

# MapIt: Collaborative student summary with concept maps

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## ABSTRACT

Making summaries for lecture notes, textbooks, assignments is an effective way of studying for quizzes and exams. However, not all students do them, and even if they do, resulting summaries are poorly organized, lack visual information, and are mostly kept private. One example of a good representation for a summary is a so-called structure map (special kind of a mind map) introduced by German psychologist Martin Krenzel, which emphasises the general picture of a large concept and relationships between its smaller constituting parts. In this paper, we present *MapIt*, our prototype platform where users can collaboratively create structure maps in real time. We aim to provide User studies were conducted on our implementation of *MapIt* which provided valuable insight on different aspects of the platform such as quality control and motivation. Finally, we discuss future work to improve upon the platform from what we have learned.

## Author Keywords

Crowdsourcing;Learnersourcing;Concept maps

## INTRODUCTION

Writing summaries is a highly efficient approach to studying since it helps to understand and memorise materials better. Unfortunately, when students do them, their summaries are badly structured, lack visual aids, and are not shared with each other. Crowdsourcing students' efforts in creating summaries available for all students in a visually-friendly way would make the learning process much more effective. One possible visually efficient approach for these bad summaries is a structure map, which is a special type of a mind map focused on the overview of the big idea and the relations between its smaller parts [3].

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In the paper, we describe our attempt to solve all of the above problems. We devise a scenario in which students learning class material in a traditional classroom setting struggle from the intake of information in a passive, lecture based format. Where each student's learning process is highly individualised and communication between them is limited because of the lack of systemic communication. We introduce *MapIt* in such a setting, where students learn from each other while summarising class material together. By collaborating through our platform *MapIt*, students fill in each others' fragmented pieces of learnt information and ultimately build a concise visual representation of the class material for other participants to see. We provide a video depicting our user scenario in the following link: <https://youtu.be/b-86ViLrAqI>

## BACKGROUND AND RELATED WORK

Various studies have shown that graphical summarisation of knowledge is an effective way of studying [5, 2, 6, 4]. The structure maps which are used on our proposed platform are such a way of graphical summarisation. They were invented by the German author and psychologist Martin Krenzel [3]. The general goal is to visualise the complexity of a topic in a simple way. Similarities, differences, hierarchies and the logical sequences of arguments can be made clear by using them. Therefore they are ideal to get an idea of the Global Picture of a topic. Generally structure maps are created similar to mind maps, in which subtopics are branching from their parent topic. In contrast to mind maps however, structure maps require the user to include inter-dependencies between different subtopics. Additionally the user is not limited to summarise topics in few words inside a node but can also write longer texts, especially in lower hierarchy levels. The hierarchical and sequential arrangement of subtopics is also unique to structure map. In our proposed platform most of the features of a structure map are already supported. The user is able to build a tree structure, define inter-dependencies and add textual summaries to every node and dependency. However the user is not yet encouraged to reflect hierarchies and sequences in his map.

There already exist several online tools for the collaborative creation of structure map-like documents, as e. g. Bubbl.us<sup>1</sup>, MindMup<sup>2</sup>, Canva<sup>3</sup> and mindmeister<sup>4</sup>. Some of them however are not freely available and to the best of our knowledge none of these platforms are designed to be used in a classroom environment and they also lack guidance of the students in order to study effectively.

One study examined the effects of offline collaborative concept mapping inside a classroom [1]. It however was only advantageous for students whose cognitive ability was below the median and who were assigned to a group in which the students generally had a low cognitive ability. The advantages of graphical summarisation couldn't be shown in this case. However it is not clear, if this is due to limited benefit of graphical summarisation or due to effects of offline teamwork. Additionally the result cannot easily be transferred to the online environment as there some disadvantageous effects of teamwork are circumvented.

## SYSTEM

Our system initially aimed to be used in a classroom environment. Where the professor or lecturer encourages the students to take part in our platform to collaborate together in visual summary through building structure maps. However such a classroom environment could not be arranged in our circumstances. Due to restrictions in deployment of our platform in a classroom environment, we tweak few features from our initial scenario. We chose not to distinguish between different courses, and instead provided the global list of all maps. This was in order to allow our limited user pool to delve into each others maps, hence enhancing collaborative behaviour. The prototype platform we developed consists of three distinct views. First is the main page of map lists, where users could view their own maps as "My Maps", and maps that others have created as "Public Maps". Here, a signed in user can create a new map of their own or join existing maps created by others. The implemented view can be shown in Figure 1.

### Map it

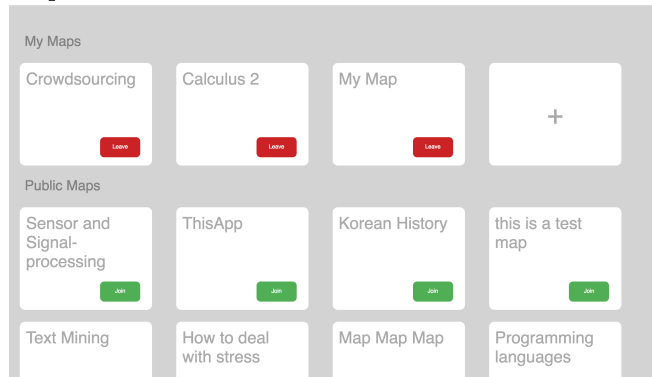


Figure 1: Map list page where My Maps and Public Maps are listed.

<sup>1</sup><https://bubbl.us/>

<sup>2</sup><https://www.mindmup.com/>

<sup>3</sup><https://www.canva.com/graphs/mind-maps/>

<sup>4</sup><https://www.mindmeister.com/>

When users click on one of the maps they have already joined from the map list page, they are directed to the map editing page. In the map editing page, a map created by previous users joined in the group remains in its last state. If a user has just created an entirely new map, then only the root node appears on screen. When the user clicks on a certain node, the node turns blue in order to notify the user that the particular node is of concern. If a certain node is clicked, its title and summary contents are displayed on a sidebar to the right. The user can add a new node connecting from the chosen node or delete the chosen node from the buttons on the side bar. We also implemented editing functions for relationships between nodes. Because relationships between the content is a critical theme in the concept of structure maps. When a node is chosen by the user's click, one of the buttons appearing on the side bar to the right is the "Define relationship" button. If a user clicks on the "Define relationship" button, the user can define a new relationship between the chosen node and a different node. When the second node is chosen by a click, a new relationship appears between the two nodes depicted by a blue arrow. Further information about the relationship can be added after clicking on the blue arrow and filling out its description on the side bar to the right. The overall view of the Map Editing page is shown in Figure 2.

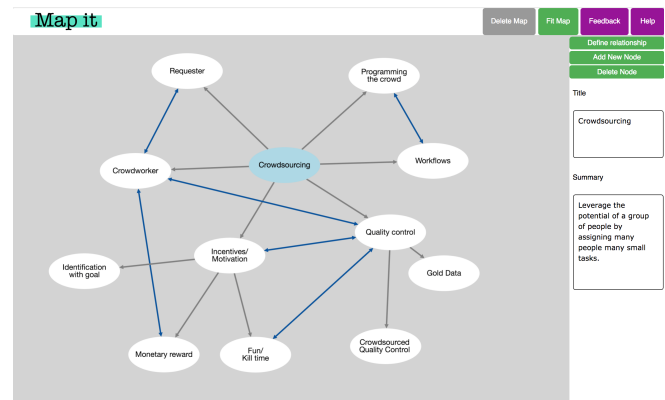


Figure 2: Map Edit page where participating users can add, edit information visually through nodes and relationships.

As it is shown in Figure 2, the size of the map can grow outwards without any limitations, while the view-port visualising it is limited to a confined area. In order to enable users to navigate along the map effectively, we provide simple zoom in and out mechanism through mouse scrolls. Also the map content can be navigated in its two dimensional plane with simple mouse drags. We have provided a "Fit Map" button on the top right for users to conveniently fit the entire map on the view-port. Summary information can also be displayed on the map view-port when the user double-clicks on a content element, either a node or relationship.

Map editing is synchronised between users in real-time. Multiple users editing any information on the map simultaneously can see each others' changes in real-time.

In order to inform users more thoroughly on the concept of structure maps, we provide a help section on the top right. Also we request feedback from users with a feedback section.

Users can only view maps that they did not join. When a user clicks on a map from the list of public maps, they enter the map view page. Here, all the map navigating functions such as zoom-in, zoom-out, drag navigation and summary views are enabled. But the user can not edit any of the map's contents from the viewing page. The overall view of the Map Viewing page is shown in Figure 3.

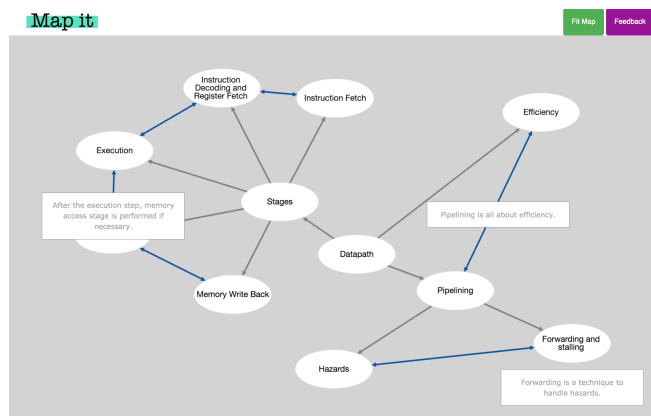


Figure 3: Example of a map created by users

## EVALUATION

During deployment we had 45 users, and 40 maps. But most of the created maps were trial maps, which users just tried out map editing functions rather than filling out actual summary content. Out of the 40 maps, 12 remained after we deleted trial maps. The remaining maps had partial summary contents, but only 4 of them were extensive enough to be considered as a useful structure map of course material.

Out of the 45 users, 12 of them gave us feedback. We received valid insights from the feedback. Overall, most people found the platform intuitive, helpful for studying for exams and liked the fact that ideas could be interchanged. Users suggested adding a FAQ section, displaying contributors for maps, showing real-time collaborators logged in on the map editing page. Also there were some comments about quality control, however we intentionally gave people freedom in this release of our prototype to allow users to experiment with the platform. We believe the lack of quality control mechanism has helped with our deployment into a random user pool. But we admit that a deployment in a proper classroom setting would require thorough quality control by moderators.

## DISCUSSION

During deployment of the platform we learned various lessons about the design of a crowdsourcing and social computing platform. First we noticed the big challenges that come along with parallel, real-time and collaborative use of the platform by different users. It requires the platform to merge changes made by different users and to ensure, no changes are overwritten. Second, as users don't visit our platform for the sole purpose of earning money but out of intrinsically motivation, they like

to experience social interaction on the platform. Many users provided feedback regarding social interaction so it seems like this is an important factor to make the platform more attractive and interesting. Our third lesson was eventually connected to the users motivation as will be also discussed later. Our platform is meant for learning which is by nature not necessarily rewarding. Additionally users first have to provide some commitment to our platform before they will be benefit from the content, they created. For this reason most users just created simple maps without meaningful content until they had explored all features of the platform. This is however also due to many users using our platform not for studying but because they were recruited by us as test users. If the platform is used for actually studying we can expect stronger motivation of the users. Furthermore we want to increase motivation of our users in future versions as discussed below.

In the following we will discuss two limitations of the platform. The first and probably biggest challenge is the students motivation. We assume that most of the students developed an individual way of studying and are not actively looking for more effective ways of doing so. In their understanding students might for example have to read as many books as possible in order to get good grades. Therefore if a students way of studying does not include the creation of graphical summaries and if he is not actively looking for new ways of studying we will not be able to motivate the student to use our platform.

Another limitation of our platform is that it is not suitable to study for all types of exams. For example in case of a mathematical or physics exam it might be helpful to summarise and arrange relevant formulas in a graphical way. However in our opinion the most important part of studying for these types of exams is practising in solving exercises which our platform is not meant for.

As the built platform is still a prototype, there is quite some potential for improvements of the platform. A first minor improvement is to add additional functions to the map editor as for example colouring of nodes, including images, emoticons, styles and equations. However we want to make sure that the platform is still minimalist, to prevent distracting students from studying. Another possible improvement is to show users a tutorial when first entering the platform, which is for now still hidden in the help section. Additionally a dialog could guide students when creating a new map in order to lead them in the right direction. This could also be achieved by adding motivational messages that appear occasionally. For example if the user added ten nodes to a map, he could be told: "Great job! You already added many nodes. Now let's define some relationship to get the global picture."

One important improvement is to include more possibilities for social interaction, which we also got much user feedback about. In future version it could be possible to see which user contributed how much to which platform. It could be possible to show active users and their current active node in a map as well as chatting with other users of the same map. A function to appreciate other students work on the platform could also add social interaction and serve as a motivational factor.

Quality control could be improved in further version of the platform, too. We decided to give the user a lot of freedom on the platform for the prototypical deployment as we expected a limited user base and still wanted to give our users possibilities to explore the platform. In the future we would like to have moderators as for example TAs or professors who filter inappropriate content. Additionally every map should have an owner who is the only one who can delete the map and invite people for editing.

Lastly the deployment in the classroom environment should be more emphasised on the platform. This implies the creation of lecture subgroups which allow only their members to see each others map. Additionally the platform could be promoted to the students by a professor or teacher. Active contributions to the platform could be rewarded in order to motivate the students and would require the authentication of students and the analysis of individual students or student groups contribution by the teacher or professor.

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