Project Title:

Onscreen annotation for digital reading to support paperless learning in Higher Education

Keywords:

LiteMap, Onscreen Annotation, Digital reading with fun, Paperless learning, Higher Education

Your name:

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Executive Summary

Understanding students' preferences and habits about digital reading is fundamental to support paperless learning. Students who are not used to learn from digital content may find studying print text easier and more enjoyable. Literature is limited about how to engage students from higher education with onscreen reading through online annotation maps. A considerable gap is to understand whether an annotation mapping tool would scaffold this process. What are the drivers and challenges for promoting paperless learning?

This qualitative study supported by learning analytics examined 18 students' views about onscreen annotation and their practices with LiteMap.

LiteMap is a Web tool for mapping out visually online content across different Web pages or Websites. With LiteMap users can collaboratively mark up and annotate onine content with their ideas, comments, questions, etc and connect them in meaningful network graphs. LiteMap supports Web annotation and visual summarisation to trigger reflection, promote deeper understanding and improve engagement in online content reading.

Participants from the COLEARN community, who are learners of OpenLearn Create, were invited to join the LiteMap tool and enroll in an OpenLearn online module. The cloud-based application LiteMap was used as a novel online learning environment for learners to map their online annotatations using their web browser.

Findings revealed that most of the participants were used to annotating on print text. The key motivation factors for using a novel annotation tool were to facilitate the process of reading, save time and completing tasks of the online module more effectively.

Four groups of participants were identified in terms of the ways they used the LiteMap annotation tool: non-users who only joined the tool, note-takers who tagged content to complete tasks, note-makers who created notes to increase their comprehension and note-mappers who benefited from mapping notes to better present their argumentation.

This study enabled also to identify some key drivers for onscreen annotation, which were familiarity with digital tools, interest in collecting, mapping and interpreting online content. Some key barriers for engaging studenst with paperless learning were overcoming technical problems, engaging with a new tool and developing onscreen annotation skills.

Aims and scope of this project

An increasing number of universities have been supporting paperless education by offering their course materials for students entirely online for formal and non-formal learning. Examining students' habits and preferences about reading on-screen content versus print materials became very relevant. There are various reasons for encouraging students to use digital content instead of paper materials; not only for economical and environmental reasons; but also, because most current knowledge is on the web. However, literature is still very limited about the effects of onscreen reading supported by online annotation tools to help learners to engage with digital text.

Students of distance education universities need to adapt how they study online-only module to be successful. Learning from digital content is fundamental for students to benefit from the variety of options available which includes videoclips, podcast audio, online discussion forums, blogs, social media posts, digital materials from online libraries, and articles from open repositories. Underpinned by Stebbins' work, this study claims that even students find academic reading for learning sometimes dull, it can be also fun when they acquire knowledge, reach their own goals and enjoy the experience with positive feeling (Okada & Sheehy, 2020).

This study considers the importance of exploring computer application tools to help students develop new study habits, such as reading onscreen materials rather than printing them out and creating their own notes supported by annotated content. Students who are used to annotating their learning materials with a pen or highlighter should be encouraged to do this electronically. However, the annotation functions of an online application may be not as intuitive for students as their post-it notes and margin comments on paper documents.

The overall aims of this exploratory study was to investigate the drivers and challenges for students to annotate online content using a novel mapping tool .

The specific goals of this research work focused on three research questions:

RQ1. Are students of an online-only module used to read and annotate learning content on screen?
RQ2. What are the students' motivations for using a novel online tool to annotate content?
RQ3. In what ways can they use an online annotation and mapping tool?

The purpose of this study was to provide further recommendations for the technology development team of LiteMap as well as advance in the field of technology-enhanced online annotation.

LiteMap is a cloud-based application for collaborative and individual knowledge mapping. It was developed by the Knowledge Media Institute team led by Dr. Liddo in 2014. It was translated to Portuguese and tested at a large scale by the Colearn Community led by Dr. Okada as part of the European ENGAGE project in 2015.

LiteMap is an online collaborative tool for individuals or teams to make sense of complex issues or topics. Students can use LiteMap to annotate and map digital content, for example, web pages, online discussion forums, and blogs. In previous studies LiteMap has proved to enable untrained users to better make sense of open-ended content, online conversation, or text, through **the creation of** online notes and evidence-based dialogue maps (Okada, 2014).

It is constituted by four features: 1. a toolbar for bookmarklet to harvest and annotate content while browsing the Web; 2. 2D-mapping canvases to connect ideas and build argument maps; 3. a group annotation interface to collaboratively create and share maps; and, 4. a visualization dashboard to support sensemaking and reflection.

LiteMap was designed to organize data, information, and knowledge through notes and hypermedia maps individually or collaboratively. A hypermedia map is a graphical representation with a set of notes (nodes) that are characterized by distinctive icons: questions, ideas, pros, cons, arguments and comments. Each node contains an icon, description, extra information and a tool bar with options to access its content, web links , (URL of the icon), like, dislike and delete. Each content of icon also contains a full description, URLs, author, date of creation, and a Menu of options: print, chat about the node, outline view, and map view. The toolbar for bookmarklet enables users to enter data into LiteMap while browsing the web.

The 2D-Mapping canvase interface is composed of three areas: 1.name of the map, 2.Inbox area with notes, 3. Mapping area to connect notes from annotation and own words (See Figure 1).

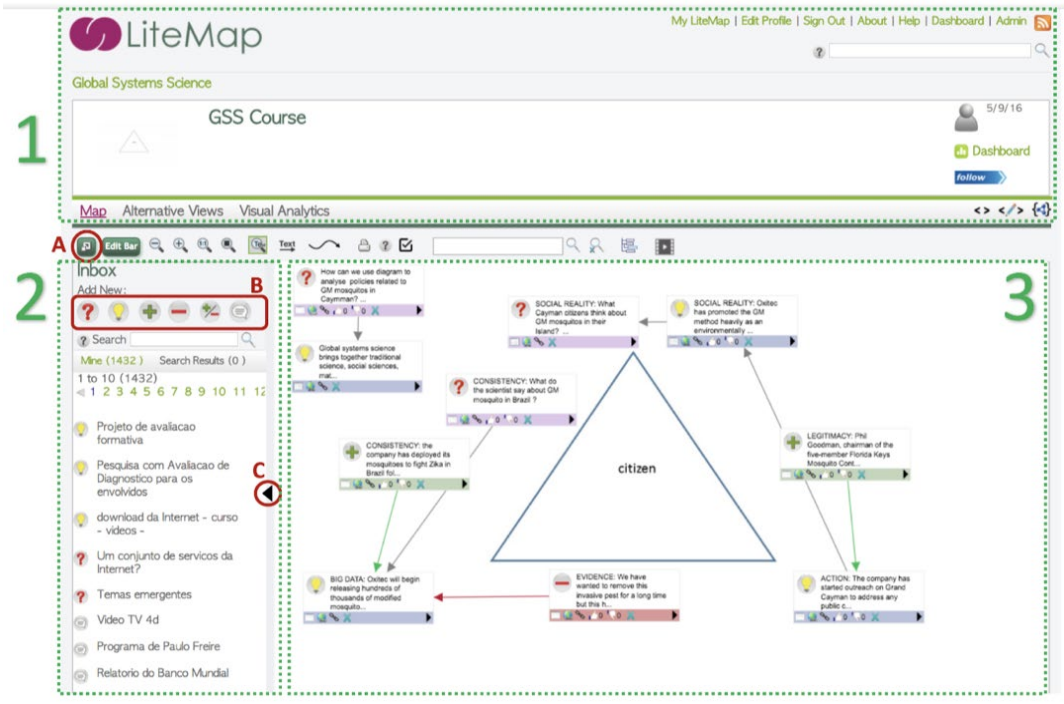


Figure1: LiteMap – Mapping area

Its visualization dashboard (Figure 2) contains an interface that provides 10 types of graphs for visualizing individual and group notes and its connections: Quick Overview, Conversation Network, Social Network, People & Map Ring, Contribution River, Conversation Nesting, Activity Analysis, User Activity Analysis, Contribution Stream and Voting.

This exploratory work examines students' views about annotating online content including their practices with LiteMap. This work also observes drivers and challenges for promoting onscreen annotation for online sensemaking.

Figure2: LiteMap – Group Analytics

Methodology

The overall approach of this exploratory study (Figure 1) combined students' views about their previous experiences in studying online modules, current preferences about reading learning materials and observation of the ways that students used LiteMap through the analysis of learning analytics data (analytical dashboard, activity log, students' maps and summaries). These reflections were obtained through semi-structure questionnaire and online discussion forum; and analysed using NVivo.

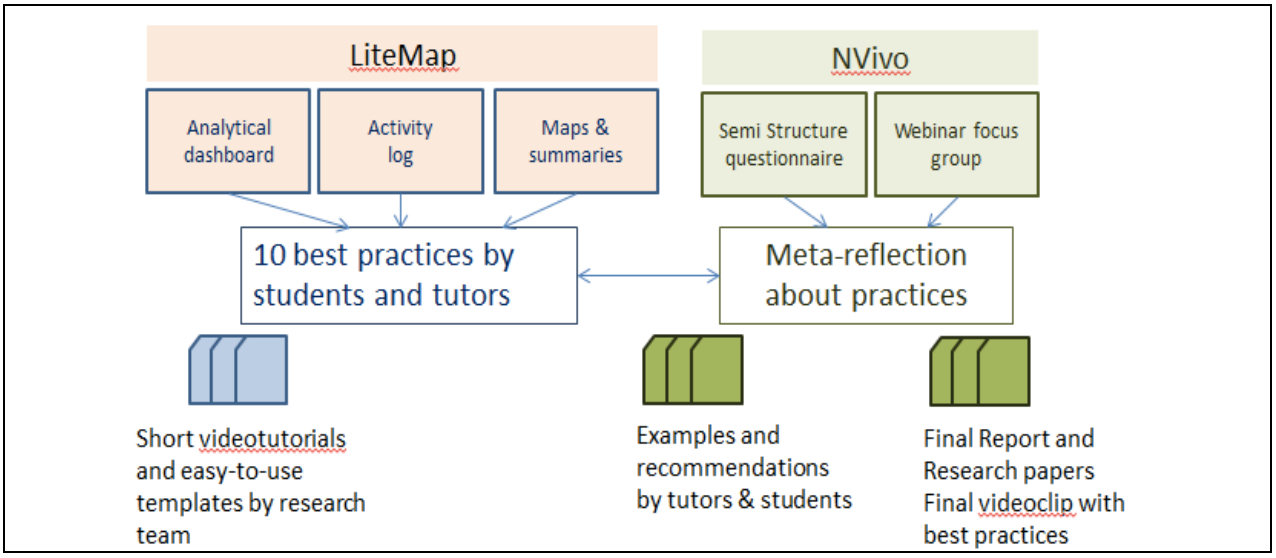


Figure 3: Iterative Methodology to engage participants

Objectives [Plan]	**Expected research milestones [Activities]**	**Issues Faced**	**Updated Plan**	**(**Tool used for analysis**) & Data**
ENGAGE Students to learn LiteMap tool, explore and use it	1. Engage a group of students from OpenLearn to attend an online workshop and replying a semi-structure survey questionnaire	It was difficult to recruit students in OpenLearn. The lack of participants caused various delays.	An open invitation was announced to Colearn Community users of OpenLearn Create as well LiteMap recent users who had just joined the tool	(NVivo) A total of 18 students joined the study and replied the survey semi-structured questionnaire
	2. Run a workshop for students to annotate, produce a map and a short abstract to facilitate their module activity	Students were not available to attend the workshop	LiteMap team produced then a video tutorial to provide step-by-step guidance	(LiteMap) The webtutorial was successful; 142 views
	3. Engage students to collaborate with annotations supported by an online meeting	Students were not available for synchronous interactions	A community-group was created in LiteMap for asynchronous support and interactions	(LiteMap) 15 members joined the community
SUPPORT students to complete an activtity in the module using annotation	4. Select and provide examples for students to engage in annotation	A few students developed annotations and maps	Researchers facilitators and Litemap team created maps to provide examples for students	(LiteMap) Researchers created 8 maps

and creating a map with their notes	5. Support students to annotate or create own notes and integrate them using maps	Most of the active students (11) were able to annotate (by just extracting content with the LiteMap Toolbar and attributing an icon) but only a few students added their own comments about the extracted content	New examples were created by researchers-facilitators; the forum discussion was also used to engage students	(LiteMap) The community members shared 44 annotations
	6. Solve technical problems related to LiteMap	Students' questions were related to technical issues. There were no questions exploring the use of LiteMap for mapping notes	Questions were replied in the forum discussion and also by email	(LiteMap) FAQ was shared with students to facilitate technical issues
COMPLETE the study with reflections about the experience	7. Select best practices using LiteMap by most active students	Most of students were busy.There was not enough examples	Researchers team extended the period more examples were produced	(LiteMap) 4 types of learner-annotators were identified
	8. Develop a focus group	Students were very busy to attend a focus group	A discussion forum was used instead	(NVivo) Students' final comments were collected about their experience using LiteMap

Table 1: Activies developed during this study. The green golour refers to data generated with an external tool Google forms analysed in NVivo; and orange refers to data generated in LiteMap and analysed using the tool dashboard.

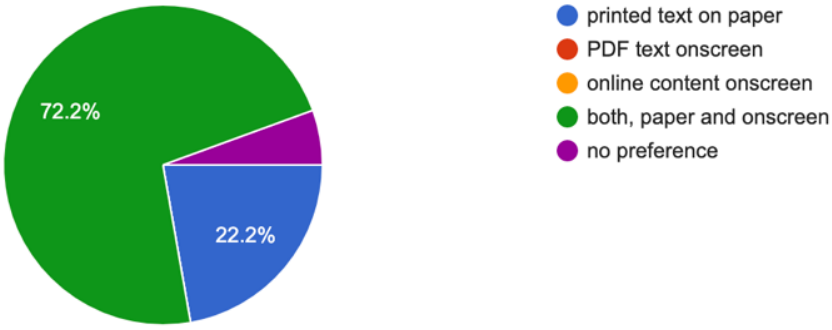
Evaluation

There were various changes made to the initial plan in various aspects (See table 1). The main reasons were various, difficulties to: 1. recruit volunteers, 2. Keep participants engaged, 3. Support participants to complete the study.

However, the researchers involved in this qualitative study developed various strategies to complete this exploratory research work. Data generation was produced in the LiteMap tool and also through a semi-structured questionnaire survey and online discussion forum (see table 1).

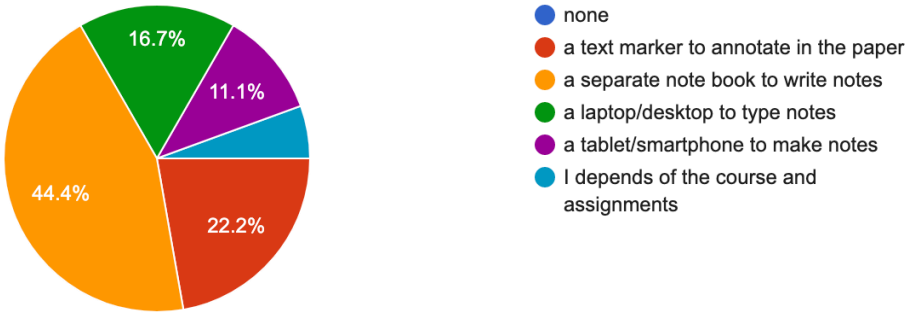
Findings

Data related to questionnaires indicated that students who were used to annotate in paper became more aware about the online annotation opportunities through LiteMap. Participants were asked about their preferred type of study material (Graph 1), 22.2% of students preferred printed text on paper; 72.2% preferred both, paper and onscreen and 6.6% indicated no preference. There were no students whose preference was PDF text on screen nor online content onscreen.



Graph1 – Students' preference about types of learning materials

The participants were also asked about the most frequent approach for making notes about printed text and online annotation. In terms of printed text, many students, 44.4 %use a separate note book to write notes, or a text marker to annotate in the paper. In terms of onscreen annotation, 5.6% are not used to digital annotation and 33.3 print most of digital material to take notes in the paper. There are students (26.7%) who take notes in the PDF (e.g. using adobe) and many (44.4%) use apps to make notes, such as, one note, evenote and gdrive doc.



Graph2 – approaches used by students to make notes on print materials

Graph3 – approaches used by students to make notes on online materials

Four groups of participants were identified:

non-users who only joined the tool: there were 4 students who joined LiteMap but not used it for annotation. Figure 4 shows an example of a member who did not create any notes nor maps.

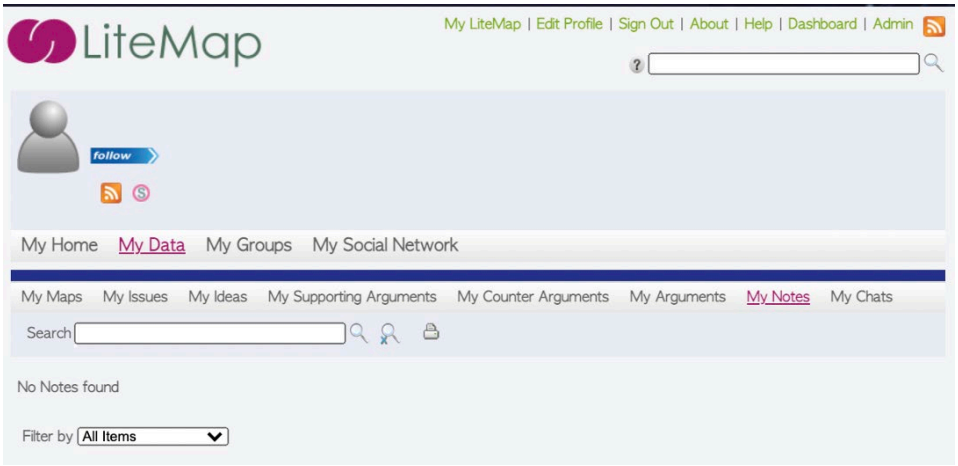


Figure 4: Group member data

note-takers who tagged content to complete tasks: most of the participants who used LiteMap ToolBar while reading the content used the annotation. All group members who had the LiteMap Toolbar activated in the browser were able to access the notes of other colleagues as well theirs. Figure 5 shows an example of annotations of a note taker.

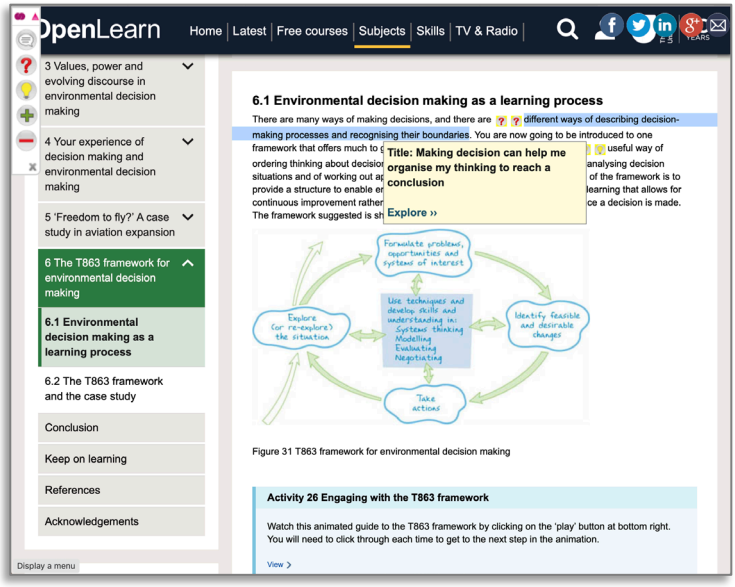


Figure 5: Group member data

note-makers who created notes to increase their comprehension. There were 11 out 18 students who created ideas supported by the content that they highlighted from the learning materials. Figure 6 shows a note created by a student about an activity of the module related to environmental issues.

Figure 6: Ideas created by a student

note-mappers who benefited from mapping notes to better present questions, ideas and arguments. There were 5 out 18 students who created maps. Figure 7 shows an example of a student who created 5 notes indicated by numbers in orange. The note 3 shows the URL which enables anyone access the sources of the notes and also visualise where was the annotation.

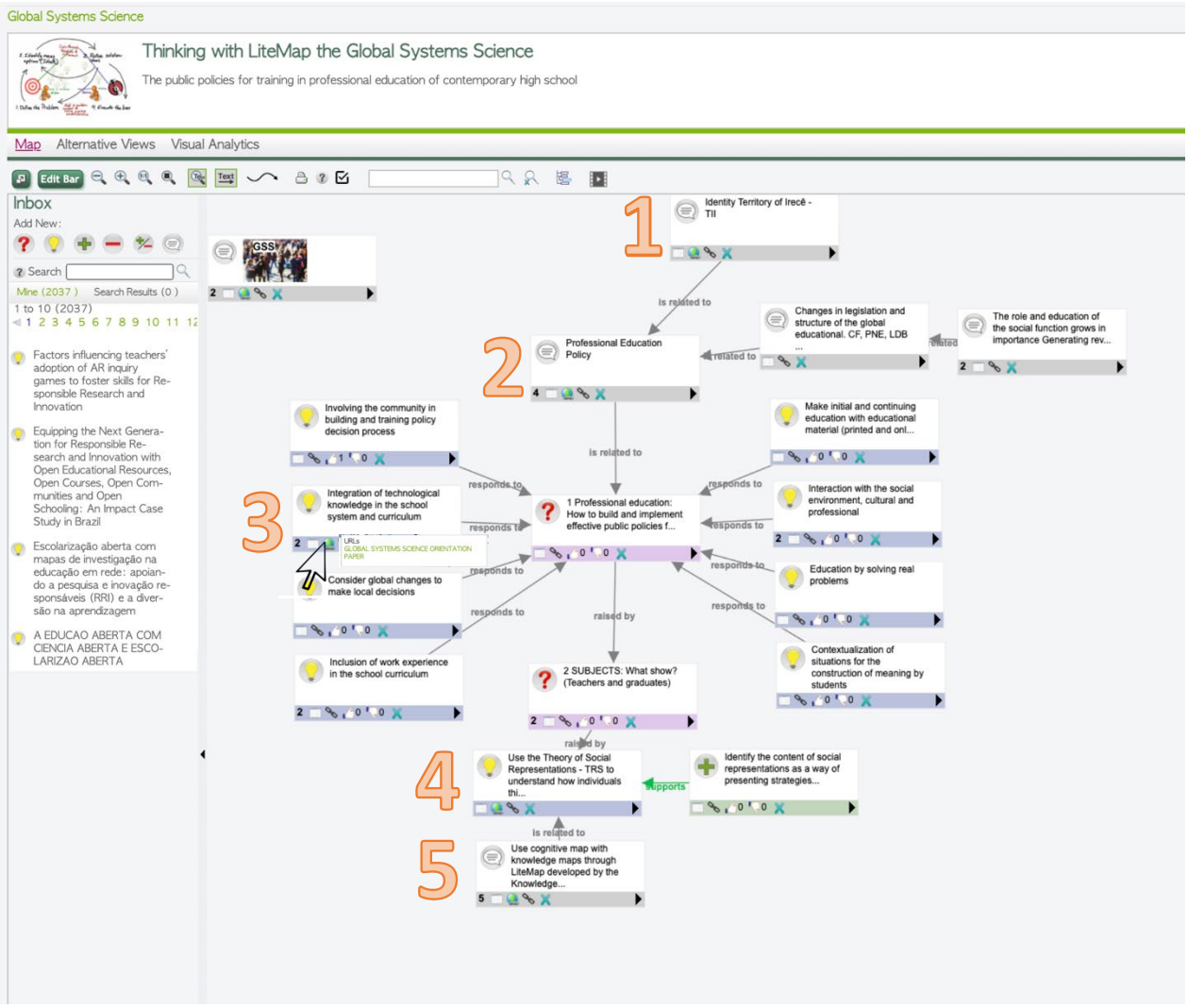


Figure 7: Map about notes and ideas to prepare an assignment created by a student

There were also students who used LiteMap to share technical issues. Figure 8 provides an example. Sharing the issues in Litemap Group was useful for students to help each other and be supported by researcher facilitators and LiteMap team.

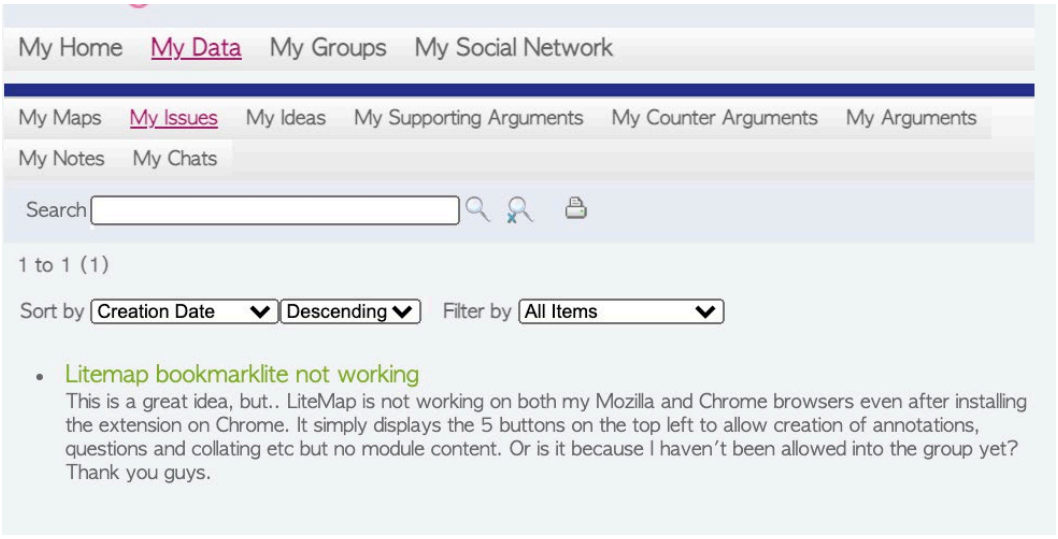


Figure 8: Technical Issues shared by a student

Qualitative data from the forum discussion indicated three groups.

First group refers to the majority of students who were active users in LiteMap. They mentioned that will be willing to carry on mapping their annotation. The drivers for onscreen annotations were: integrating notes from various locations(see student 2); being able to move from print to digital to reuse and reorganise notes (see student 4); feeling capable to learn through onscreen annotation (see student 9)

> *"It is is a practical way to keep notes together, given that relevant content is all in different webpages, distinctive sources and locations and keeping all together including primary sources linked and accessilble, are very useful".* student 12

> *"I consider myself such a wonderful snail in creating notes on printed text so that i feel actually quite excited about this the best miracle that is happening in my study world. The online annotation is a good learning technique (to reorganise note) and working pretty well*". student 4

> *"The Litemap ToolBar was helpful to annotate using icons as hints to categorise my notes. These hint-icons were very practical for extracting, tagging and grouping the content that I need for learning. I was surprised to see other learners' hints on the webpage that I annotated… very cool… This is exactly the way that I learn!"* student 9

Second group refers to the students who still prefer to read on paper, but probably will use an annotation tool when necessary. The reasons for using both – annotation on paper and perhaps on screen) are because the familiarity and preference about reading print content, for creativity using notepads combined with mapping tools and for special educational needs.

> *"I am a total handwritten notes friend. It like colour coordinated highlighters, I use pens and post-its etc ! I admit I prefer to read from print content on a piece of paper; but, I do believe that change is not a bad thing"* student 5

"I am addicted to reading books and print materials. I am always used a note book to take notes, such as pukka pad, memo books, scratch notebooks and diaries . I also mind map learner who enjoys a great piece of software , and open to use a new tool when necessary." student 16

"I used a Dictaphone when attending tutorials in person or on line. I am a disabled student and found it really helpful. However, it is time consuming. I also take notes and re-listen to the recorded information". student 7

Third group refers to students who prefer not to use an annotation tool. These students prefer to use the traditional method such as pen and paper. There are students with special educational needs and disabilities; and also students who use other tools and considered that LiteMap to map notes on screen are not relevant for them.

"I will be still using my notepad and sticky notes. I prefer to use a pen to write my notes intead of typing them in the computer because I will remember things better." (student 11)

"I have real difficulty in the note taking as I am dyslexic." (student 18)

"I suffer from an eye condition. I have already quite a bit of software on my machine to help me. Sanocent is an audio Notetaker, Dragon anywhere is a professional-grade mobile dictation App, MindView is a professional Mind Mapping software application". (student 13)

Discussion

There are various annotation strategies to help learners become critical readers. For example, notetaking is commonly used by readers to highlight key content, connect keywords and link it with their own words. Notemaking enables readers to present their own views about the content using their own words and it can also be supported by both notetaking and notemapping. Notemapping is a visual way to annotate by using words, drawing and arrows to brainstorm or structure existing and new ideas about and around content (Okada, 2014).

This exploratory research shows similar annotation strategies adopted by on paper readers, which were identified through some examples provided by onscreen reading learners.

Literature about reading strategies with notetaking has been investigated since 80's focusing on various specific techniques such as linking existing and new knowledge; scanning and recognizing text structure (Carrell, 1998); highlight key academic vocabulary (O'Hara & Sellen, 1997), and onscreen notes supported by tools (Muter & Maurutto, 1991). Since 2000 new studies have emerged about strategies supported by technologies, for example, previewing text supported by a purpose in mind; sustained reading with digital libraries; distinctive strategies screen-based versus print-based reading; readability-enhanced digital content and readers' preferences toward reading digital texts (Sheorey & Mokhtari, 2001; Mercieca, 2004 Huang; Chern & Lin, 2009). Previous studies in secondary and higher education indicated that these annotation strategies can be facilitated by technologies - techniques and tools - to activate readers' thinking and make it explicit (Okada, 2008; 2014; Rocha et. al, 2018; Ramos et. al, 2019).

This exploratory research indicated new approaches for online learners to annotate and map their own notes using hint-icons to reorganise what is useful for personalising learning. These hint-icons conduct each learner to interrogate the text and seek cues, for example, What is the main idea? What are the statements that support the main idea? What are the pieces of evidence in which statements are underpinned? So that, while students are reading the content, they will be asking questions and thinking about what they should be annotating. The process of annotation through questioning facilitates the

process of breaking down the text (Weimer, 2002) to present it in a simple and comprehensible way supported by own students' words and knowledge.

Annotation is a process for learners to become active readers by taking the responsibility to engage with learning content, make sense and make decisions during reading; that means what, why, and how to record thinking to make understanding explicit. The inner dialogue, which readers established with the content which can be annotated while reading, helps students to think about what they already know about the topic to support their learning, what they do not know, which needs to be understood, what the next steps in terms of references or procedures are to increase their comprehension. Through the notes, learners can make their thoughts visible to support them to think about their thinking. Rethinking helps them enhance the process of reflecting on their reflections. This process of metacognition, which is part of reflective annotation moves students from surface learning to deep learning in particular when they experience joy and fun, so that annotation becomes part of self-fulfilling reading.

The fast advancement of open educational resources, open science, open data, as well large amounts of digital repositories and online libraries require readers today to transfer and extend skills to study digital content. Learning from onscreen content instead of print materials propitiate more economical and environmental alternative. Three factors highlighted by literature during the last two decades made onscreen reading and learning more acceptable and fun (enjoyable):

- The experience of onscreen reading improved significantly due to high resolution of devices and better readability of electronic content including for special educational needs and disabilities;
- Digital content has become more attractive for readers including the ones who find reading boring as they can access hypermedia materials based on their interest, look up word definitions, synonyms, translations, and examples faster and easier than printed texts;
- Tagging and archiving digital text with an annotation mapping tool help learners retrieve, link and reuse content; these can be used to support, structure, and develop inquiry-based learning and digital writing skills supported by note taking, note making, and note mapping.

This exploratory research developed in the context of a non-formal learning platform OpenLearn, which has been used also to support OU formal learning, indicated the importance of considering students' learning preferences as well their special needs or disabilities. Further studies will be necessary to examine these potential barriers in order to make onscreen annotation an inclusive and accessible practice for all learners. In contrast, motivations for students' change must be taken into account to support formal and lifelong learning competencies including online learning and fun (Okada and Sheehy, 2020a, 2020b). These potential drivers are vital to enable students to follow the pace of knowledge enhanced by digital technologies for individual and group annotation.

Impact

This exploratory study has provided important insights for further investigations about student experience, teaching including supervision of PhD students interested in annotation and mapping. The impact of this project outside the OU was through LiteMap community of external users; which has increased significantly with examples provided by the COLEARN Community.

Previous studies show that mapping supports forum discussions, writing and teamwork (Okada et al, 2014). However, there is not enough research on annotation and how it can improve both mapping and interpretation of online content.

This study enabled:

- Technological improvement of LiteMap,
- Showcase of examples of annotations and maps applied in various contexts,
- New approaches for online learning through annotations and mapping including hint-icons,

Future Research

This study has highlighted a series of interesting open questions that could be addressed in future research.

1.To what extend onscreen annotation technologies can improve engagement and comprehension of online learning material while supporting a variety of learning preferences and styles.
Evidence of the 4 types of user engagement facilitated by LiteMap (non-users, note-taker, note-maker, and note-mappers) confirms how learning attitudes and preferences will always be very personal. Therefore, technology solutions for learning will need to cater to a variety of needs and learning styles, including lurking (non-users), implicit reflection (note-taker), explicit reflection (note-Makers), and structured abstraction (note-mapper).
This study demonstrated that LiteMap has effectively facilitated a diversity of engagement levels. It is an open question though, the extent to which the tool is able to support better comprehension of the learning content, improved participation in onscreen reading, or engagement with the learning material, across the four different groups and learning styles.
Future research should look into a more systematic experimental evaluation of LiteMap in real learning contexts and by measuring a variety of metrics of engagement, reading, and understanding of the learning materials pre and post LiteMap use (within-subject evaluation), and/or between diverse groups (between-subjects study).
2.What are the advantages and tradeoffs of technology-mediated web annotation in collaborative learning tasks?
Previous research shows that LiteMap is particularly useful as a collaborative tool, for example for collective inquiry learning. In this study, we did not look at the impact of collective reading, group note-taking, and mapping in student cohorts. It is possible that whereas the specific nature of the learning task requires students to engage in virtual collaboration (group assignments or collective inquiry) this technology may improve group performances compared to existing alternative technologies.
A follow on study may look at the impact of LiteMap more specifically on collaborative learning activities, in which students are required to interact, collaborate and share. In these contexts students, preferences for specific learning styles and technological support need to be harmonized by the teachers or negotiated between learners. LiteMap could therefore offer a unique alternative for collaborative web annotation of online materials.

List of outputs

This work enabled various outputs which was supported by students from LiteMap, OpenLearn, FutureLearn and OU Modules who found examples of annotation and map, including resources, presentation and articles about this study on the web.

1. **Litemap examples:**

   Environmental Decisions

   https://litemap.net/group.php?groupid=18227a01-f206-43a6-9f9f-634fff36b081&isgroupadmin=false&max=20&orderby=date&sort=DESC&filternodetypes=MAP#-1

   Global System Science

   https://litemap.net/group.php?groupid=a21efa69-707a-4bdb-8e42-90ee9db1729e&isgroupadmin=false&max=20&orderby=date&sort=DESC&filternodetypes=MAP#-1

2. **Video tutorial using Litemap for support and dissemination**

   https://www.youtube.com/watch?v=nXSaLZqdC8Y&feature=youtu.be

3. **LiteMap Report**

   Okada, Alexandra and De Liddo, Anna (2019). ***LiteMap - Mapeamento do conhecimento.*** Open University.
   http://oro.open.ac.uk/66365/

Okada, Alexandra and De Liddo, Anna (2018). *LiteMap Outreach and Usage by Brazilian Universities.* Open University KMI.
http://oro.open.ac.uk/66366/

4. **Conference Articles**

Rocha, Ana Karine Loula Torres; Rocha, Ana Beatriz L. T. and Okada, Alexandra (2018). Rubric to Assess Evidence-Based Dialogue of Socio-Scientific Issues with LiteMap. In: Technology Enhanced Assessment 20th International Conference, TEA 2017: Revised Selected Papers (Ras, Eric and Guerrero Roldán, Ana Elena eds.), Communications in Computer and Information Science, Springer, Cham, pp. 137–149.
http://oro.open.ac.uk/52598/

Okada A. (2019) Onscreen annotation for digital reading with LiteMap ASE Annual Conference. Readings. (abstract)

Okada A. (2019) Paperless learning in Higher Education with a mapping notes tool. Computing International Conference. London

Ramos, A. L., Korb, T., & Okada, A. (2019). Immersive Analytics Through HoloSENAI MOTOR Mixed Reality App. In Intelligent Computing-Proceedings of the Computing Conference (pp. 1259-1268). Springer, Cham.
http://oro.open.ac.uk/58241/

5. **Conference Presentations**

VISION Visual Interface for students and professionals to annotate, map and outline academic papers in STEM The 8th eSTEeM Annual ConferenceSTEM Scholarship–From Inquiry to Implementation8-9 May 2019 Open University

Okada (2019) VISION - Visual Interface for Students to Interpret Online Notes and become scientific writers. the Advance HE STEM Conference 2019, Delivering Next Generation Higher Education in STEM, being held on 30-31 January at Millennium Point in Birmingham, UK.

Journal Paper

Okada, Alexandra; Quadros da Rosa, Luziana and Vieira de Souza, Marcio (2020). Open schooling with inquiry maps in network education: Supporting Responsible Research and Innovation (RRI) and fun in learning. Exitus, 10(1), article no. e020053.
http://oro.open.ac.uk/71015/

Okada, Alexandra (under review) Onscreen annotation for digital reading to support paperless learning in Higher Education. International Journal of Educational Technology in Higher Education.

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Muter, P., & Maurutto, P. (1991). Reading and skimming from computer screens and books: The paperless office revisited? Behavior & Information Technology, 10(4), 257-266.

O'Hara, K., & Sellen, A. (1997). A comparison of reading paper and on-line documents. In Processing CHI '97, Conference on Human Factors in Computer Systems (pp.335-342). Atlanta, GA. Retrieved November 12, 2007 from http://www.xrce.xerox.com/publis/cam-trs/html/epc-1997-101.htm

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Weimer, M. (2002). *Learner-centered teaching: Five key changes to practice*. John Wiley & Sons.

Other links related to learning content mapped by participants

OU (2019) Studying on a screen. https://help.open.ac.uk/studying-on-a-screen

article is available to the following audiences: student, apprentice and public.

OU (2019) Introducing environmental decision making
https://www.open.edu/openlearn/nature-environment/introducing-environmental-decision-making/content-section-0?intro=1

If your project required specific approval from university committees, please provide the appropriate information below. This is a necessary requirement for future publication of outputs from your project.

Research Ethics Approval - Project LiteMap - HREC/3470
This study focused on OpenLearn students and LiteMap users: SRPP/SSPP not necessary

LiteMap data (developed by STEM – KMI) follows the OU data management procedures and requirement.

Appendix B Feedback received by eSTEeM team about this scholarship

Thank you for submitting the final report for your eSTEeM project **Onscreen annotation for digital reading to support paperless learning in Higher Education**. Understanding how students learn from reading of online content is a topic of great and growing interest (especially given the events of the last year!), so it was great to read about how you carried out your work, the results you obtained and the conclusions that you could come to.

It was fascinating to read about how the group of volunteer students on an OpenLearn module engaged in different ways with LiteMap. It was good to see that you managed to recruit a sufficiently large group of students that you could start to draw some conclusions about different patterns of use of the tool. The fact that there are different approaches to note-taking and learning from reading is an important aspect of thinking about the delivery of online materials, and within the OU we need to continue to be sensitive to variety in individual learning styles. Having access to a tool that has the functionality to allow students to engage with annotation in a way that suits their learning would seem to be a very beneficial development. I particularly liked the fact that your future research section acknowledges the importance of individual learning styles and preferences – this must always be an important consideration as we implement new technologies. Reading about your ideas about LiteMap and collaboration was also interesting – especially as while an individual can choose their level of engagement with a particular tool, there is a different dynamic when a tool is used collaboratively.

It was interesting to read your commentary. It is clear that you faced some challenges in carrying out this work, but that you addressed these successfully and developed your experience in conducting scholarship projects. I was glad to hear that you felt well-supported by eSTEeM as you pursued your project.

It was good to see the range of outputs you have produced. I notice that you mention several conference papers and journal papers. Could I suggest that if (when) these are on ORO that you provide us with the relevant ORO links and we can add them to your project page – this should help give wider exposure to your outputs.

Thank you for completing this very interesting piece of scholarship. I hope that you found it to be an interesting and enriching experience, and it is clear that you have some very good ideas for taking your work forward.