Students managing personal knowledge: By instinct or intervention?

By Joy McGregor

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In initial discussions about my topic for this SCIS Oration, it was suggested that I carry on what Ross Todd began in his SCIS Oration two years ago. He spoke to you about *knowledge management in smart schools* at that time (Todd 2001). He explored the challenges of knowledge-management initiatives in schools and presented research findings about knowledge-management processes and outcomes. He pointed out that the 'central role of the teacher librarian focuses on the creation of the school as an information-knowledge community, one that has knowledge construction, sharing and use at its heart'. Todd laid the groundwork for developing an understanding of the place of knowledge and knowledge management in a school community. Since I can't assume that all of you were there to hear Todd's presentation, I will review a few main points that lead me to my topic.

Todd points out that 'a *smart school* is an Information Age school where knowledge construction and knowledge use are the primary goals and the primary activity of the school. The creation of the school as an information-knowledge sharing community, one that has knowledge construction and knowledge use at its heart, is the central role of the teacher librarian' (2001, p. 3). He distinguishes between knowledge and information by considering knowledge as 'human knowing in all its forms … the stuff of the human mind' (p. 3) and information as 'the formally published representations of people's knowing, in some form' (p. 4). He suggests that formal publishing can describe a wide range of formality, and he would include not only book, website and newspaper types of publications but also less formal collections such as procedures manuals and teaching materials created as part of our work. He states that knowledge management brings together 'human knowing … and the documentary face of information … and finding structures and systems' that allow us to 'maximise the information-knowledge environment of the school for knowledge construction and knowledge use' (p. 4). He then proceeds to explain why we, as teacher librarians, would want to do this.

Discussions about what knowledge management is, and is not, are ongoing. Some would argue that any physical representation of people's knowing turns knowledge into information, whether formal or not, and therefore we can only manage the resulting information, not other people's knowledge itself. It's not my purpose today, however, to examine in detail these varying interpretations of ideas or endorse any particular one. But few would suggest that individuals cannot manage their own personal knowledge to some degree. This thought indicates the direction this oration will take.

I want to think laterally about the topic of knowledge management, away from the common focus usually associated with knowledge management. Knowledge management principles and initiatives are typically directed at adults, and in the case of the school learning community, at teachers, administrators, teacher librarians and other staff members. They deal with the knowledge held by these people and how it might be shared. Ross Todd places this knowledge solidly within a constructivist framework and a vision about learning for creating a shared understanding. Student learning is at the centre of that vision, with any knowledge management efforts supporting knowledge construction. He concludes with a recommended approach: 'establishing initiatives that facilitate the interaction of the human face of knowing and the documentary information world in dynamic and exciting ways to provide rich learning opportunities for students' (Todd 2001, p. 19).

I would like to focus on that group of inhabitants of this information-knowledge community. I want to consider the personal knowledge management of students with active construction of student knowledge as a goal. We often think of managing the knowledge held by adults to enrich student learning. Today we will think about managing knowledge at the other end of the continuum – that held by children. I'm referring to an amorphous concept, one that I will build from a brief exploration of a range of fields. We will be thinking more about *managing knowledge* than about *knowledge management* in the traditional sense. We will touch on knowledge management, outcome measurement, thinking processes, learning objectives

and inquiry learning. I want to make connections among these topics, because making connections for learning is something I am passionate about. I hope it all comes together, and I expect that it will come together in different ways for each of you, since as a constructivist, I know that you will construct your own meaning from what I say, based on what you already know and have experienced. The connections and assertions I make might be quite contestable, but if you contest them, at least you will have thought about them. In the end, if you think about children and the way in which they develop and manage their personal knowledge, I have achieved my goal.

Ironically, knowledge is a word that has caused great misunderstanding when different groups have used that word in communication with each other. The word means different things to different people. I had first-hand experience with this when I was a newly minted PhD, giving my first presentation about my research to a very academic audience. In my research, I used Bloom's taxonomy (the one developed in 1956) as one of my theoretical models. Any of you familiar with this taxonomy know that it described *knowledge* as the basic skill level, and defined it as *recall*. Everything else was built on this basic skill: *comprehension, application, analysis, synthesis* and *evaluation*. Three-year-old children reciting the alphabet or counting to 10 were exhibiting *knowledge* because they could recall a sequence of sounds, but that did not mean they had any understanding or comprehension of what those letters or numbers signified. In my presentation to this audience of academics, I described what I had found in terms of these six levels of Bloom's taxonomy, defining the levels only briefly. When I opened the floor to questions, one of the first was from someone who challenged that definition of knowledge. He was coming from a different but common conceptual background in the field of information science where the hierarchy is *data–information–knowledge–wisdom*. In this case, one collects *data,* which in itself has no meaning, but after collection, provides the analyst with *information*. Again, the *information* is meaningless without context, analysis and interpretation, at which point one comes to *knowledge*. Synthesising that *knowledge*, along with other bodies of knowledge, leads the user to *wisdom*. This hierarchy appears to have developed originally from a poem by TS Eliot called *The Rock*, which says:

> Where is the life we have lost in living?
>
> Where is the wisdom we have lost in knowledge?
>
> Where is the knowledge we have lost in information?

Harland Cleveland, in 1982, defined the hierarchy and ascribed the concept to TS Eliot, adding *data* to the beginning of the previously unidentified hierarchy. Clearly knowledge represents a much higher level of development in this model than in Bloom's taxonomy.

I was aware of that hierarchy but, as an educator, was much more familiar with Bloom's taxonomy so I was not quite prepared for the intensity of the argument that developed from that question and my answer to it. Carol Kuhlthau approached me afterwards and suggested that this is a common problem – when the worlds of education and information science intersect – and that it was in my best interests to acknowledge from the outset that there are different definitions of knowledge.

Interestingly, in recent years, Bloom's taxonomy has been revised by a group of people who have impeccable credentials to be able to do so. One of them is David Krathwohl, who partnered with Benjamin Bloom on the development of book two of the *Taxonomy of Educational Objectives* in 1964, which dealt with the affective domain. Book one, the one we are most familiar with, dealt with the cognitive domain. The authors of the current revision, Lorin Anderson and David Krathwohl (2001), make the point that the original taxonomy was always meant to be revised as further data was collected regarding educational objectives. A major element of this revision is the change in how the word knowledge is used. The original taxonomy was one dimensional, but the new one has two dimensions, the knowledge dimension (or what learners know) and the cognitive-process dimension (or how they think) (Anderson & Krathwohl 2001, p. 38). These two dimensions work together to provide teachers with the material for writing objectives, which describe intended outcomes. The cognitive process is the verb and the knowledge is the object of that verb. The cognitive-process dimension contains the pieces with which we have always identified Bloom's taxonomy, with some changes in terms.

My point is not to discuss the entire revision here, but to point out that the word knowledge has been removed entirely as the first level of the cognitive-process dimension and made into a dimension of its own (Anderson & Krathwohl 2001). The new basic level of the cognitive-process dimension is called *remember.* The authors recognised that the word knowledge has a broader meaning in the outside world than the original taxonomy ascribed to it, and that even teachers use *knowledge* to refer to a greater depth of understanding than simply *recall*. Therefore, they have used the word to describe four different kinds of content of a discipline: *factual knowledge, conceptual knowledge, procedural knowledge* and *metacognitive knowledge*. These four types of knowledge reflect a continuum from concrete to abstract, in which factual knowledge tends to be highly concrete, metacognitive knowledge highly abstract, and conceptual and procedural knowledge ranging in level of

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Joy McGregor

Joy McGregor is a senior lecturer at Charles Sturt University. She is course coordinator for the Master of Education (Teacher Librarianship) and the Graduate Certificate in Applied Science (Information Literacy) courses and the director of the Centre for Studies in Teacher Librarianship. Formerly a teacher and teacher librarian in Canada and a teacher librarianship educator in the United States, Joy's research deals with student thinking and information use. She holds a doctorate from Florida State University and a Master of Education in teacher librarianship from the University of Alberta, Canada. She can be reached at <jmcgregor@csu.edu.au>.

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abstraction and sometimes overlapping somewhat. The more abstract the type of knowledge, the more likelihood the learner will be using higher levels of cognitive processing. And one can think about these kinds of knowledge at many different cognitive levels.

Where does this expanded view of knowledge take us, in terms of students managing their own knowledge? First of all, by using the knowledge dimension I have just described in conjunction with the cognitive-process dimension, teachers can develop objectives to develop cognitive processes and enable students to gain the skills for managing their own knowledge.

If we look at the four types of knowledge and think about the ways in which resource-based learning might facilitate development, we can see that we have done a good job with the factual knowledge. Factual knowledge subtypes are *knowledge of terminology* and *knowledge of specific details and elements*. We teach children to find information, especially facts. We provide resources in many formats that provide the facts that learners turn into their own knowledge through the process of constructing understandin – think of the reference collections and services that help children locate and understand unfamiliar terminology or find needed or interesting facts.

Our information resources provide the material for development of a great deal of conceptual knowledge too. The subtypes of conceptual knowledge are *knowledge of classifications and categories*, *knowledge of principles and generalizations*, and *knowledge of theories, models and structures*. Many resources will direct the learner to these three subtypes of conceptual knowledge. Indeed, the classification system used in the library is foundational to all the information contained therein, organising it into categories based on subject. Within the subject areas, we see examples such as the biology book that provides taxonomies of living things. The history resources will give access to various principles and generalisations. Mathematics information leads the learner to algebraic theories, probability models and geometric structures.

What about procedural knowledge? We can find some of that in our resources too, as in the information in the various subject areas that guides the user in the skills needed to perform certain tasks, such as carrying out science experiments, painting with water colours, speaking a language or playing soccer. The techniques of the scientific method of writing novels can also be located in the resources. Entire volumes provide criteria on when and how to apply particular procedures such as environmentally sound gardening practices or first aid techniques. As teacher librarians, we also help students develop procedural knowledge by teaching them about the research process and aid them developing information literacy skills that allow them to effectively use the process. We connect the curriculum, the resources and the process, and we help children to help themselves in satisfying their own curiosity, and becoming expert researchers and information finders and users. We develop lifelong learners if we are doing a good job at this.

But how do we do at the most abstract level, the level of metacognitive knowledge? This is a type of knowledge that was unrecognised by the original Bloom's taxonomy (1956), but one that stems from the recent research that shows how important to learning is a knowledge about how we think, and how we can control our own cognition. It comes from the constructivist models of learning that emphasise the importance of reflection.

Most of the examples we have looked at related to the first three types of knowledge have nothing to do with self-managing knowledge, except potentially some of the procedural types. And even that tends to focus more on managing information than managing knowledge. But when we move into the area of metacognition, we find a place in which we, as teacher librarians, can actually help our students to manage their own knowledge, by giving them the tools to do it with. The subtypes of metacognitive knowledge, according to the revision of Bloom's taxonomy, are *strategic knowledge*, *knowledge about cognitive tasks* and *self-knowledge*. Here is where students become aware of their own thinking. They are able to understand strategies for thinking, learning and problem solving. They learn to judge the complexity of the thinking required, whether they are required to memorise, summarise or solve a problem. They know their own strengths and weaknesses in terms of their own thinking and learning.

This kind of awareness makes it possible for students to actually manage their own knowledge. They are armed with the strategies for thinking about ideas, the ability to determine how they must learn the ideas if they are to become part of their own knowledge system, and the way in which they can solve related problems or use the ideas in problem solving. They are able to incorporate new knowledge into their existing mental models in a conscious way.

Students need certain skills in order to manage their own knowledge. They also need tools for turning those skills into strategies. We will return to the concept of metacognition and consider some tools in a few minutes, but I'd like to jump back into the knowledge-management world first with a look at knowledge management skills as described by Ross Todd and Gray Southon in an *Australian Library Journal* article and relate them to students self-managing their knowledge.

In a research study of library and information professionals, Todd and Southon (2001) identified skills believed to be necessary for effective knowledge management. The skills were grouped into people skills, cognitive skills, management skills, organisation and business skills, information processing skills and information technology skills. A quick perusal of that list tells us that many of these skills are skills we should be developing in our students to use in managing their personal knowledge. Let's look a little more closely and see how well the subdivisions are or could be incorporated into the curriculum.

In the area of people skills (Todd and Southon 2001), we see that many of the subdivisions are characteristics that we attempt to promote by using teaching techniques such as collaborative learning or the *I-Search* process. An effectively designed and implemented collaborative learning process – and I'm not talking about students simply working in groups, but about a process in which each group member is responsible for the learning of other group members as well as their own – will incorporate teamwork and networking, co-operation with others and the opportunity to develop trust in others. At the same time, it will require perseverance and motivation, and it commonly involves conflict resolution and negotiation. Opportunities for building alliances within the group will

be present, and advocating for the needs of the individual within the group and perhaps the outcomes of the group's collaboration will be an essential skill. An I-Search process (Macrorie 1988; Joyce & Tallman 1997), which is typically an individual endeavour, will also promote perseverance and motivation, and will develop the interviewing skills mentioned by the participants in Todd and Southon's study. Practising, developing and applying these skills will enable group members and individuals to manage the knowledge they construct within these projects.

When we examine the area of cognitive skills (Todd and Southon 2001), we see a perfect match with what should be going on in the classroom at all times. The resources we provide are useless if students are not developing and applying thinking skills, analytical skills, synthesis, judgment and evaluation to the information they discover. By applying those skills they incorporate that information into their own knowledge systems or mental models, and they construct new personal knowledge. Defining the scope of the information needed, communicating what has been learned, and presenting the newly constructed knowledge is all part of the information process and provides further support for managing personal knowledge.

As we move on to management skills (Todd & Southon 2001), we see that the terms used tend to define these skills in a very adult manner. But for the most part, they are also skills students are learning through the information process and through effective resource-based learning experiences. Various elements of information literacy probe these areas too, and strengthen their ability to construct, and then manage, personal knowledge.

The fourth group of skills identified in Todd and Southon's research is organisation and business skills (2001). While it might be difficult to match some of these as easily with skills students are developing, we can see that in some areas, information literacy education will develop a mind that can see the bigger picture or imagine the future.

The above four types of skills (people, cognitive, management, and organisation and business) were those most heavily emphasised by the library and information professionals in the Todd and Southon study. Also mentioned, though, were information processing skills and information technology skills, both of which are promoted heavily by the teacher librarian when information literacy is incorporated into the curriculum. I suggest that these skills might have more importance to personal information management by students or adults than they did to adult professionals in the workplace, some of whom may or may not work intensively with technology. You can see, by examining Todd and Southon's list of information processing skills – packaging information, recording information, methods of storage and retrieval, organising information, distributing information, content management, cataloging and classifying – that much of this is part of information literacy. And the same applies to the information technology skills of database design, information systems, web publishing, Internet publishing, use of groupware software and computer software skills (Todd & Southon 2001), which students may learn as such, to different degrees, at different age levels. These skills seem to encompass various things that information consumers and the information producers do, both roles being important in effective construction and management of personal knowledge.

It is fine for us to link these knowledge management skills to students managing their personal knowledge, but even if they develop the skills, how do we know they will turn them into strategies for management. How will we know that they have successfully managed their personal knowledge? Without some way to gauge the gains they make, we will know nothing about how successfully they are constructing and then managing their knowledge. Assessing the results of knowledge management in the business world is very difficult, since it is hard to relate specific causes to outcomes. It is no easier in the world of education. Another factor in assessment is that we are often seduced into thinking that we are evaluating our practice or student success when we assess outputs. But if we don't assess *outcomes* we don't really know if any differences have resulted.

We hear a lot about evidence-based practice these days – a concept that comes from the world of medicine and that has been widely adopted in many other fields including education. What we mean is that we base our practice on sound principles established by gathering evidence that what we have done has made a difference. In the world of teacher librarianship, we have come to realise that unless we can show the decision makers that a teacher librarian makes a difference to student learning, they may decide that we are irrelevant. Immense research efforts are now going into proving that we do, indeed, make a difference. To show that, we need to examine outcomes.

Sometimes outputs and outcomes are confused. What is the difference between them? A non-profit charity organisation in the United States has developed a model for measuring program outcomes (United Way of America 1996). Their model has been adopted widely by other kinds of organisations, including libraries, and it demonstrates the difference between outputs and outcomes. The model states very simply that inputs are used to develop activities, which lead to outputs, which result in outcomes for participants. Inputs are defined in this model as 'resources dedicated to or consumed by the program'. These might be financial, material or human resources. Activities are 'what the program does with the inputs to fulfil its mission'. We can easily identify many activities in the school library that result from the use of the resources described under inputs. Outputs are 'the direct products of program activities'. In libraries, these are often considered to be evidence that something worthwhile is going on. These include circulation statistics, counts of collaborative lessons planned and taught, number of classes in the library in a given period of time, number of teachers involved in collaboration, number of books read, number of minutes spent reading. But do they give us any information about whether anything has made a difference? No. Unless we link those outputs to what they achieve, we won't know what gains have been made. We need to determine the outcomes, which are 'the benefits for participants during and after the program activities'. What have our clients gained from these inputs, activities and outputs? What learning has occurred? And what difference does it make to the learners?

The topic of assessment and evaluation is large enough to fill several hours, so I don't plan to go into detail here. I will not go into how to assess outcomes, other than to say that self-reporting is a common way of determining what outcomes have been achieved. Asking participants what the results have been, although not an entirely reliable way of assessing

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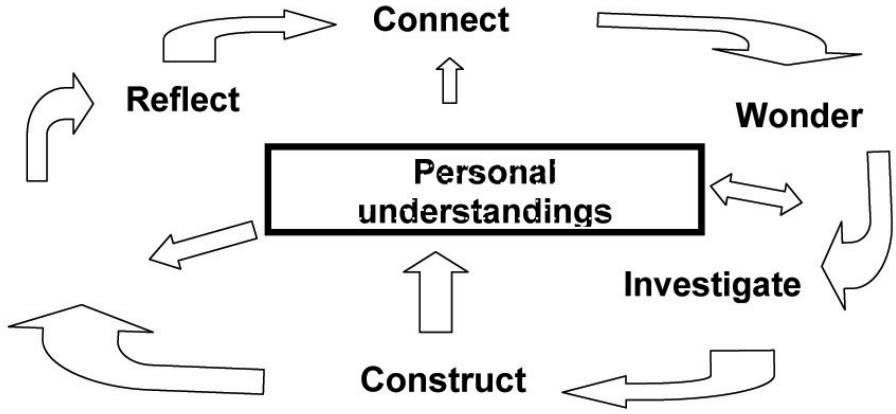
outcomes, is probably the most accessible way to find out what difference a program or an activity has made to students and to gather the stories that can give a personal punch to statistical evidence. Students might find self-reporting difficult at first, but will become better at reflecting on what is happening as they practice these metacognitive acts. I primarily want to touch on what we might consider assessing in terms of personal knowledge management. As we think about outcomes, I'd like to suggest that we should pay attention to the small-scale, intermediate outcomes as well as final ones. We should be evaluating processes as they are carried out, not only the final product at the end. The outcomes of personal knowledge management can be examined at many points along the journey, and the skills that are demonstrated in one activity might be the outcomes from previous activities.

As we think about processes, it is time now to reintroduce the concept of metacognition, which is the most abstract type of knowledge identified in the revised Bloom's taxonomy (Anderson & Krathwohl 2001). My title questions whether student personal knowledge management occurs by intuition or intervention. Research that I have conducted on student information use shows that as students take in information, they are typically not aware of thinking processes that might convert this to knowledge (McGregor 1994). The students I studied tended to respond as if their thinking was intuitive. It just happened as if by magic, and there was no conscious effort on their part to control it or manage it. Most of them were blissfully unaware that they were doing any kind of thinking. When you think about it, though, is that any surprise? How often are any of us aware of our own thinking or of how we learn or manage our knowledge? Unless students are taught skills that enable them to develop metacognitive habits of mind, they will continue to be at the mercy of their intuition, or lack of it. Without intervention in the form of someone making them aware of their own thinking and of how they learn and construct knowledge, personal knowledge management will be limited and random.

A metacognitive approach to learning tasks is developed through processes that stimulate thinking and inquiry. Metacognition is not something you teach as a subject, just as teaching other thinking skills in isolation makes transfer difficult. An inquiry approach to learning can provide opportunity for purposeful and conscious analysis of thinking throughout the stages of satisfying a need to know. Inquiry is a journey, a quest. And inquiry is more than a process – it is an attitude. We see it in small children as curiosity. As children get older, they seem to lose that inherent curiosity, probably because the adults around them cannot answer the question *why* unceasingly, and the children do not have the tools to satisfy their own curiosity. Attitudes don't develop unless processes become habits. Students who are encouraged to inquire and to follow up on their inquiries will practise behaviours that will in turn become habits of mind. They will develop skills to use in constructing and managing knowledge. Inquiry-based learning is open-ended – students' questions can carry them in many directions on their learning journey. They begin with a question and use resources of many kinds to pursue an understanding and construct new knowledge. Teachers and teacher librarians can support their inquiry and construction and management of knowledge by providing opportunities that support inquiry and by supporting them in developing the tools they will need as the need emerges.

The inquiry process is demonstrated in a framework described by Barbara Stripling (2003, p. 7) (see figure 1). A central feature are the *personal understandings* that students are continually developing. These are the understandings that will become new and modified knowledge in the process of constructing knowledge. Many experiences in the lives of students, both personal and educational, build basic understandings or mental models.



Source: Stripling B 2003, 'Inquiry-based Learning', in Curriculum Connections through the Library, *eds B Stripling and S Hughes-Hassell, Libraries Unlimited, p. 7. Reproduced with permission of Greenwood Publishing Group, Westport, CT.*

Figure 1: Inquiry framework.

The first step in the inquiry process (Stripling 2003) is to *connect* with the knowledge you already have and to build background knowledge. We can help students build background knowledge by giving them the opportunity to experience and observe the fascinating things that exist in their world. Part of this background experience comes through stimulating activities, but part of it also comes through exposure to stories and facts and ideas in books. Students need to recognise the prior knowledge they do have in order to be able to consciously build on it. They will need help in recognising where prior knowledge might actually connect with new ideas. Here is a place where the teacher and the teacher librarian can trigger that prior knowledge by stimulating broad thinking about ideas related to the questions they are asking. Students might not have the background to know that connections do exist. For example, a child who is curious about why their new puppy wants to chew on the legs of furniture may not realise that the situation is similar to her baby brother who is currently

teething and wants to gnaw on anything he can get into his mouth. When students begin to *wonder*, the teacher and teacher librarian can help them connect with their prior knowledge or help them build some related background knowledge. I experienced a perfect example of this on Thursday, after I registered for this conference. I had an experience that I assumed was solitary, but I have since found out that there are a lot of you who have struggled with this same problem. I received my registration package and my name tag. I examined the conference handbook and learned that the passport, found in the name tag package, was essential for admission into the events I had registered for. I thought I'd check to see what I was entitled to attend, which meant getting at the passport – not an easy task for me and for others that I've talked to! I looked this chunk of plastic over and over, and nowhere could I find a way to get at that passport. I thought about all the name tags I have had had in the past, and knew that, based on prior knowledge, there should be an opening somewhere in that section of the container. No luck. I handed it to my husband, who solves most problems easily, and he too became convinced it was sealed permanently. We were on our way back to the room for a knife to cut it open, when we decided that it could not possibly be necessary to do that, so we headed for the registration desk to ask for help. On the way we encountered a teacher librarian – quite a predictable event, considering where we were! I told this teacher librarian my problem and she showed us how to get at the passport (after laughing at me, I might add). Then she tried to link the solution to my prior knowledge in a completely different area. If she had had her inquiry hat on, this next part would have come first, instead of demonstrating what to do. She compared this plastic unit to a kangaroo. 'Think of a kangaroo with a pouch,' she said. I did not mention to her that I had never heard of a kangaroo that had a pouch front and back, but we won't go into that. Suffice it to say that her comparison to something I knew at least a little about was designed to link my prior knowledge with my current question.

Once students have connected with prior knowledge related to their questions, they can then formulate some questions that probe the gaps in their knowledge and they can predict what the answers might be. They should be thinking, 'I wonder if or whether such and such might happen if I do this or that'. The wondering leads to *investigating* the possibilities and also leads to some changes in personal understandings. If I had heard the kangaroo comment before I knew the solution to my problem, I might have investigated the possibilities further, since I could now be assured that I probably would not have to cut the thing open! Joeys normally get out of pouches without having to be cut out of them! As students investigate the questions about which they wonder, further questions and investigation might occur and new personal understandings might continue to be *constructed*. The ideas might be expressed to others to share the learning that has occurred and the ideas might be applied to new situations or contexts. This leads to *reflecting* on what has been learned and how the new knowledge applies. I would suggest that it also leads to the need to manage that new knowledge in such a way that it can continue to be useful. Reflection will make that happen, by bringing up new *connections* and new questions.

Stripling (2003) points out that the framework should be viewed as a spiral since 'each inquiry experience should lead to new understandings and new questions and, therefore, to new inquiry'.

Is inquiry the same thing as resource-based learning? Teacher librarians have touted the importance of resource-based learning for many years and have emphasised the need for students to have access to multiple resources that will enable them to see different viewpoints and wrestle with contradictions. I suggest that, too often, resource-based learning has deteriorated into using a number of sources to write reports that simply regurgitate what they find in multiple resources, often highly plagiarised. Perhaps what we have really intended has been inquiry-based learning but we have not stopped to think about the differences. We need to be conscious of the special characteristics of this kind of resource-based learning that differentiates it from the all-too-common research paper. You know the one I mean – it does nothing to stimulate interest and probably little more to encourage construction of knowledge. We might even want to consider promoting a term that includes inquiry, rather than the broader resource-based learning. We need to use a term that shows how what we do is at the core of learning and the curriculum. I can't decide whether I prefer resource-based inquiry, inquiry-based learning or simply inquiry. But that is another discussion for another time. What tools do students need to be able to carry out inquiry? What skills are important in moving through the phases of inquiry and incorporating new knowledge into the existing mental models they hold? What tools will enable them to manage that knowledge? I move back now to the revised Bloom's taxonomy and offer to you the cognitive-process dimension as a structure for considering these questions. A quick overview of how the revised taxonomy compares with the original and how it links to the knowledge dimension follows.

There are still six categories of cognitive processes, as in the original. Emphasis is placed on the variety of processes within each category in this version, 19 of them in all. You will recall that I said earlier that in the revision of Bloom's taxonomy, the first category was changed from *knowledge* to *remember*. You will notice in that change that the part of speech has changed too. The categories and processes within the categories are now verbs instead of nouns in order to make it easier to state objectives in which the process becomes the action to be carried out. Students at this level are remembering relevant knowledge. That knowledge can be of any type, from factual to metacognitive, or a combination of types.

The next category in the hierarchy is *understand*. Here, students will construct meaning from various kinds of communication. It goes beyond remembering or recalling and includes the construction of something meaningful – making sense of new knowledge. Only knowledge that makes sense can be managed or incorporated into a personal knowledge system. Again, the knowledge could be factual, conceptual, procedural or metacognitive. The many processes that are part of *understanding* include interpreting, exemplifying, classifying, summarising, conferring and explaining. These elements of understanding are considered the first steps in providing students with the ability to transfer knowledge. They are also integral to the development of conceptual knowledge in particular. We see the importance here of managing personal knowledge in order to be able to give it enough meaning to be able to use it in a variety of appropriate places.

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The third category is *apply*, which represents only a change in the part of speech used to name this category, compared with the former title of *application*. Here, students can carry out or use a procedure in a given situation. The situation might be familiar or unfamiliar, represented by the two processes listed here.

The fourth category of cognitive processes is *analyse*. Students learn to break down ideas into component parts and see how they relate to each other and to an overall structure. In this category, some of the processes require students to recognise patterns. *Analysing* should be considered as an extension of *understanding* and as the initial steps required in the later categories of *evaluating* and *creating*.

The fifth category is *evaluate*, in which the learner makes judgments based on some criteria. The criteria might be imposed or they might be developed by the learner. These criteria are what separate this category from the judgments that are made throughout most of the cognitive processes. This category was considered the highest level in the original hierarchy but has been moved to the fifth level in this revision. While this decision was not reached easily by those involved with the revision, the empirical data they collected seemed to support the idea that the sixth category of *create* was the most complex of the categories and therefore should be listed last, since the cognitive-process dimension roughly represents a hierarchy of complexity.

Albert Einstein said: 'It is the supreme art of the teacher to awaken joy in creative expression and knowledge.' He recognised the connection between complex thinking and knowing. *Create* is what we used to call *synthesis*. This is where the students put elements together to create a new whole. The new whole will be original in some way, whether it is through the development of an entirely unique product or the synthesis of ideas into a new structure or organisation. *Creating* involves generating problems and hypothesising possible solutions, planning for solving the problem, and producing or constructing the new whole.

These cognitive processes (remember, understand, analyse, apply, evaluate and create), in combination with the various types of knowledge (factual, conceptual, procedural and metacognitive), provide the tools of inquiry. They also provide the tools that allow students to construct new knowledge from the information they are exposed to and then manage that knowledge in whatever way that may be appropriate to the individual. Students who are practising these cognitive processes, and know they are doing so, are developing their metacognitive abilities and, therefore, the tools to monitor and improve their own thinking. Students will learn to use the tools when they practise them in curriculum-based inquiry projects. It is important that they learn them and practise them in the context in which they are needed, not as isolated independent concepts, disconnected from the real world.

In the end, we cannot manage the knowledge of our students for them. We can only equip them to do that for themselves. And teacher librarians must work with teachers to make this happen. We need to promote conversations with teachers about the ideas and principles I have shared with you today. And these conversations need to be based on a language that everyone understands. Teacher librarians: do your teachers know what you are talking about when you use terms like information literacy or resource-based learning? Teachers: do you use other terms to refer to similar concepts? In June, I attended a session by Ellin Oliver Keene at a conference in Toronto. She is a teacher and she was addressing a large group of teacher librarians. She was talking about deep comprehension and how students develop it across the curriculum. I began to realise that she was talking about information literacy in many ways but she was not aware of that fact. It made me realise how important it is for people on both sides to really listen to what is being said, and perhaps less to the terms being used. This applies to students too. Conversations with them about their thinking will help them recognise that they are thinking and that it might not be a totally intuitive process. Helping them recognise cognitive processes will enable them to manage their knowledge purposefully, instead of it happening incidentally and without awareness. And perhaps, through managing their own knowledge effectively, they will come to wisdom. William Cowper (1785) wrote these words in his poem *The Task*:

> Knowledge, a rude unprofitable mass,
>
> The mere materials with which wisdom builds,
>
> Till smoothed and squared and fitted to its place,
>
> Does but encumber whom it seems to enrich.
>
> Knowledge is proud that he has learned so much;
>
> Wisdom is humble that he knows no more.

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