EJSIT
European Journal of Science, Innovation and Technology
ISSN: 2786-4936
www.ejsit-journal.com
Volume 3 | Number 1 | 2023

Formative Assessment and Metacognition towards Relevant Learning

Rochelle L. de Vera*
San Jose National High School, Malilipot, Albay 4510, Philippines

Abstract

Improving metacognition through formative assessment is viewed to be one of the best possible attacks to make learning more relevant to students. The proposed paradigm is a shift from the traditional classrooms' value to assessment for the purpose of evaluating and providing credit to students' performance to an effective and efficient opportunity to monitor students' process of learning and provide feedback both to the students and teachers while learning process is still intact. Embedding assessment in the teaching and learning process through metacognitive instruction is thought to help engage the students in activities that does not only promote superficial learning but more on the understanding of and applying the concepts for life-long learning. Embedded formative assessment here are activities and techniques such as: self-assessment, parallel or peer assessment, and tutor feedback or external assessment that are likely to help develop students' understanding, synthesis and creative thinking, application and performance, and analysis and critical thinking.

Keywords: formative assessment, metacognition, self-assessment, peer assessment, teacher feedback

Introduction

Critical to educators is the use of assessment to inform their teaching and the learning of their students. Assessment informs the teacher about what students think and about how they think. Classroom assessment helps teachers to establish what students already know and what they need to learn (Susuwele-Banda, 2005). Using a wide variety of assessment activities allows a teacher to determine which instructional strategies are effective and which need to be modified. In this way, assessment can be used to improve classroom practice, plan curriculum, and research one's own teaching practice, apart from its usefulness to provide feedback to children, parents, and administrators (Badders, 2009).

Two kinds of assessment are used in education-summative and formative assessment. For generations, summative assessment has dominated most classroom assessment work, especially in secondary schools, where the bulk of teacher time has been taken up with creating tests, marking, and grading. There is a strong emphasis on comparing students to national standards, and feedback to learners comes in the form of marks or grades. Typically, they don't give much indication of mastery of ideas or concepts because the test content is generally too limited, and the scoring is too simplistic to represent the broad range of skills and knowledge that have been covered.

Recently, there has been a paradigm shift in the way the academe thinks about the role and nature of assessment. View on classroom assessment as a formative rather than a summative approach to assessment is increasingly becoming acceptable. Formative assessment as a significant element of classroom work aims to improve the quality of student learning, not to provide evidence for evaluating or grading students. It provides faculty with feedback about their effectiveness as teachers, and it gives students a measure of their progress as learners. Further, the aim of classroom assessment is to provide faculty with information on what, how much, and how well students are learning. Formative assessment provides teachers with

* Rochelle L. de Vera, ORCID: https://orcid.org/0000-0002-9348-8951

information with which to modify or change the teaching and learning activities in which students are engaged.

Unlike standardized exams or major term papers, techniques employed to classroom assessment provide speedy feedback on student learning while teaching-learning relationship is still intact, flexible and can be tailored according to specific concerns, and can be anonymous for students which was proven useful in freeing students to express not only what they do understand but also what they do not understand.

Moreover, research indicates that classroom assessment equally had relevant impact both to students and teachers. Classroom assessment contributes to greater student involvement because they are forced to think about what they have learned and yet to be learned. In the same way, it helped many teachers re-think how they teach their classes and learn more about what is working and what needs to be changed in their classes.

Current perspectives on assessment put forward that meaningful and relevant learning occurs when learners are actively engaged and trained to become aware by which they learn and to take control of their own learning, hence becoming more self-reflective learners who monitor and evaluate their progress as they develop the capacity to become self-directed learners.

For that reason, metacognition becomes an increasingly important component in successful learning. As Jacobson (1998) cited in Sbhatu (2006) writes:

> *Metacognition or knowing the process by which one learns is then vital to the renovation of the current educational system. If we do not recognize what the students know, what they believe that they know, or more important yet, what they do not know, efforts to improve education will be futile.*

Metacognition refers to higher-order mental processes involved in learning such as creating learning plans, using appropriate skills and strategies to solve a problem, making estimates of performance, and calibrating the extent of learning (Dunslosky & Thiede, 1998 as cited in Coutinho, 2008). To some researchers, it is the act of monitoring and evaluating one's learning and implementing intentional strategies to regulate learning beneficially impacts learning by increasing either effectiveness, efficiency, or both (Pintrich, 2002; Schraw & Dennison, 1994).

Research has shown that metacognition can support student learning with understanding in many subjects (Donovan & Bransford, 2005). Metacognition is important in learning and is a strong predictor of academic success. Students with good metacognition demonstrate good academic performance compared to students with poor metacognition. Students with poor metacognition may benefit from metacognitive training to improve their metacognition and academic performance. Metacognition enables students to be strategic in their learning by, for instance, learning new information rather than focusing on studying information already learned.

Classroom processes should then be geared towards active involvement of students and the employment of metacognitve instructional approaches promoting sense-making, self-assessment, and self-reflection. Teaching should be focused on developing learners' metacognitive abilities. It follows, then, that assessment tasks should be engaging and relevant to the learning process. Effective assessment as learning should help students monitor their learning, empower students to reflect on their own strategies for learning and make necessary adaptations and adjustments. Assessment processes should also provide feedback to students and should emphasize metacognition and self-assessment and transfer their learning to new settings. Classroom assessment involves students in active mental processing of new information and makes them aware of themselves as learners.

While both formative assessment and metacognition are gaining popularity in educational setting as potential and effective means of restructuring traditional classrooms, the

idea of integration of these two frameworks in teaching-learning processes is intended to be established in this paper. Recent literature and studies draw a great deal of support, proofs found in the plethora of testimonials and anecdotal records, and statistical data available in multitude of reports and publications dealing with metacognition and formative assessment to effect relevant learning.

Paradoxically, many classrooms still value assessment for the purpose of evaluating students' performance and grading; not to monitor, provide feedback and use this feedback to further improve teaching and learning. Instruction and assessment place much emphasis on development of cognitive skills rather than metacognitive skills. This paper intends to establish the rationale of the paradigm utilizing formative assessment to improve the metacognitive skills of students. Specifically, it attempts to review and to provide a synthesis of researches and papers supporting a shift to a new perspective for formative assessment focusing not so much on the product but on the process to improve the metacognitive skills and teach students become self-regulated learners. In doing so shed light on the rationale supporting formative assessment and metacognition that promote learning not just for grading, but for life, not just for recall, but for lifelong logic, reasoning and transfer of learning.

Methodology

Journals, articles, and other publications dealing with formative assessment and metaccognition were reviewed, critically analyzed and synthesized in this paper. It should be noted however that references are drawn from various websites from different publications from other neighbouring countries because of the dearth in literature and studies on formative assessment and metacognition within the local context. This review and analysis is an effort to examine the potential of promoting students' metacognition through formative assessment.

Results and Discussion

Metacognition and Learning

Early researchers recognize metacognition as thinking about your thinking and the ability to self-regulate one's learning with the goal of transferring learned skills to new situations. Many researchers' and educators' interest were attracted for its potential contribution in improving learning outcomes as well as its role in supporting cognitive theories of learning. It is increasingly recognized as an important component in successful learning, and many have emphasized the importance of metacognition in educational practice. Metacognition becomes paramount with the increasing need for graduates to develop the 21st century skills to the diverse and constantly evolving world.

Cognitive skills are what most classroom instructions generally teach the students. Such makes the students more conscious about the grades or credit they will gain from the task, not so much on the value of developing metacognitive abilities- learning how to learn, and knowing what they know about the task, how the knowledge or skill they know be applied, when to use it or when not to use to compete the task, or why certain procedure works and under what conditions or why one procedure is better than another.

If one is interested in enhancing teaching and learning, it seems only reasonable to begin with an understanding of how students learn. Because students' metacognition and academic achievement are connected, educators should first become aware of their students' metacognitive awareness and then undertake efforts to raise any low metacognitive awareness levels they may find. As Webster (2002) cited in Sbhatu (2006) noted 'The need for students to become more actively involved in the management of their own learning implies an associated need for each student to be more metacognitively aware of their personal resources'.

One of the main struggles that students face in trying to develop an understanding of metacognition and ways to develop strategies that positively impact themselves is an overall lack of awareness to their own learning process. Most learners who employ these various metacognitive strategies do not even know that they are using them, but the students who even at a rudimentary level have some basic understanding of their own knowledge and thinking are often the ones who have developed good metacognitive abilities through their previous learning experiences and often become the best learners.

Flavell described three basic types of awareness, related to metacognitive knowledge. The first is an awareness of knowledge (self-knowledge), which is described as an understanding of what one does and does not know, and what one wants to know. Second, there is an awareness of thinking (knowledge about cognitive tasks), which describes an understanding of cognitive tasks and the nature of what is required to complete them. Finally, there is an awareness of thinking strategies (strategic knowledge), which describes an understanding of approaches to directed learning.

In a more recent review, researchers have differentiated two important aspects of metacognition: the knowledge of cognition and regulation. The knowledge of cognition includes three components: declarative, procedural and conditional knowledge; while metacognitive regulation is comprised of five components: planning, information management, monitoring, debugging, and evaluation.

Declarative knowledge is the factual information that one knows; it can be declared—spoken or written. An example is knowing the formula for calculating momentum in a Physics class (momentum = mass times velocity). Procedural knowledge is knowledge of how to do something, of how to perform the steps in a process; for example, knowing the mass of an object and its rate of speed and how to do the calculation. And conditional knowledge is knowledge about when to use a procedure, skill, or strategy and when not to use it; why a procedure works and under what conditions; and why one procedure is better than another. For example, students need to recognize that the example word problem requires the calculation of momentum as part of its solution (Peirce, 2003). Our knowledge of cognition refers to what we know about how we learn; what we know about the procedures and strategies that are the most effective for us; and, what we know about the conditions under which various cognitive activities are most effective (Schraw et al., 1995).

Han (2008) further used a picture puzzle metaphor to describe the first two types of knowledge of cognition. According to her, we have lots of small pieces of puzzle at the beginning of a game, but it is not meaningful until we construct the full picture. To understand the full picture, we need to connect each piece, and only after we assemble all of the pieces would the picture reveal a meaning to us. In this metaphor, how to connect each piece of the puzzle means procedural knowledge while the full picture means declarative knowledge. That is, procedural knowledge provides a structure for meaningful declarative knowledge. Similarly, to understand a particular knowledge, we need to connect each concept that we already have. Consequently, without procedural knowledge, we do not obtain conceptual understanding; rather, the most we can expect is rote memorization.

Metacognitive regulation, the second aspect, involves: planning; information management, involving how one organizes new information; monitoring, the act of checking for understanding or strategy effectiveness during a learning event; debugging, "fixing" those learning behaviors which are not working; and evaluation, checking for understanding or effectiveness after a learning event (Nietfeld, Cao, & Osborne, 2005; Schraw & Dennison, 1994; Schraw & Moshman, 1995).

While studies on metacognition are characterized by increasing theoretical complexity, findings mostly indicates that metacognitively aware learners are more strategic and perform better in problem solving situations than unaware learners. High level of awareness is

associated with a desire for self-knowledge, whereas low self-consciousness breeds intellectual defensiveness (Luca & McMahon, 2004). Metacognitively aware learners allow for planning, sequencing, monitoring, and reflecting in a way that improves their performance. The trend has not always been about the fact that learners are constructing their own perceptions of the world but more on creating a method for them to do this in a repeatable, effective, and efficient manner (Moore, 2004).

Coutinho's (2008) article discussed two lines of metacognitive researches: one which has shown that metacognition is an important predictor of academic performance, that students who are able to effectively distinguish information they know and do not know are more likely to review and retain new information. Results of those researches described metacognition as a discrepancy-reduction strategy where the learner begins study by setting a specific desired state of learning for the material. The student allocates resources to learn new information and monitors the degree to which new material has been learned. Learning is discontinued when the student believes that he or she has mastered the information and achieved the desired state of learning.

A second line of metacognitive research that Coutinho had reviewed has shown that metacognitive training, even if administered for a short time, can improve performance considerably. These researchers have shown that students provided with metacognitive training, in addition to task-based training, are likely to improve their performance scores much more than students who receive only task-based training. Even more encouraging is that academically weak students are found to benefit from metacognitive training. Since all students do not spontaneously engage in metacognition, some require explicit training and coaching to learn such skills.

As educators, the question on how we help students develop their metacognition is a great concern. According to Han (2008), two conditions are necessary to help students develop their metacognition. The first condition is students' actual experience in constructing knowledge through inquiry teaching methods or constructivist pedagogy. Most literature stated that inquiry teaching is an effective method for students to develop both declarative and procedural knowledge that are activated during the construction process.

The second condition is the chance to reflect the process of knowledge construction that students were involved in. It is necessary that students have experiences in constructing knowledge, but simply involving them in learning to construct knowledge is not enough for students to be aware of the knowledge that was constructed during the learning experience. According to Dienes et al. (2002), as cited in Han (2008), simply thinking of something does not make one conscious of the thought. To be conscious of the thought, they must represent what they have thought. In other words, unless students have a chance to reflect the thought or knowledge that have been developed through experience of knowledge construction, their thought or knowledge might stay in an unconscious level.

Several decades of research in the cognitive and developmental sciences have built a knowledge base that curriculum developers can use. Three principles of learning, research synthesized by the National Research Council (NRC) described in several publications, *How People Learn: Brain, Mind, Experience, and School* (Bransford et al., 2000), *Knowing What Students Know* (Pellegrino et al., 2001), and *How Students Learn: Science in the Classroom* (Donovan et al., 2005) established the basis for curriculum and instruction (Bybee, 2006). (1) Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information, or they may learn them for the purposes of a test but revert to their preconceptions outside the classroom. (2) To develop competence in an area of inquiry, students must (a) have a deep foundation of factual knowledge, (b) understand facts and ideas in the context of a conceptual framework, and (c) organize knowledge in ways that facilitate retrieval and application. (3) A

'metacognitive' approach to instruction can help students learn to take control of their own learning by defining learning goals and monitoring their progress in achieving those (Donovan & Bransford, 2005).

To become self-directed learners, students must learn to monitor and adjust their approaches to learning. Learners may engage in a variety of metacognitive processes to monitor and control their learning—assessing the task at hand, evaluating their own strengths and weaknesses, planning their approach, applying and monitoring various strategies, and reflecting on the degree to which their current approach is working. Unfortunately, students tend not to engage in this process naturally. Thus, a focus on metacognitive aspects needs to be established through relevant and active classroom experience.

Promoting Metacognition through Formative Assessment

All assessments are created to serve some purpose, whether to diagnose a learning disability, to identify a learner who needs remediation, or to determine whether a school has met its achievement goals (Burns, 2005 cited in Kuze & Shumba, 2011). However, no one assessment serves all these purposes well. In schools, the most visible assessments are summative. Summative assessments are used to measure what students have learnt at the end of a unit, to promote students, to ensure they have met required standards on the way to earning certification for school completion or to enter certain occupations, or as a method for selecting students for entry into further education (CERI, 2008), but they do not they do not tell us the kind of information the learners need to master or what errors in thinking led to the incorrect answers in the tests (Burns, 2005 in Kuze & Shumba, 2011).

Getting the kind of information about the teaching and learning would require the teachers to utilize the results provided by the consistent use of classroom formative assessment. In classrooms, formative assessment refers to frequent, interactive assessments of student progress and understanding to identify learning needs and adjust teaching appropriately. Teachers using formative assessment approaches and techniques are better prepared to meet diverse students' needs – through differentiation and adaptation of teaching to raise levels of student achievement and to achieve a greater equity of student outcomes (CERI, 2008).

Formative assessment, also known as assessment as learning (Angelo, 2003) takes place anytime during a lesson. It identifies strengths and weaknesses of the learner and is intended to enhance the learner's final performance. This means that it is not only used to support learning, but also teaching. 'Assessment as learning' (Angelo, 2003) is stressed to improve teaching and the learning of learners and also as an 'integral part of the learning, teaching and assessment cycle.'

Pinchok and Brandt (2009) quoted Heritage, Kim, Vendlinski, and Herman's (2009) definition of formative assessment as "a systematic process to continuously gather evidence and provide feedback about learning while instruction is under way". Popham (2008) in Pinchok and Brandt (2009) clarified that formative assessment is always a *planned* process; it does not happen accidentally. Other definitions extend the concept of formative assessment as a *process* by incorporating assessment tools when they can be seamlessly integrated into classroom activities (Heritage, 2007 in Pinchok & Brandt, 2009) for the explicit purpose of gathering feedback to inform instruction or learning. Taken together, Pinchok and Brandt (2009) defined formative assessment as a process in which teachers use various tools and strategies to determine what students know, identify gaps in understanding, and plan future instruction to improve learning.

Two educational theorists, Paul Black and Dylan Willian (1998), define formative assessment broadly and include anything the students and teachers do in the learning process that can provide information on ways to adjust teaching and learning: "it is to be interpreted as encompassing all those activities undertaken by teachers, and/or by their students, which

provide information to be used as feedback to modify the teaching and learning activities in which they are engaged." Extensive review conducted by Black and William (1998) put forward that formative assessment produced significant improvements in student learning, than those not engaged in formative assessment. The level of improvement of learning though is based on the quality of the interactions between the student and the teacher, and whether the information provided during the formative assessment process is subsequently used by the teacher and the student. Regardless of these factors and other factors limiting the success of formative assessment, their review of the studies and other studies showed that "attention to formative assessment can lead to significant learning gains."

Formative assessments are the most instructionally sensitive types of assessment and are considered an ongoing activity or process. They are embedded within instructional activities and are linked directly to current teaching and learning activities in the classroom. The teacher determines the specific assessment given to each student or group based on their areas of need or the concepts being taught, and the data are used to differentiate or individualize instruction. The results help diagnose student progress, identify gaps in knowledge and understanding, and determine how to help teachers and students improve student learning (Perie et al., 2007).

Any form of assessment from performance-based to multiple-choice items can be used in formative assessment practice. They also can include journals, checklists, rubrics, written papers, graphic organizers, Socratic questioning, and other evidence-eliciting techniques. It can range from a five-second assessment to a scoring guide reviewed periodically by students and teachers while producing a product. The purpose of the assessment items, tasks, or activities must be that they are windows into the students' cognitive processes. Assessments that allow students to show their thinking and allow teachers to best elicit evidence about these cognitive processes is where the emphasis should be.

Badders (2009) presented a wide range of assessment that are available for restructuring (science) assessment in the classroom based on the following general targets: declarative knowledge (the "what" knowledge), conditional knowledge (the "why" knowledge), procedural knowledge (the "how" knowledge), application knowledge (the use of knowledge in both similar settings and in different contexts) problem solving (the process of using knowledge or resolve an issue or problem), critical thinking (evaluation of concepts associated with inquiry), documentation (a process of communicating understanding), and understanding (synthesis by the learner of the concepts, process, and skills).

Angelo and Cross' (1993) comprehensive study in classroom assessment techniques provide a compendium of good ideas for assessing and improving student learning. These were categorized into four selections of techniques: assessing prior knowledge, recall, and understanding; assessing skill in synthesis and creative thinking; assessing skill in application and performance; and assessing skill in analysis and critical thinking.

According to Pinchok and Brandt's (2009) *Introductory Guide for Educators*, many teacher-made assessment measures concentrate on the lowest levels of intellectual skills, namely, on measuring students' abilities to remember and reproduce what is presented by others. Yet the emphasis in the 1980s reform movement is on the development of critical thinking, problem solving, and independent thought-the capacity to critically analyze the ideas of others and to generate ideas of one's own. This higher-order capacity is much more difficult to measure though.

While cognitive skills are more focused on a specific subject area, metacognitive skills "span multiple, often divergent subject areas and involve a greater degree of thinking about the learning process" (Christensen, 2009 in Niedwiecki, 2011). For example, a student may be skilled at describing the water cycle process, which is a cognitive skill. Determining however when to modify his knowledge about water cycle to describe other atmospheric phenomenon would be considered a metacognitive skill, which requires a more complex and deliberate

thought process. Researches in cognitive psychology linked metacognition to several constructs including metamemory (declarative and procedural knowledge), critical thinking (analysing, inferring, judging or evaluating, decision making or problem solving), and motivation (Lai, 2011).

Metacognition and self-regulation are considered key competencies in the 21st century. It is of particular importance for successful learning and working (Händel et al., 2013). Metacognition is not something that can be tackled as a discrete entity, but something that can be taught and enhanced through engaging at the subordinate levels of monitoring and controlling of thinking process. By simply asking the students to answer a question without asking them to think on how to deal with the question and how they got the answer does not help students become metacognitvely aware of their abilities. The issue with this traditional method, even if thought to be one of the proven ways to test the students' reasoning skills, is that this process fosters an environment where the students focus on getting to the answer or developing an end-product.

Often, students do not know that the questioning is meant to practice their skills such as synthesis, analogical, inductive, and deductive reasoning skills. Because teachers do not usually detail or explicitly discuss the goals of this method, they are engaging in implicit teaching—the students are just supposed to understand the types of reasoning without the teacher ever telling them that's what they are doing. Teaching metacognition implicitly only likely benefits those students who have already high metacognitive awareness and abilities. The failure of explicitly detailing the underlying thought process that gets the students to the answer or end-product will have a detrimental effect on the students' ability to transfer and their learning to new and novel situations (Stropus, 1996 in Niedwiecki, 2011) and strategies to their individual study repertoire.

Students need to know what they know, do not know, supposed to know, and how to do it. Embedding metacognitive cues, modeling metacognitive behavior, and explicitly teaching metacognitive strategies by trying to focus on process as well as the product have proven to be highly effective in improving academic performance and understanding (Moore, 2004). Assessing the process of the students' learning will help keep students from repeating the same mistakes.

Although current moves to improve education recognize the need for training our students to be better self-regulated learners and how to incorporate better metacognitive strategies, rarely that classroom practices utilize important teaching opportunities to implement enough changes to teach these important skills. One way to promote metacognition among students is to attack and critique their learning process instead of simply assessing the end-product. The most positive and effective way to attack the process is through the formative assessment process.

Classroom assessment for that matter must focus on helping students become aware of their knowledge and help them achieve success through their own efforts and using techniques that work for them (metacognitive strategies). It should be made understood among students that being wrong, committing mistakes and struggling to learn and understand something are important ingredients of learning. Metacognition can help young minds to change their ideas about intelligence and understand how they can become smarter, better learners. As William says, "It's no longer about how smart you are, but how you can get smarter" (Black & William, 1998). Formative assessment process can go a long way in helping students' learning abilities and sharpen their metacognitive skills.

Conceptual Framework

Recent cognitive perspective proposed that relevant learning is reflective, constructive, and self-regulated. The importance of knowing not just how to perform, but also when to

perform and how to adopt that knowledge to new situations which are metacognitive in nature is widely recognized as significant element in meaningful learning. Acquisition of these metacognitive skills now becomes the appropriate target of classroom formative assessment paradigm presented in the subsequent discussion.

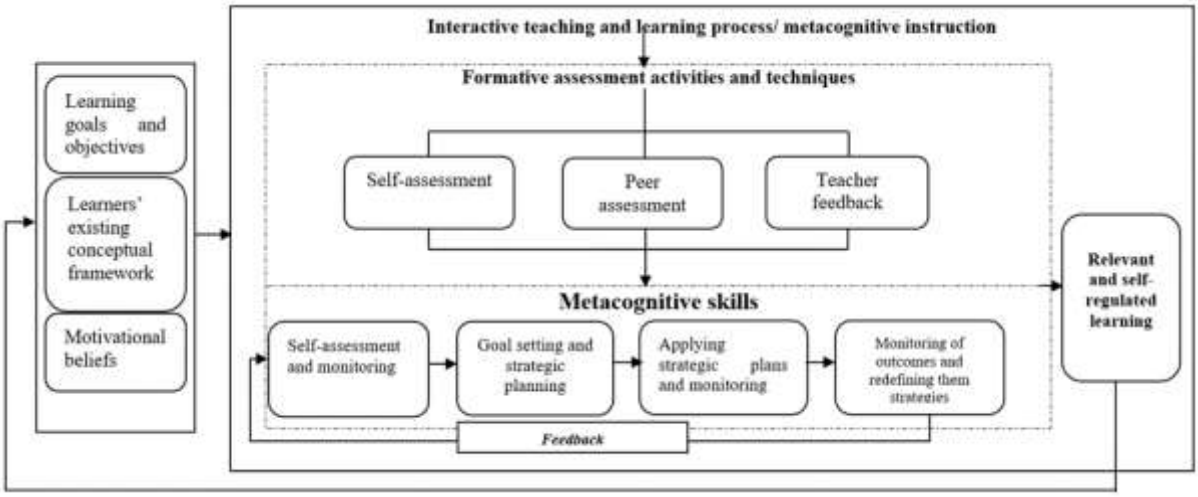

Figure 1. A conceptual model of classroom formative assessment promoting metacognition

Constructivism is one of the underpinning principles in the proposed assessment paradigm. Constructivist theory postulates that learning is an active process of building meaning for oneself. Learning according to Bruner is a process, and through the processes, students discover and build their knowledge. Learners construct knowledge and understandings based on what they already know and believe. Constructivists believe that the learner's preconception and ideas about the subject matter are critical in shaping new understanding of concepts.

The assessment paradigm based on constructivist theory underscore the significance of the three related issues: students' prior knowledge (and misconceptions), motivational beliefs, and teaching for depth of understanding rather than for breadth of coverage as critical factors for relevant and interactive teaching and learning process where meaningful assessment is embedded. Meaningful assessment involves examining the learners' entire conceptual network, not just focusing on discrete facts and principles. According to Bruner, students can and have to discover knowledge by themselves and so the teacher should encourage students to discover their knowledge and monitor the changes and conceptions as teaching and learning proceeds. Self-motivation also plays a crucial role in learning. According to Black and William (1998), success itself does not necessarily motivate. It depends to a great extent on why we think we have been successful in our learning. Even the performance of a very able student can plateau or even diminish if they believe that they have reached what they consider to be the limits of their intelligence – that their level of intelligence is fixed, and they are powerless to increase their capacity to learn.

Another critical factor in the paradigm is the learning goals and objectives. Learning goals and criteria for success should be clearly identified and communicated to students before appropriate learning activities and assessments are suggested to make it more likely that students achieve the desired results. If appropriate learning activities and assessment plan is in place students actively participate in the learning process. As Stephen Covey says, "To begin with the end in mind means to start with a clear understanding of your destination. It means to

know where you're going so that you better understand where you are now so that the steps you take are always in the right direction."

Vygotsky's sociocultural theory also views education as an ongoing process, not a product. Vygotsky suggests that students can be guided by explanation, demonstration, and can attain to higher levels of thinking if they are guided by more capable and competent adults. This conception is better known as the Zone of Proximal Development (ZPD). The Zone of Proximal Development is the gap between what is known and what is not known, that is, generally higher levels of knowing. The ability to attain higher levels of knowing is often facilitated and, in fact, depends upon, interaction with other more advanced peers, who for Vygotsky are generally adults. Social context of learning posits that teachers could understand children's thinking and scaffold their learning. Interaction and scaffolding shapes higher order abilities and dispositions. Through increased interaction and involvement, students can extend themselves to higher levels of cognition.

Research claims that instruction and formative assessment are inseparable. Following the sociocultural theory, the paradigm proposes that embedding assessment in the teaching and learning process through metacognitive instruction will help both teachers and students gauge what are the competencies successfully learned and not, how far the students are learning, how well teachers' strategies work, or what modifications must be considered to help students improve their performance. It is not limited on engaging the students in activities that promotes superficial learning but more on the understanding of and applying these concepts for life-long learning. Embedded assessment here refers to the formative assessment activities and techniques such as: self-assessment, parallel or peer assessment, and tutor feedback or external assessment that are likely to help develop students' understanding, synthesis and creative thinking, application and performance, and analysis and critical thinking.

Applying the social cognitive approach to learning, it is equally deemed important that students should be provided with enhanced approaches to learning and assessment that teaches and support them to develop awareness of their own thinking and assume responsibility of learning, set their learning goals effectively, to plan and use effective strategies to achieve their goals, to monitor the outcome of their understanding, and to assess their progress towards their goals. Teachers should then provide sensitive and constructive feedback to students and use assessment practices that encourage self-assessment and metacognition. Simply stating that something is correct or incorrect is not enough some information on how to correct the mistakes, the reason for the error, or good examples of what was expected are not provided. Research suggests that feedback should be given in a timely manner, detail the strengths and weaknesses of the students' work, offer suggestions for improving, and involve praise and constructive criticism.

Example of classroom activities and assessment techniques that provide avenue for metacognitive learning are those that require people to interact and work together as a group or with a team on real life problems against independent activities and assessment. It is seen as opportunity to facilitate learning in several ways: effective thinking, providing mutual constructive feedback and valuing the elements of critical thought. In this manner, metacognitive skills are gradually becoming part of the learner's system and help develop their capacity to become self-regulated learners thus making learning more relevant.

Conclusion

Metacognition is not a skill that is traditionally taught and assessed regularly in schools yet developing student's metacognition is believed to be reasonable effort in making their learning more relevant and transferable to new and novel situations. A significant number of researches claimed and provided evidences, strategies, and techniques to help improve students' metacognitive abilities through metacognitive instruction with emphasis on the

formative assessment process. Embedding formative assessment in classroom instruction through self-assessment, peer assessment and tutor feedback is viewed in this paper's proposed paradigm that will further develop students' ability to take responsibility of their own learning, hence making it more engaging and meaningful.

Acknowledgement

The author thanks her professor, Dr. Alvin Sario, for his encouragement and useful insights to improve the paper. To her family, Charles and Xian, for the support and inspiration, to her mother, Rose, and above all to the Almighty Creator.

References

Angelo, T. A. (2003). *Reassessing (and Defining) Assessment*: *A Handbook for Faculty*. Ann Arbor, Michigan: Michigan University Press.

Angelo, T. A. & Cross, K. P. (1993). *Classroom Assessment Techniques* (2nd ed.). San Francisco: Jossey-Bass. http://www2.creighton.edu/fileadmin/user/AEA/docs/CATs.pdf

Badders, W. (2009). *Methods of assessment.* http://www.eduplace.com/science/profdev/articles/badders/html

Black, P. & Wiliam, D. (2009). Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability*, *21*(1), 5-31. https://kclpure.kcl.ac.uk/portal/files/9119063/Black2009_Developing_the_theory_of_formative_assessment.pdf

Black, P. & Wiliam, D. (1998). *Inside the black box: Raising standards through classroom assessment.* Kings College, London.

Bransford, J., Brown, A. & Cocking, R. (Eds.) (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Bybee, W. R. (2006). *Enhancing science teaching and student learning: A BSCS perspective*. Research Conference. http://www.acer.edu.au/documents/RC2006_Bybee.pdf

CERI (2008). Assessment for learning – the case for formative assessment. https://www.oecd.org/site/educeri21st/40600533.pdf

Continho, S. (2008). Self-efficacy, metacognition, and performance. *North American Journal of Psychology, 10*(1), 165-172.

Covey, S. R. (2005). *The 7 habits of highly effective people.* Current Perspectives on Assessment. Assessment and Reporting Unit. Learning Policies Branch Office of Learning and Teaching.

Donovan, S. & Bransford, J. (Eds.) (2005). *How students learn: Science in the classroom*. Washington, DC: National Academy Press.

Han, J. S. (2008). *Metacognition: Self-awareness of knowledge construction process*. http://serc.carleton.edu/NAGTWorkshops/metacognition/workshop08/participants/han.html

Händel, M., Artelt, C. & Weinert, S (2013). Assessing metacognitive knowledge: Development and evaluation of a test instrument. *Journal for Educational Research Online, 5*(2), 162-188.

Heritage, M. (2011). Formative assessment: An enabler of learning. *Better: Evidence-based Education, 6*, 18-19. http://www.bestevidence.org/better/

Kuze, M. W. & Shumba, A. (2011). An investigation into formative assessment practices of teachers in selected schools in Fort Beaufort in South Africa. *Journal of Social Sciences, 29*(2), 159-170. https://www.tandfonline.com/doi/abs/10.1080/09718923.2011.11892966

Luca, J. & McMahon, M. Promoting metacognition through negotiated assessment. In R. Atkinson, C McBeath, D. Jonas-Dwyer & R. Phillips (Eds), *Beyond the comfort zone:*

Proceedings of the 21st ASCILITE Conference, pp. 562-570. http://ascilite.org.au/conferences/perth04/procs/Luca.html

Mirhan, D. *Classroom assessment techniques*. University of Southern California. Center for Excellence in Teaching. https://crlt.umich.edu/sites/default/files/resource_files/ClassroomAssessmentTechniquesHopkins.pdf

Moore, K. C. (2004). *Constructivism & metacognition*. Tier 1 Performance Solutions, 2004.

Niedwiecki, A. S. (2011). *Teaching for lifelong learning: the metacognitive skills of students through more effective formative assessment techniques*. http://works.bepress.com/anthony_niedwiecki/1

Peirce, W (2003). *Metacognition: study strategies, monitoring, and motivation*. A greatly expanded text version of a workshop presented November 17, 2004, at Prince George's Community College.

Pellegrino, J., Chudowsky, N. & Glaser, R. (2001). *Knowing what students know: The science and design of educational assessment*. Washington, DC: National Academy Press.

Perie, M., Marion, S., Gong, S. & Wurtzel, J. (2007). *The role of interim assessments in a comprehensive assessment system.* Washington, DC: The Aspen Institute. http://www.nciea.org/publications/PolicyBriefFINAL.pdf

Pinchok, N. & Brandt, W. C. (2009). *Connecting formative assessment research to practice: An introductory guide for Educators*. Learning Point Associates.

Pintrich, P. R. & De Groot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, *82*, (1), 33-40. http://rhartshorne.com/fall-2012/eme6507-rh/cdisturco/eme6507-eportfolio/documents/pintrich%20and%20degroodt%201990.pdf

Sbhatu, S. B. (2006). *Investigating the effects of metacognitive instruction in learning primary school science in some schools in Ethiopia.* http://www.lib.ncsu.edu/theses/available/etd-03302006-142719/unrestricted/etd.pdf

Schraw, G. & Moshman, D. (1995). Metacognitive theories. *Educational Psychology Review*, *7*, 351-373.

Susuwele-Banda, W. J. (2005). *Classroom Assessment in Malawi: Teachers' Perceptions and Practices in Mathematics*. http://scholar.lib.vt.edu/theses/available/etd-02212005-131851/unrestricted/wjs-b_dissertation_JAN2005.pdf