EFFECT OF CONCEPT MAPPING ON MYERS-BRIGGS PERSONALITY TYPES

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Abstract. The process of constructing a concept map is approached differently by each of the Myers-Briggs personality types because these types are characterized by different preferences for information processing. Sensing types are most at ease with linear thinking that sees knowledge in the form of lists of facts and procedural rules (linear learners), whereas intuitive types are most at ease with pattern thinking that sees knowledge as interconnected concepts (integrative learners). The need for certainty in the sensing type creates a significant barrier to both learning and implementing concept mapping, while the need for big picture learning makes concept mapping a satisfying intellectual exercise for intuitive types. Because concept mapping includes several orders of cognitive complexity, it is a tool that can be used to sensing types overcome the tendency to avoid the use of higher order thinking skills. The result is better developed critical thinking and improved long-term memory. Concept mapping benefits each of the Myers-Briggs personality types by helping to develop the use of their non-preferred mental functions. Recommendations for teachers include the need to review early attempts at maps with students, the need for an explicit stepwise procedure, encouragement to continue building existing maps, and to use maps in teaching only in overview form to encourage active learning by the student in completing the map.

1   Introduction

It is logical that a learning tool such as concept mapping, designed to develop analytic thinking (Novak and Gowan, 1984), would be used differently by students who process information differently. These differences can be identified with the Myers-Briggs Type Indicator (MBTI), a personality instrument developed to sort preferences within several dimensions of thinking (Myers, et al., 1998). The Myers-Briggs personality types represent different mental habits used for information processing and, as such, they represent predictable skills and attitudes with respect to the construction of concept maps. Since the Myers-Briggs preferences do not represent limitations in thinking, they are opportunities for development of learning skills. This paper summarizes 20 years of experience in teaching both concept mapping and Myers-Briggs psychological type principles to medical students and other health professions students and to faculty as a tool for developing learning skills.

2   Myers-Briggs Basics

The Myers-Briggs Type Indicator is a psychological instrument that was developed to reliably determine the personality preferences first described by Jung (Myers, et al., 1998). When taken together, the mental functions observed by Jung describe mental habits that lead to a consistent thinking style in information processing. These mental functions involve: 1) information input, 2) generation of alternative possibilities, 3) deduction of the most logical alternative, and 4) assessment of human outcomes/values. Since all types use all of the functions in their learning, they are different in which one of these functions are emphasized over the others. Identification of the emphasized function allows the adoption of strategies to develop the lesser used functions.

The MBTI only measures normal differences in behavior that are established as mental habits, and thus does not measure abnormal behavior. Since all of the preferences that are measured are found in normal thinking, personality type is nothing more than a comfort zone where thinking occurs with less effort and with the greatest trust. When a student of a given personality type uses a non-preferred mental function, for example at work, they use more mental energy and tire easier. But, like any motor skill, use of the non-preferred side can be developed and mastered. Thus, no one is limited, or compartmented, by their type; the limitation is usually a lack of awareness of type preferences and, thus, a lack of awareness of why some aspects of thinking are more difficult than others. The available data do not support a relationship between personality type and intelligence nor a connection with any psychopathology. Each dimension of type, as described below, is exercised to different degrees by individuals of the same type preference due to the influence of other personality traits and life circumstances.

2.1   Extraversion and Introversion Preferences

Students differ in their preference for whether their best thinking is achieved through "talking it out" or through "thinking it through." Those students who have extraversion preferences will have an easier and more effective learning experience if they can verbalize their learning as it is happening. This includes making mistakes or changing their mind…sometimes in mid-sentence. If they are kept quiet during their learning, such as during lecture, they will often carry on a dialogue silently in their head as an attempt to replicate their preferred mode of learning. While verbalizing learning is impractical in some learning settings, it has an energizing effect on study groups.

The opposite preference for introversion is seen in students who have a more effective learning experience when they are able to process new information quietly before it is discussed…if it is discussed at all. They also go through the process of changing their mind, but this is not visible. If they are required to speak about their learning they are very uncertain and uncomfortable unless they are given a moment to process the information. While this type of learning can lead to isolation from others, if used regularly in a study group it will bring depth of thinking to the group process. Thus, extraverts talk-to-think while introverts think-to-talk.

2.2   Sensing and Intuitive Preferences

Students differ in their preference for the way they give their attention to new information. Those students who have sensing preferences tend to trust information that is perceived directly by the senses, i.e. vision, hearing, touch (manipulation), taste, and smell. This information exists in the present as facts and details and carries a high degree of certainty. If a pattern or relationship exists, it is also perceived as a fact…but is only "discovered" as a relationship with great effort. When studying in a group, the sensing student is always alert to completeness of the facts.

The opposite preference for intuition leads students to trust their ability to find patterns and relationships. This information exists in the future as a possibility and, since several relationships might exists, it is variable and even random in its construction. While a minimal set of facts are needed to form a pattern, once the pattern is decided the remaining facts are ignored. When studying in a group, the intuitive students help with the discovery of patterns and bring the alternative points of view that are essential to critical thinking. Thus, sensing types think about "what is" while intuitive types think about "what if."

2.3   Thinking and Feeling Preferences

Students differ in their preference for the way they react to new information. Those students who have thinking preferences tend to trust their logic to evaluate the facts and possibilities. They are impersonal and objective in their analysis since they seek to obey the laws of deductive and inductive reasoning. While they have feelings, they do not trust their feelings in reaching a decision or making a judgment. When studying in a group, the thinking types draw attention to the "correctness" of relationships and the clarity of thinking.

The opposite preference for feeling judgment leads students to trust learning decisions based on personal and subjective analysis. This analysis is still a rational process, but it references to human outcomes rather than laws of logical reasoning. When confronted with a conflict between a logical alternative or a personally valued alternative, the feeling type will choose the latter, even while realizing the former is also valid. When studying in a group, the feeling type students bring harmony and enhance communications. Thus, thinking types need to include feelings and values as facts in their thinking while feeling types need to realize that thinking types have difficulty trusting feelings and values.

2.4   Judging and Perceiving preferences

Students differ in their preference for the way they conduct their learning activities. Those students who have judging preferences tend to organize their time around a plan. They are motivated to obtain closure by completing their plan or checking off items on their task list. Since they are deadline oriented, their work is

usually accomplished ahead of schedule and their course grades tend to be higher than their perceiving type-matched counterparts. They will tend to sacrifice learning additional information if that learning prevents them from completing their schedule. When studying in a group, they keep the group on task and help it to be more efficient.

The opposite preference for perception leads students to conduct their learning in a flexible and adaptable manner. They are motivated to discover new information that makes a more complete set of facts or a more complete pattern. They may attempt to follow a schedule, but they will value the acquisition of additional information over meeting a deadline. Because their assignments are often completed at the last minute, their course grades tend to suffer. When studying in a group, they keep the group open to new information in resolving learning issues. Thus, judging types seek "the joy of closure" while perceiving types seek "the joy of discovery."

3   Representation of Complexity in a Concept Map

Sensing and intuitive type students seek opposite levels of cognitive complexity (Myers, et al., 1998). Both types of students are fully capable of learning at all levels of cognitive complexity but they learn easiest with the mental function that they trust the most. The sensing type orientation toward facts and details results in the majority of study time spent on remembering information precisely as it was taught. This leads to neglect for the need to apply that information at higher levels of complexity. Likewise, the intuitive type orientation toward possibilities and alternatives results in the majority of learning time spent on extending understanding beyond the way it was taught, but using only the minimum set of facts necessary.

3.1   The Quellmalz Framework of Thinking Skills

Cognitive complexity has been represented in a variety of taxonomies, the best known being Bloom's taxonomy (Bloom and Krathwohl, 1956). However, greater insight into the contribution of concept mapping to the different learning needs of sensing students and intuitive students can be obtained from the Quellmalz Framework of Thinking Skills (Quellmalz, 1987). This is a simpler taxonomy with only five levels of complexity compared to the six described by Bloom and it can be used more easily to explain the functional anatomy of a concept map (Table 1).

Category	Recall	Analysis	Comparison	Inference	Evaluation
Description	Remembering or recognizing key facts, definitions, concepts, etc.; repeating verbatim or paraphrasing information that has already been provided to the student.	Understanding relationships between the whole and its component parts and between cause and effect; sorting and categorizing.	Explaining similarities and differences. Comparisons start with whole/part relationships in the analysis category and carry them a step further.	Reasoning inductively or deductively.	Expressing and defending an opinion. Students to judge quality, credibility, worth, or practicality.
Sample Trigger Words	define list label name	sort categorize classify sequence	compare contrast distinguish	hypothesize synthesize use evidence apply a rule	judge evaluate best solution justify
Corresponding Bloom Categories	Knowledge Comprehension	Analysis	Analysis	Application Synthesis	Synthesis Evaluation

Table 1. Quellmalz Framework of Thinking Skills. Adapted from Measuring Thinking Skills in the Classroom, Revised Edition, by Richard J. Stiggins, Evelyn Rubel, and Edys Quellmalz, National Education Association, 1988.

3.2   The Quellmalz-Concept Mapping Connection

Sensing type students focus their attention on the propositions that are the fundamental element of a concept map. These are the basic facts that are linked together to form the map and they are represented in the Quellmalz Framework by the Recall level of information processing (Figure 1). Intuitive type students avoid giving attention to any facts that do not connect into a pattern.
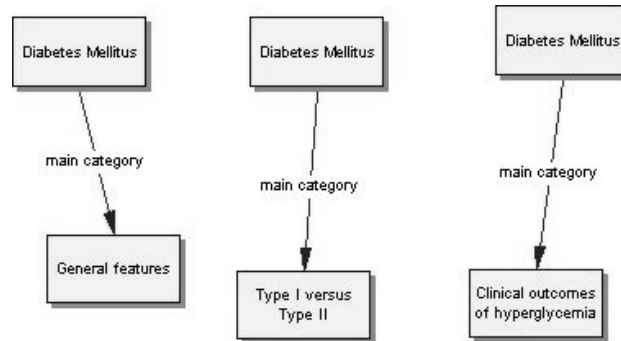

Figure 1. Propositions do not have to be connected together to be factually correct. Each proposition represents a fact that can be learned at the recall level in the Quellmalz framework. This figure represents the way sensing types see knowledge if they do not use their intuitive skills to create seek out and create hierarchies.

Both sensing type students and intuitive type students focus on levels of hierarchy (represented in the Quellmalz Framework as the Analysis level of information processing, Figure 2), but for different reasons. The sensing student will have learned the level of hierarchy as a fact. Indexing or grouping terms serve as factual representations of commonality and can be memorized. Grouping terms are anticipated or discovered by intuitive types, rather than memorized as taught. Intuitive type students will often find new ways of organizing, or re-organizing, that were not originally taught.
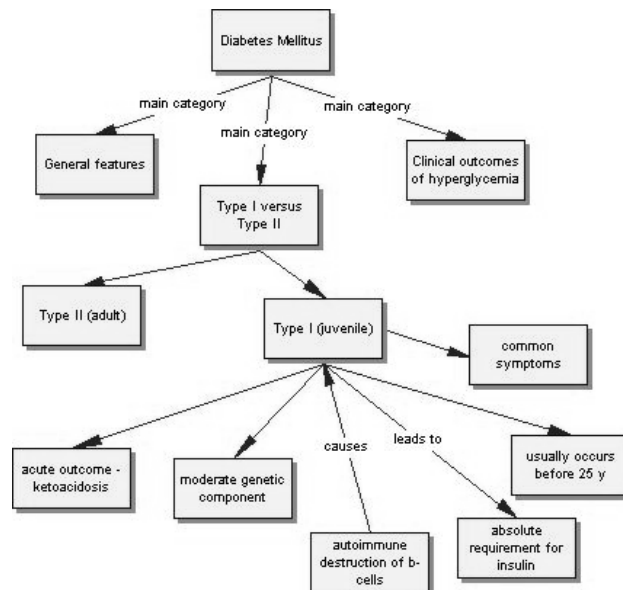

Figure 2. Each branch point represents the analysis level in the Quellmalz framework. Analysis involves a determination of how facts can be grouped together. This map has three levels of hierarchy.

Intuitive type students focus their attention on finding the cross-links and they actively seek them out during their learning. The cross-links are represented in the Quellmalz Framework by the Comparison level

(Figure 3). While sensing type students are uncomfortable constructing any cross-link that was not taught as a fact, they can learn this skill through an explicit, step-by-step process. Sensing type students who practice this process for several weeks will consistently comment that they "read differently now" or that they "see the material differently now." They can't describe how it is different, but they do display a significantly greater confidence with the process.
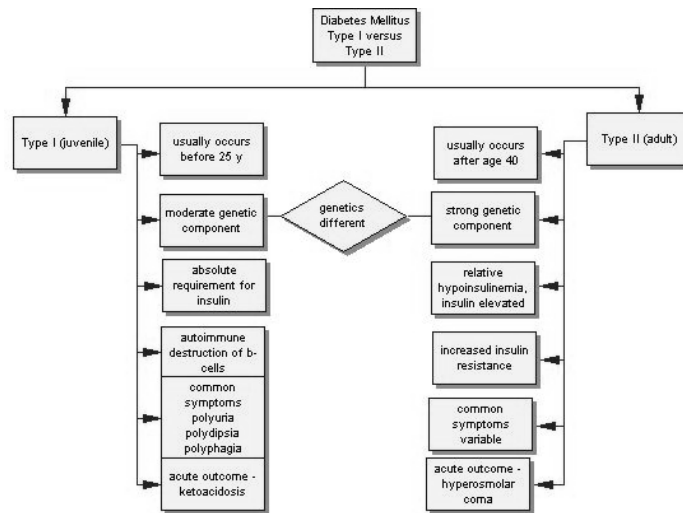

Figure 3. The construction of cross-links represents the comparison level in the Quellmalz framework. Comparison involves seeking out possible relationships between hierarchical branches. Cross-links can include a node or simply a linking qualifier. This map only has a single cross-link, but a cross-link could be constructed between each of the vertically juxtaposed nodes. Sensing type students are uncomfortable identifying a cross-link that was not explicitly taught as a fact.

4   Contribution of Map Construction to Learning In Different Types

Concept mapping helps to develop the learning skills that characterize each of the type preferences in different ways (Pelley and Dalley, 1997). This is described below for each of the four dimensions of MBTI type.

4.1   Concept Mapping for Extravert and Introvert Types

Extraverts prefer action oriented learning, especially when it can be verbalized. Each step in the construction of a concept map can be verbalized, from the development of a list of terms to be mapped to the discovery of cross-links. Introverts prefer quiet thinking time to process and discover. If they don't verbalize their learning, however, they cannot test their thinking. Thus, introverts can discuss their finalized map with other students to express the thinking that originally occurred quietly. Students in study groups have frequently remarked that they would not have realized that their thinking was incorrect if they had not had to explain their map. The map serves as a visual platform to focus dialogue.

4.2   Concept Mapping for Sensing and Intuitive Types

Sensing types give their attention to specifics. This results in a linear reading style that involves a slow but steady process moving from the beginning of the assignment to the end without digressing or returning to material previously covered. The only reading of previous material occurs when the entire assignment has been finished and the linear progression through the material begins again. This is in stark contrast to the more spontaneous, random focus of the intuitive type who will frequently complain of difficulty staying on task. Concept mapping helps intuitive types stay on task due to the goal oriented nature of the reading while it forces sensing types to refer to previously covered concepts to evaluate the grouping terms and the potential for cross-links.

4.3   Concept Mapping for Thinking and Feeling Types

Thinking types will evaluate a map for its logical consistency. Its appearance will not matter as long as the construction makes sense to them. They may construct alternative maps to determine the most logical map and they will use readily use technology to make the process more efficient and more effective. Their logical orientation can lead them to challenge what they have been taught. A concept map drawn by a medical student resulted in an instructor modifying a lecture after trying to help a student who had mapped it (personal communication). The instructor concluded after attempting to make sense of the students map that his lecture needed to be re-organized. While a correct organization is also valued by a feeling type student, it is equally important for the map to be pleasing in appearance. They will use color and other decorative additions to enhance the map and make it visually pleasing. This makes their learning more enjoyable. The emotional attachment to a map enhances memory during examinations and allows for recall of the details of the map. Feeling types tend to be intimidated by technology.

4.4   Concept Mapping for Judging and Perceiving Types

Judging types will tend to see a map as a final document due to their orientation toward closure. A completed map that is correct should not be altered in their view because they will believe that all possible alterations are already in the map. This leads to a rigidity that is not open to new learning except as a new experience that starts over at the beginning. Starting over is not a need for the perceptive type student, since they see the map as a living document – new nodes appear as they are discovered and nodes that have become mastered disappear. Thus, concept maps reflect the student's understanding at a given point in time, but they need to be updated as understanding deepens.

5   Recommendations From Experience

The recommendations described below represent over 20 years of experience in teaching medical students and medical faculty about the use of concept mapping as a tool for developing learning skills in each of the Myers-Briggs personality types. While advice is often tailored to individual circumstances, the recommendations provided here represent those principles that have been most consistently successful. They are not listed in any particular order of importance.

5.1   Maps are living documents – help them grow.

Help students understand that a concept map is just a snapshot of their grasp of material at the time the map was constructed. Encourage them to revisit maps and to read them out loud. New knowledge gained in a course of study can often be added into an existing map.

5.2   List, group, and compare.

Sensing type students have a greater comfort following a well defined stepwise procedure in their learning. They can be taught to remember the maxim "list, group, and compare." This takes them through the Quellmalz hierarchy starting with their most comfortable level. It breaks the habit of linear non-analytical reading by causing them to look for grouping terms first. The primary difference is that they are actively looking "for" something instead of just passively looking "at" it. The final step of finding comparisons between hierarchies allows the construction of cross-links and develops their critical abilities. If their maps are scored, then weighting cross-links more than the value of propositions will encourage both sensing and intuitive type students to emphasize the more analytic comparison level learning. Intuitive type students will find the process more efficient if they follow the "list, group, and compare" maxim because they will tend to start most maps prematurely with the very first pattern that they discover.

5.3   Sensing types need feedback…but only a little.

Sensing type students respond strongly to a personal review of their maps with a teacher. Often, their early maps are a single linear array of nodes connected from the top of the page to the bottom, a reflection of

how they read. This allows for a brief discussion of their thinking and an active learning moment as they modify their maps. They experience visible feedback on how to develop their thinking and they take away a greater sense of confidence in their ability to identify more complex knowledge independently. It will be rare for any student to request this assistance more than twice. They do return for a third visit, but only to report how much higher they have scored on their examinations.

5.4 Maps help to focus group problem solving.

Groups can develop maps from the beginning or they can compare maps prepared ahead of the session. When groups discuss or build concept maps the participants help to develop each others thinking. The sensing types are helped to develop their intuitive skills as they hear intuitives verbalize their thinking. Similarly, intuitive types are helped by sensing types to include all of the details, not just those that establish a basic pattern. The visual structure keeps the group on task (judging type skills) and the process of "growing" the map keeps the group open to new possibilities (intuitive and perceptive type skills).

5.5 Construct maps step-by-step during teaching and never do a complete map.

Always keep in mind that a concept map is a learning tool, not a presentation tool. Any single concept map represents the current knowledge of the person who constructed the map. Thus, if a teacher uses mapping to present a lecture, the student sees the teacher's thinking and is prevented from actively constructing their own understanding. One exception to this would be an exercise where the students are challenged to reorganize a map just presented. As a rule, however, concept mapping is an opportunity for the student to actively discover groupings and relationships and to push their learning to higher levels of complexity. Teachers can use maps as advance organizers or as summaries that students, especially those new to concept mapping, can take away and complete individually. When mapping is done as a teaching modality, it is important to start with a blank page or screen and develop the map from the beginning. This allows the teacher to model their thinking for the student. Sensing type students (and faculty) are particularly vulnerable to the appearance of a completed map on the screen. They will comment that they don't know where to begin or what to look at, or in the words of one student, "That just blew all my circuits!"

6 Summary

Concept mapping is used differently by students who process information differently. The Myers-Briggs Type Indicator was developed to help identify preferences within several dimensions of thinking that give insight into how students of different types will process the same information differently. These dimensions are related to: 1) whether the thinking is spoken or silently processed, 2) whether attention is given to specifics or to patterns, 3) whether the response to new information is logical or subjective, and 4) whether learning is open-ended or closure-oriented. Learning is most effective for all students if they can develop the skill of their opposite way of thinking in addition to their preferred way of thinking. Concept mapping helps to achieve this goal. Maps can be verbalized (extraversion preference), but require focus and concentration (introversion preference) as they are organized. Maps are composed of as many details as needed (sensing preference), but the patterns of specific relationships among the details (intuitive preference) are needed to develop a complete map. Maps can be represented with differing, but equally correct organizational hierarchies (thinking preference), but maps that are pleasing to look at (feeling preference) take advantage of the essential contribution of emotion to long-term memory. Maps acquire new propositions and lose unnecessary propositions as experience is acquired by the student (perceptive preference), but at any point in time all of the relevant information must be included during map construction (judging preference).

Concept maps help to develop an ability to identify more complex relationships and to include more facts during study. Sensing students will avoid looking for levels beyond the recall of facts unless they have a systematic process for constructing groupings and relationships between groups. Intuitive students will avoid including all of the details in their learning if they cannot attach these details to a pattern. Students eventually realize that concept mapping is another way of reading. They must first actively seek out major terms that organize and group information. They must then read to actively prioritize terms that form the

most inclusive groups and evaluate various organizational designs. Then they read to find all of the detailed information that makes the map a complete representation of what they have read. This type of reading prohibits the linear study habits of the sensing type student by requiring constant scanning for relationships to show levels of hierarchy or cross-links. Because sensing type students have a high need for certainty, they will initially resist mapping to avoid the anxiety of "doing it wrong." A few brief feedback sessions that require the student to talk about how they were thinking as they constructed their maps will be sufficient to encourage the student to trust their maps. Map comparisons by study groups also help to develop confidence in sensing type students. If a teacher constructs a complete map of a subject, the student only has a representation of the teacher's thinking. Teachers will stimulate active learning if they only provide organizational starter maps… and not many of those.

7   Acknowledgements

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