ConTag (Contextual Tags) in Video-based Collaborative Learning

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Structured Abstract

This research work designs an interactive and contextual visualization tool called ConTag (Contextual Tag) for video-based learning scenarios. The purpose of this study is to better understand the variation of learners' interactions and collaborative learning processes supported by ConTag. The system consists of i) contextual tags, ii) word clouds, and iii) transcript pointers. The paper examines how learners participate in and interact with ConTag and evaluates how they perceive their experience. The results indicate that learners actively participated in discussions and took good advantage of ConTag. Learners' interactions included self-reflection, elaboration, internalization, and support, and they showed moderately positive attitudes toward ConTag participation. The implications of using ConTag and its social collaborative tool (Twitter API) are discussed in the video-based learning context. .

BACKGROUND

ConTag introduces an interactive visualizer as a learning instrument that can depict the context of knowledge in video content that may vary within a collection of videos. For this, the paper proposes ConTag, a novel system that can help learners immediately grasp the context through its interactive and contextual visualization features right before they watch the video and during the discussion. In addition, ConTag can pinpoint or provide direct access to any particular scene in a video.

PURPOSE

An experiment was conducted to examine how people would learn in a video-based learning scenario by using ConTag. Two major research questions were proposed: i) how learners collaborate and interact during the video-based learning process with ConTag and ii) how learners perceive their experience using ConTag in video-based learning.

DESIGN/METHOD

A total of 89 participants were randomly selected for the experiment. The experiment took five weeks total. Two types of data were collected: i) a questionnaire and ii) the learner's conversation log. How the participant perceived his or her experience using ConTag was analyzed using the questionnaire. A coding scheme was developed to analyze the participant's collaboration and interaction during the learning process.

RESULTS

The results provide a better understanding of various types of interactions and learning experiences based on ConTag in a video-based learning context and thus should enrich collaborative video-based learning (self-paced learning).

CONCLUSIONS

The results demonstrate ConTag as an effective method for engaging learners in collaborative video-based learning. The coding scheme is expected to provide a better understanding of various types of interactions during the video-based learning process.

KEYWORDS

Video-Based Learning, Collaborative Learning, Self-Paced Learning, Tag Cloud, Message Annotation.

Introduction

Existing video-based learning scenario settings only enables learners to watching and listening to the video. Learners may interact with the video by posting comments or sharing it. Interactions typically take place when the video ends and consist of a thread of questions, comments, responses, or reviews summarizing feelings, expressions, and opinions concerning the video. In addition, such conversations usually refer to the whole video (YouTube Press, 2014).

This paper evaluates a CSCL (computer-supported collaborative learning) platform called ConTag (Rosli et al., 2013), which introduces an interactive visualizer as a learning instrument that can depict the context of knowledge in video content, which may vary within a collection of videos. The system helps learners grasp the context immediately through its interactive and contextual visualization tools right before they watch the video and during their discussion.

Literature Review

Video Based Learning

The demand for online learning has increased sharply as a result of rapid advances in internet technologies producing interactive media-rich content (Ke & Kwak, 2013). What is more interesting is that the incorporation of audiovisual materials (e.g., video or streaming media) and SNSs (social networking services such as Facebook, Google+, and Twitter) into traditional learning environments has created a more engaging experience, encouraging collaboration and clearly producing more interesting outcomes than words on a piece of paper (Kim & Yan, 2014). Learning through videos can be more effective because they provide learners an opportunity to learn and revisit the material (Delen, Liew & Willson, 2014). Several studies have explored ways to facilitate learning through video-based learning systems.

In video-based learning scenarios, existing video features do not allow learners to pinpoint a particular part of a video for questions and discussions, limiting their collaboration with others. In addition, discussions are not synchronous (De Jong et al., 2013). Therefore, it is difficult for learners to communicate in particular contexts because they cannot access any particular part of the video and refer to it and vice versa for a corresponding part (e.g., to ask questions or make comments). Such situations raise the question of how learners can be facilitated to deliver contextual information, particularly in collaborative video-based learning. This requires a tool that can identify or enable direct access to any particular part of a video scene.

Computer Supported Collaborative Learning (CSCL)

Recent advances in internet technologies have shifted the definition of learning. Some researchers have viewed this development as an irresistible platform for facilitating CSCL. Learning through audio visual and multimedia platforms has become common for learners because of its ability to reach every corner of the world (Saranya & Vijayalakshmi, 2011). The demand for video-based learning as part of the learning process has increased because learners anticipate increased convenience in accessing required resources. For example, Synote can enhance web-based teaching and learning by integrating various applications such as PowerPoint, Twitter, and speech recognition software (Li et al., 2011). Synote's PPTX and XML converter enables lecturers to easily capture their lectures and replay them. The system also provides a simple and free way to capture rich student interactions occurring in the classroom. In addition to Synote, Panopto, Echo360, Tegrity, and Camtasia Studio provide products for lecture recording, screen casting, and video streaming (Arnold, 2013; Mark, Vogel & Wong, 2010; Treadwell, Ibrahim & Callaway, 2013; Evans, 2013). This mechanism motivates learners to collaborate using a platform for sharing and creating a sense of social community, e.g., forming informal mentorship (Wang, et al., 2013).

Word Cloud

In general, a word or tag cloud is known as a visual representation of word frequency in some written material such as lecture notes or textbook chapters (Bateman, Gutwin & Nacenta, 2008) and represented through word size and color effects based on word frequency. This enables a quick impression of relevant concepts in the written material. Gottron (2009) points out that the user has to read the text to understand which word is important. In addition, ideas for enhancing the learner's perception of documents through visualization techniques have been borrowed from the tag cloud. Similarly, Cui et al. (2010) use word clouds to depict representative keywords, and Miley and Read (2012) introduce word clouds as a tool for assisting student learning. Such tools enhance learners' motivation and ability to learn.

This paper develops a ConTag system based on a text-mining technique that takes advantage of video transcripts readily available in the video (Rosli et al., 2013). The idea behind the use of word or tag clouds is to visualize topics over corresponding transcripts.

ConTag System Architecture

ConTag (Contextual Tag) is designed to provide interactive access directly to video content. It helps users decide whether it is worthwhile to watch the whole video, which is necessary to save their time and help them efficiently interact with the video as well as with other learners. Figure 1 shows the ConTag system architecture, a detailed development description of which was presented at the 5th International Conference on Data Mining and Intelligent Information Technology Application (Rosli et al., 2013). ConTag introduces three distinct interactive and contextual visualization features (see Figure 2):

i. It helps learners determine whether it is worthwhile to watch the whole video through the "contextual tag," an interactive and contextual feature that summarizes video content.
ii. It creates a "word cloud" while maintaining the semantic content of the video.

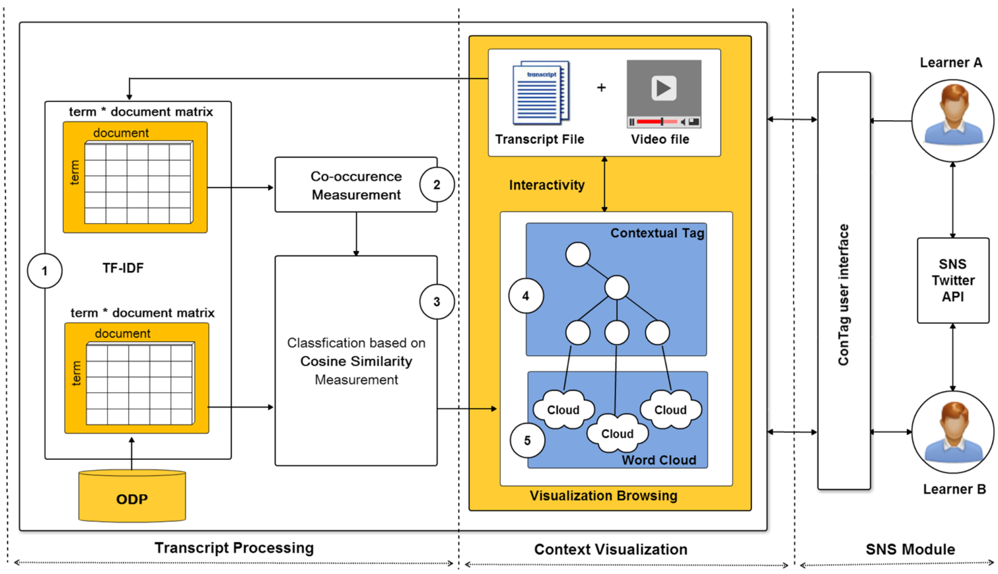

Fig. 1 ConTag System Architecture.

iii. It provides tools for directly accessing video content from a "transcript pointer" and its generated URL. The pointer is integrated with the Twitter API to enhance the ConTag

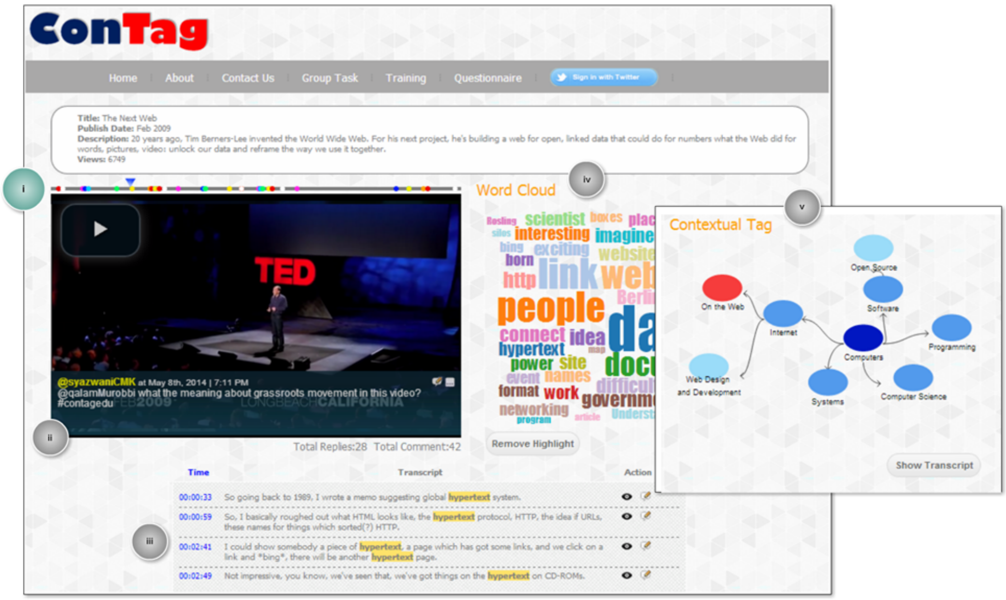

Fig. 2. ConTag interface snapshot (i-Message Indicator, ii-Message Panel, iii-Transcript Pointer (transcript panel), iv-Word Cloud and v-Contextual Tag).

communication mechanism, which helps to promote active learning. It also helps learners reach any particular part of the video from its URL.

The system is divided into three modules: i) the text-processing module (steps 1-3), ii) the visualization module (steps 4 and 5), and iii) the SNS module (Rosli et al., 2013).

The Experiment Setup

Participant

A total of 89 undergraduate students from Computing Department, Faculty of Art, Computing and Industry Creative were participated in this study. These studies take place at Sultan Idris Educational University (UPSI), Malaysia.

Experiment Procedure

A general introduction was given before the learner's participation using the system. This included a brief explanation of the purpose of the experiment, an introduction to the system, and a short demonstration for using ConTag. Here 20 to 30 minutes were allocated to let the participant become familiar with the system through the training page. Detailed training instructions were provided to guide them through to all of ConTag's interactive and contextual visualization features and its related interface. They were allowed to begin the experiment at any time as long as they were fully familiar with the system.

The instrument

The experiment used two video clips. The first clip was for training. This training clip allowed the participant to become familiar with the interface of ConTag and its contextual visualization tools. The second clip was for the experiment: a 16:20-minute clip entitled “The Next Web”. All participants were asked to watch the clip and discuss it actively.

Data Collection

Data were collected from ConTag communication logs and Twitter timelines (questions and comments). The first data set was used mainly to measure collaborative learning interactions in video-based learning. The second data set was quantitative and collected from a questionnaire given to the participants immediately after the experiment. Here a five-point Likert-type scale ranging from "strongly disagree" (1) to "strongly agree" (5) was employed (Tempelaar et al., 2013). This data collection method was employed to investigate how the participants perceived their experience using ConTag.

Research objectives

The experiment was conducted to examine how the participants collaborated using ConTag in video-based learning scenarios. Two major research questions were addressed: i) how learners collaborate and interact during the video-based learning process with ConTag? and ii) how learners perceive their experience using ConTag in video-based learning?

The Analysis and Discussion

Conversation logs analysis

All conversations were collected, analyzed, and classified into three categories as follows:

i) Discussion Topics

Appropriate arguments and discussions with respect to the given material represented an important factor defining the learner's participation in the collaborative scenario. As posited in Bloom’s taxonomy of learning action, defining ConTag learners’ discussion topics may help reflect their level of knowledge construction (Kidwell et al., 2013). In this regard, the experiment employed Charmaz's (2006) conversation-coding scheme, a grounded theory approach used to define the systematic mean from collected data. As a result, five topics based on coded schemes employed in the experiment were identified (see Table 1).

Table 1: Discussion topics from video conversation logs

Discussion topics (n=328)

Topics = *t*	**Examples**
t1 = The history and background	*“Who actually invented the WWW 20 years ago? Can someone explain more about this?”*
t2 =The Open-data and Linked-data	*“The project creates and distributes free geographic data for the public, e.g. Google maps. #ContagEdu”*
t3 = The examples	*“I guess you should try to have a look on this URL https://www.data.gov/. #ContagEdu”.*
t4 =The problems and risks	*“How safe our data on the web? What is the problem that we might face?”*
t5 =Others	*“Tim Berners Lee so frustrated? Why would he?”*

Table 2: Density of discussion topics in learners’ conversation logs

Discussion Topic (n=328)

Topic = *t*	**Number**	**Percentage (%)**
t1	76	23.17
t2	181	55.18
t3	15	4.57
t4	45	13.72
t5	11	3.35

Table 2 shows the participants' conversations about the given material, a 16:20-minute clip entitled “The Next Web”, which accounted for 55.18% of all conversations. This result was clearly due to the video material, which promoted open and linked data. It also implies that the participants were highly motivated to discuss such topics with other learners. This was followed by discussions about the historical background of the topic, and these discussions accounted for 23.17% of all conversations. Discussions on problems and risks accounted for only 13.72%, and the least discussed discussion in the "other" category accounted for only 3.35%.

ii) Interaction Categories

The interaction-coding scheme in Gao (2013) was adopted (see Table 3). This scheme was employed based on eight mechanisms of collaborative learning (Dillenbourg & Schneider, 1995) and 11 interactions of collaborative learning (Pena-Shaff & Nicholls, 2004). A total of 328 message annotations were generated using ConTag communication logs at the end of the experiment.

Table 3: Interaction coding schemes

Categories	Behaviours	Examples
Self-reflection	Learners reflect and interpret what they have learned from the video	*"If I were you, I will definitely made the code available to others"*
Elaboration / clarification	Learners build upon an existing comment by adding supporting examples and justification.	*"It depends on the scenario. For example, in blogs you can protect some of your data with private setting"*
Alternative / complementary proposal	Learners offer a complementary or alternative view	*"Yup, data are connected together. The more get connected, the more powerful it is"*
Internalization / appropriation	Learners paraphrase the concept / idea presented by their peers or acknowledges learning something new.	*"Take this point of view, especially from the discussion or forum…they share the experience and knowledge with others"*
Conflict / disagreement	Learners show disagreement or conflicting opinion	*"I don't get it, what do you mean by this?"*
Support	Learners express agreement without further explanation, establish rapport, or share feelings	*"Yes, it can cure cancer"*

As shown in Table 4, 42.38% of all messages were active interactions concerning elaboration and clarification. This clearly indicates that the "message panel" feature helped to grab the participant's attention, motivating him or her to respond to messages left by other participants. In fact, 26.83% of all messages corresponded to internationalization or appropriation, which represented the participant's attempt to share his or her point of view on the discussion. Some participants provided some examples or URLs to support the answer. This was followed by 15.24% providing some self-reflection based on the participant's best knowledge of a certain part of the video clips. Further, 14.32% offered complementary or alternative views. This indicates positive and healthy conversations among the participants. As a result, only 1.22% were involved in some conflict or disagreement.

Table 4: Learners interaction categories

Interaction category (n=322)

Type	Number	Percentage (%)
Self-reflection	50	15.24
Elaboration / Clarification	139	42.38
Alternative / complementary proposal	47	14.32
Internalization / appropriation	88	26.83
Conflict / disagreement support	4	1.22
Total	**328**	**100.00**

iii) The focus of collaborative conversations

To define the participant's focus on the collaborative learning process, the same data set was used to classify various types of responses. Responses were classified into four categories (see Table 5).

As shown in Table 5, the participants demonstrated healthy and focused collaborative conversations, and as a result, only 2.13% of all responses were irrelevant. This indicates that the participants took full advantage of direct access to a specific part of the video through the "transcript pointer" feature. Here 179 (54.27%) responses were made directly to scenes. In addition, these responses received 139 (42.38%) replies from other participants. Some of the direct comments were left without any reply. This suggests that these comments were either not important or similar to existing messages. These results suggest that ConTag facilitated active discussions among the participants in the video-based learning scenario.

Table 5: Focus of collaborative video-based learning

Collaborative conversation focus (n=328)

Response	Number	Percentage (%)
Response to a scene: a response directly to a specific part of video (i.e.: a comment or question).	179	54.27
Response to a comment or question: a response towards message annotation.	139	42.38
Response to inform: a response to acknowledge or inform other learners.	3	0.91
Irrelevant response: a response that irrelevant to the video.	7	2.13
Total	**328**	**100.00**

Learners' Perceptions

A questionnaire was designed to measure the participant's perceived experience with ConTag as a video-based learning platform.

Table 6: ConTag Questionnaire

Item	Question	SD	D	U	SA	A	Mean
1	The "contextual tag" function is helpful to my understanding of video content.	5 (6%)	9 (10%)	12 (13%)	33 (37%)	30 (34%)	3.86
2	The interactivity between the "word cloud" and "transcript panel" functions is useful for helping me unfold what is more related to the word.	4 (4%)	9 (10%)	8 (9%)	37 (37%)	31 (35%)	4
3	The "transcript pointer" function is helpful for redirecting me to a particular part of the video.	6 (7%)	8 (9%)	9 (10%)	45 (51%)	21 (24%)	4.02
4	ConTag allows me to easily share my thoughts with others.	4 (4%)	10 (11%)	18 (20%)	31 (35%)	26 (29%)	3.78
5	Participating in the discussion using ConTag contributes to my understanding of video content.	4 (4%)	9 (10%)	17 (19%)	26 (29%)	33 (37%)	3.76

i) ConTag - Interactive contextual visualization tools:

As shown in Table 6, more than 71% of the participants agreed that the "contextual tag" feature helped their understanding of video content. This suggests that the feature can facilitate a better overview of video content even before it is watched, particularly in video-based learning scenarios. In addition, it may help address existing scenarios in which most video resources are represented only by titles, general thematic content tags, and video durations.

The "word cloud" feature is a video content visualization tool in the form of words. Learners can use this feature to interact back and forth between the "word cloud" and the video transcript. According to the results, 72% of the participants were satisfied with the interactivity between the "word cloud" feature and the transcript. This suggests that this interaction can help learners, particularly visual learners, better understand and discover more of what was related to a given word.

The "transcript pointer" feature allows learners to have instant access to a particular part of the video. This feature can significantly reduce the cognitive load of learners by eliminating the need to manually drag or scroll video timelines. More than 75% of the participants agreed that the "transcript pointer" helped them access any particular part or scene of the video instantly.

ii) Collaborative Video-based Learning

ConTag is designed to enhance the video-based learning experience and promote efficient collaborative learning through interactive and contextual visualization tools. According to the results for item 4, almost 64% of the participants agreed that ConTag allowed them to easily share their thoughts with others, and 66% agreed that participating in discussions using ConTag helped them better understand video content.

Conclusion and Future Works

This paper evaluates how individuals learn in video-based learning scenarios by using ConTag. The results show active participation in this collaborative learning activity. The participants perceived that ConTag helped them interact with video content and other learners (Table 6). In terms of responses to specific video content (Table 5), 54.27% were directly to specific scenes in the video clip and accounted for 42.38% of all replies. This suggests that ConTag can motivate learners to participate in video-based learning interactions. Some participants felt that the "message indicator" feature helped them pay attention to the most discussed (important) part of the video clip. Additionally, the analysis on learner perception and communication logs helps to improvise and enhance the system especially in addressing missing part which may help them in video-based learning environment. Future research should employ a wider range of video clips and consider the learner's background in terms of his or her competency and readiness in using CSCL tools or platforms for more insightful results.

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