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Beneath a learning management system - Understanding the human information interaction in information systems

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Abstract

Studies on learning management systems have largely been technical in nature with an emphasis on the evaluation of the human computer interaction (HCI) processes in using the LMS. This paper reports a study that evaluates the information interaction processes on an eLearning course used in teaching an applied Statistics course. The eLearning course is used as a synonym for information systems. The study explores issues of missing context in stored information in information systems. Using the semiotic framework as a guide, the researchers evaluated an existing eLearning course with the view to proposing a model for designing improved eLearning courses for future eLearning programmes. In this exploratory study, a survey questionnaire is used to collect data from 160 participants on an eLearning course in Statistics in Applied Climatology. The views of the participants are analysed with a focus on only the human information interaction issues. Using the semiotic framework as a guide, syntactic, semantic, pragmatic and social context gaps or problems were identified. The information interactions problems identified include ambiguous instructions, inadequate information, lack of sound, interface design problems among others. These problems affected the quality of new knowledge created by the participants. The researchers thus highlighted the challenges of missing information context when data is stored in an information system. The study concludes by proposing a human information interaction model for improving the information interaction quality issues in the design of eLearning course on learning management platforms and those other information systems.

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1. Introduction

Advances in information and communications technology (ICT) has led to the adoption of innovations in various aspect of life. The educational sector has seen continuous adoption of eLearning and learning management systems to provide alternative learning opportunities for students [1, 2, 3], whilst extending the boundaries of teaching and learning to the otherwise unreachable students. These categories of students include workers especially, and those remote students who cannot avail themselves for face-to-face teaching and learning due to a myriad of factors. Studies on learning management systems (LMS) [2] have largely been technical in nature with an emphasis on the evaluation of the human computer interaction (HCI) processes in using the LMS. However, beyond the user interface, is the information interaction processes [4] where users try to understand the information presented via the LMS in some imaginary context. This is primarily because the information presented to the users lack the semantic and pragmatic characteristics [5]. And even more challenging is the fact that the true value of the information presented to the users has transitioned from the content expert, content developer, and the facilitator to the user, leaving in its footprints information interaction gaps. This makes it even more difficult for the participants on the eLearning course to make the most out of the information presented to them in order to construct the required knowledge expected to be gained on the eLearning course. The differences in the human behaviour and environmental characteristics such as perception, culture, and technology among others may affect how users interact with information. This paper attempts to explore the human-information interaction experiences of participants on an eLearning course on a LMS platform.

2. Background of the study

The study explores the factors affecting human information interaction in an information system. The human actors were participants on an eLearning course in Statistics in Applied Climatology (eSIAC), run by the Statistical Services Centre (SSC) of the University of Reading, UK. The eSIAC course is a development-oriented course for anyone who wants to analyse climatic data and use the results to improve decision making in agriculture, food security, health, tourism, and any other sector that climate affects [6]. The genesis of this course is that Meteorological (MET) Services often provide short and medium term forecasts. At best, the medium term forecasts are predictions of the coming season, and are useful in agriculture, tourism and many other sectors. These are useful forecasts, but they miss out on a baseline. Analysing historical data can provide a valuable base-line, which the short and medium-term forecasts can build on. This way, a much clearer picture of what is really happening to our climate can be built, which can lead to better decision making across industry and government.

In this course, participants learn how to get valuable results by studying historical datasets. The SSC through its collaboration with MET services across the world provide real data for participants on the course to practise, based on the assumption that the best way to learn statistics is to use it in real-world examples [6]. The course runs on Moodle, a learning management system but the contents are developed using Articulate Storyline embedded with a mix of text, images, videos and audio files [1, 7]. Articulate Storyline helps create compelling e-learning courses with stunningly simple and powerful features [7].

This study was initiated from a summer student internship the lead author undertook as an eLearning Content Developer at the Statistical Services Centre, University of Reading, UK from July – September, 2014; and subsequently from working as an eLearning Facilitator from September-December, 2014 at the same unit. From the task of critiquing and reviewing the previous run of the eSIAC course, it was observed that there were problems of missing information context with the information system (eLearning course). Thus the course content was found to lack some pragmatic and semantic characteristics [5] to make for creating the expected knowledge from the content of the course. These were thought of as being problems with the human interface design of the information systems [4]. This study therefore sought to explore the use of the semiotic framework as a lens to assess the human information interaction processes on the eLearning course as a proxy for information systems. It is hope that the results would have implications for improving the design of the eLearning course, and those other information systems by providing a model for human information interface design.

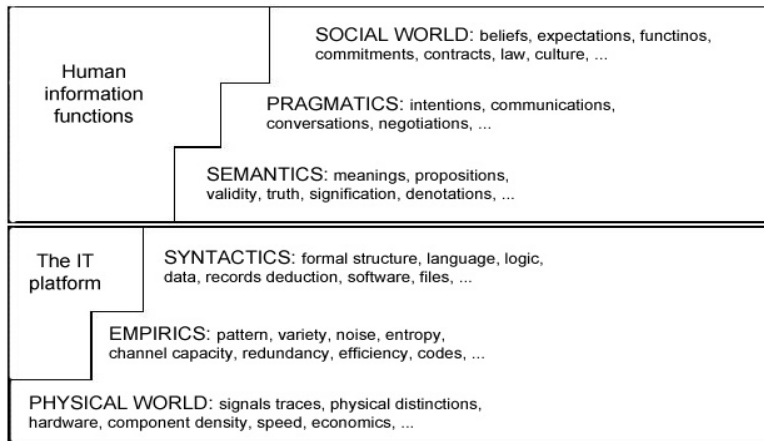


Fig. 1. The Semiotic Framework [8].

In the context of this study, the semiotic framework (Fig. 1) is used as a basis to examine the eLearning course as it is synonymous with an information system (IS) which deals with a symbolic representation of reality [8]. The work of the content experts and the content developers of this course are to create and communicate the course materials to the participants who should be able to understand the contents within certain social boundaries [8].

The focus of the researchers is more at the human information functions level of the semiotic framework rather than the IT platform level. This links very well with the study because eLearning courses just like most information systems are already automated or electronic in nature. Thus, the physical world, empirics and syntactic components are assumed to have been adequately represented in the eLearning course. To emphasize the statement of the problem for this study, it is envisaged that there could even be challenges at the interface between the IT platform and the human information functions of the semiotics framework. In effect the problems of information gap between the people involved in the entire eLearning course from the content experts, through the content developers, and then the testers, and the non-editing teachers, facilitators and ultimately the users or participants are not far from anticipating.

3. Study approach

The study is in two parts which follows the quantitative-qualitative model. The first part which is captured in this report represent the exploratory phase which seeks to highlight the various factors affecting the participants understanding of some aspects of the contents of the eLearning course by identifying the information gaps using the semiotic framework as a guide. A quantitative approach is thus used in this phase which would be followed by a qualitative approach in the next phase of the study. Data for this phase of the study therefore involves a survey of the immediate past participants on the eSIAC course on issues relating to their interactions with the information conveyed in the course content. The questionnaire is made up of both closed-ended and a few open-ended questions. In all data was collected from 160 participants who took part in the course in 2013. The results from the exploratory study are analysed and presented in this report leading to a proposed conceptual model of human information interaction. The next phase of this study will involve a use of qualitative techniques, which would make up for the lack of depth typical of quantitative techniques such as the use of questionnaire survey for this exploratory phase. Also, since the issues involved in the study are highly human oriented, the qualitative approach mainly through interviewing to be adopted in the next phase of the study would provide for a deeper understanding of the human information interaction issues experience by participants on the course.

4. Results and discussion

The participants were from several developing countries including Benin, Ghana, Kenya, Lesotho, Seychelles,

Tanzania, Uganda, among others. They held various positions including but not limited to Agronomist, Agro meteorologist, Climatologist, Disaster Risk Officer, Extension Officer, Forecaster, Meteorologist, Natural Resources Manager, among others. Out of 149 valid responses, for 23 (15.4%) of the participants, it was their first time of taking an online computer-based course as against 126 (84.6%) participants who had ever taken an eLearning course. The experience of the participants in taking a previous eLearning course was not expected to impact their responses to the questions in this exploratory study.

The information interaction experiences of the participants on the eSIAC course are shown in Table 1 (average ratings on a scale of 1 – 5). The data for the study revealed that the participants were somewhat impressed with the extent to which the training fulfilled their learning objectives. They rated this as 4.5 out of 5, indicating a gap of 0.5 in terms of the extent to which they felt the training fulfilled their learning objectives and perhaps the objectives of the course. Generally, a perfect fit between the expectations and experiences of the participants with respect to the course meeting their learning objectives would have been ideal. Whilst, the gap may not be totally due to how the course information was presented to the participants from the design perspective, it is a possibility if an only if the course content was excellent.

Table 1. Average ratings of participants' experiences on an eLearning course in Statistics.

Participants experiences	Average rating	Gaps
Extent to which the training fulfil your learning objectives	4.5	0.5
Extent to which the assignments help you to understand the ideas taught	4.7	0.3
Effectiveness of the team in helping you to apply the topic content	4.5	0.5
How easy or difficult did you find the course	3.1	1.9

Semantics has to do with understanding. It was observed that a gap of 0.3 in the semantics of the overall course content with respect to how the course assignments helped them to understand the ideas introduced in teaching sessions is worth attention by the content experts and developers of the eLearning course. Clearly, an average rating of 4.7 out of 5 seems good but certainly not excellent. The objective is to achieve total understanding from interactions with information stored in any information system, just like on the eSIAC course.

One of the measures of the performance of information systems is effectiveness. The results in Table 2 show that effectiveness of the course team in helping participants to apply the content was rated 4.5. This indicates a good potential for the participants to be able to adapt and apply the knowledge gain from the course to future development projects. Whilst this indicates a good fit in terms of matching intentions of the course to usability or application to real life situation (potentially), a gap of 0.5 (i.e. pragmatics gap) in the rating of the participants is of considerable concern to the researchers. Thus, the content of the eLearning course was not pragmatic enough to guarantee an excellent fit, perhaps because of some level of missing information context during the design and storage of the information in the information system.

The data for the study also revealed that the participants rated the level of difficulty of the course as 3.1 or just about the right level on a scale of 1-5 where 1- too easy and 5 – too hard. This leaves a huge gap of 1.9 with respect to how easy or difficult the eLearning course was. Given that the majority of the participants have had previous experiences on online computer-based course, the difficulties they might have experience could probably be due to how they were interacting with the information rather than the LMS. It is thus possible that there were challenges in adequately representing the content at the design stage of the eLearning course. This indicates that somehow, there is a gap either at the syntactic, semantic and pragmatic levels [5] which have to do more with the information interface design issues.

The participants also responded to an open-ended question regarding anything they particularly liked or disliked about the course? Using the semiotic framework as a guide, several information interaction problems were identified. At the syntactic level, some of the problems identified include lack of sound in most of the presentations, data validation problems resulting from difficulties in approximation of numerical answers to questions, as well as lack of interactivity of the presentations. Some of the semantic problems deified include ambiguity in the content, information dissymmetry, inadequate information as well as limited scope content of the topic necessary to facilitate understanding. The pragmatic and social context problems identified had to do with challenges adapting the data to

meet the use intentions of the participants and lack of data from the participant's local environment. The results in Table 2 show some instances of information gaps experienced by the participants but only those that relate to their information interaction experiences at the different semiotic layers.

Table 2. Some instances of information gaps on an eLearning course in Applied Statistics.

Problems	Semiotic layer	Information gaps/effects	Frequency
Lack of sound	Syntactic	Lack of sound affected information representation	5
Data validation		Difficulties in approximation of numerical answers/decimal conversion errors.	12
Interface design		The course was not interactive	4
Ambiguity	Semantic	Most of instructions were not direct/difficulty understanding some questions	8
Information dissymmetry		Contents in offline version was different from the online version	3
Inadequate information		More instructions/explanation is needed especially on using the software and its functionality	8
Non-exhaustive content		Limited scope/range of knowledge in some of the topics	6
Challenges adapting data to meet use intentions	Pragmatic	Usability challenges/unable to adapt the given data to my country	5
Lack of social context	Social context	Irrelevance of information/lack of local climatic data	6

There is evidence from the data that the content of the eLearning course has problems of missing information context in the stored information. These problems are more of human interaction problems rather than systems interaction problems.

In the light of the current challenges of missing context of information when data is stored in an information systems [5], in this case the eLearning course, the researchers proposes a conceptual model of human information interaction (Fig. 2) which when incorporated into the human information interface design for information systems would help improve the outputs from information systems by making the information more pragmatic.

The proposed human information interaction model is premised on the assumption that at the syntactic level, data from the content development of the eLearning course to a large extent is somewhat captured by the human computer interface (HCI) built into the eLearning course using both the LMS (Moodle) and Articulate Storyline. However, there are semantic and pragmatic gaps [5] at the human information interface where meaning of the course content is to be assimilated by the participants in order to construct the knowledge they are expected to gain on the course. Even more challenging is the issue of adaptability and application of the knowledge gained within the specific social environments of the participants, which is dependent on culture and many other factors within the participant's social environment.

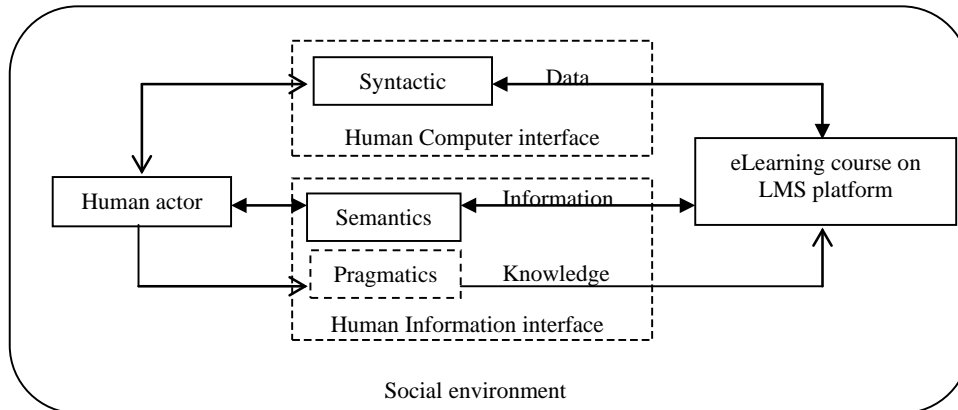


Fig. 2. Human information interactions on an eLearning course.

Whilst traditional information systems (IS) development approaches such as the Systems Development Life Cycle (SDLC), are very methods for developing IS just like in the case using the SDLC for the eLearning course, these approaches focus more on the syntactic level or the IT platform level, without or with little attention to the human information functions. However, beyond the IT platform is the information interaction activities, where users try to make meaning of the content of the information systems, in most cases from the missing information context stored in the system. There are therefore information gaps especially between the intentions of the information creator and those of the user, making stored information less pragmatic than expected. An integrated approach to the design of IS that focuses on addressing both the IT functions and the human information functions will go a long way to provide users with a near perfect content which will enhance their understanding and usability of information in IS for creating new knowledge. This proposed model would thus be useful in helping bridge the wide gaps in the intentions of information creators and those of the users in order to make the context of the IS more pragmatic.

5. Conclusion

This paper has reported an exploratory study which identified factors affecting participant's interaction with an information system - the content of an eLearning course in applied statistics in climatology. Using the semiotic framework as a guide, syntactic, semantic, pragmatic and social context gaps or problems were identified. The information interaction problems identified include ambiguous instructions, inadequate information, lack of sound, interface design problems were identified from the questionnaire survey of participants on the previous run of the eSIAC course. The researchers therefore highlighted the challenges of missing information context when data is stored in an information system by proposing a human information interaction model. The next phase of this study is to test and evaluate the proposed conceptual model through a qualitative approach by interviewing participants at the end of the current run of the eSIAC course. This would inform the future design of the eLearning course in SIAC and those other information systems by the use of the semiotic framework for the analysis and design of human information interfaces to solve the current problem of missing context of stored data in information systems. The results of two other concurrent studies looking at improving the design process of the eLearning course: a semiotic approach; and information systems quality on a LMS: towards a model for the design of persuasive eLearning courses would be reported in the near future. Future research could explore and test the proposed human information interaction model in business settings or with business information systems.

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References

- [1] T. Rienzo, B. Han, *J. Info. Sys. Edu.* 20 (2009) 123-127.
- [2] L. Sun, K. Ousmanou, 383-395, 2006.
- [3] D.H. Suryaningrum, E. Wuryani, I. Y. Purbasari, 9 (2014) 570-576.
- [4] K. Kamata, H. Maehara, K. Wakimoto, S. Usui, in *Proceedings of the 19th Symposium on Human Factors in Telecommunications (HFT2003)*, 2003.
- [5] S. Opoku-Anokye, Y. Tang, in K. Liu, S. R. Gulliver, W. Li, C. Yu (Eds.), *Service Science and Knowledge innovation*, Springer, Heidelberg, 2014, pg. 358-367.
- [6] Statistical Services Centre, *Statistics in Applied Climatology*, SSC-University of Reading, Reading, 2014.
- [7] Articulate Global, *Articulate Storyline*, Articulate Global Inc., New York, 2014.
- [8] K. Liu, *Semiotics in information systems engineering*, Cambridge University Press, Cambridge, 2000.