

## Chapter 2

# Metacognitive Knowledge in Theory

Some decades ago, the behavioristic view in educational psychology research on human learning was joined by a cognitive view. As a result, learning was no longer merely perceived as the conditioning of behavior, but also as information processing. More importantly, this change in perspective led to an understanding of how mental processes, such as memorizing, operate. Learning, considered from an information-process perspective, led to, among other things, an interest in meaningful learning and the construction of knowledge. In other words, learning became synonymous with the understanding and application of subject matter through declarative knowledge (i.e., knowing facts, concepts, and principles), procedural knowledge (e.g., knowing how to perform subtraction, multiplication, and division regarding mathematics), and conditional knowledge (e.g., applying the correct tense in sentences).

In addition, learning how to learn came into the picture in that it was questioned how students could become independent learners. That is, how could students become in charge of constructing cognitive knowledge by advancing their learning of their own accord. This seemed an essential question, particularly since the focus in schools at that time was on a clear apprehension of subject matter and hardly on learning how to learn.

In this chapter, a theoretical overview is presented of the descriptions of metacognitive knowledge in educational psychology to infer what general knowledge of the learning process encompasses theoretically. Whenever possible, the focus will be on learning, i.e., how students are learning to learn and how they develop learner expertise. In the final paragraph of this chapter, the main elements of metacognitive knowledge are translated to the context of learning and presented as a theoretical account of what general knowledge of the learning process can encompass.

## 2.1 Metacognitive Knowledge and Learning to Learn

The first researcher who gave a thorough description of metacognitive knowledge was John Hurley Flavell (1979). From the beginning, Flavell's research interests focused on developmental psychology and, in particular, on children's thinking about their own thinking processes.

### **Children's Thinking About Thinking Processes**

From 1963 to 1965, at the beginning of his research career, Flavell traveled from New York to Paris to study children's development of memory skills. One of his research questions was concerned with whether children were aware of the support that rehearsing provides for memorizing. For example, his study (Flavell, Beach, & Chinsky, 1966) on children's memory skills showed that older children were more aware of how to make the best of their memory skills than younger children were. In this study, the experimenter provided children of three ages (i.e., kindergarten, second grade, and fifth grade) with seven familiar pictures and pointed to three pictures in a specific order. Next, the experimenter replaced the pictures in a new arrangement and asked the children to point to the three pictures in the same order as the experimenter had earlier.

The results showed that the older children performed better than the younger ones due to silently rehearsing the names of the pictures as the experimenter pointed them out. In this way, they could keep the pictures and their order in short-term memory. The kindergarten children's recall was poor because they did not know that rehearsing could help them to memorize the pictures and their order.

Flavell's studies of children's thinking about their thinking processes were greatly influenced by the work of Jean Piaget, who has been of great significance to developmental psychology. It also required a new word to indicate that thinking about thinking is ranked at a higher level than thinking itself. For example, on the basis of the work of Piaget, Flavell (1977, p. 107) described children's development of formal operations as "...[children's] formal operations constitute a kind of 'meta-thinking', i.e., thinking about thinking itself rather than about objects of thinking. Children certainly are not wholly incapable of this and other forms of 'metacognition.'" In the years to come, Flavell would study metacognition mainly as children's metamemory or their understanding of the working of their own memory.

**Questions About the Working of One's Own Memory**

Whenever someone is questioning the working of his or her memory, then he or she is asking himself of herself questions such as

- Do I ever forget anything?;
- When do I remember something?;
- When do I not remember something?;
- Am I better in memorizing things compared to others?;
- When is it easy to remember something?;
- When is it difficult to remember something?;
- Is recognizing easier than recalling or not?

However, questions like these are particularly difficult for young children. For example, 30 % of the 5-year olds studied by Flavell said in reply to the first above-mentioned question that they remembered everything, suggesting that they do not know their memory abilities very well.

Flavell's studies were above all focused on the already mentioned development of metamemory in children and on children's theories of mind. Children's theories of mind can be defined as children being able to impute mental states to themselves and others. An example of children's theories of mind (Flavell, 2000, p. 15) is "A developmental psychologist shows a 5-year-old a cookies box with a picture of cookies on it and asks her what is in it. 'Cookies,' is the ready answer. The child then looks inside the box and to her surprise sees that it actually contains crayons, not cookies. 'What would another child who had not yet opened the box think was in it?,' the experimenter now asks. 'Cookies!,' says the child, amused at the trick. The experimenter then tries the same procedure with a 3-year-old. The answer to the first question is the expected 'cookies,' but the response to the second is unexpected: 'crayons.' Even more surprising, the child also maintains that he himself had initially thought that the box would contain crayons. Unlike the 5-year-old, the 3-year-old shows no evidence of understanding that either he or other people could hold a belief that is false."

In a nutshell, Flavell studied children's knowledge about their mental world with regard to perceptions, beliefs, intentions, thoughts, feelings, knowledge, and attention. Research showed that children's understanding of these mental states develops during primary education. In this school period, children come to realize that perceptual information has to be adequately present to engender knowledge and that other persons are also continually experiencing mental activities that represent thinking.

Importantly, in 1979 Flavell published what is known to be as the first detailed description of the concept of metacognition. He described metacognitive knowledge as knowledge and beliefs about what factors act and interact in what ways to affect

the course and outcome of cognitive enterprises. Some examples of metacognitive knowledge are believing that one can learn most things better by listening than by reading (i.e., personal factor), knowing that some cognitive enterprises are more demanding and difficult than others (i.e., task factor), and knowing that a good way to learn is by focusing on the main points and trying to repeat them in one's own words (i.e., strategy factor). Flavell emphasized the importance of metacognitive knowledge for selecting, evaluating, revising, and abandoning cognitive tasks, goals, and strategies in relation to one's personal abilities and interests and with respect to being effective in achieving the intended learning performances.

Flavell was also the first who mentioned the concept of a metacognitive knowledge base. He defined a metacognitive knowledge base as one's stored knowledge of the world that can influence the course of an intellectual enterprise. By assuming that metacognitive knowledge is stored in a mental base, it is possible not only to understand it, but also to add to it, to delete from it, and to revise it. In this respect, Flavell argued that metacognitive experiences might also be stored in one's metacognitive knowledge base. For example, students preparing for a school test may experience that studying and memorizing are taking up quite some time. When they store this experience in their metacognitive knowledge base, perhaps with some information about the context such as the kind of learning task, then this experience may help them in recognizing similar school-test situations. That is, they now have knowledge of a school-test situation which can inform them that they will have to reckon with extra preparation time.

To summarize, Flavell considered metacognitive knowledge to be crucial for students. He meant by this that students who can learn of their own accord, would be students who are capable of thinking through their general knowledge of the learning process. Such students have the ability to think through their learning in advance in terms of which study and memorization techniques are likely to be most effective for them to learn a particular learning task.

Someone else who has been of great significance to the understanding of metacognitive knowledge was Ann Leslie Brown (1987). Brown was an educational psychologist, who was interested in how students can become better learners. Although Brown's research studies included an extensive range of subjects, one of the subjects that she examined frequently was children's learning through text comprehension. Brown studied children's learning from texts via the training of study techniques such as summarizing, questioning, and clarifying. Her reaction to Binet, who wrote in 1909 that the habits of work, effort, attention, reasoning, and self-criticism would lead to the pleasures of intellectual self-confidence, phrases her research interests most profoundly: "... he was a little vague about how we might do this. No actual training descriptions survived" (Brown, 1994, p. 9). During her research career, Brown set herself to increase our understanding of how training in learning could be improved.

Brown contributed to the theory of metacognition by providing it with clear-cut accounts. For example, her article *Metacognition, Executive Control, Self-Regulation, and Other More Mysterious Mechanisms* (1987) is an explicit attempt to see the woods for the trees regarding metacognition. At that time, the newly discovered concept

of metacognition had led to a diversity in ideas, beliefs, definitions, critics, and theories, which Brown attempted to arrange through elementary scientific evidence. Particularly, she included Kluwe's (1982) distinction between metacognitive knowledge, in terms of a person thinking through his or her stored factual knowledge of cognitive processes to direct learning, and the executive processes, in terms of a person regulating cognitive processes to manage learning activities. This has also been referred to as the distinction between thinking through in advance of what needs to be done and, accordingly, act on how it needs to be done by ensuring the best possible course of actions.

Brown defined metacognitive knowledge as knowledge of one's own cognitive processes. She described metacognitive knowledge in the context of learning as the kind of information learners possess about themselves and about the learning context. For example, knowledge learners possess about themselves includes personal characteristics such as a tendency to begin with learning too late, the ability to memorize rather quickly (e.g., compared to others), and being hindered when facing a school test by feelings of stress. Moreover, the knowledge learners possess about the learning context includes knowledge about learning tasks and study and memorization techniques. Furthermore, Brown pointed out that metacognitive knowledge is usually assumed to be late developing because of the mental demands that come with having to consider one's cognitive processes.

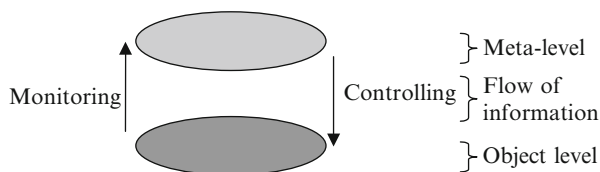
The theories of both Flavell and Brown indicated that metacognitive knowledge consists of an awareness and an understanding that can help learners to learn effectively. Learners are considered to have an understanding of metacognitive knowledge when they can respond to their own questions about learning, such as, what do I need to do to understand the material profoundly and to memorize the material sufficiently? Accordingly, Brown specifically pointed out that this kind of thinking through of effective learning can also support students in the managing and monitoring of their learning activities.

### **Managing Reading Comprehension: Monitoring for the Intended Effect**

To monitor one's progress when reading a text for comprehension and study purposes, one can ask oneself questions to evaluate

- one's understanding;
- if the obtained information is memorable;
- if one can now proceed to the next step in reading.

A further clarification of the distinction between cognition and metacognition was made by Nelson (1996), who differentiated between object level and meta-level. At the object level, students are concerned with external objects such as reading a text, performing a mathematical equation, and recalling facts. That is, at the object level students are concerned with products such as knowledge of facts, procedures, and conditions. At a meta-level, students are concerned with the *processes*



**Fig. 2.1** Illustration of the relationship between object level and meta-level (Nelson, 1996)

related to constructing this declarative, procedural, and conditional knowledge. Therefore, at a meta-level students make use of thoughts (i.e., the light-gray oval) to decide on useful study and memorization techniques (i.e., setting up a learning plan by using their metacognitive knowledge) and, next, to decide on the use of the executive processes to manage their learning activities. For the execution of the learning process, students need to draw up a course of action (i.e., an action plan) to enable progress, use monitoring to evaluate the learning activities, and use controlling to adjust, if necessary, the present state of the learning activities in line with the intended state. That is, the executive processes of action planning, monitoring, and controlling are essential to regulate one's cognitive processes (see Fig. 2.1).

Although the distinction made between object level and meta-level further clarified the differences between cognition and metacognition, it also led to new issues. In particular, the trustworthiness of metacognitive statements was questioned, which were called by some “introspective observations.” That is, for researchers, the newly defined concept of metacognitive knowledge evoked questions, such as, do students need to understand their metacognitive knowledge to express it and are students' metacognitive reports trustworthy? Furthermore, researchers tried to find ways to examine in what way students can be expected to differ in their metacognitive knowledge.

## 2.2 Expert Learners

An answer to the question of which individual differences may occur in students' metacognitive knowledge can be found in Schraw and Moshman's (1995) well-considered theoretical account of metacognitive theories. They described metacognitive theories as systematized frameworks of mind that can consolidate metacognitive knowledge. It follows that metacognitive theories can be characterized as mental explanatory systems of metacognitive knowledge in that they contain explicit and systematized constructions. Of course, such explicit and systematized constructions can change and develop whenever new learning opportunities arise.

Schraw and Moshman made a distinction between tacit, informal, and formal metacognitive theories. For example, tacit metacognitive theories consist of metacognitive knowledge that someone cannot make explicit. This means that one's general knowledge of the learning process appears to be unavailable in that it cannot be expressed. When students appear to be unable to express their metacognitive knowledge, it can be expected that these students do not yet have an understanding of this knowledge. What does the notion of *not yet having an understanding of* imply? Not yet having an

understanding of metacognitive knowledge implies that one knows that there is something that one vaguely remembers, that one seems to have experienced, though without being sure what it is exactly. In other words, one senses that some metacognitive knowledge appears to exist though one does not seem to be able to point it out specifically.

Tacit metacognitive knowledge can raise feelings of knowing. Feelings of knowing should not be confused with feeling-of-knowing judgments. Feeling-of-knowing judgments are predictions of subsequent memory performances. An example of a research study examining children's feeling-of-knowing judgments was conducted by Flavell, Freidrichs, and Hoyt (1970). They presented to preschoolers and fourth graders sequences of pictures of familiar objects and asked them to predict how many of the pictures they could recall in their correct serial order. Next, the children were asked to recall the sequence of pictures. When these two kinds of data were compared, it turned out that the children could predict their recall rather accurately, though the preschoolers tended to overestimate their ability to recall. That is, the fourth graders' feeling-of-knowing judgments were rather accurate.

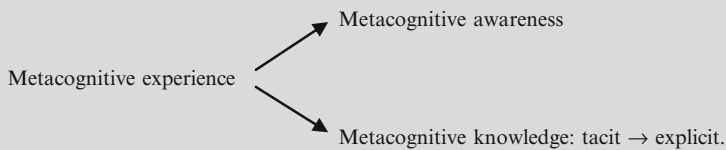
The concept of feelings of knowing appears to provide for similarities with the concept of implicit memory. Implicit memory means that stored knowledge cannot be recalled though it can influence one's behavior. One could say that information and experiences that have not received our fullest attention, in terms of adding meaning to it and organizing it, could end up as implicit memories that are at the background of our accessible memories. For example, when listening to English songs, one may not be specifically focused on the English language, though when writing an essay, the suggested meaning or connotation of certain words heard in the English songs may be taken into account. In the same vein, tacit metacognitive knowledge can play a role in learning though without it being recognized as such. However, the experience of having heard and understood the connotation of certain words in an English song, can be memorable. Flavell (1979) described these metacognitive experiences as experiences that encapsulate a lot of thinking possibilities. For example, most of us have probably encountered metacognitive experiences such as noticing that one has adequately memorized information, noticing that one was hindered in understanding essential subject matter, and sensing that the learning went well or not so well.

This raises the question of whether metacognitive experiences can lead at all times to understood metacognitive knowledge. In fact, it may not. For example, when someone has learned well, though without reconsidering what was essential for being able to learn so well, then this metacognitive experience seems to resolve into an impression or tacit metacognitive knowledge that may not be useable to direct learning. In other words, someone can have stored metacognitive experiences without understanding the full potential of these experiences for directing his or her learning. That is, the metacognitive experiences are there, though they cannot always be used to support someone in learning effectively. On the other hand, metacognitive experiences are the trigger to develop metacognitive knowledge. That is, the metacognitive experiences can evoke someone to think through and reconsider his or her learning. For example, someone might realize that learning went well because of a flowchart that was devised to study the chapters of a study book. When this realization leads to the thinking through of the use of the flowchart for studying other study books, then an understanding of general knowledge of the learning process is being developed.

### Metacognitive Experiences

White (1999) explored students' descriptions of their metacognitive experiences. These students were all studying via distant learning. The metacognitive experiences White collected appeared to be highly memorable. According to White, this is so because metacognitive experiences are intense.

In this respect, Hacker (1998) described metacognitive experiences as the “awarenesses” and the “a-has” in that one is aware of a current experience and can recognize it. It seems that metacognitive experiences can go in two directions: someone can become aware of having had a metacognitive experience and someone can infer metacognitive knowledge from a metacognitive experience.



Moreover, the study of White showed in particular the difference between students' metacognitive experiences that do and those that do not lead to changes in directing one's learning. Examples of these two findings are presented below.

Metacognitive experiences that do influence or change one's metacognitive knowledge. For example: “Spanish verbs are really difficult. I tried various things: repeating verbs—having conversations with myself. None of these things made a dramatic improvement, so I dropped them. Eventually it occurred to me that verbs are hard, and that there is no single solution. From that point I turned to ... working with verbs in lots of ways ... And, for me, this more varied approach does work” (White, 1999, p. 44).

Metacognitive experiences that do not influence or change one's metacognitive knowledge. For example: “After about the third week of study I thought I had been going quite well. I looked ahead through the rest of the units and realized there was so much more to do ... and I felt my confidence plummet ... and [I] felt increasingly unsure about things. Looking ahead had been a trigger for massive self-doubt” (White, 1999, pp. 43–44).

The first example shows a more cognitive or intellectual orientation while the second example shows a more affective orientation. Furthermore, one of the conclusions White made on the basis of the results of the study was that the metacognitive experiences took place frequently when there was a break in learning.



Next, Schraw and Moshman described informal metacognitive theories as mental frameworks including more explicit though still fragmentary metacognitive knowledge. In other words, the metacognitive knowledge in informal metacognitive theories is not yet completely explicit and integrated and, therefore, it lacks meaning and structure. By pointing out that informal metacognitive theories are not yet completely explicit and structured, it is implied that informal metacognitive knowledge consists of a measure of obscurity. In other words, informal metacognitive knowledge is fragmentary because it is not yet thoroughly comprehended in that the reasons regarding effective learning (i.e., knowing why) are not yet included nor explicitly available. Consequently, fragmentary metacognitive knowledge cannot be used optimally to direct one's learning.

Finally, Schraw and Moshman's formal metacognitive theories include highly systematized accounts of metacognitive knowledge. Formal metacognitive theories consist of explicit and structured or integrated metacognitive knowledge that can exert a profound impact. This implies that, regarding learning, students will be able to state and clarify the knowledge they possess about their general knowledge of the learning process and they will be able to use it optimally. In other words, when students can state and clarify their metacognitive knowledge, they are not only able to express it clearly, but they also understand the reasons with regard to what to do to learn effectively. It follows that students who have general knowledge of the learning process will be able to direct their learning and will also be in the position to advance their own learning.

Being able to develop metacognitive knowledge in the context of learning means developing expertise in learning. In this respect, Sternberg (1998a, p. 132) connected metacognition to learner expertise by pointing out its necessity for success in school while emphasizing its developmental character: "... because expertise is typically not at an end state, but in a process of continued development." Moreover, some of the characteristics that are common in experts (Chi, Glaser, & Farr, 1988; Ericsson, 2005; Ericsson & Smith, 1991) can be translated to expert learners. For example, experts are characterized as having well-organized knowledge in that they spend relatively much time on problem representation and planning. In the same vein, it can be expected that expert learners have well-organized metacognitive knowledge and spend relatively much time on the thinking through of learning tasks and the setting up of learning plans.

## **2.3 General Knowledge of the Learning Process**

The text presented above implies that general knowledge of the learning process can be developed and used for thinking through the effectiveness of study and memorization techniques. The title of this book, metacognitive learning, refers to the development of general knowledge of the learning process to become able to direct

learning of one's own accord. For example, when learners begin to think through what will be the most effective techniques to take up a learning task, then these learners can be expected to consider their general knowledge of the learning process. This thinking through of a learning task by deciding on the most effective study and memorization techniques, requires that one has some kind of overview about the suitability of study and memorization techniques in related to the learning task and oneself as a learner. Such an overview of knowledge of the learning process is needed to be able to set up a learning plan that states what needs to be included to learn a learning task effectively. Accordingly, after having decided on such a global plan for learning, one can begin to think over how to execute this plan in an efficient manner—which will require an action plan that includes an efficient course of actions through which learning activities can be managed by regularly making use of monitoring and control.

This raises the question of which components are included in general knowledge of the learning process. According to Flavell (1979), metacognitive knowledge includes three major components—strategy, task, and person. According to Brown (1987), metacognitive knowledge regarding learning includes knowledge that learners have about the learning context and about themselves. The descriptions of Flavell and Brown can be synthesized into three components.

- (a) General knowledge of developing cognitive knowledge (i.e., general declarative, procedural, and conditional knowledge of constructing cognitive knowledge by processing and memorizing subject matter);
- (b) General knowledge of learning-task demands (i.e., general knowledge of task requirements and conditions that can affect learning);
- (c) General knowledge of oneself as a learner (i.e., general knowledge of stable learner characteristics and personal strength and weaknesses in studying and memorizing regarding oneself as an active agent in one's own learning).

These three components will be considered below in more detail.

The first component, general knowledge of developing cognitive knowledge, refers to the learning of subject matter through general knowledge regarding the processing and memorizing of subject matter. This knowledge includes knowing when certain study and memorization techniques can be suitable to learn subject matter. For example, when reading to learn subject matter one needs to be able to make use of reading comprehension, extract essential information from the text, and retain that information. When one also knows that active reading increases comprehension, that summarizing is suitable for deciding what is essential in a text, and that the organization of textual information improves remembering, then it can be said that one knows when certain study and memorization techniques can be suitable for reading to learn information.

**Cognitive Knowledge**

Cognitive knowledge includes knowledge of facts and concepts, knowledge of procedures, and knowledge of conditions. Cognitive knowledge includes the subject matter that is learned in schools. In school, we learn facts, definitions, and concepts such as the capital cities of countries, the meaning of words such as optician, and the meaning of concepts such as density of material. In school, we also learn how procedures can be performed to deal with, for instance, numbers (e.g., subtraction, multiplication, and linear equations) and letters (e.g., build vocabulary, draw inferences, read texts, and write down information). For example, we learn how to subtract numbers, how to translate words into another language, and how to identify plants. Finally, in school we learn the conditions that state which procedure is required for which situation. For example, to increase quantities quickly, multiplication is more appropriate than addition. In other words, cognitive knowledge includes declarative, procedural, and conditional knowledge.

In the same vein as cognitive knowledge (see framework above), general knowledge of developing cognitive knowledge also includes knowing that there are various study and memorization techniques, how these techniques can be performed, and when these techniques can be used. That is, where cognitive knowledge refers to the reading of a text, the making of a sum, the writing down of information, and etcetera, general knowledge of developing cognitive knowledge refers to the thinking through of which study and memorization techniques are needed to effectively read a text, solve a numeric problem, produce a meaningful text, and etcetera. Table 2.1 presents examples showing cognitive knowledge and, for comparison, general knowledge of developing cognitive knowledge.

The second component, general knowledge of learning-task demands, consists of an understanding of the similarities and differences of learning tasks in terms of their requirements. For example, learning tasks such as an exam, a school test, a

**Table 2.1** Distinguishing cognitive knowledge and general knowledge of developing cognitive knowledge regarding fractions and practice exercises

Cognitive knowledge		
Facts	$\frac{3}{4}$ and $\frac{1}{2}$	I know for a fact that their value is less than one
Procedures	$\frac{3}{4} \times \frac{1}{2} =$	I know how to calculate the answer
Conditions	$\frac{3}{4} \times \frac{1}{2}$	I know that when fractions are multiplied, their value is decreased
General knowledge of developing cognitive knowledge		
Facts	I know for a fact what practice exercises are	
Procedures	I know how to do practice exercises	
Conditions	I know that practice exercises can help me to learn to solve routine mathematical problems	

presentation, and an essay, might be found academically demanding and difficult, while fill-in exercises might be considered less demanding and difficult. Flavell (1979) also mentioned other general learning-task demands such as availability and comprehensiveness. That is, students' general knowledge of learning-task demands also includes knowing whether learning tasks are short or comprehensive and whether their purpose is clear or unclear, respectively. Having an understanding of general knowledge of learning-task demands means knowing what to expect when certain learning tasks are encountered. For example, imagine a teacher who sets his or her students a learning task of which the purpose is unclearly phrased. Then the students are supposed to figure out the purpose of the learning task by themselves. When it is known that, generally, unclearly phrased learning tasks require the finding of links, elaborations, and inferences, then one is better capable of unraveling what an unclear learning task is requiring.

Finally, the third component, general knowledge of oneself as a learner, consists of the knowledge that students possess about themselves as learners. Flavell (1979) referred to this as personal characteristics. Brown (1987) described this as the stable knowledge students have about their strengths and weaknesses with regard to learning. It seems that this component can include both cognitive information as well as emotions and affects (cf., Pekrun, Goetz, Titz, & Perry, 2002) in that it can include, for instance, anxiety regarding learning.

Stable knowledge of one's strengths and weaknesses as a learner can be found in students' metamemory and their reasons for studying. Metamemory refers to personally preferred ways of memorizing in that one knows one's strengths and weaknesses. For example, a student stating that memorizing requires a lot of effort when it involves having to read numerous pages of text, appears to know that he or she may encounter difficulties when he or she has to memorize information from numerous pages of texts. Next, reasons for studying refer to personally preferred reasons for using the activity of studying. For example, students may want to study because they like to know, want to understand subject matter, become educated, and improve themselves. These personally preferred reasons for studying may influence their learning and as such become their strengths and weaknesses in studying. Therefore, students who know their reasons for studying can have insight in, not only their characteristic way of studying in general, but also what they will regard as their strengths and weaknesses in studying.

## 2.4 To Conclude

The above theoretical overview of scientific research shows that students' general knowledge of the learning process is expected to influence how they direct their learning. This means that general knowledge of the learning process can support students in knowing how to interpret learning tasks and, accordingly, coming up with the most effective study and memorization techniques while taking into account

themselves as learners. This knowledge includes general knowledge regarding developing cognitive knowledge, learning-task demands, and oneself as a learner.

However, knowing the function and components of general knowledge of the learning process does not answer the question of what these components encompass. That is, we still do not know what students' general knowledge of the learning process can encompass in that we do not know how they themselves describe this knowledge. In the next chapter, senior high-school students (i.e., 10–12 Grade) and first-year university students' general knowledge of the learning process is described in more detail by means of the results of three research studies.

Metacognitive Learning

Advancing Learning by Developing General Knowledge  
of the Learning Process

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