
Year seven students, concept mapping and the issues of transfer

James E. Herring
Charles Sturt University, Australia

This paper focuses on the use of concept maps by year 7 students in three rural schools in New South Wales, Australia. The study examined the views of students, teachers and teacher librarians on the use of concept maps and the extent to which students would transfer concept mapping skills across time and across subjects. Grounded theory was used as the method for the study. Data was gathered via student diaries, questionnaires and interviews, and teacher and teacher librarian interviews. Data was analysed and interpreted using grounded theory techniques. Findings indicated that transfer was a complex issue for students and school staff

Introduction

The context of this paper is a wider study by the author of the use of information literacy skills by year seven students in three rural Australian schools. One class from year 7 was selected in each school, and a total of 75 students participated in the study, as well as three teacher librarians and nine teaching staff (See Appendix 1 for details of the schools). The paper also draws on previous research conducted by the author of year seven and eight students' use of concept maps in UK secondary schools. While the wider study examined students' views on and use of a range of information literacy skills, (e.g., students' definition of purpose, question formulation, information retrieval and evaluation, note taking and assignment writing), this paper focuses on students' views on their use of concept maps. The teachers and teacher librarian introduced concept maps to students before the students completed a history assignment in term three of the school year. Students were encouraged to draw up simple concept maps on paper, using a central circle for their topic and smaller, linked circles for subtopics. Students completed diaries and questionnaires, and were interviewed after they had developed and used their concept maps.

Areas of Exploration

The aims of the study were to examine the views of year seven students, teachers and teacher librarians on concept mapping, and to examine the views of these students on the extent to which they were likely to transfer concept mapping skills across subjects and across time. As this study used grounded theory methods, areas of exploration were identified, in place of research questions. These areas were:

- How students, teachers and teacher librarians viewed concept mapping as an information literacy skill
- To what extent students viewed concept mapping as a useful skill in relation to completing an assignment
- What the views of students, teachers and teacher librarians were on the transfer of concept mapping skills
- To what extent students viewed themselves as transferrers of concept mapping skills across subjects and across time

Literature Review

Information Literacy

In the field of teacher/school librarianship, the topic of information literacy has been one of the most debated areas in the literature in recent years. Much of the literature relating to information literacy is related to practice in schools. In recent years, there has been more in-depth research carried out on information literacy in schools, and this research has been reported by key authors such as Woolls and Loertscher (2002), Barranoik (2004), Kuhlthau (2004), Farmer (2005), Herring (2006), Todd (2007), Williams and Coles (2007) and Wolf (2007). Loertscher (2008) notes that despite the wide range of research and publications, a number of issues relating to information literacy remain unresolved. The authors cited above have critically evaluated a range of different definitions of both information literacy and other literacies, such as digital literacy; cognitive and affective aspects of information literacy; information literacy models which have been used in schools, either by teachers as the base for teaching information literacy, or by students as a form of scaffolding when completing assignments; teachers attitudes to and views on information literacy; and the implications of new technologies, particularly use of the web, for teaching information literacy. Information literacy remains a key focus for research in teacher/school librarianship, particularly in relation to teaching students who are developing their information literacy skills and practices in a reflective manner. This author defines information literacy as a critical and reflective ability to exploit the current information environment, and to adapt to new information environments; and as a practice. Students' use of concept maps and their ability to transfer the use of concept maps to new learning situations, including the ability to reflect on the potential benefits of using concepts maps in new situations, is the focus of this study.

Concept Mapping

Novak and Canas (2008, p.1) define concept mapping as "Concept maps are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts." The authors argue that concept maps are often structured hierarchically, and contain links between concepts which are often show in the form of arrows or lines linking different concepts or aspects of a topic. Novak and Canas (2008) identify the origins of concept mapping in educational psychology, and argue that concept mapping is related to a constructivist view of knowledge.

While some of the research into information literacy has included concept maps, few studies have focused on this topic in any depth. An examination of student views on concept maps was part of research by Herring, Tarter and Naylor (2002), Herring (2006), Herring and Hurst (2006) and Herring and Tarter (2007). These studies provided empirical evidence that students in both primary and secondary schools viewed concept mapping in a favorable light, and saw a number of benefits in using concept maps. These benefits included improved question formulation, keyword generation and information retrieval. Students also used concept maps to identify prior knowledge and gaps in existing knowledge. Concept maps were also seen as aiding students in evaluating the relevance of information retrieved, and could be used as the basis for students to write up their assignments. The issue of students transferring concept mapping skills was examined, but only briefly, in the Herring and Hurst (2006) study. Gordon (2000) found that, for some students, the use of concept maps improved the quality of searching, and made students more likely to take a more metacognitive approach to information retrieval.

In the wider field of education, Novak and Canas (2008) explained in a detailed study the theoretical basis of concept mapping and its use in schools. Novak is recognised as the first developer of concept mapping in education, with his work relating to students' knowledge in science. Novak and Canas (2008) also provided guides for teaching students how to use concepts maps effectively, i.e., in a way which would increase their learning, Vanides, Yin, Tomita, and Ruiz-Primo (2005) argued that, in the context of science teaching, "Concept maps provide a unique graphical view of how students organize, connect, and synthesize information," and the authors stated that concept maps helped students to explore connections between scientific terms, display their thinking about these terms visually, and reflect on the extent to which they understand the terms. Also in the field of science education, Roth and Roychoudhury (2006) explored how concept mapping helped students work collaboratively in developing their understanding of scientific concepts. Kinchin and Hay (2000) cited improvements in metacognition among students who used

concept maps effectively. Cain (2004) examined primary school students' use of concept maps in relation to improving student literacy and confidence, and concluded that concept mapping had the potential to improve both. None of these studies focused on whether students transferred what they learned about concept mapping.

In the context of information literacy, it can be seen that concept mapping has a dual role, firstly in expanding students' knowledge of the topic they are researching, and secondly in providing students with the basis for use of the concept map later in the assignment process, e.g., in developing sound search strategies.

Transfer

While there is much implied attention given to the concept of transfer in relation to information literacy, there is little coverage of this issue in the school related literature. In the wider education field, the transfer issue has been debated for over one hundred years. The focus of most educational literature is on the transfer of learning, and in particular, the transfer of learning content, i.e., do students transfer knowledge from one subject to another or from one year to another? While there is some focus on skills transfer in schools (Haskell, 2001), this research has related to the transfer of skills in subject such as mathematics and modern languages. There does not appear to have been any previous studies of information literacy skills transfer in schools. Detterman (1993), Haskell (2001), Royer, Mestre, and Dufresne (2005) and Hakel and Halpern (2005) discuss definitions, theories and types of transfer in educational settings. There is a range of views on transfer, with some authors such as Detterman (1993) arguing that transfer is unlikely to happen, while others such as Royer et al take a more positive view. Taking a wider and more sociocultural view than previous studies, Royer et al (2005) argue that transfer should be viewed not simply as the transfer of knowledge or skills from one learning situation to another, but should be assessed in relation to how knowledge or skill gained in one learning situation may influence another learning situation.

The present study also took a sociocultural approach, in that it considered the students' learning environment and the influences of their peers and their teachers and teacher librarians, when interpreting their views on transfer. Haskell (2001) argued that a key element in transfer in schools was the presence, or, more often the absence, of a culture of transfer. The present study views a culture of transfer as implying that both staff and students would have a commitment to discussing and reflecting on the transfer of concept mapping skills as an important element in developing information literacy in the school.

Methodology

The present study's theoretical perspective is a sociocultural one. Lloyd (2007) argued that a sociocultural perspective leads the researcher to study learners within their particular environment, and considers how social and cultural factors impact on the way learners construct knowledge. A constructivist grounded theory approach was taken to the study, and constructivist grounded analysis was used to analyze and interpret the data. Constructivist researchers (Philips, 1995 and Pidgeon & Henwood, 2004) view both knowledge and data collection and analysis as being constructed by individuals, and take the view that constructivist researchers seek to interpret their participants' constructions of reality. Grounded theory was introduced in the early work of Glaser and Strauss (1967), and was developed by Strauss and Corbin (1998). Constructivist grounded theory is a further development and its leading proponent is Charmaz (2006). The key elements of constructivist grounded theory are that the researcher is viewed as an interpreter of the observed world and that data, such as student diaries, is viewed as a construction of reality by participants in the study. In grounded theory, the researcher evaluates and interprets what emerges from the data. There is no preconceived hypothesis from which the researcher works, with a view to proving or disproving a hypothesis. Grounded theorists, Charmaz (2006) argued, seek to explain studied phenomena, but there is no attempt to generalise from their findings.

Critics of grounded theory, including Goldthorpe (2000), argue that modifications of categories and theoretical statements during the research process, and the lack of any testing of grounded theory by those developing the theory, may invalidate the theory developed. This

researcher would argue, in agreement with Charmaz (2006), that modifications enhance the strength of the theory developed, and that testing of theory can be a challenge for further research. Within this constructivist grounded theory approach, the techniques used to gather data were student diaries (Harada, 2002), student questionnaires, student interviews, and interviews with teachers and teacher librarians (Patton, 2002). Students completed structured diaries when they were researching for and writing a history assignment in term three of the school year. Students completed the questionnaires after they had researched for and written a term four assignment in English, Japanese or Science, depending on their school. Students were interviewed at the end of term four. Teachers and teacher librarians were interviewed at the start of term three.

Following grounded theory (Charmaz, 2006) methods, the author engaged in theoretical sampling and interviewed staff and students in term two of the following year. All interviews were recorded. Theoretical sampling (Charmaz, 2006 and Pidgeon & Henwood, 2004) involves the researcher in returning to the field of study and presenting the participants with the findings of the study, in the form of categories. The theoretical sampling interviews enabled the author to confirm the validity of the established categories. As noted above, the present study is part of a wider study of information literacy skills and transfer. The focus on concept mapping was part of the wider study, and formed a key element of data collection.

Grounded theory techniques were used to analyse and interpret the data, and these techniques included initial and focused coding, category formulation, and constant comparison (Charmaz, 2006). The coding and recoding of the data led to the formation of categories (e.g., students valuing concept mapping) and the categories are discussed in the following section. Appendix 2 provides a detailed explanation of the researcher's analysis of data. In the wider study, a grounded theory was developed relating to information literacy and transfer, and elements of that theory are presented in the Discussion section below. Table 1 below shows the participants in the study. In the Findings section to follow, the school staff and students are referred to by their school designation, e.g., the School A history teacher.

Table 1. Details of schools, staff participants, and students participants and activities

School	Staff Participants	Student Participants and Activities
School A	teacher librarian, history teacher (term 3), science teacher and English teacher (term 4)	25 students completed diaries and questionnaires. 12 students were interviewed
School B	teacher librarian, history teacher (term 3) Japanese teacher and guidance teacher (term 4)	25 students completed diaries and questionnaires. 12 students were interviewed
School C	teacher librarian, history teacher (term 3), and two English teachers (term 4)	25 students completed diaries and questionnaires. 12 students were interviewed

Findings

This section presents an analysis of the findings as follows:

- Student diaries and concept mapping
- Student questionnaires and concept mapping
- Staff interviews and concept mapping
- Student interviews and concept mapping

Student diaries and concept mapping

In term three, all students completed a concept map for their history assignment and were directed to do so by their teachers. In relation to the potential benefits to be gained from a concept map, students in all three schools cited the following:

1. The concept map as an aid to understanding the topic, e.g., "It will help judge who is the cruellest tyrant and it will give us better facts. It will give us more branches on our facts"
2. The concept map as an aid to question formulation, e.g., "It will help me to look at the questions I need for my assignment"

3. The concept map as a precursor to information retrieval, e.g., "Because it's got the things that I want to find out on the Internet or in books"
4. The concept map as a tool to refer back to at later stages of the assignment, e.g., "Well, you can look back on it and know where things are and what things are connected to"
5. The concept map as a note taking tool, e.g., "Because as soon as I get ideas I can write them down"

A small minority (7, or less than 10%) of students indicated that they did not think the concept map helped them, or they indicated that they did not know whether the concept map helped them. The great majority (61, or over 80%) of students did make positive comments about the benefits of a concept map, and the researcher noted that students might be seen to value concept mapping.

Student questionnaires and concept mapping

In term four, students were reminded about the concept maps they did in term three, but were not required to develop a concept map for their term four assignment. Students were firstly asked whether they developed a written concept map for their assignment in Term four and were also asked to explain, if they responded "no", why they had not done so. Only 25% of students stated that they had developed a concept map for their assignment. The students who did not develop a concept map gave a variety of reasons, although some students did not give a reason. The reasons included (in rank order of the number of responses):

1. No need to do a concept map e.g. "because I didn't need to" (20 students)
2. No time to do a concept map e.g. "no because I did not have time" (10 students)
3. Having a map in their head e.g. "because I had a mental map" (6 students)
4. Did not want to do a concept map e.g. "no – because I didn't want to. I just wanted to find it out in the book or internet" (4 students)

Students cited the aspect of not having time, but it was not clear what students meant as drawing up a concept map took very little time.

Students were then asked if they thought that they had a mental map (as some students had indicated this in their diaries). Over 65% (49) of students responded that they did have a mental map. Students who indicated that they did have a mental map were asked whether the mental map helped them with their assignment, and were given a list from which they could select one or more responses. Most students (53 or 70%) indicated that they thought a mental map would make their assignment easier to do, while 20% (15) thought that it would help them to find information better, help them with their assignment work later on, or help them make up questions for their assignment.

Students were then asked whether they thought that it would be a good idea to write out a concept map on paper when doing assignments in the future. Of the students who responded, most students (70% or 53) indicated that they did think it was a good idea, and 30% (23) of students responded negatively. Students were also asked to give a reason for thinking that it would or would not be a good idea. Positive responses were varied, and included helping with the assignment, producing ideas, helping you to remember what you've done, finding information, helping with question formulation, and preferring a written map to a mental map. Some interesting comments included: "It could help you make up questions to answer some of the questions that you made up," and "So you could make sure that's what you wanted to do." Students who did not think it would be a good idea to use a written concept map also had a range of responses, and these included preferring a mental map, e.g., "no – because I can do it in my head"; and fearing that it might be different from a mental map, e.g., "no – because it might be different from what's in my head."

Overall, this analysis showed that for most students, concept mapping – either on paper or mental – was of value, but there was no clear commitment on the part of most students to put into practice what they had learned about concept mapping while completing their term three assignment.

Staff Interviews and Concept Mapping

In the initial interviews with teachers and teacher librarians (one teacher librarian and three teachers from each school), staff members were asked about their views on students' use of concept maps. Some of the teachers stated that they assumed that students would know what a concept map was, and would have had previous experience of using a concept map. For example, the history teacher from School A stated that "You would expect them to have previous experience of concept maps but you'd be surprised how they react sometimes – even those who have used a concept map before – they don't always seem to remember what it might be for". Other teachers disagreed and argued that it could not be assumed that students had experience of concept maps. For example, the history teacher from School C stated: "A concept map was a new concept to them. The idea of planning was alien to them - most of them had the idea right from the start that they wanted to go headlong into the project". Teacher librarian B concurred with this view, stating:

But they all seem to be in a hurry – get the assignment done and get on to something else. So mind mapping and formulating questions? I'm sure a lot of them think that this will get in their way – so they don't think about it.

Japanese teacher from School B argued that, while most students may have had experience of concept maps, for some students "It's just far too an advanced skill for them because of the mental stage they are at, or the development stage they are at. It's a maturity thing". The reference to development was echoed by the science teacher from School A who stated: "You get a full range of maturity in the class and this shows up to a far greater degree in the girls, in that they tend to be a lot more [mature] but they also have better research skills."

The approach of the teacher librarians interviewed was clearly focused on teaching students how to define their information need, and how to find and use library resources. There was little evidence of students being introduced to aspects of information literacy skills such as concept mapping. The emphasis was very much on students' location and use of resources, particularly library resources. The teacher librarians tended to express less confidence in most year seven students being able or willing to use a concept map effectively, although they indicated that they thought that the more able students would use concept maps to good effect.

When teachers were asked about their views on whether year seven students were likely to transfer concept mapping skills, they were agreed that the majority students would not transfer these skills without prompting. Most teachers saw some students as being capable of transfer and identified these students as the most able. There was no agreement amongst the teachers on the reasons for lack of transfer. Some teachers argued that, for many year seven students, transfer was a difficult concept, while others argued that students took a very compartmentalized view of school subjects, and that this separation restricted transfer. The teacher librarians took a similar view to that of the teachers, that few students were likely to transfer concept mapping skills. The teacher librarians agreed with the teachers that students tended to view all information skills as discrete, and not to be transferred unless told to do so. Neither teachers nor teacher librarians had any empirical evidence to support their views.

In the theoretical sampling interviews, teachers and teacher librarians were interviewed as a group. They were firstly asked about whether students valued concept mapping skills. There was general agreement that most student valued concept mapping skills in principle and that some students would, without prompting, use these skills when planning assignments. One School B teacher stated "It's strange, you know, because my year seven enjoyed doing their concept maps and though they [concept maps] were a great idea. So they do value them." The English teacher from School A agreed that students valued concept mapping skills in theory, but identified what he saw was a major drawback to students, stating

When they did the planets assignment, they didn't have to do a mind map if they didn't want to and some students I could see were writing questions, which I thought was good and that would substitute for the mind map, *but* [teacher's emphasis] when I asked some of the rest of them about a mind map, they told me that it took too much time! I told them that it took no time at all, but they were clearly in such a rush to get it out of the way, that they rejected the idea. I think it's a cultural thing amongst some of them – everything has to be quick.

Other teachers and the teacher librarians agreed that students' concept of time and their "product orientation" (School C English teacher) made many students focus too much on completing the assignment in the shortest time possible. All staff agreed that there was a small

minority of students who did not value concept mapping skills, as these students lacked an understanding of the purpose of these skills, were not able to reflect on the use of these skills, and could not see the connection between concept mapping and, for example, information retrieval.

In relation to transfer, staff in all three schools had similar views to the initial interviews, i.e., that while a minority of the most able students would transfer concept mapping skills, and clearly benefit from doing so, most students would not transfer skills without prompting by the teacher or teacher librarian. In these theoretical sampling interviews, the staff in all three schools, with no prompting from the interviewer, discussed where responsibility for transfer lay. Staff members were equally split between those who saw the students as primarily responsible, and those who saw teachers and teacher librarians as primarily responsible. Those focusing on students agreed with the teacher librarian from School B who argued that "I think that we should expect that most students should be able to think about transferring skills like concept mapping and to apply these skills in different situations, without always being reminded." Those staff focusing on the teachers and teacher librarians argued that assumptions should not be made about students. The School B guidance teacher stated, "There's a problem with a lot of students taking the attitude that if we don't specifically tell them to do a concept map, then they don't have to do it. We can't assume otherwise."

Staff members were finally asked about whether the schools had a culture of transfer and it was universally agreed that these three schools did not have a culture of transfer. The School A history teacher, who was acting as deputy principal at the time, summed up the collective view, stating:

No. Categorically not! It's very hard to look at. It's something that the principal and I are trying so hard to look at, so that other members of staff could analyse each other's curriculum and find cross curriculum content, cross curriculum skills. To actually provide some meaningful projects for our kids, so that they can study timelines in history at the same time as they are studying timelines in mathematics. It doesn't happen. We all go our own way.

Some staff argued that there might be elements of a culture of transfer in small pockets in the schools, for example within individual departments, but there was general agreement that, while school staff were in favour of a culture of transfer, it did not exist in these schools. The opinions of the school staff interviewed for theoretical sampling confirmed the categories identified by the author, in relation to students' valuing or not valuing concept mapping skills, and the likelihood of students transferring these skills.

Student Interviews and Concept Mapping

At the end of term four, in each school, three groups of four students were interviewed. In these initial interviews, there was an enthusiastic response from most students about how they had used concept maps in terms three and four. Students appeared to see the benefits of concept mapping in a range of ways. One School B student reflected the general view that concept mapping was a useful base for information retrieval, stating that "Well, it [concept map] helps if you put a keyword down and you go to the library and you find it out in a book or in the internet and you just write it down". Several students commented on how they saw a concept map as being a checklist at different stages of an assignment, for example in ensuring that all aspects had been researched in books or on the web, or using the concept map as a guide to including or excluding aspects in the written assignment. Students provided a range of examples of approaches to concept mapping, demonstrating that almost all of the students who were interviewed reflected on their use of concept mapping. One articulate student explained that his concept map on the cruellest dictator included awarding marks out of ten for aspects of cruelty (e.g., to one's own family) and stated "I like to do things that way. I know it's my way – I don't know about other people. It displays your ideas and you have your information in one place and it organises it into categories".

In five of the school groups, there was one student who clearly did not understand the purpose of concept mapping, or the potential use of a concept map at later stages of the assignment process. These students were also rather inarticulate and tended to give responses such as "I'm not sure" or "I don't understand". Other students, perhaps sensing possible embarrassment for these students, always immediately took over the discussion.

In relation to transfer, most of the students interviewed stated that they had transferred concept mapping skills from term three to term four, but the students qualified their responses in different ways. Some students, such as one School C student, argued that they transferred concept mapping skills, but did this mentally, and did not have a written concept map. This student stated, "I remembered about the mind map [the term used by students] and I organized things in my head." There was debate in some of the groups as to whether this constituted transfer and a School A student argued, "Just thinking about your topic in your head isn't really a mind map. You have to write it down and use it well".

In the theoretical sampling interviews, students were asked if students valued concept mapping; if students made connections between concept maps and other aspects of doing an assignment; if students were engaged more by using concept maps; and if students were likely to transfer concept mapping skills. This section focuses on value and transfer in the theoretical sampling interviews.

When students were asked about valuing concept mapping, it was clear that most of the students interviewed saw clear value in concept mapping and they cited similar benefits as they had done in the initial interviews in relation to information retrieval and assignment structure. In the theoretical sampling interviews, students argued that concept mapping was also valuable in evaluating the relevance of ideas and information found in websites ("I go back to my mind map and check to see if what I've found is really what I want," said one School B student.); and in extending students' interest in the topic being studied ("Once you do it [concept map] you can get really interested in what you might find. It makes you want to *explore* [student emphasis]," provided a School A student).

One theme that emerged from the student groups, but was not prompted by the interviewer, was the absence of concept mapping by *other* students. Most students expressed that they would transfer concept mapping skills without teachers' having to tell them to do so. A School B student summed up this view stating, "I think it might be OK for teachers to remind people to do a mind map of some kind, but they don't need to tell us. Well, what I mean is they do have to tell some students, but not all of us." Other interviewed students agreed and there were unprompted discussions in the groups about why other students would not transfer. The reasons for lack of transfer included doing an assignment as quickly as possible ("It would better for them to be told by the teacher to have a mind map – to slow them down," said a School A student); lack of motivation ("Some people just aren't interested. They don't think about their topic, they just go straight to finding any information," shared a School C student); and a lack of understanding ("Look – some students just don't get it. A mind map just seems a strange thing to do" a School B student stated.)

When students were asked about how more students could be encouraged to transfer concept mapping skills, it was clear that most students saw this as the responsibility of the teachers and the teacher librarians. A student from School A reflected the general view, stating "Like they could draw a mind map on the board and say 'Remember you did this [mind mapping] in year seven in science' if they're doing science in year 8. But it doesn't happen. The teachers don't do it." Some students argued that teachers did emphasise the transfer of knowledge within subject, but ignored the transfer of skills. This point was articulated by a School B student who stated, "So if you could do revision on what we're talking about [concept mapping skills], just like we get revision after we've done certain things in maths – so you could get revision after we've done an assignment." The interviewer did not use the term 'culture of transfer' with the students, but all groups emphasised what they saw as a lack of interest in transfer amongst teachers and teacher librarians.

The theoretical sampling interviews confirmed the major categories that the author had established, i.e., students valuing concept mapping skills, and aspects of transfer. These categories formed the basis of the grounded theory developed in the larger study. Some aspects of that grounded theory are explored in the discussion section below.

Discussion

The author's analysis and interpretation of the data led to a focus on the following themes, which form the basis of this section:

- Students' and staff's views on valuing or not valuing concept mapping;
- Students' and staff's views on making connections from their concept maps;

- Students' and staff's views on transfer;
- Culture of transfer.

Students' and Staff's Views on Valuing or Not Valuing Concept Mapping

The concept of value can be expressed in different ways, and this author defines value in the present study as the realization of the benefits of concept mapping, but also the ability to reflect on these benefits. The students who valued concept mapping in a holistic manner were those students who did not view concept mapping simply as a set of skills. These students reflected on why they might use a concept map, how they might develop a concept map, how they might make good use of their concept map, and how concept mapping fitted their own learning style. These students also viewed concept mapping as a motivation to explore their chosen topic in greater detail. Other students – the majority of students as shown by the evidence above – took a more utilitarian view of concept mapping. These students valued concept mapping but more narrowly, and saw concept mapping more as a set of skills, rather than a reflective ability. While they could see some benefits of using a concept map, they tended not to take the wider view of how concept mapping might relate to their own learning style. A third group of students – a very small minority of students – did not value concept mapping, as they were unable to understand why a concept map might be used, and failed to foresee potential benefits.

The literature relating to concept mapping (Gordon, 2000; Vanides et al., 2005; Roth & Roychoudhury, 2006; Herring & Hurst, 2006; Herring & Tarter, 2007; Novak & Canas, 2008) covers a range of aspects of students' use of concept maps, but none of these studies focused on whether students value concept maps. One of the potential implications of the present study is that teachers and teacher librarians should teach students to value concept mapping before teaching them how to put concept mapping into practice.

Students' and staff's views on making connections from their concept maps

The evidence provided above demonstrates that school staff and many students viewed making connections between concept mapping and other information skills and techniques as important. The students who most valued concept mapping and who took a holistic view of their own learning and their approach to assignments engaged in critical thinking about making connections between concept maps and their other information literacy tasks. These students not only made connections between their concept maps and, for example, the way they structured their assignment, but also they also reflected on the benefits of making those connections. It is this critical thinking about connections that distinguishes this minority of students from other students.

The majority of students were able to make connections between concept mapping and information retrieval, but the data (especially the diaries and questionnaires) suggested that few students in this category identified further connections. This group of students did not engage in the critical thinking about concept mapping as some of their peers did. Both staff and students in the interviews suggested that this group lacked motivation or interest, or took a received practiced view of concept mapping. The third group of students failed to make connections between concept mapping and subsequent stages in the assignment process, as they did not understand the concept of making connections.

While the literature on concept mapping in relation to value contains some discussion of students making connections (e.g., Herring & Hurst, 2006; Novak & Canas, 2008) exists, it is not a strong focus in those studies. In the wider information literacy literature, there is focus on students' critical thinking about aspects of information literacy skills (Kuhlthau, 2004; Todd, 2007; Wolf, 2007), but there is little attention paid to students making connections; rather, these studies tend to assume that students will make connections. The results of the present study strongly suggest that teachers and teacher librarians should include the benefits of making connections when teaching students about concept mapping.

Student and Staff Views of Transfer

When considering aspects of the transfer of concept mapping skills, the author identified the same three groups of students as outlined above. The first group, who may be termed the reflective and practical transferrers, in that these students were able to reflect on the benefits of transferring concept mapping skills to new learning situations, as well as actually transferring the skills. The

second group may be termed theoretical or reluctant transferrers, in that these students – the majority in each school – were in favour of transferring concept mapping skills in principle, but were reluctant to do in practice, unless prompted by a teacher or teacher librarian. The reasons for this reluctance included lack of motivation to transfer and overreliance on school staff. The third and very small minority of students may be termed non-transferrers, as these students failed to understand the concept of transfer, and in practice, did not transfer concept mapping skills. There has been considerable attention paid to transfer in the educational literature (Royer et al., 2005). In the literature relating to information literacy in schools, some studies such as Kuhlthau (2004) and Wolf (2007) have implied or assumed that transfer might take place, but the only study focusing on the transfer of information literacy skills, including concept mapping, was Herring and Hurst (2006).

Conclusion

This study has provided empirical evidence from three schools about year seven students and concept mapping. Future research could investigate students in the upper levels of secondary school, and focus on the extent to which students continue to use concept mapping, as well as how students develop their own individual information literacy model. For teacher librarians, the potential implications of the study are that they could help to develop a culture of transfer of information literacy skills, including concept mapping, by focusing more on concept mapping as a key information literacy skill; raising the issue of the transfer of information literacy skills and abilities at whole school meetings; discussing with teachers ways of ensuring that students transfer concept mapping across the curriculum; and developing strategies for helping students who lack the willingness or ability to transfer information literacy skills and abilities.

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Author Note

Dr James Herring has taught at university level for over 30 years, first at the Robert Gordon University and then at Queen Margaret University College in Scotland, where he was the Head of the Department of Information Management. In 2004, James joined Charles Sturt University in Australia as a lecturer in teacher librarianship. James has been researching and writing about school libraries since the late 1970s. He is the author of nine books, as well as many articles and conference papers on information literacy, school libraries, and the Internet in schools. James' blog for teacher librarians can be found at <http://jherring.wordpress.com>.

Appendix 1 Schools involved in the study

School A is situated in a town of 4000 people and is the only secondary school in the area. It attracts students from the two primary schools in the town and from other primary schools in the surrounding countryside. The school has 280 students and 27 teachers, including the teacher librarian who has clerical assistance for two days per week. The students come from a mixed socioeconomic group in the town itself, and some students travel into the town from surrounding country areas. The teacher librarian teaches a programme of library-based information literacy skills lessons for year seven students and liaises with some teachers on student project work. The library is reasonably well stocked and has a small computer room

School B is situated in a town of 6,300 people and is the only secondary school in the town. There is a specialist secondary school in a nearby village. The school attracts students from a wide surrounding area as well as from two primary schools in the town. There are 500 students and 47 teaching staff, including the teacher librarian who has 1.5 FTE (full time equivalent) clerical and technical staff. The students come from a mixed socioeconomic group and some students travel into school from surrounding country areas. The teacher librarian hosts a series of library based lessons for year seven students and liaises with some staff on student projects. The library is reasonably well stocked and there is a group of 8 computers in the library.

School C is situated in a regional city with a population of 60,000 people and is one of three state high schools. In the city, there are also a number of fee-paying schools, some of which are religious based. School C has 615 students and 70 teaching staff, including the teacher librarian who has one full time clerical assistant. The school is situated in a socioeconomically disadvantaged area and has the highest number of aboriginal students in the city's schools. The library is reasonably well stocked and has a block of 12 computers. The teacher librarian does not teach any library-based lessons relating to information literacy skills.

Appendix 2 Data collection and analysis techniques for the larger study

