Integrating AIS Course Content
Using Concept Maps

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Abstract

This paper introduces the use of a concept mapping technique to suggest an approach to teaching accounting information systems. The concept mapping technique has been successfully used elsewhere in the field of education, and has characteristics suited to the instruction of accounting information systems. Included in the paper are illustrations of the use of concept mapping technique to show how students' knowledge of accounting can be leveraged to logically integrate in their education the information systems view of accounting.

Introduction

An accounting information systems (AIS) course typically attempts to impart a complex body of knowledge. The complexity arises from its multidisciplinary nature. Predominantly focused on accounting, a typical AIS course tries to integrate into accounting both the information systems perspective and the accounting applications of information technology.

From the viewpoint of content alone, the course has three dimensions: accounting, systems, and information technology. The third component may be minimized if the course is primarily taught in the context of a manual AIS. However, not many strictly manual accounting systems exist in today's environment. Consequently, all three components should be included and balanced against each other in the course.

Although the situation may vary across universities, students enrolled in an AIS course would most likely have acquired a moderate to high level of accounting knowledge. They should understand, for example, the nature of economic transactions, and how to identify, analyze, and record such transactions in the accounting records of an entity. However, their understanding of accounting as a profession or discipline may be narrow at this stage. This is because they may have a transactional rather than systems perspective of accounting. A transactional perspective limits the student's understanding to the content of the discipline, while a systems perspective imparts a holistic understanding of accounting. Although it may be a good beginning, the transactional perspective is narrow in its scope and the accounting students need to rise to a systems view of accounting.

Herein lies the problem in teaching an AIS course. The multi-disciplinary nature coupled with the students' lack of a common understanding in all three disciplines makes it difficult for the instructor to help students link these disciplines together. Because the students generally have a very narrow, non-systemic, understanding of financial accounting, they do not see the linkage between financial accounting and information systems. They feel, for example, that an AIS course should show them how information technology (using the computer) can make it easier for them to process transactions. A mindset here is that of viewing the information technology as a tool rather than the backbone of an AIS. The students generally do not have a basic comprehension of information systems to allow them to grasp the logical transition from a transactions-based understanding of accounting to a systems-based understanding of accounting. Any endeavor to teach this linkage in the AIS course is generally resisted by the students. In sum, the multidisciplinary nature of an AIS course combined with the generally low and varying levels of understanding of the disciplines involved provide a significant challenge in imparting a systems-based

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understanding of accounting. This dilemma can be addressed by using various approaches discussed in the next section.

Potential Approaches

One approach would be to provide an information systems orientation from the starting gate. Beginning with the first accounting principles course and throughout the accounting curriculum, a systems approach to accounting would be emphasized and recapped in a capstone AIS course. This would be an ideal solution, but it is constrained by the current faculty's understanding of information systems. The majority of current faculty would have to be trained in the systems approach. The gap of common understanding between AIS faculty and accounting faculty is wide and continues to widen. Consequently, this would be a long-term solution that may never come to fruition.

A second approach would be to require additional information technology classes. This becomes a resource issue. Not only would it take additional faculty it would also increase the graduation requirements unless another course(s) in the curriculum is sacrificed. This would be hard to sell in an already full curriculum.

A third approach would be to eliminate the AIS course and integrate the concepts throughout the accounting curriculum. This approach would face the same constraints as the first approach. Faculty would have to be retrained or courses would have to be team-taught, both of which would be resisted by some faculty. An additional argument often advanced by accounting faculty is that their courses are already very heavy in time commitment, with no room for additional information technology or information systems requirements.

A fourth approach would be to leverage the students' basic understanding of accounting to help learn accounting information systems. This approach would use the narrow but thorough understanding of transactions-based accounting to more easily learn the information systems and information technology disciplines necessary for a complete understanding of accounting information systems. The technique of concept mapping can be a potentially powerful lever to achieve this.

The use of concept maps is an ideal tool to aid in leveraging a student's prior knowledge to learn new concepts. Presumably, the knowledge of transactions-based accounting is generally at a higher level than that of systems or information technology. Under this condition, one might begin with what is familiar to the students and, based on similarities between AIS and IS, help students "see" the systems view of accounting. Thus, students' learning of AISs can be facilitated by relating the concepts learned in accounting to newer concepts in information systems and information technology. This approach, shown in Figure 1, is the focus of the rest of the paper.

The basic purpose of this paper is to illustrate the use of a concept mapping technique to integrate the first two of the three knowledge domains: accounting, information systems, and information technology. Concept mapping is a knowledge representation method that facilitates the linkage of related concepts within and across disciplines. The concept mapping method is discussed further in the next section.

Concept Mapping

A concept map is a knowledge representation tool. Novak (1998, p.21) defines concepts as perceived regularities in events or objects, or records of events or objects, designated by a label. For example, there are various shapes and kinds of things we call a chair, but once a child acquires the concept *chair*, that child will label correctly almost anything with a seat, back, and legs as a chair (Macnamara, 1982). The concept mapping methodology is developed using Ausubel's theory of meaningful learning, which suggests that meaningful learning is a process in which new information is related to an existing relevant aspect of an individual's knowledge structure. Novak explains it as follows:

Figure 1: An Overview of the Approach
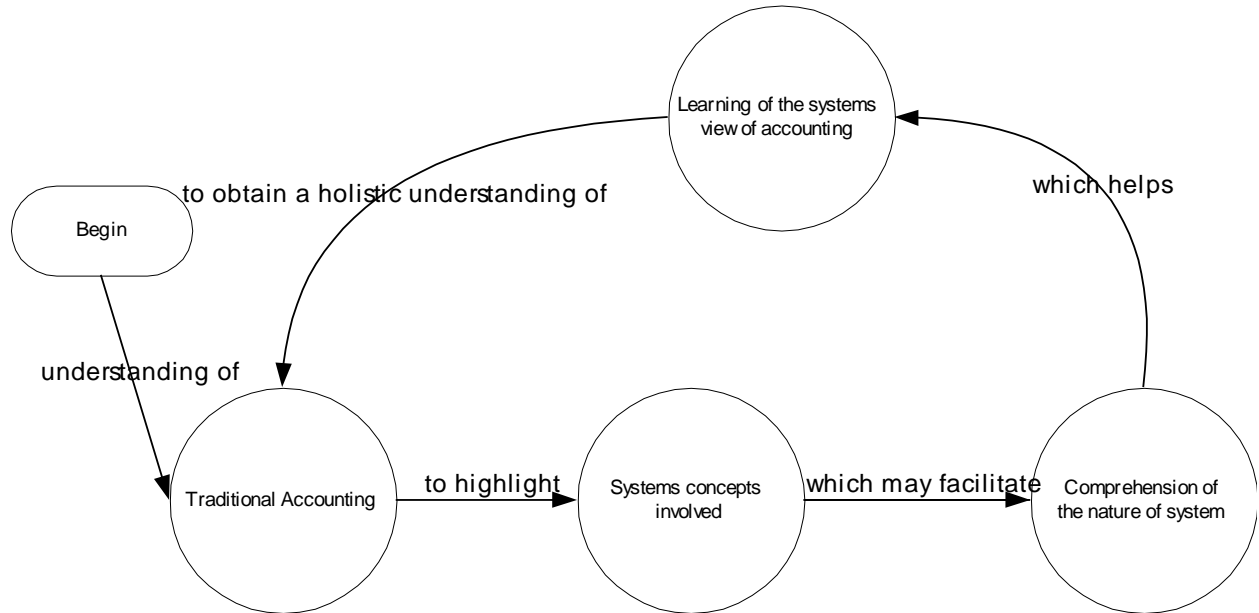
Although we do not know the biological mechanisms of memory, we do know that information is stored in regions of the brain and that many brain cells are involved in the storage of a knowledge unit. New learning results in further changes in brain cells, but some cells affected during meaningful learning are the same cells that already store information similar to the new information being acquired. With continued learning of new information relevant to information already stored, the nature and extent of neural associations also increase. . . . It is into our idiosyncratic knowledge frameworks that new knowledge must be assimilated. (Novak 1998, 51-52)

In the process of meaningful learning, new information is linked with existing concepts in the cognitive structure. The role of concept maps is to promote and enhance learning in an interactive manner. A concept map thus facilitates movement of relevant information through the perceptual barriers and provides a base for linkage between newly perceived information and previously acquired knowledge. Application of the concept maps in accounting education has been demonstrated (Leauby and Brazina 1998). Leauby and Brazina incorporated concept maps into their auditing class. One aspect of their study allowed students to use concept mapping to answer essay questions in lieu of the traditional narrative response.

It is clear that meaningful learning depends in part upon the adequacy of our prior knowledge. If we try to learn new knowledge in a domain (e.g., AIS) which does not appear to be related to the existing knowledge (e.g., financial accounting), the concept may be incomplete or poorly organized, making meaningful learning difficult, time consuming, and tiring.

Concept Mapping as an Educational Tool

The concept mapping methodology is 25 years old and has been extensively used as a research and evaluation tool in science education. Originally, it was intended as a means for exploring meaningful learning acquired through audio-tutorial instruction in elementary school science. Since that time it has been employed at all levels in diagnosis and testing, instructional design and curriculum development, assessment design (Suen *et al* 1997) and as a metacognitive aid in helping students learn-to-learn (Novak and Gowin 1984). Novak and Gowin suggest several educational applications of concept mapping. These include exploration of what the learners already

know, roadmapping a learning route, and extracting meaning from textbooks. Markham, Mintzes, and Jones (1994) conducted a study to determine the concurrent validity of concept mapping as research and evaluation tool in science education. They found that the concept map provides a theoretically powerful and psychometrically sound tool for assessing conceptual change in experimental and classroom settings.

Concept maps are intended to represent meaningful relationships between concepts in the form of propositions. Propositions are two or more concept labels linked by words in a semantic unit. In its simplest form, a concept map would be just two concepts connected by a linking word to form a proposition. For example, "accounting is a language" would represent a simple concept map forming a valid proposition about the concepts "accounting" and "language." Most concept meanings are learned through the composite of propositions in which the concept to be acquired is embedded. Although concrete empirical props may facilitate concept learning, the regularity represented by the concept label is given additional meaning through propositional segments that include the concept. Propositional segments such as, "a system has an environment," "a general journal is a transaction file," and "transactions are inputs," can help to increase the understanding of financial accounting as a system.

Concept maps help provide clarity to students, teachers, and textbook authors about the small number of key ideas that they must focus on for any specific learning task. A concept map can also provide a kind of visual road map showing some of the pathways that may be taken to connect meanings of concepts into propositions.

The process of developing concept maps is simple. For a selected topic, labels are first collected and compiled. These are then linked together in a somewhat hierarchic form. When these labels are connected they create relationships. Also, a label may be connected to one or more other labels, causing multiple branching of the concept in its propositional form. Horizontally, relationships may be joined using cross-links. Depending on the level of understanding and complexity of the concept, the map may have several levels of hierarchy. The process is largely heuristic and iterative in nature. Figure 2 demonstrates the basic elements of a concept map. The hierarchical, multiple, and cross-linking relationships are all depicted in this figure.
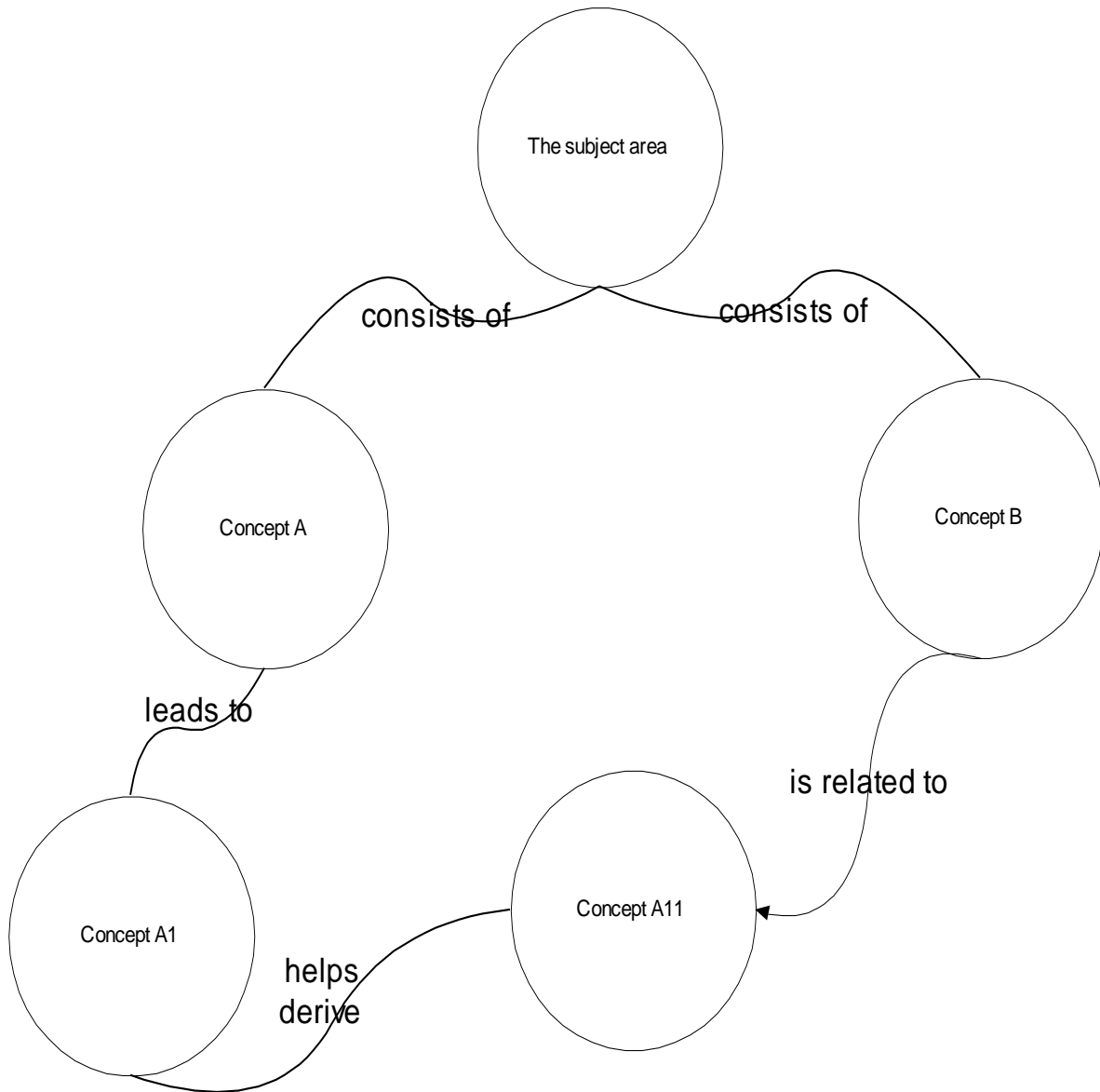
Integration of AIS Content Using Concept Maps

In developing the use of concept maps to integrate an AIS course content, the approach was to first identify concepts in accounting. These concepts were then matched with related concepts in information system and information technology. Initially, concepts were related at a higher level (see Figure 3). Figure 3 shows how the three concepts, accounting, information, and system are linked. Accounting generates information and is a type of system that is designed to produce information output. The label "system" is thus associated with accounting. Additionally, it is established that outputs of accounting are all some type of information.

This high level map was then used to delineate further the detailed concepts involved. The identification of concepts within concepts can proceed in two directions. One is to stay within the discipline (accounting, for example) and the other is to connect across disciplines (accounting and systems, for example). Figure 4 is a map that exclusively relates to accounting. As a link, it introduces the financial accounting cycle and labels it "a subsystem", an important concept in information systems.

The second direction is to link the concepts across the disciplines of accounting and information systems. Figure 5 shows a typical financial accounting cycle linked to corresponding concepts in information systems: inputs, file, processing (e.g., update), and output. Figure 6 extends the general ledger concept from Figure 5 and maps it into certain file organization concepts. Although these illustrative views are substantively accurate, they may not completely correspond with the views that a particular instructor may have about the subject matter. However, it is feasible to customize and further implode these concept maps to an individual instructor's views.

Figure 2: Structure of a Concept Map

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                    ┌──────────────┐
                    │              │
                    │ The subject  │
                    │     area     │
                    │              │
                    └──────────────┘
        consists of                    consists of

   ┌──────────┐                          ┌──────────┐
   │          │                          │          │
   │ Concept A│                          │ Concept B│
   │          │                          │          │
   └──────────┘                          └──────────┘

     leads to                             is related to

  ┌──────────┐        ┌──────────┐
  │          │        │          │
  │Concept A1│        │Concept A11│
  │          │        │          │
  └──────────┘        └──────────┘
       helps
       derive
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Benefits

The hierarchy of related concept maps used in this study provide a useful and an effective method for teaching AIS courses. Note that when students are asked to create concept maps, their pre- and post-learning maps of the new concepts to be acquired are very likely to be different. Maps evolve over the learning curve, and this process of adjustments is one of the vehicles to offer clarity in understanding concepts.

Learning by developing concept maps is an interactive process. Concept maps are developed, discussed and challenged as learning continues. Thus, concept maps can enhance the learning process. The clarity of

understanding prior concepts to learn new concepts is demonstrated with concept mapping. This is easily seen from the linkages between accounting concepts and information system concepts.

Figure 3: An Overview of Accounting Information Systems
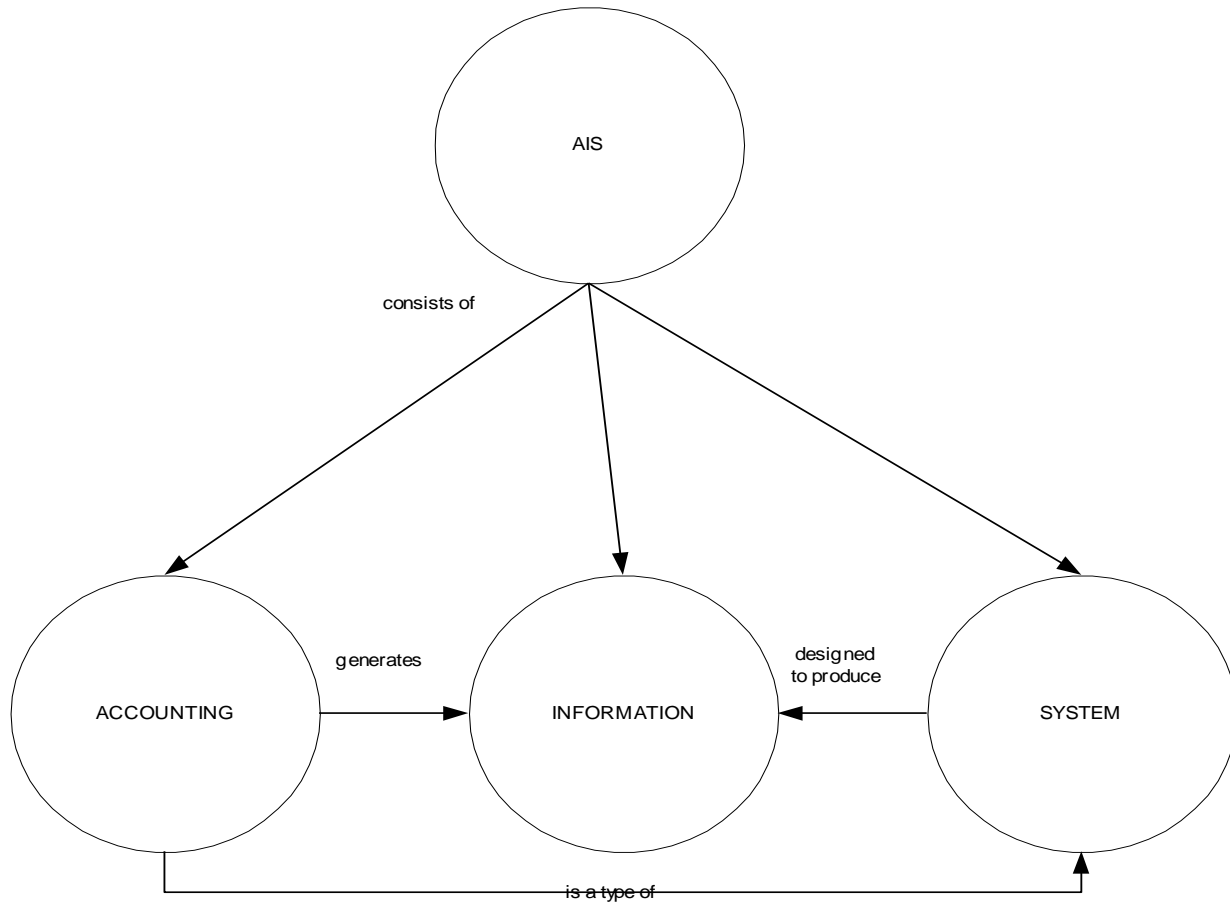
This particular method of navigating an AIS course offers a powerful advantage in that the students are now able to relate the AIS course to previously learned accounting concepts. Consequently, students are likely to perceive the course as relevant to an accounting major and therefore, are likely to benefit more from the course. Going from existing knowledge to new knowledge is meaningful and comforting, making it possible for students to comprehend accounting as a holistic discipline. In the process, the isolation of an AIS course from other accounting courses is also minimized in a planned manner.

Limitations

It is not suggested here that a hierarchy of concept maps is a substitute for other learning resources. Rather, it is a resource that complements other resources and at the same time, provides an effective path to help integrate concepts progressively throughout the term of the course. An exclusive use of concept maps does not seem to be appropriate; other resources, such as data base management systems (i.e., MS Access) and auditing software (i.e., ACL) may be necessary to reinforce the concepts to be learned and to apply the concepts in tutorials and cases. Where concept maps are used as a complementary learning resource, a whole set of concept maps delivered to the students at the beginning of an AIS course would add very limited value. Rather, the greatest potential benefit lies

in having students develop such maps as they learn new concepts and subsequently compare an instructor-supplied concept map with the student's version.

There are several other concerns in using concept maps in an AIS course. A full comprehension of a concept may require more than just the linking of two labels. Also, a concept learned in accounting may be muted somewhat, not enabling a clear link to the systems area. Moreover, when concepts are "drilled down" to several levels, the layers of maps created need to be articulated with each other. Consequently, just the magnitude of concepts and relationships among them could be overwhelming to students. Additionally, if the existing concepts from which you project newer concepts are weak in the mind of a student, the transfer of new concepts may also remain weak. For example, those students who do not understand the concept of a ledger would have difficulty grasping the concept of a master file (See figure 5). Also, certain information systems concepts may not have a comparable concept in the traditional accounting domain, thus limiting the extensions from accounting to the systems area. Finally, concept maps may not be very useful where information systems concepts are already well understood by accounting students. The linkage between accounting and information systems concepts may already be intuitive to such students. However, in such cases, the use of concept maps to confirm certain relationships could still be effective.

Conclusion

Concept mapping should prove useful in teaching multidisciplinary courses such as AIS. Similar and overlapping concepts can be quickly identified to build bridges for the transfer of knowledge from a known discipline to a relatively new discipline. The basic idea is to leverage what the students already understand well. This would increase the students' comfort level with new concepts to be learned and thus enhance the relevance and effectiveness of an AIS course. Although empirical evidence on the use of concept maps in an AIS course is not available at this time, based on studies in other disciplines, it appears that selective and careful use of concept maps in an AIS course would most likely enhance the understanding of AIS concepts. Likewise, concept maps may be useful in teaching accounting to those who are very familiar with only information systems.

Suggestions for Future Research

The development of a comprehensive set of concept maps and its use in an AIS course can provide considerable insights in the value of the approach proposed here. A controlled study can be designed where an experimental group of AIS students use concept maps and the control group of AIS students use traditional learning materials. A selective backward integration of concept maps into traditional accounting courses that precede an AIS course can also be attempted in a study where benefits and constraints in the use of concept maps in accounting are carefully measured and evaluated. Finally, groundbreaking insights can be obtained by reversing the direction, that is, by conducting a study in the use of concept maps to teach accounting to non-accountants (information managers, engineers) who thoroughly comprehend systems but are new to accounting. 📖

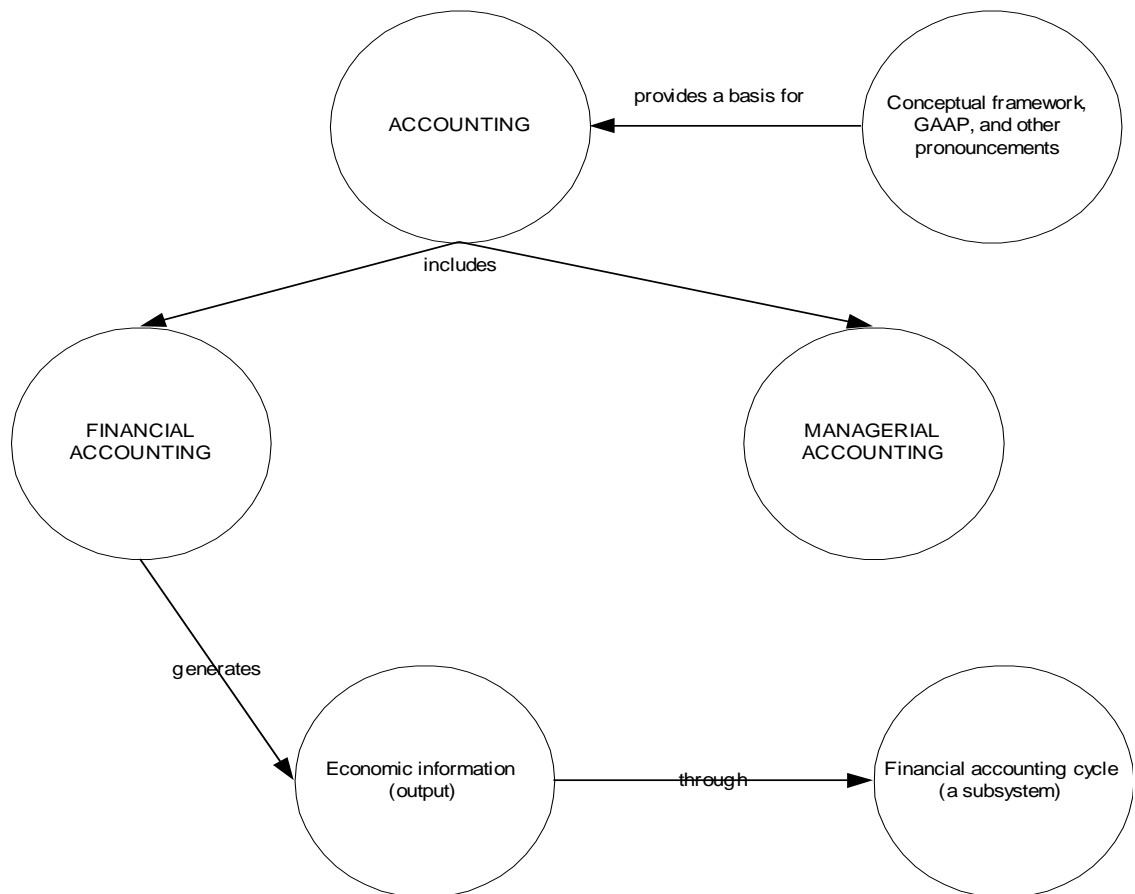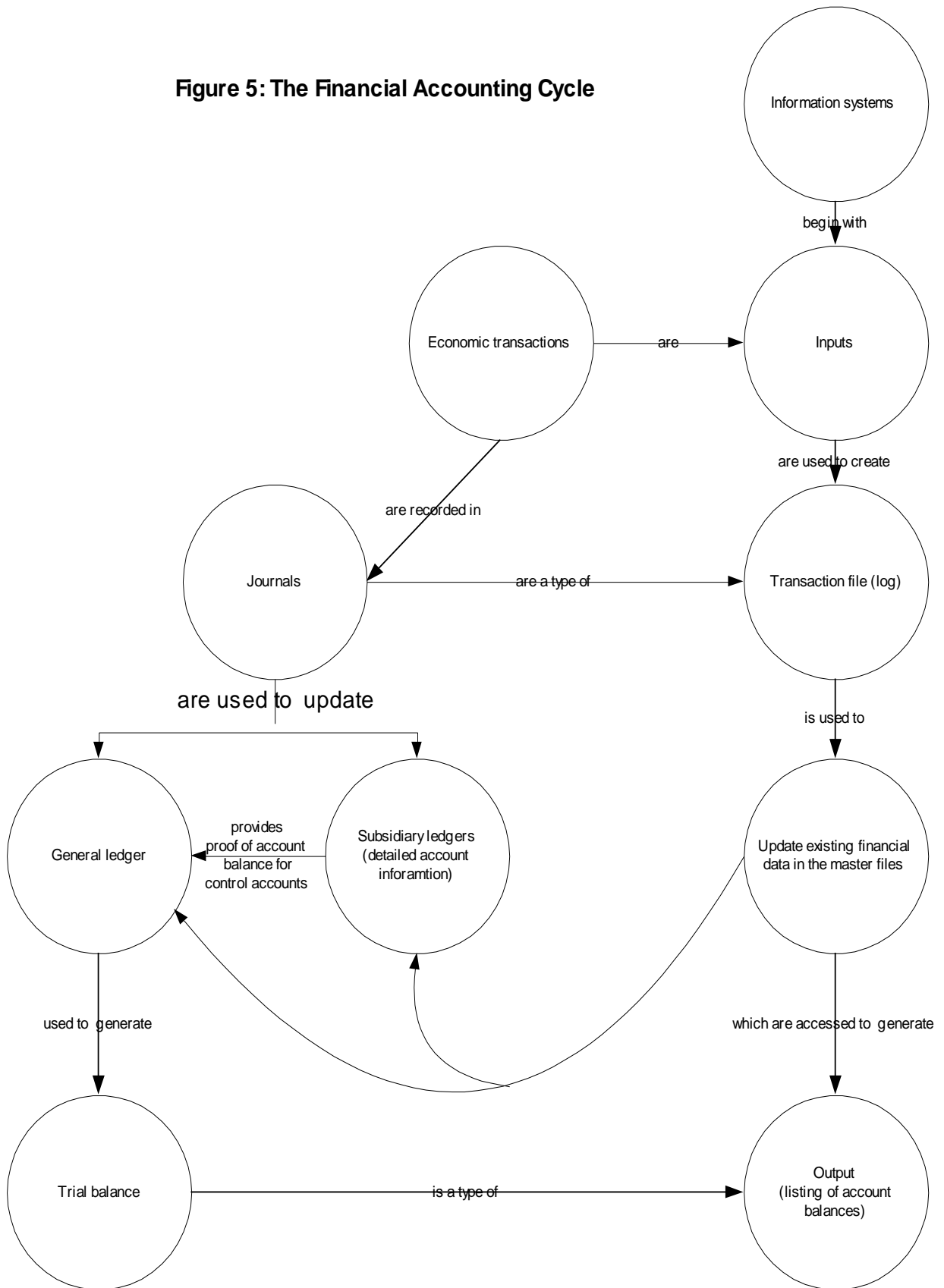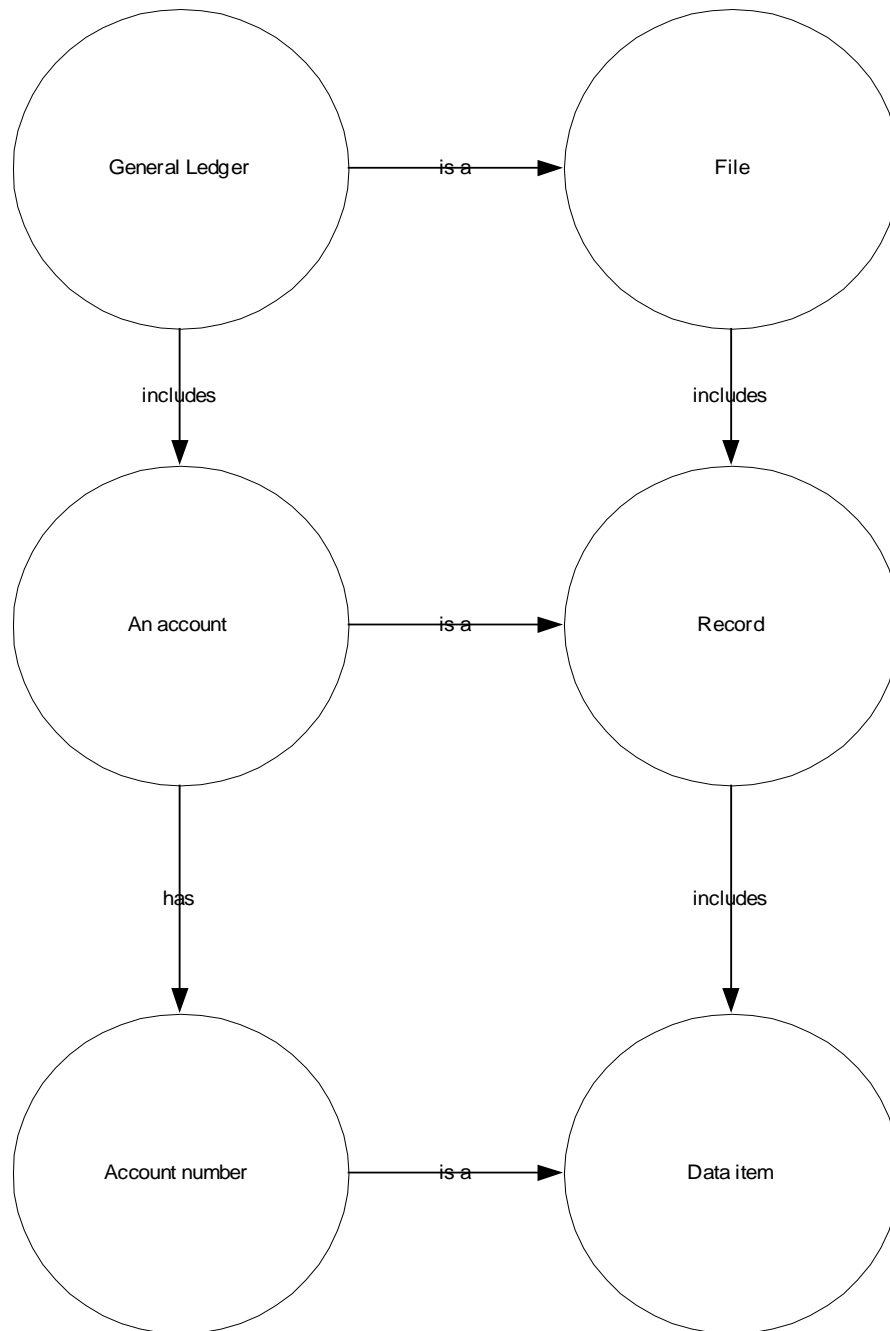**Figure 4: A Partial View of Accounting**

Figure 5: The Financial Accounting Cycle

Figure 6: General Ledger's View as a File

References

1. Leauby, B.A. and P. Brazina, "Concept Mapping: Potential Uses in Accounting Education," *Journal of Accounting Education,* Vol. 16, No. 1, pp. 123-138, 1998.
2. Macnamara, J.T. *Names for things: A study of human learning,* Cambridge, MA: MIT Press, 1982.
3. Markham, K.M., J.J.Mintzes, and M.G.Jones. The concept map as a research and evaluation tool: Further evidence of validity, *Journal of Research in Science Teaching*, Vol. 31, No. 1, pp. 91-101, 1994.
4. Novak, J.D. *Learning, Creating, and Using Knowledge: Concept Maps as Facilitative Tools in Schools and Corporations,* Mahwah, NJ: Lawrence Erlbaum Associates, 1998.
5. Novak J.D. and D.B. Gowin. *Learning How to Learn,* Cambridge: Cambridge University Press, 1984.
6. Suen, Hoi, B.Sonak, D.Zimmaro, and D.M.Roberts, "Concept map as scaffolding for authentic assessment," *Psychological Reports,* Vol. 81, p. 734.

Notes