

An experiment in mind-mapping and argument-mapping: Tools for assessing outcomes in the business curriculum

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Abstract

Distinguished from other teaching-learning tools, such as mind and concept mapping in which students draw pictures and concepts and show relationships and correlation between them to demonstrate their own understanding of complex concepts, argument mapping is used to demonstrate clarity of reasoning, based on supporting evidence, and come to a conclusion, which enhances business decision making skills, a common learning outcome in the business curriculum. In this study on business education, argument mapping was demonstrated as an effective methodology to assess student learning and conceptualization of a business and as a useful classroom activity to present a business problem and have students develop business solutions, as individuals or in groups. The paper describes classroom-based evidence from an introductory business course, in which students developed an argument map and then shared their work to stimulate discussion about the business problem/argument to be solved and appropriate business decisions to make.

Keywords: Argument mapping; mind mapping; concept mapping; business education; knowledge acquisition; pre-experimental design.

JEL Classification: I21

PsycINFO Classification: 3530

FoR Code: 1302; 1503

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Introduction

The history of mind mapping and its use likely dates back to Pascal (1963) and his spiritual two ways of knowing the “esprit de finesse and the esprit de géométrie,” (p. 233) which translate from the French language to the spirit of finesse and spirit of geometry. Pascal talked about the difference between reasoned knowledge (intuition/feeling) and revealed knowledge (mathematics/geometry) demonstrating that intuition, which describes finesse, is intrinsic to judgment, whereas mathematics, describing geometry, is intrinsic to the mind.

Despite that Pascal strongly believed that Christianity requires both reasoned and revealed knowledge, he also believed that Christian religion requires separate faculties of knowledge as well. The purpose of the study was certainly not religious but Pascal’s ideology was used as the theoretical framework of this study to test the hypothesis that business students need to possess both knowledge, as well to better grasp the information they acquire from courses and apply it to various business scenarios. The objective of this study was to demonstrate the importance of argument mapping among business students and its impact on the knowledge acquired. The methodology used was pre-experimental design (quasi-experimental design) because one single group was studied in class assignments, using a before and after comparison of student learning at the beginning and end of a 16-week long semester course. No control group was used.

Literature Review

The Concept of Mind Mapping

Mind mapping has been defined under different names (Davies, 2011) and used for different purposes by different disciplines (Al Naqbi, 2011; Balım, 2013; Edwards & Cooper, 2010; Mattos et al., 2012; Warren, 2012). It was developed by learning researchers in the 1960s but first popularized by Tony Buzan in 1974 (Buzan & Buzan, 1996). Mind mapping is defined as the “nonlinear visual outline of complex information that can aid creativity, organization, productivity, and memory,” (Murley, 2007, para. 1) and it is today known as the “Swiss army knife of the brain.” (Buzan, & Fifield, 2004, para. 3) The design consists of keeping/drawing the main topic or idea central while all its major subtopics close to it. Similarly, sub-subtopics are kept/drawn close to their topics to make relationships and connections easier to see.

While it is feasible to hand-draw mind mapped information, the use of software or computer applications is required to create mind maps of complex information. Some of the software that are mostly used and suggested by the literature are: iMindMap, Mindjet/Mindmanager, mindmeister, and freemind. Students in this study were asked to use mindmeister as it is freely available from the web and it does an acceptable job of creating mind maps, which can be exported to PDF, JPG, PNG, HTML, and XHTML.

Whatever discipline we are using a mind map for, the objective is the same, a representation through mapping of the relationships between concepts in a diagram using a software. An exhaustive search of the literature revealed, “pictures and structures diagrams are thought to be more comprehensible than just words, and a clear way to illustrate understanding of complex topics.” (Davies, 2011, p. 279) The main purposes of mind mapping are first to enhance students learning (Bahadori & Gorjian, 2017; Chiou, 2008; Khalifa, 2016; Ritchie et al., 2013; Surapaneni & Tekian, 2013; Zipp, Maher, & D'Antoni, 2015). It is in fact deep and not surface way of learning as all these authors agreed upon. Secondly, mind mapping is easier to follow especially when used for business purposes (Anchors, 2013; Business Pundit, 2011; Davies, 2011; Eaton, 2017; MatchWare, 2009; Shagrin, 2014; Scutti, 2016; Sugai, 2005). Some of the businesses described by the authors found success through the use of mind

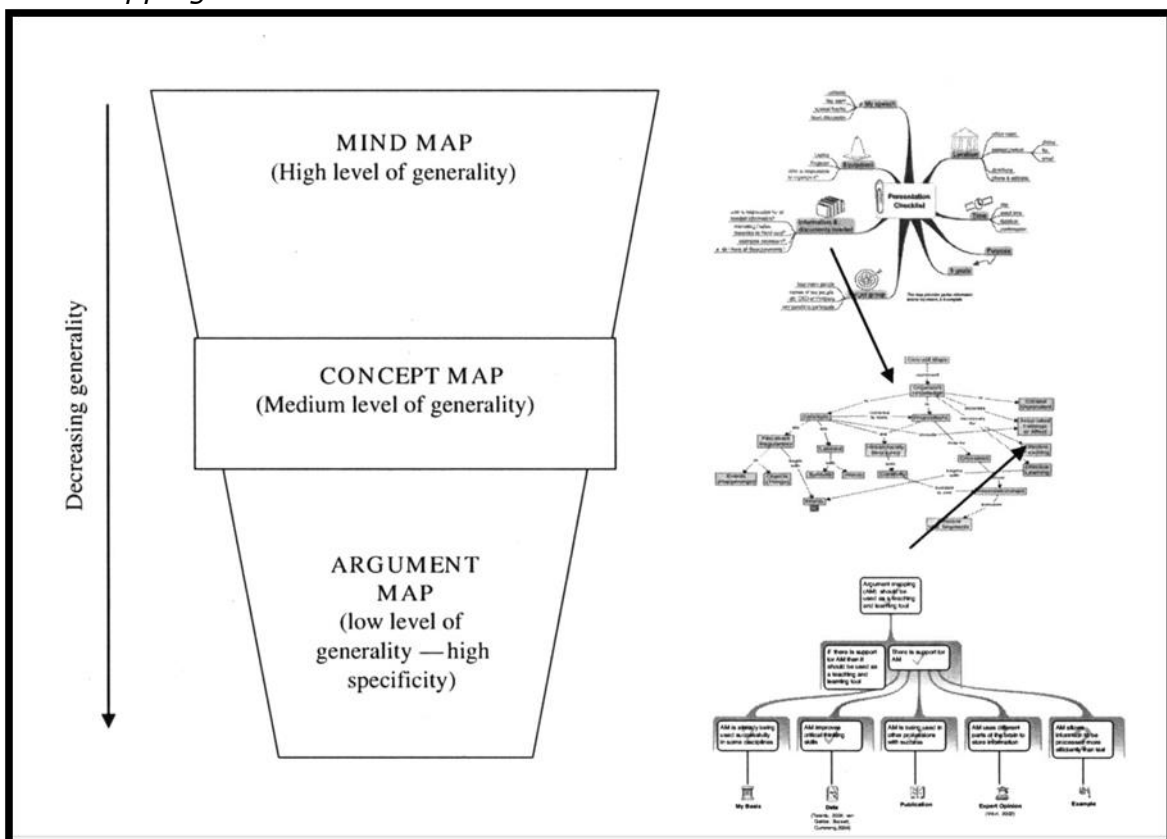
mapping, especially in better understanding customers' wants and link them directly to their need. Lastly, mind mapping evokes creativity, engagement, and critical thinking of the user/learner (Abi-El-Mona & Adb-El-Khalick, 2008; Barkley, 2010; Eftekhari, Sotoudehnama, & Marandi, 2016; Wilson, 2016).

Mind Mapping vs. Argument Mapping

While used synonymously, concept mapping and argument mapping are other tools forms that differ from mind mapping in their application as Davies (2011) discussed in his article. The scope of this study is not to deeply discuss their differences or the advantages and disadvantages of each tool, but the significance of the study is based on the difference between mind mapping and argument mapping and the importance of the use of argument mapping among business students as a learning tool. Argument mapping is relatively recent and its use among professionals and/or academia remains underused.

Argument mapping is different from mind mapping and concept mapping (Figure 1). As Davies described, while mind mapping is based on the associative connections among images and topics and concept mapping is concerned about the interrelationships among concepts, argument mapping "... is interested in the inferential basis for a claim being defended and not the causal or other associative relationships between the main claim and other claims" (p. 286). The inference described by Davies relates basically to the opinion that is formed because of known facts or evidence.

Figure 1:
Mind mapping tools



Source: Adapted from "Concept mapping, mind mapping and argument mapping: What are the differences and do they matter?" by M. Davies, 2011, *Higher Education*, 62(3), p. 195.

Argument mapping is claimed to benefit student learning, especially the crucial skills of critical thinking and decision-making (Eftekhari, Sotoudehnama, & Susan, 2016;

Scheuer et al., 2014; Swatridge, 2014). Knowing that the primary goal of a business faculty is assisting business students to learn how to effectively synthesize information, think critically, and use concepts appropriately, argument mapping help in attending this goal as the schematized arguments include statements of fact (premises), objections (co-premises, and alternative premises), and conclusions that include decisions (Billings & F.A.A.N., 2008). The premises and conclusions could be written as statements in full sentences. The assignment that was used for data collection and analysis in this study, was adapted from a recently published study (Naatus, Pon, Passerini & Somers, 2015) that created a similar assignment structure and use of mind mapping by students to visually display and to capture evidence of student learning and perceptions. In the previous study, the purpose of the study was different, and was focused not on acquisition of knowledge by students in a single course, but to assess student learning outcomes at the end of the business degree program, aggregate the data and then compare outcomes between groups of students completing undergraduate business degrees in different countries and in different cultural contexts.

Method

As discussed in the literature review, argument mapping is a technique for visually displaying information, in which the thinking process is visually represented, by connecting concepts and ideas related to a central issue or problem (Billings & F.A.A.N., 2008; Buzan, 1996). It can provide insights into critical thinking, understanding of a complex problem and other examples of knowledge acquisition and organization, through the visual representation of the manner in which people organize concepts around a central issue (Kern et al., 2006).

In this study, mind maps were used first to capture students' understanding of the concept of a business entity, including important internal and external elements, at the beginning and then the end of a Principles of Management undergraduate-level course at Saint Peter's University. The assignments gathered from students and the material in the manuscript has been acquired according to modern ethical standards and has been approved by a collegiate Institutional Review Board as part of a broader collection of mind map data from students at universities in 5 different countries and that led to a publication by Naatus et. al. (2015) that is cited in this article. The purpose of this assignment, generating the data for our study, was to first visually capture students' perceptions of what comprises a business (internal) and the external environment within which an organization operates. Students were asked to draw a business at the center of the map, using mapping software Mindmeister.com. In the inner ring outside the business, they were asked to include all terms, concepts, functions that exist within a business or organization that are required for a business to run and that managers must be aware of. In the outer ring of the map (outer circle) students were asked to identify any and all external forces that they could think of that would affect a business or organization and that managers must be aware of. The assignment requires the use of both concepts/facts learned and argumentation.

The maps were then analyzed to examine if business students applied argument mapping and if the mapping techniques have any impact on the knowledge acquired and their ways of thinking. The maps were completed as class assignments with no graded component at the beginning and end of the Fall 2016. Fourteen total students have participated in this study and 20 minutes of time was given to students at the beginning of the semester and after 16 weeks after, towards the end of the semester. The methodology used was quasi-experimental design because one single group was studied for this class assignment to test the analogy to Pascal (1963) theory that business students need to possess reasoned knowledge (intuition/feeling) and revealed knowledge (mathematics/geometry) to better grasp the information they acquire from

courses. Only 10 out of 14 results were retained as four students submitted without properly naming their file either the first time or the second time.

The assessment criteria used for this study were previously determined by the Novakian concept maps (Novak, 1981; Novak & Can˜as, 2006) and refined by Devies (2010, p. 289). Devies used the following criteria to compare different mapping techniques.

Table 1:
Comparison of Mind Mapping Techniques

	Mind Mapping	Concept Mapping	Argument Mapping
Purpose	Associations between ideas topics or things	Relations between concepts	Inferences between claims (conclusions) and support (arguments)
Structure	Non-linear, organic, radial	Hierarchical, tree like	Hierarchical, tree like
Level of abstraction	High generality	Medium generality	Low generality
Nodes	Pictures, words, diagrams	Boxes	Boxes and lines
Linking devices	Lines, line thicknesses, colors, shading	Arrows	Lines, colors, shading
Linking words	Associative words ("Use" and "colors" and "links")	Relational phrases ("in relation to", "is composed of", etc.)	Inferential linking words ("because", "not", "however")
Language register and granularity	Loose	Medium	Tightly constrained

A reminder that argument mapping's main focus is to explain the inferential or related structure of arguments. Images and topics are the main association to mind mapping, and relations between concepts are the main focus of concept mapping. Inferences between whole propositions are the key feature of argument maps. For a detailed look at the students' mind maps created in the first class and at the end of a 16 week semester, see Appendix A.

Results

Based on the analysis of each of the student's before and after maps, some generalizations can be made. Despite that students were not asked to write a report that would demonstrate their critical thinking on the topic, which represent one of the limitations in this study, students in the class discussion at the post-test period were more dynamic and engaged to discuss some of the concepts especially the second part of the assignment which was to identify any and all external forces that they could think of that would affect a business or organization and that managers must be aware of.

Using Davies (2010) assessment factors of mapping techniques previously discussed, it was noticeable that students in their mapping and discussion used purpose, structure, level of abstractions, nodes, linking devices, linking words, and the language register and granularity of argument mapping as it was described by Davies (2010). As a matter of fact, students included statements of fact premises supported by examples from case studies covered during the semester and/or concepts discussed in class. Students have also presented their objections on the impacts of some external environment factors. When objecting, students talked about politics, economic changes, etc. and presented arguments that were well grounded from the things they learned in class. Students' conclusions included decisions about things that managers should pay more attention to and managers' first priorities. Students' engagement with the first part was limited to asking questions about the things that need to be done or making statements such as "I don't remember what I have learned from my previous business classes" or exchange of eye contacts between each other.

A closer look to the maps revealed that students' thinking became clearer and more organized among the majority (Student 2, 4, 5, 6, 10); however, in their mapping some were trying to find an interrelationship between the concepts they learned (Student 5, 6, 8, 9); proving their revealed knowledge. It was also noticeable that more words were used than pictures, symbols, or phrases; students 9 and 10, for examples have tried to say more in their drawing as it was clear that they were objecting about some of the concepts discussed in class; proving their reasoned knowledge. The results revealed enough evidence to retain the analogical reasoning on Pascal (1963) theory advancing that business students need to possess reasoned knowledge (intuition/feeling) and revealed knowledge (mathematics/geometry) that would allow them to better grasp the information they acquire from a business course.

Discussion

From the results, the first noticeable thing was that no mind mapping was used; it was more about concept mapping that was submitted by students. Mind mapping and concept mapping were used synonymously. The concept mapping inducted to argument mapping that was more discussed in class than represented in maps. In the pretest, students were limited to asking questions to develop a sufficiently clear understanding of the topic and issue and a precise nature of the task at hand, which is one of the criteria of argument mapping that was demonstrated by the students with their questions in the pretest period. In their argument mapping, students demonstrated a specific utility and considerable fitness to the argument/assignment purpose. Argument mapping has a very specific utility, which was well represented by this assignment. It was clear from this assignment that mind/concept mapping and argument mapping benefited students' learning, their critical thinking, and decision making about the topic at hand. It allowed the student to build on an existing knowledge about the topic. Results also revealed that mapping forms have complementarity function and it would be more beneficial for students to depart from concept mapping to converge to argument mapping.

Conclusion

This study provided a sample mind mapping assignment in an introductory business class that inducted to an argument mapping, and also has learning applications that could be used in classroom activities and/or to evaluate students' critical thinking and decision-making. Mind, concept, and argument mapping, as it was demonstrated by this quasi-experimental study, if introduced at the beginning of a semester and used through the course, would lead to an assessment tool that could be used by either instructors or students to assess the students' change in perception, understanding, and

thinking of the makeup of an organization, including functional areas and units internal to the business, as well as the external environment in which a business operates. In this study, the concept mapping inducted to argument mapping that was more discussed in class than represented in maps. In the pretest, students were limited to asking questions to develop a sufficiently clear understanding of the topic and issue and a precise nature of the task at hand. In the post-testing, Students were more engaged when presenting their concept mappings. In their discussions, students included statements of fact premises supported by examples from case studies covered during the semester and/or concepts discussed in class. Students have also presented their objections on the impacts of some external environment factors. When objecting, students talked about politics, economic changes, etc. and presented arguments that were well grounded from the things they learned in class. Students' conclusions included decisions about things that managers should pay more attention to and managers' first priorities. Argument mapping has a very specific utility, which was well represented by this assignment.

Concept mapping should be introduced first as it was proceeded in this pre-experimental study and followed by an explanation of what argument mapping means. The assignment format can be replicated in different types of business courses, and as indicated can be used for assessment purposes and for continuous improvement of teaching methods and refining how concepts are taught. In addition, mind mapping results can be used to assess differences in learning outcomes, in this case the understanding of a business both internally and in relation to the external environment, as was validated in a recent study (Naatus et. al., 2015) examining the role of cultural and national differences on business students' understanding of a business enterprise in France and the United States.

In addition to the small sample size, a shortcoming of this study is lack of longitudinal data that would allow for comparison over time and consider different variables in assignments or teaching methods on students' business knowledge as expressed in the maps. One final limitation, that could be addressed in future studies, was that no standard deviation was calculated before the experiment and after the experiment to empirically confirm that mapping in general has a positive impact on students' learning. The analogical reasoning using Pascal (1963) theory advancing that business students need to possess reasoned knowledge (intuition/feeling) and revealed knowledge (mathematics/geometry) that would allow them to better grasp the information they acquire from a business course could now be empirically tested through the use of mapping tools, which could be the subject of future research.

Integrating mind maps into assessment and assignment design helps open a window into thought processes of our students and can provide a perspective on students' cognitive development and broader understanding of the nuances and relationships involved in complex topics and inter-relationships.

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Appendix A

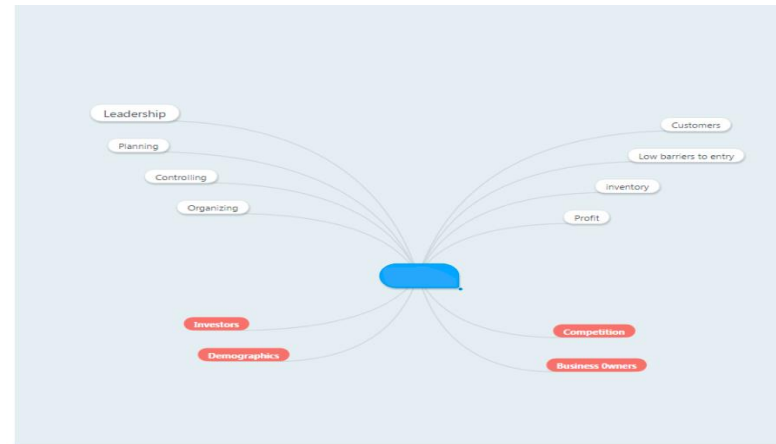
Results of Student Maps (Pre and Post Assessment)

Student 1

Pre-Assessment



Post-Assessment

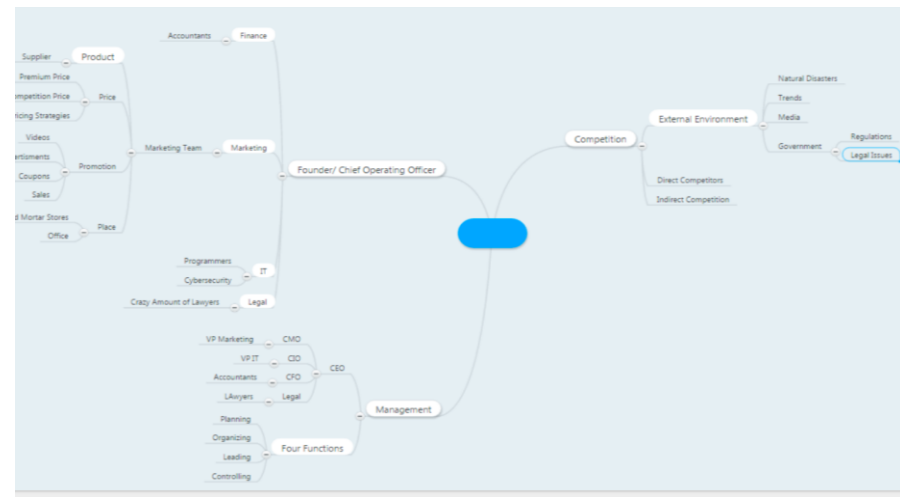


Student 2

Pre-Assessment

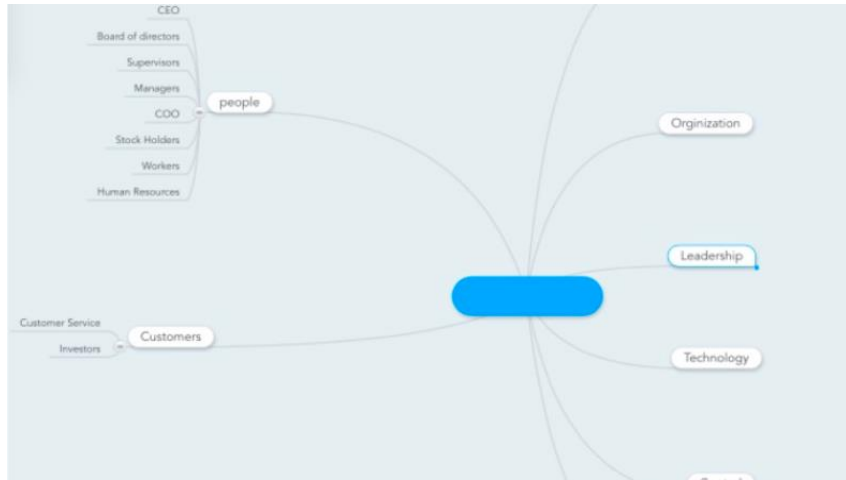


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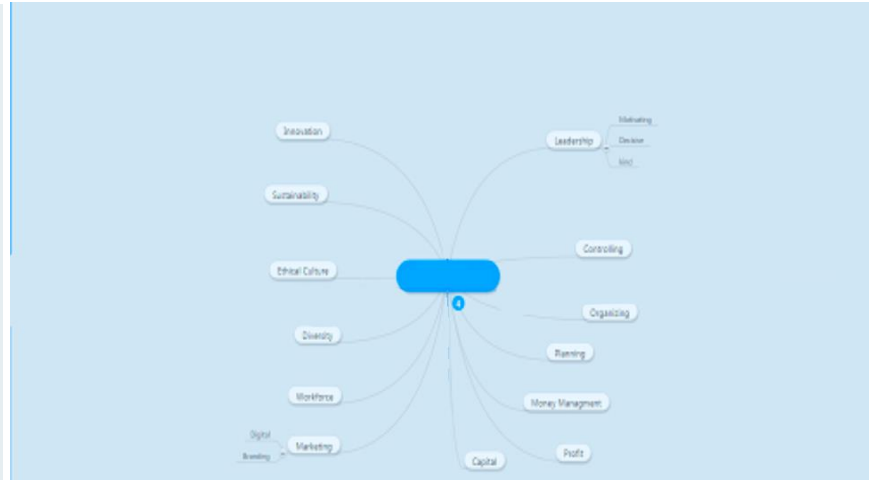


Student 3

Pre-Assessment

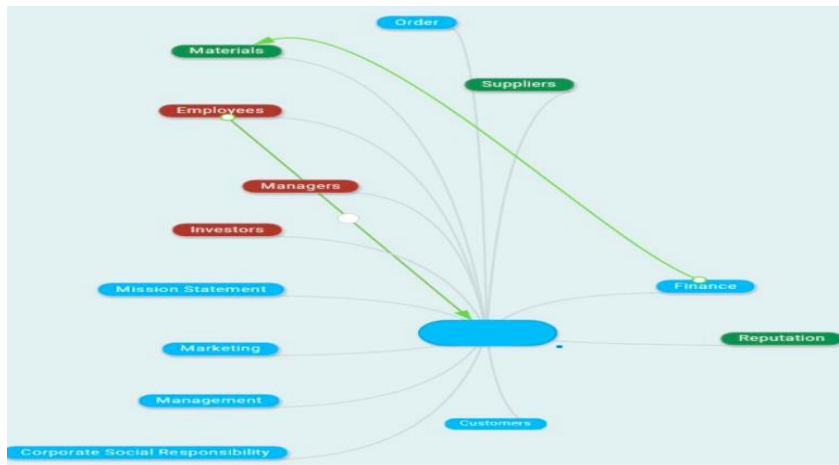


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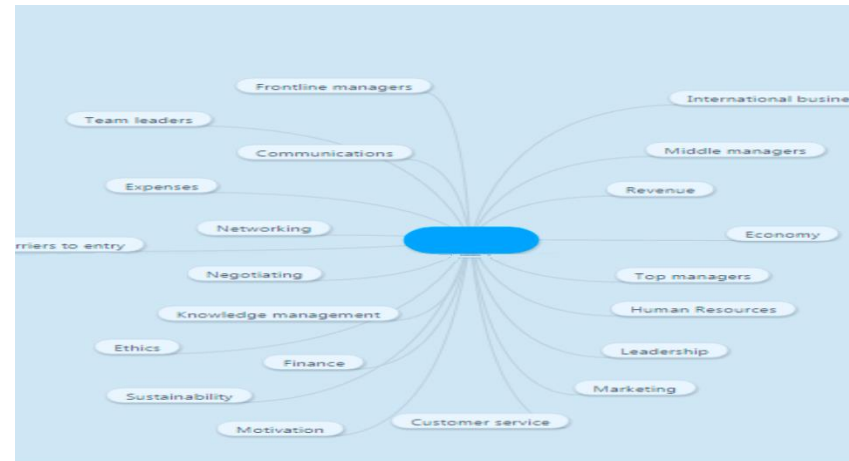


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Pre-Assessment

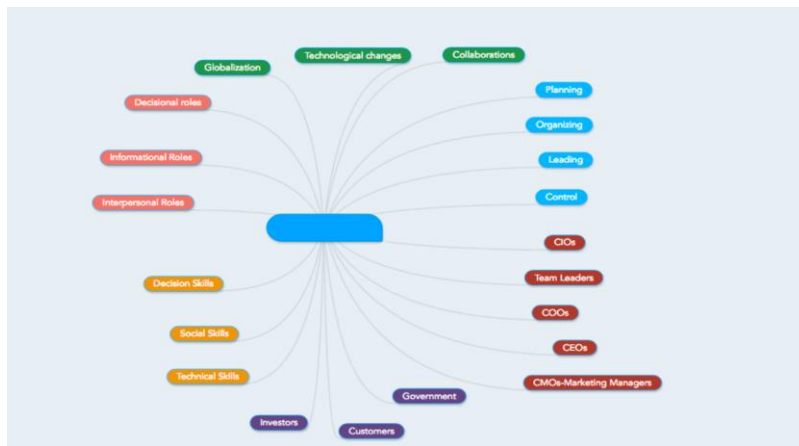


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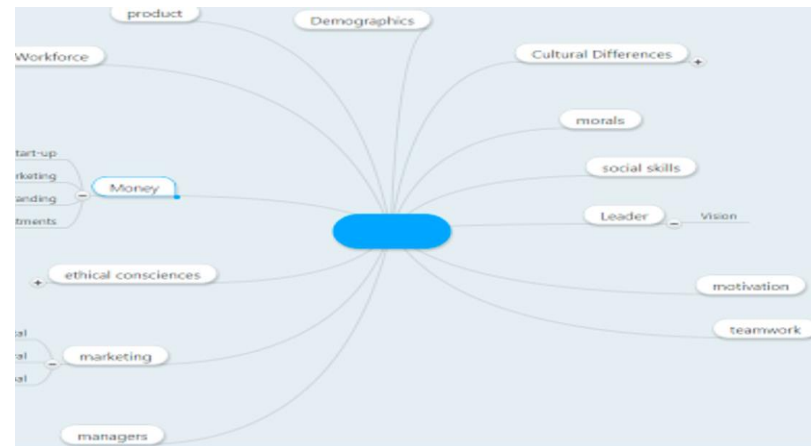


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Pre-Assessment

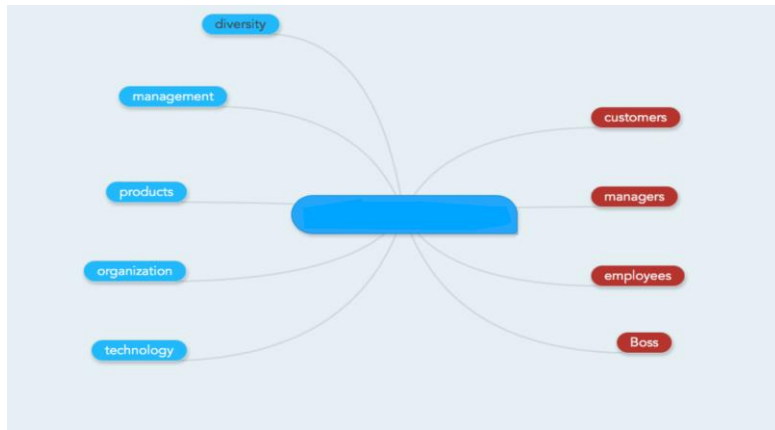


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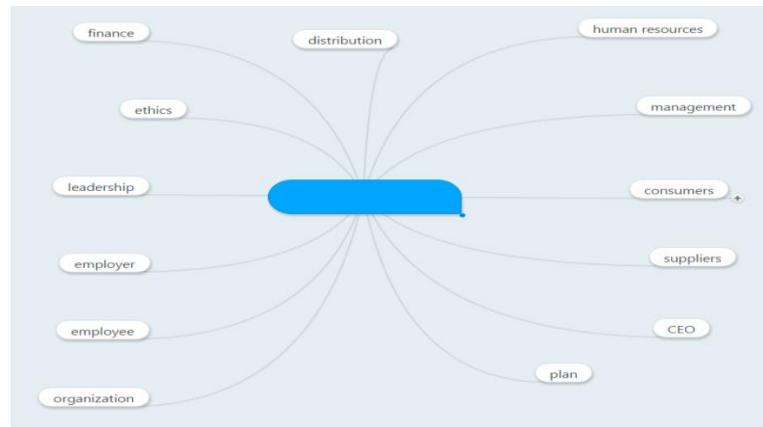


Student 6

Pre-Assessment



Post-Assessment

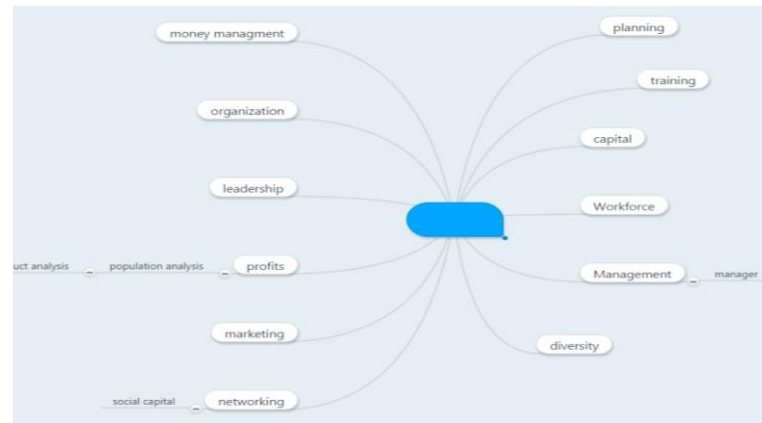


Student 7

Pre-Assessment



Post-Assessment

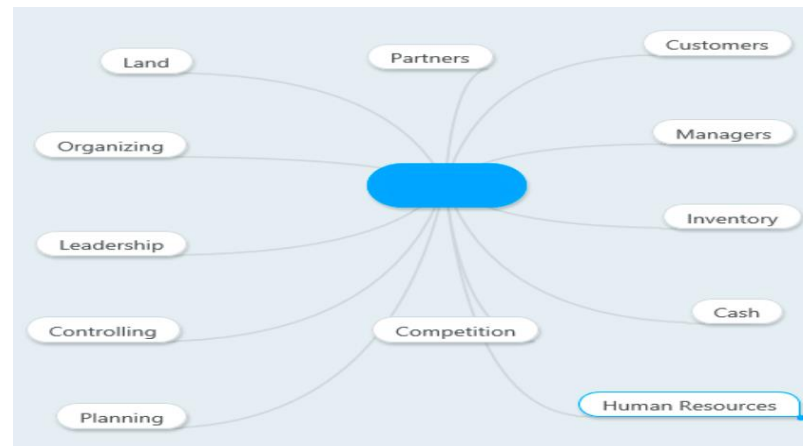


Student 8

Pre-Assessment



Post-Assessment

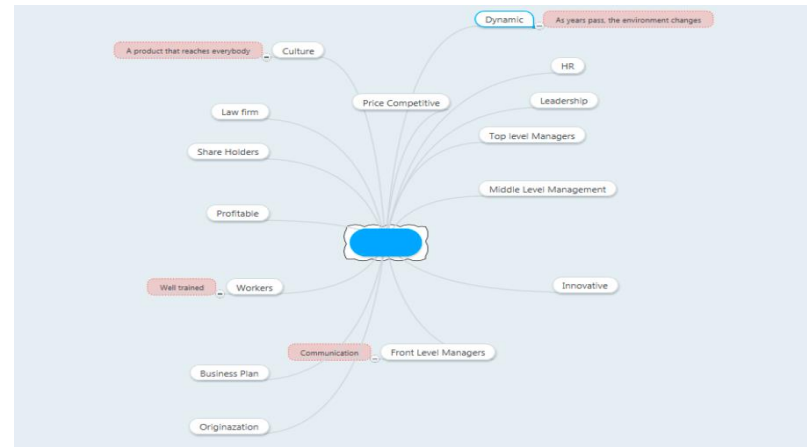


Student 9

Pre-Assessment



Post-Assessment



Student 10

Pre-Assessment



Post-Assessment

