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# The Role of Formative Feedback in Promoting Higher Order Thinking Skills in Classrooms: A Theoretical Model

**Butakor, Paul Kwame**
Department of Teacher Education,
School of Education and Leadership,
University of Ghana, Post Office Box LG 1181, Accra, Ghana.
E-mail: pbutakor@ug.edu.gh
Tel: +233248415593

**Abstract**

Feedback plays an important role in the teaching and learning environment because it provides learners with information intended to help them improve their learning. For feedback to be successful in this role, the information from feedback must also highlight the type of thinking exhibited in performing any tasks. However, very few studies have been conducted to examine the role feedback plays in promoting higher order thinking. The purpose of this paper is to propose a theoretical feedback model that can promote higher order thinking. The components of the model include: conducive learning environment, instructional activities, task characteristics, validating students' thinking, and providing feedback. Future research is needed to empirically test the variables and their relationships as proposed in the model.

**Key Words**: classroom environment, formative assessment, formative feedback, higher order, thinking.

## Introduction

Feedback is considered as one of the most central phenomena to the development of student learning (Hattie & Timperley, 2007), and several studies have

 

been conducted into the effectiveness of teacher feedback for the improvement of student learning (Sadler, 2010). Reviews of research by Black and Wiliam (1998), and Shute (2008) which have all focused on formative assessment and feedback support the idea that feedback leads to the improvement of student learning. According to Shute (2008), formative feedback is the message communicated to students intended to bring modifications to the student's thinking or behaviour in order to improve learning. For students to benefit from feedback to improve their learning, they need to comprehend the feedback message, identify with certainty the aspects of their work that need attention, and the assessment task specifications, along with information about how their work will be assessed (Sadler, 2010). Feedback can also provide information on the type of thinking skills or strategies students exhibit when responding to instructional tasks.

Teachers and schools are interested in finding out how well their students think and are focused on how to improve that thinking ability (Brookhart, 2010). This is important because, when a student completes a task or answers a question correctly, s/he assumes mastery of the subject. It is therefore necessary to provide useful feedback to students so that they become aware of the depth of their knowledge as they move from lower level to higher level cognitive skills. Feedback on students' performance in class or on tasks enables them to restructure their understanding that leads to construction of higher level thinking skills.

However, not many studies have been conducted to examine the role feedback plays in promoting higher order thinking in classrooms, though the majority of the studies in the literature on feedback indicate that it can help students to improve their performance (Shute, 2008; Kluger and DeNisi, 1996). The purpose of this paper is to make contribution to this research gap by proposing a theoretical feedback model that can promote higher order thinking skills in the classroom. The proposed theoretical model was developed out of review of articles which are mostly theoretical and hence will need to be subjected to empirical studies to establish its validity and provide evidence on its contribution to this research gap. Though the proposed feedback model was created on the basis of theoretical papers, it still holds promise to contributing to this research gap because it contains cognitive, emotional, and instructional variables that are associated with feedback and higher order thinking.

**Definition of Higher Order Thinking (HOT)**

The term higher order thinking (HOT) has been widely used in the literature of cognition but there is little agreement between researchers on its definition. Whiles some perceive it as a kind of thinking; others see it as consisting of other cognitive activities (Schraw, McCrudden, Lehman, & Hoffman 2011). For instance, Schraw and his colleagues (2011) see higher order thinking as comprising of four non-mutually

exclusive components, which are reasoning skills, argumentation skills, problem solving and critical thinking, and metacognition. Another twist to this non-agreement between researchers on the definition of HOT has to do with the perspectives with which it is viewed. HOT can be viewed from an educational perspective (i.e. as a performance) or from a cognitive psychological perspective, that is as an underlying process (Leighton, 2011). This review will focus on definitions of HOT based on the educational perspective. Most researchers from this perspective have associated HOT with Bloom's taxonomy of educational objectives which is used widely by teachers and assessments experts to design test items that measure a variety of thinking skills (Haladyna, 2004). Nitko and Brookhart (2007) regarded HOT as referring to the top end of Bloom's taxonomy, which are the analysis, synthesis, and evaluation domains. In this regard, the lower levels of the same taxonomy signify lower order thinking. On her part, Resnick (1987) characterised HOT as having the following characteristics: non-algorithmic, complex, effortful, and yielding multiple responses. She furthermore states that HOT requires nuanced judgement, uncertainty, application of multiple criteria, and self-regulation. Similarly, Stein and Lane (1996) characterised HOT as using complex, non-algorithmic thinking to respond to a task, in which there is no known predictable, well-known approach or pathway explicitly suggested by the task, task instruction, or worked example. That is to say that HOT involves solving tasks where an algorithm has not yet been taught or applying algorithms to unfamiliar contexts.

The preceding discussions reveal the challenge of defining HOT, but for this study I adopt the definition by Zohar and Dori (2003). They characterised HOT as involving the analysis, synthesis, and evaluation domains of Bloom's taxonomy as well as cognitive activities such as the construction of arguments, posing research questions, making comparisons, solving non-algorithmic complex problems, handling controversies, and identifying hidden assumptions. This definition focuses on HOT as the manifestation of skilled performance and not as a category of thought based on its underlying process (Leighton, 2011). Since this description of HOT is what is typically used in the educational domains, it leads us to consider how teachers can teach and assess HOT.

**Teaching of Higher Order Thinking**

Training of students to move from mere recall of information to a state of actively processing information, and hence thinking at the higher levels, is considered a major instructional goal and has necessitated a lot of reforms in education (Lubezky, Dori, and Zoller, 2004). For instance, a number of US states and other national reports are calling for their teachers to teach in way that will enhance the application of

concepts to solving problems, and not just the recollection and comprehension of knowledge (American Association for Advancement of Science [AAAS], 1989).

Though many teachers and educators agree that students' development of HOT is a primary focus of instruction, data show that only few classroom activities support the teaching of HOT (Lemons & Lemons, 2013). Teachers' cognition in relation to the teaching of higher order thinking could be a factor in this case. In a study to investigate teachers' declarative metacognitive knowledge of HOT skills, Zohar (1999) found that teachers' pre-instructional knowledge of metacognition of thinking skills was unsatisfactory for the purpose of teaching HOT in classrooms. This means that the teaching of HOT together with professional development in HOT will be important variables to improve student achievement. In this regard, teacher educators must consider the teaching and assessing of HOT when designing training programs and instructional activities for both pre-service and in-service teachers.

It is evident in the literature that when teachers purposely teach for the promotion of higher order thinking through activities such as dealing with real-world problems, and enhancing open-ended group work and class discussions, there is a high likelihood that students will develop those skills (Miri, David, & Zoller, 2007). Another way of teaching students to develop higher order thinking skills is by asking questions in class that call for higher order thinking, because student responses to classroom activities are influenced by the type of questions asked in class. Also, students who are taught by teachers, who teach for both lower order thinking and higher order thinking, perform better than students of teachers who only teach for lower order thinking (Wenglinsky, 2002). The type of tasks engaged in the classroom provides the contexts by which students learn to think about their subject matter, and different tasks may provide students with different cognitive opportunities (Henningsen & Stein, 1997). Thus, teachers should provide students with tasks that have the potential to influence and structure their thinking and broaden their views of the subject matter they are engaged in. To do this, teachers can employ the following strategies in the classroom: teach the concept of concepts, move from concrete to abstract and back (i.e. going from basic to sophisticated), connect concepts, teach inference, teach concept mapping and graphic organizers, encourage questioning, and cooperative learning. This means that when teachers purposely teach for the development of higher order thinking and ask questions that call for higher order thinking, then they must provide students feedback that can also promote the development of higher order thinking.

**The Formative Feedback Model**

The formative feedback model is presented diagrammatically in Figure 1 below. The model starts with providing a classroom learning environment that is safe, and moves through instructional activities, task characteristics, validating of students

thinking, to providing feedback. It is envisaged that each part in this proposed model if properly operationalized in the classroom would play important role in providing feedback that can promote higher order thinking.

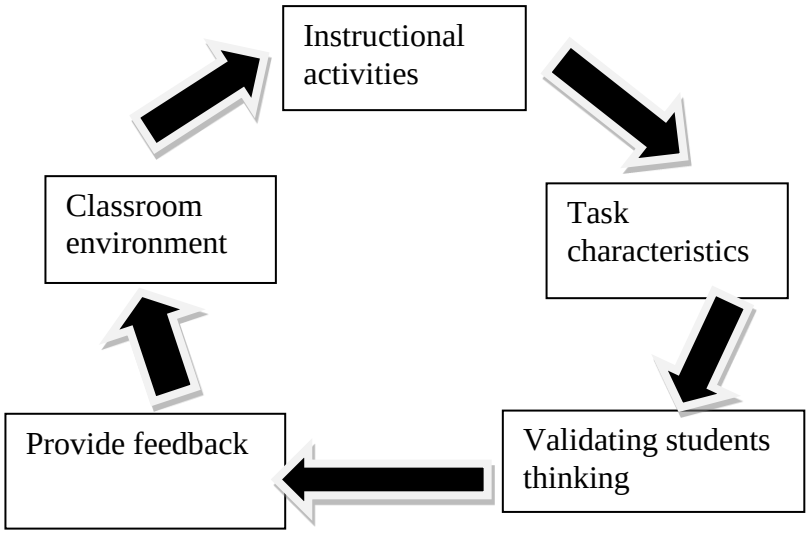


Figure 1. A feedback model to promote higher order thinking skills.

**Classroom Environment**

The classroom learning environment is an important variable in students learning and several studies have documented the influence classroom learning environment has on students learning and performance (Ames, 1992). The way the classroom learning environment is structured also influences: the type of learning goals emphasized; the kind of mental models students create, and instructional activities undertaken.

According to Seitz, Chu, Bustos, and Leighton (2012), when students are in classroom that is safe and secure with a trusting teacher-student relationship, students are likely to feel more secure taking risks and making mistakes in their attempts to learn. This trusting relationship in the learning environment is fundamental and required for feedback to become useful and formative. In a study to experimentally test the learning errors and formative feedback model (LEAFF) originally proposed by Leighton, Chu, and Seitz (2012), Bustos (2013) found out that by explicitly discussing the sources and importance of learning errors in the classroom, students reported feelings of comfort and safety, trust in the teacher, and motivated to learn and perform well. This study demonstrated the importance of emotional variables in the learning

environment. The only setback of this study insofar as this paper is concern is that the study didn't focus on the role of specific learning errors and no evidence was provided to show that the instructional tasks provided were meant to measure higher order thinking.

For feedback to promote higher order thinking, it is proposed that teachers must structure the classroom learning environment in ways that the students will feel safe and secure such that the teachers can openly and honestly make use of students' errors as an opportunity to help them develop higher order thinking. When students' perceived the classroom learning environment as safe, they are more likely to develop mastery orientations and according to Ames (1992), mastery goal orientation is necessary to facilitate self-regulated learning and associated with the preference for challenging work and risk taking. So when teachers emphasize the development of mastery goals in their classrooms, it will facilitate their students' spending more time on learning tasks and persist when they encounter difficulty. With this mastery goal orientation, students can apply effective learning and problem-solving strategies knowing that the use of such strategies will lead to success and that failure can be corrected by a change in strategy (Ames, 1992). Also, when students perceived the classroom learning environment as safe and secure with trusting teacher-student relationship, there is the likelihood that they will believe and accept the feedback message as useful and use its content to modify their thinking and learning (Leighton, Chu, & Seitz, 2012).

**Instructional Activities**

A safe and secure classroom learning environment with a trusting teacher-student relationship prepares the grounds for instructional activities to be undertaken in the classroom. This is because, though the teacher structures the classroom learning environment by selecting the appropriate teaching methods, learning activities and tasks, students also play an important role in the interactions that take place within the classroom (Ames, 1992). For feedback to be effective, students' active participation in the instructional activities is vital. One way of guaranteeing this active participation is by providing a safe and secure learning environment.

The type of activities or tasks engaged in the classroom provide the contexts by which students learn to think about their subject matter, and different tasks may provide students with different cognitive opportunities (Henningen & Stein, 1997). Thus, teachers should provide students with instructional activities and tasks that have the potential to influence and structure the students' thinking and broaden their views of the subject matter in which they are engaged. Once students are provided with appropriate instructional activities and tasks, there is the need to provide feedback on their performance. To structure classroom learning activities to elicit feedback that can

promote higher order thinking as depicted by this model, the following instructional activities are proposed.

Teachers need to adapt a taxonomy of educational objectives that is synchronous to their definition of higher order thinking. Though Bloom's taxonomy of educational objectives is used widely by teachers and assessments experts to design test that measure a variety of thinking skills (Haladyna, 2004), there are other meaningful taxonomies too. For example; Assessment Standards for the Dimensions of Learning model, Marzano and Kendall three domains of knowledge, the SOLO Taxonomy, and the Webb's Depth of Knowledge levels (Brookhart, 2010, pp 39-43). All these taxonomies are useful for categorizing learning objectives, instructional activities and tasks according to levels of complexity. Teachers' instructional activities and tasks should match the intended learning target in both what the students learn (content) and what they can do with the learning (cognitive complexity).

An open and honest discussion of learning errors should feature predominantly in the instructional activities because learning errors play an important role in helping students consolidate their understandings as they move from lower level tasks to higher level tasks (Leighton, et al. 2012). By openly discussing the importance of learning errors, their sources, and their motivational and instructional values, the students' will gradually do away with the fear of making errors in the classroom learning environment. When students are not afraid of making errors because they understand the sources and usefulness of learning errors in the classroom, the teacher can identify what they students understand and what they do not and hence provide feedback specific to the errors identified. This can help promote higher order thinking skills in the classroom as the students will have the opportunity to identify the sources of their learning errors such as any misconceptions held, incorrect mental models created, and inappropriate techniques or algorithm already developed.

**Task Characteristics**

When teachers purposely teach for the promotion of higher order thinking skills, they should provide students with tasks that also call for higher order thinking because students' responses to classroom activities are influenced by the type of questions asked in class. However, the ability of teachers to design assessment tasks or questions asking for higher order thinking has been a challenge (Leighton, 2011). This difficulty has to do with teachers' inability to translate the definition of higher order thinking into operational assessment items that actually measure higher level thinking skills. It is proposed that teachers should strive to design test items whose level of complexity are aligned with the taxonomy of educational objectives adopted. For example, Zohar and Dori (2003), characterised higher order thinking as involving the analysis, synthesis, and evaluation domains of Bloom's taxonomy as well as cognitive

activities such as the construction of arguments, posing research questions, making comparisons, solving non-algorithmic complex problems, handling controversies, and identifying hidden assumptions. Hence, appropriate test items must be designed to match this definition of higher order thinking.

The formats of the assessment items also have a role to play if the items are to target higher order thinking. Some studies have shown that performance test items are suitable for assessing higher order thinking (Leighton, 2011). Performance tests can take any of the following forms; portfolios, projects, term papers, research papers, peer or self-assessments, short-answer completion questions, visual observation, and writing samples. These assessment formats are expected to provide students with the opportunity to reason, reflect, actively process information and make sound decisions on their own without promptings from their teachers. Though performance tests are regarded as suitable for assessing higher order thinking because they elicit non-algorithmic and complex forms of thinking, multiple choice items might also be structured in ways that are amenable for assessing higher order thinking (Haladyna, 2004; Brookhart, 2010). For instance, a context-dependent multiple-choice item set which offers introductory material and then one or more multiple-choice items based on the material might be expected to assess higher order thinking because it gives the students something to think about. To design multiple-choice items or tasks that assess higher order thinking, classroom teachers should: use introductory material or allow students access to resource material so that they can have something to think about; use novel material; and manage cognitive complexity and difficulty appropriately (Brookhart, 2010).

For instructional tasks or test items to elicit higher order thinking, the instructional tasks must possess certain characteristics. For example, Resnick (1987) characterised higher order thinking as having the following characteristics: non-algorithmic, complex, effortful, and yielding multiple responses that require nuanced judgement, uncertainty, and application of multiple criteria. Stein and Lane (1996) also characterised higher order thinking as using complex, non-algorithmic thinking to respond to task, in which there is no known predictable, well-known approach or pathway explicitly suggested by the task, task instruction, or worked example. That is to say that higher order thinking involves solving tasks where an algorithm has not yet been taught or applying algorithms to unfamiliar contexts. The following task characteristics; novelty, complexity, and creativity, were identified and measured on a 7-point scale in a meta-analysis study by Kluger and DeNisi (1996, p. 272). Instructional tasks that are to be designed for assessing higher order thinking can be structured to have these three characteristics.

 

**Validating Students' Thinking**

One way of helping students to develop higher order thinking skills is to validate the type of thinking or reasoning processes they exhibit whiles performing a task (Cui and Roberts, 2013). Validating the students' thinking exhibited whiles responding to instructional tasks will lead to the identification of the students' sources of learning errors. Once the students' sources of learning errors are identified and discussed, feedback can be provided so that the students can modify their inappropriate thinking and misconceptions to improve their performance and reduced the number of learning errors (Leighton, et al., 2012). All these can be possible because: the classroom learning environment has been perceived as safe by the students; the teacher has openly and honestly discussed the sources and importance of learning errors in the classroom; and the students have been provided with the appropriate instructional tasks. The challenge here is identifying accurately the knowledge, thinking skills, and learning errors students' exhibit when responding to the instructional tasks. Several methods for addressing this challenge have been proposed in the literature. Some of these methods are: (a) statistical analysis using the hierarchy consistency index (Cui & Leighton, 2009); (b) empirical procedures that yield verbal report data reflecting misconceptions in students' thinking and problem solving, and analysis of the errors patterns detected (Leighton, et al. 2012); and (c) think-aloud procedures (Leighton, 2011). Though some of these procedures may appear technical and challenging to some teachers and researchers, they still hold a lot of promise if students thinking processes and learning errors are to be understood and identified.

**Providing Feedback**

When the classroom learning environments are made to be safe with trusting teacher-student relationship; teachers teach using a taxonomy of learning objectives and explicitly discuss the source and importance of learning errors in the learning process; students provided with tasks that are novel, complex, creative, and non-algorithmic; students' thinking processes validated to identify possible learning errors; feedback must be provided to the students to complete the circle of the model. The four preceding conditions are necessary and need to be satisfied if feedback is to function formatively. For instance, if a student perceives the classroom learning environment as safe, s/he will feel vulnerable and ease at making mistakes and errors whiles learning. These learning errors will actually reflect what the student doesn't know or some misconceptions held. In this regard, the feedback about the student performance will be specific and based on the learning errors and the student is likely to accept the feedback message as relevant and useful. The feedback message will then be used to modify and restructure their thinking.

 

Further, according to Brookhart (2010, p.12), assessing higher-order thinking increases student motivation as well as achievement. That is using tasks or assessment items that require intellectual work and critical thinking is linked with increased student achievement and also holds students accountable for higher-order thinking. Ways of interpreting students' responses to such items can be helpful in assessing higher-order thinking. For example, applying criteria about the quality of thinking exhibited in responding to a task, observing and discussing students reasoning directly can be helpful in assessing higher order thinking. That is to say that, when students are given an assessment task, teachers should have conversations with the students about their thinking, or give written feedback. The feedback should be based on the learning target and the criteria established earlier. According Sadler (1989), the following conditions are necessary if students are to benefit from feedback in instructional tasks. The student must know: what is meant by good performance; the relationship between current and good performance; actions to take to close the gap between current state of performance and good performance.

For feedback to promote higher order thinking, the following guidelines can be adopted from Shute's (2008) focus on formative feedback paper are suggested:

- Feedback should signal a gap between a current level of performance and a specified level of performance. This will help clarify any uncertainty about how well a student is performing on a task.
- Feedback should be specific to provide information about particular responses and provides details on how to improve such responses.
- Feedback should serve as a means of scaffolding which will enable students to do more advanced tasks demanding higher thinking and problem solving than they could without such means.

Similarly, for feedback to be constructive and promote learning, teachers must have a clear idea of the learning targets, objectives they are teaching, and must share this information with their students in clear terms and language that the students understand (Brookhart, 2010). This strategy if adopted in the classroom can also help promote higher order thinking because it will enable students to be active participants in their own learning.

## Conclusion

The teaching and assessing of higher order thinking skills in schools have received wide spread attention across several countries. It is believed that in this era of technological advancement, students need to develop the appropriate critical thinking skills, creativity, and problem-solving skills to stay in line with this advancement. In this paper, a proposed feedback model that can promote higher order thinking in the

classroom was presented. A review of the research gap was highlighted in the introductory section followed by the model and description of its components. The model starts with providing a classroom learning environment that is safe and secure with trusting teacher-student relationship. Teachers then engage students with instructional activities and tasks that are appropriate for eliciting higher order thinking as well as an explicit and honest discussion of the sources and importance of learning errors in the learning process. The next section of the model demands validating the thinking processes students' exhibit whiles performing the tasks provided. In this case, the students' learning errors and misconceptions can be identified and feedback that is appropriate, relevant, useful, and specific provided to the students. When this happens the students will use the feedback message to restructure their thinking and modify their understanding as they move from lower order thinking to higher order thinking. Because the model proposed here is made up of both emotional and instructional variables that are useful and associated to feedback, it may contribute positively to the research gap identified. However, there will be some challenges or limitations that have to be addressed if the model proposed here is to make valuable contributions to the research gap.

Some of the limitations are associated with the challenge in defining higher order thinking. Though higher order thinking has been widely used in the research literature, there is little agreement between researchers about its definition. Researchers and teachers must therefore strive to have a working definition of higher order thinking that can be operationalize in the classroom. Another limitation that is associated with the proposed model has to do with the difficulty in validating the thinking processes students exhibit whiles performing on the test. Teachers and researchers could have a workable definition of higher order thinking; however, if appropriate methods and techniques are not employed to validate students thinking processes, it will be difficult to identify the students learning errors. Because the model presented here was created from the synthesis of theoretical research literature, there is the need to empirically test the variables and their relationships proposed in the model. For instance, future research needs to focus on investigating and validating how well the definition of higher order thinking adopted by the teacher is reflected in the tasks that are provided. Though teachers might be using universally acceptable definition of higher order thinking, if this link is not established, the feedback message to be provided will be addressing something different other than higher order thinking. There is also the need for future research to be conducted to establish that the learning errors student make are as a results of the characteristics of the tasks provided. There could be several reasons contributing to the errors students make while learning and hence there is the need to establish that the errors were made because the tasks were demanding higher order thinking.

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