method improves learner's understanding and memorization of a document they are working on.

A Semantic Web and web services- supported multimedia in the context of Computer Supported Collaborative Learning (CSCL) can promote knowledge sharing and improve learner's reading comprehension. PAMS 2.0 is a such system that provides anchoring management, document management, association management and annotator management (Yang, et al, 2011). The experimental results pointed out that using PAMS increases reading comprehension in a collaborative e-learning context because this system encourages commenting, discussion and questions.

Linked Data Technology (Nithya, C. and Saravanan, K., 2014), allows video annotation and browser platform with tools like Notitia, a semantic video annotation tool, and Sansu-Wolke, a semantic-based video searching browser. The first tool helps users to annotate video resources using vocabularies set by Linked Data Cloud, whereas the second tool enables users to browse semantically linked educational video resources. The use of this tools can provide more value- added information and contributes to the extension of linking open data community.

E-learning tutoring (Nunes, et al., 2012), has emerged the need for a highlighting annotation tool that enables users comprehend much better the learning material. Such a tool consists of two main modules, Student Module and Staff Module. The evaluation of this system has been based on factors like usage, satisfaction, application, collaboration and future use and had an overall positive impact in the learning process. The above model was tested in an e-learning course with over 750 students that actively use it and enables the reading and learning process to become a collaborative and shared activity. This highlighting tool supports active reading a well-known and efficient means of learning which can be served over the internet.

Also, it brings to the digital environment the same metaphor of the traditional highlight marker and puts it in a social context. It is a minimalistic approach where users can intuitively make use of the tool just by doing the same they would do when reading a hard copy document. This way users are able to emphasize certain portions of digital learning objects. Furthermore, it provides students, tutors course coordinators and educational institutions new possibilities in the teaching and learning process with information to be as an improvement of the content taught and the student's learning experience. This highlight annotation tool was evaluated useful while the contents mainly contain definitions of concepts significant to the respective course. As future works highlight tool can be expanded in order to improve the whole learning experience.

Another study (Mendenhall, et al., 2011), implements a structured method to engage students in question-answering tasks in the context of a face to face English course and made use of an online social annotation tool called Hyligher. The purpose of this study was to document the impact of this tool on students' mental models, motivation for the course, and achievement in the course. There were four articles in which participants read and answered questions relating to the content of the article. Contrary to what it was assumed, a review of data for the three dependent variables indicated that there was no serious violation of the assumption of normality. Outcomes of this process include greater shadiness of mental models on achievement. The findings and limitations of this study provide several directions for future research. This study is significant though in that it reports a variety of ways of looking into the effects of the tools, especially in students' mental model.

Lee, et al, (2009), in their paper algorithm named EKAA is proposed as in auxiliary tool for students to read the e teaching materials based upon the cluster to which a student belongs then annotation sharing system adaptively provides the student a suitable sharing model. The models serve as a scaffolding to guide the students learning intending to achieve the purposes of auxiliary learning and knowledge sharing. The research targets where 110 students of high school who took the tests in the purpose of verifying whether the model can enhance the learning effect of the students of different clusters The study discovers that the students in medium and low score cluster have significant improvement Furthermore it founds that most of the students of high score cluster belonged to field dependence since they had their own ways of learning and less depended on external assistance.

Azouaou and Desmoulins (2006), talk about ‘‘Memonote’’, a semantic annotation tool, targeted teachers and it has three facets: semantic facet for specific ontologies, cognitive facet with a visible form and personal facet that expresses teacher’s standpoint. The important function that Memonote has is its semi-automatic property that provides teachers a virtual wallet. It also has tested flexible and extensible architecture and its main parts are two hardware components and five software components. Finally, this system is an integrated approach dedicated to educational context management that can be reused for other e-learning functionalities.

Desmontils, et al., (2004), analyze a synthesis of the characteristics of the annotations and architectures of annotation systems that is created and they propose a new architecture for an annotation system, which is easy to use, light weight, efficient, non-intrusive, saleable, sharable and platform independent. Dinosys system takes advantages of two existing types of architecture but also bring into light a new concept, ‘‘ distribution’’. It is divided into three parts: a client, a portal and a set of identical proxy servers. The Dinosys system is distributable and can be used to various e-learning applications, such as management of the student’s collaborative work on the same project and also in tutor and student’s communication. It is also worth mentioned that a first version of this system was implemented in the framework of an e-learning course.

Another self-regulated learning assisted mechanism in collaborative reading annotation system has been developed for individual learners to promote their reading comprehension performance in English language (Huang, et al., 2012). The experimental procedures contain accessing prior English proficiencies of two groups of learners. The outcome of this system evaluation confirmed that reading comprehension performance and annotation abilities of learners are significantly improved when using the proposed system. The existence of limitations provides directions for future research, whereas there is a growing tendency of looking into the effects of the tools, especially in student’s mental model.

Another particular study (Nor, et al., 2013). describes how students used an online annotation tool to help them interact more effectively with the assigned online reading materials. The design of the tool takes into accounts personalized reading and collaborative learning factors. It allows the readers to mark-up a text by highlighting, understanding and writing notes. The findings of the case study showed that the students used an annotation tool in various ways. It helped them to organize their notes with their friends, hence student’s

responses can be divided into two types, personal and collaborative learning. The act of highlighting has been shown to be most useful. Furthermore, the three different colors assisted in making more structured annotation. A significant insight is that the immediacy of making annotations online is beneficial because active reading is promoted, while students encode their ideas.

Moreover, Glover, et al. (2007) paper discusses annotation in educational context and introduces some of the relevant web annotation systems, such as Annotea, Annoty, Crit, e-Marked, Gibeo, Third Voice, YAWAS. Although the overall results showed that there is a positive attitude to the Annoty, software limitations of this system has showed up. Moreover, eLaws, is a new developed system, which intended to address the main problem encountered by those who tested Annoty, and it also provides increased flexibility to users. The number of currently available systems shows that there is interest in the application of annotations to web pages.

KAPUST2 system, Beydoun, G., (2009), which is constructed from captured students trail a conceptual lattice guiding student's queries. This system is used as an e-learning software for an undergraduate class over two semesters. The semantic web is constructed with user trails and formal concept analysis. It is developed an e-learning tool to work with existing browser. The developers also have borrowed several rules from psychological studies of social navigation on what makes a good navigation system. This has made the tool easier to use, since it is a form of open multi agent system.

Furthermore, Chen et al. (2012) paper describes the development and evaluation of Web 2.0 annotation system to foster online communication and sharing in an e-learning environment. In order to enhance online learning interaction, this study discusses the concept of online learning communities and collaborative learning. The results of the usability test that was conducted demonstrated that with factor analysis, interactivity, usefulness, helpfulness and willingness for future use were categorized to represent the perceptions of MyNote. Additionally, it was found that the factors of interactivity and helpfulness were statistically significant to predict the future use of MyNote. Lastly, the practice of taking notes also affected learners' perceptions of using it.

A graphical annotation system that facilitates e-learning architecture is the based on three components: a databased server that saves and retrieves annotations, a client that allow users to create and search annotations and a PHP- based portal that services client annotations'

requests. The aim of this project is to create a graphical annotation which will be functional in the web-learning context, supporting also information exchange between users (Giordano, et al, 2005).

Finally, Gao, F.(2013), case study describes a case study which examines how students learn online materials collaboratively using web 2.0 social annotation, Diigo. This study provides a systematic approach for researchers to examine a phenomenon of interest in order to describe and explain it. active participation of students was checked. In general, the results of the research showed that students participated actively in this collaboratively learning activity, and the majority posted far more comments than required. Furthermore, students that the social annotation tool did a good job of directing their attention to specific information in the text, but made it hard to develop a holistic of the article. The study shows that the social annotation tool supported students to examine and share ideas, and the majority of the students had a positive attitude toward learning with the social annotation tool. It also suggests that social annotation is an effective way to engage learners in collaboratively reading activities, where students highlight and discuss important issues in the reading, share different opinions and learn from others perspectives.

The same author in different article, Gao, F. (2013) attempts to understand student's interaction and learning supported by a collaboratively social annotation tool in the same system, Diigo. It is examined how students participate and interact when learning an online text with Diigo, a collaborative social annotation tool, and how they perceive their experience. With Diigo, users create a free Diigo account and then they install a tool bar, with which they can highlight text information and add notes on a webpage. It seems that this tool supported students to examine and share ideas and the majority of the students had a positive attitude towards learning with this extra annotation tool.

2.2 Annotation tools for libraries

Another category that annotation tools matters is the context of digital libraries. SHASS (Sharable Annotation Support System) is a useful tool for annotating in digital libraries that makes annotations beneficial for knowledge representation, organization and sharing (Rouane, et al.,2005). It consists of two separate tools, the SHASS browser, which is a web browser that facilitates exploring and highlighting electronic documents, and the SHASS K-Editor, which is a graph editor that enables users to create and manage external representations.

The annotation sharing ability is a crucial feature of this tool since the reader can simultaneously import and export annotations.

Moreover, DLNotes (Rios da Rocha, et al., 2009) is an annotation system, which can be easily embedded in DLS in order to enable free text in order to enable free text and ontology-based annotations. DLNotes also supports supervised annotation activities and allows discussion threads to be associated with each annotation. The important property of this system is that users can identify important passages in the text, create different interpretations and make correlations with the contents. Annotation ownership is also supported to access control to discussion threads. Moreover, DLNotes provides facilities for easing and speeding-up the understanding of DLs' contents, but certainly there are several developments to be done among future works.

2.3 Annotation Systems for more general uses

Except for educational contexts, annotation tools are also useful for categories that are related to them. A Recommender System can manage the load of information on the web by suggesting users a list of products or items (Htun, et al., 2014). Collaborative filtering, a dominant algorithmic technique can be categorized in two types, a) memory based approaches and b) model based approaches. Social tagging systems can be an effective and efficient way of using tags for recommender systems. The fundamental data available is tagging data and resource information. The proposed system requires three steps: user preference elicitation, neighborhood selection and recommendation generation, and according to this paper the above system has better results and the other state-of-the-art approaches.

Finally, distributed knowledge based system is developed using RDF/OWL technology on peer to peer network in order to build personal social collaboration services for e-learning (Yaeh, et al, 2010). Ontology technology is used to construct the context aware environment for ubiquitous learning. Each service program has three components: content, annotation and query manager, which are in charge of the learning contents management. The study has carried out the layer system architecture, in which they have combined, implemented, extended and tested the RDF store.

3. Comparative Analysis & Discussion

A comparison between the different features and properties each reviewed annotation tool has is necessary in order to obtain a complete idea about them. At the beginning, not all proposed systems have been tested with any empirical conducted study. The existence of a study, either in a small scale, is crucial in order to make conclusions on usability and effectiveness factors of a tool. Additionally, each annotation may differ from each other in the following characteristics: 1. Which is the annotated target (text, image, video), 2 The form of annotated data (text, image, link), 3. Searching option of annotated data, 4. Social Annotation or not, 5. Private annotation or not, 6. Sharing option of annotations, 7. Commenting option for others' annotations. The following table displays in a concrete way each of the above-mentioned criteria for each reviewed annotation system.

COMPARATIVE ANALYSIS OF REVIEWED ANNOTATION TOOLS										
	TE- STED	ANN. TARGET	ANN. DATA	SEARCH	SOCIAL ANN.	PRIVATE ANN.	SHARING ANN.	COMME- NTING	USABI LITY	EFFECTI- VENESS
ANNOTATION TOOLS										
UCAT (Bonifazi et al, 2002)	NO	TEXT	TEXT, HYPERLINKS, ICONS	YES	YES	YES	NO	NO	-	-
SHASS (Rouane et al, 2005)	NO	TEXT	TEXT	NO	YES	YES	YES	NO	-	-
ASIFA (Lin et al, 2011)	YES	TEXT	TEXT, IMAGES, HYPERLINKS	NO	YES	YES	YES	YES	YES	YES
SEMANTIC ANNOTATIONS (Azouaou et al, 2004)	YES	TEXT	TEXT	YES (ANNFORUM)	YES (ANNFORUM)	YES	YES (ANNFORUM)	NO	-	
R.S. (Htun et al, 2014)	NO	TEXT	TEXT	NO	YES	NO	NO	NO	-	YES
GRAPHICAL ANNOTATION SYSTEMS (Giordano et al, 2005)	NO	TEXT	JPEG, JIFF, PNG FILE, TEXT, IMAGE	YES	YES	YES	YES	NO	-	-
HIGHLIGHTER (Samuel et. al., 2011)	YES	TEXT	TEXT	NO	YES	YES	YES	YES	YES	YES
SQAR (Mostefai et al, 2012)	YES	TEXT	TEXT	YES	YES	YES	NO	NO	-	YES
CSCL (Yang et al, 2011)	YES	TEXT	TEXT, IMAGE, VOICE	NO	NO	YES	YES	YES	YES	YES
NOTITIA & SANSU-WOLKE	YES	VIDEO	VOCABURALIES, HIGHLIGHTING	YES (SANSU)	NO	YES	YES	NO	YES	YES

(Nithya et al, 2014)										
HIGHLIGHT ANNOTATION TOOL	YES	TEXT	TEXT	NO	NO	YES	NO	NO	YES	YES
(Nune et al, 2012)										
HYLIGHTER	YES	TEXT	DOC, PDF, JPEG, HTML	YES	NO	YES	YES	NO	-	YES
(Mendenhall et al., 2011)										
EKAAA	YES	TEXT	TEXT	NO	NO	YES	YES	NO	-	-
(Lee et al, 2009)										
MEMONOTE	NO	TEXT	CONTEXT DATA	NO	YES	NO	NO	NO	-	-
(Azouaou et al, 2006)										
RDF/OWL TECHNOLOGY	YES	TEXT, VIDEO, PRESENTATIONS	TEXT	NO	NO	NO	YES	NO	-	-
(Vaeh et al, 2010)										
DLNOTES	NO	TEXT	TEXT	NO	YES	YES	NO	YES	YES	-
(Rios da Roxhae et al, 2009)										
DINOSYS	NO	TEXT	INFORMAL NOTES	NO	YES	YES	YES	NO	-	-
(Desmountils et al, 2004)										
SELF-REGULATED MECHANISM	YES	TEXT	TEXT OR LINKS	NO	NO		NO	NO	-	YES
(Huang et al, 2012)										
ONLINE READING SYSTEM	YES	TEXT	TEXT, HYPERLINKS	NO	YES	YES	YES	NO	YES	YES
(Nor et al, 2013)										
DIIGO	YES	TEXT	TEXT, HIGHLIGHTING	NO	YES	NO	YES	YES	-	YES
(Gao , 2013)										
ELAWS	NO	TEXT	TEXT	NO	YES	YES	NO	NO	-	-
(Glover et al., 2007)										
ANNOTY	YES	TEXT	TEXT	NO	YES	NO	NO	NO	YES	-
(Glover et al., 2007)										
KAPUST2	YES	TEXT	TEXT	NO	YES	NO	YES	NO	-	-
(Beydoun, 2009)										
MYNOTE	YES	TEXT, VIDEO	TEXT	YES	YES	NO	YES	YES	-	-
(Chen et al, 2012)										

From the above table, it is easily noticeable that the vast majority of the systems are targeting online texts, and only three systems (Notitia, RDF and Mynote) offer to users video annotations. This is relatively explainable since the educational material is still based on texts (books or exercises). The most frequent way of annotation is text (keywords), or by highlighting lines, whereas the upload of other files, such docs, pdfs, jpegs etc is more rare. Given the fact that most users are not familiarized with such systems, it seems that their main goal for the moment is to replace the pencil-based annotations, for better reading comprehension.

Furthermore, 17 out of 24 annotation systems offer social annotations, while 16 out of 24 provide private annotations. Some users, which are mainly students, prefer making social annotations and some other not because of privacy issues. These preferences depend on each student's style of learning and there is not a wrong or right option. It is noticeable also, that 10 out of 24 systems simultaneously provide both social and private annotations.

Moreover, another crucial feature of the annotation systems is the ability to share annotations. This property can be found to 15 out of 24 systems, meaning that it is considered an important since all users can know other's users annotations at once about specific subject or topic and therefore they can broad their horizons with unknown data. Commenting feature, however is not appeared a common property (only 6 out of 24), probably because of the complexity of making threads or the possibility that the users abstain from annotated due to fear of annoying comments.

Another issue about the reviewed annotation systems is that only half of them (15 out of 24) have been tested by any kind of study. The need for testing any proposed system can affect the actual usability and effectiveness of each one. Therefore, in order to have realistic input for these, an actual study should be carried for each system out in order to measure them. It seems that each system that has been tested, has valuable results on usability and usefulness, whereas these are on question when no test has been run. Consequently, there is no safe conclusion regarding these parameters.

4. Conclusion & Future Work

It is apparent from the reviewed annotation tools that there is a growing improvement of such systems in benefit of e-learning processes. Contemporary learning techniques have incorporated such systems that generally speaking contribute to learning achievements. However, each system has also some deficiencies and limitations, meaning that there is room for more improvement. Mainly, more studies must be carried out in order to pinpoint the lacks of each system and then eliminate them. Finally, it is a common place that these tools should be more user-friendly and interactive.

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