Efficacy of Formative Classroom Assessments in Theory and Practice

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Abstract

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The articles which constitute the core of this dissertation orbit, either explicitly or implicitly, around the "theory of formative assessment". This conception is, at the theoretical level, a blend of socio-cultural and socio-cognitive perspectives. Accordingly, the theory of formative assessment holds that (1) thinking and learning processes are supported when students are given information and feedback regarding the learning criteria and standards by which they are assessed; and (2) when there is subsequent use of that feedback by students and teachers as they plan the next steps of the learning process together. Each article is intended for practitioners, policymakers, and researchers, and together they represent a methodological progression which begins with a discussion on theories that underpin formative assessment, and their implications for teaching methods and learning strategies. The second article presents a detailed case-study of the implementation of formative assessment in the Scottish region of the UK. The third and final article in the set employs a grounded theory (GT) method to build a theoretical framework to explain how the theory of formative assessment promotes self-regulated learning (SRL) in public school (K-12) classrooms.

Introductory Section

The thematic and conceptual discussions appearing in this set of articles reflect a deepening interest in the relationship between the individual mind, and the collective classroom context in which the mind learns. As Lajoie (2008) remarks, “it is the interaction between the mind and [social] environment that presents the most interesting questions in terms of the active nature of learning” (p. 471). The "active nature of learning" emphasizes student processes and peer-assessment, and refers not only to cognitive or *intra*personal participation, but also, to the active participation in social, or *inter*personal processes which promote independent and lifelong learning.

The set of articles, which this introductory paper prefaces, consists of three analyses of formative assessment. These are:

- Clark, I. (2010). Formative assessment: There is nothing so practical as a good theory. *Australian Journal of Education, 54*(3), 341-352.
- Clark, I. (2010). The development of 'Project 1': Formative assessment strategies in UK schools. *Current Issues in Education, 13*(3), 1-35.
- Clark, I. (2012). Formative assessment: Assessment is for self-regulated learning. *Educational Psychology Review, 24*(2), 205-249.

The articles will be referred to as Article I, Article II, and Article III respectively and orbit, either explicitly or implicitly, around the "theory of formative assessment" as conceived by the influential Paul Black and Dylan Wiliam (1998a; 1998b; 2009). This conception first appeared in the "Journal of Educational Assessment, Evaluation and Accountability" (Black & Wiliam, 2009), as a blend of socio-cultural and socio-cognitive theories. Accordingly, the theory

of formative assessment holds that (1) thinking and learning processes are supported when students are given information and feedback regarding the learning criteria and standards by which they are assessed; and (2) when there is subsequent use of that feedback by students and teachers as they plan the next steps of the learning process together. Each article is intended for practitioners, policymakers, and researchers, and together they symbolize a methodological progression that includes: (1) a discussion on theories that underpin formative assessment, and their implications for school systems and classroom strategies (Article I); (2) a detailed case-study of the implementation of formative assessment in the Scottish region of the UK (Article II); and (3) Article III employs a grounded theory (GT) method (Strauss & Corbin, 1990) to build a theoretical framework to explain how the theory of formative assessment promotes self-regulated learning (SRL) in public school (K-12) classrooms.

A Profile of the Publication Journals

Australian Journal of Education (AJE). The AJE, established in 1957, is a peer-reviewed journal sponsored by the Australian Council for Educational Research (ACER). Available in both print and online, AJE draws upon original research which aims to inform educational researchers as well as educators, administrators and policymakers about issues of contemporary concern in education. Original research is interpreted broadly to include policy analyses, development of research methodologies and reviews of research that contribute new insights and understandings. More specifically, AJE accepts original research, research reviews, policy analyses, comments, rejoinders and book reviews. The journal produces one volume per year, and three issues in April, August, and November. It is indexed in various databases, including Scopus, ERIC and the Social Sciences Citation Index.

Current Issues in Education (CIE). CIE, founded in 1998, is a peer-reviewed journal published by the Mary Lou Fulton Teachers College at Arizona State University (ASU). The mission of the journal is to advance scholarly thought by publishing articles which promote dialogue, research, practice, and policy as well as developing a community of scholarship. The journal accepts a range of research designs. These are, experimental, quasi-experimental, narrative, ethnography, case studies, and mixed-methods designs, literature reviews, meta-analyses, theoretical platforms. In addition, action research is encouraged which clearly demonstrates a disciplined inquiry that includes procedures, measures, and outcomes. CIE is an online journal which provides immediate open access to its content. Articles published in CIE are indexed in the Directory of Open Access Journals (DOAJ), ERIC, and EBSCO. This journal produces one volume per year and three issues per volume. Issue No. 1 spans the ASU Spring semester, issue No. 2 spans the ASU summer months, and issue No. 3 spans the ASU Fall semester.

Educational Psychology Review (EDPR). EDPR (2012 impact factor: 2.154) is an international forum for the publication of peer-reviewed review articles, special thematic issues, reflections on previous research, new research directions, interviews, and research-based advice in the field of educational psychology. The contents are appropriate to a wide readership in educational psychology and of "sufficient depth to inform the most learned specialists in the discipline" (Springer, n.d). Since its inception in 1989, EDPR has produced 25 volumes, 99 issues, and 584 articles. Articles are indexed in a wide variety of databases including SCOPUS, PsycINFO, EBSCO, Educational Research Abstracts Online (ERA), Sociology of Education Abstracts, and Vocational Education and Training Abstracts. EDPR produces one volume each year containing four issues (March, June, September, and December).

The Guiding Question

The general research question guiding the construction of the three articles, and which binds them together, is, "How and why do formative interactions support learning among K-12 students?" This is a broad question, and one which lends itself to a plurality of methodologies, and invites many conceptual 'tangents'. Any attempt to explore this question necessitates a great deal of theoretical discussion, and draws heavily from the foundational work of L. S. Vygotsky, and the socio-cognitive perspectives of Albert Bandura and his contemporaries. Black and Wiliam (1998a; 1998b; 2009) drew from these theoretical perspectives to present the formative interaction as an active dialogic process in which social interaction influences cognition. It is therefore an "interaction between external stimulus and feedback, and internal production by the individual learner which involves looking at the three aspects: the external, the internal and their interactions" (p. 11). More concretely, the provision of external feedback entails sharing learning intentions, and identifying clear assessment criteria in ways that students understand, and may internalize as useful self-management information. The daily process of sharing assessment information with and among students engages them in their own learning, developing learning autonomy, and increasing their sense of social belonging. The formative interaction depends on the active participation of children in this process. Sharing assessment information in ways that young learners understand is therefore emphasized throughout the set of articles as the *sine qua non* of formative assessment (Black, Harrison, Lee, Marshall & Wiliam, 2003; Mansell, James, & the Assessment Reform Group [ARG], 2009).

An important goal of formative feedback is the deep involvement of students in meta-cognitive strategies; such as personal goal-planning, monitoring, and reflection. The mastery of these thinking strategies supports learning by giving children “the power to oversee and steer

one's own learning so that one can become a more committed, responsible and effective learner" (Black & Jones, 2006, p. 8). Here, Black and Jones make an important link between formative assessment and autonomous learning. This link is maintained throughout the set of articles, which emphasizes that formative assessment demands the cognitive and social participation of students in their own learning processes, and those of their peers. Active participation of this nature, requires learners to take direction from and provide leadership to their peers, so that they develop a sense of *agency* (a sense of leadership in collective contexts) which supports their personal and learning goals.

A Binding Theme: Learning in the Twenty-First Century

The momentum of studies which explored autonomous learning continued into the twenty-first century; although they were more often encompassed by studies on the formative assessment theme (OECD, 2005). The realization that formative assessment possess the potential to meet the needs of the twenty-first century learner began with what Hutchinson and Hayward (2005) describe as a "quiet revolution" taking place in the K-12 policy frameworks of a number of nations (see OECD, 2005, 2008). All these articles included here contend that learning autonomy is linked to the pervasive notion of lifelong learning (Deakin Crick et al., 2004; OECD, 2005, 2008; Hoskins & Fredriksson, 2008). Independent learning skills are considered to be key lifelong learning 'meta-competencies' required to adapt to the accelerating technical and cultural revolutions, and the formation of a global society that seeks to include increasing ethnic diversity. As such, formative assessment, autonomous learning, and lifelong learning competencies can be constructed as postmodern themes of education (Edwards & Usher, 2001). Hinchliffe (2006) refers to the twenty-first century economy as the "knowledge economy", defined here as a society that exhibits "a greater reliance on intellectual capabilities than on

physical inputs or natural resources" (Powell & Snellman, 2004, p. 199). The key difference from the past is that skills and competencies relevant to the "knowledge economy" are no longer passed down from one generation to the next (Hoskins & Deakin Crick, 2008). This understanding “does not function in the rapidly changing technological and globalized world of today where it is not possible to establish which type of knowledge is needed in the next 5 or 10 years let alone a lifetime” (Hoskins & Fredriksson, 2008, p. 11). In recognition of the changing demands of the twenty-first century, the set of articles explores the benefits of formative learning environments, and their potential to promote learning autonomy, and the equitable learning outcomes which close the achievement gap (Stiggins, 2007; OECD, 2005; 2008), and prepare K-12 learners for college and citizenship, including those deemed "at risk".

Karoly (1993) attributed the rising wave of studies on autonomous learning to “cultural, economic, and political forces” (p. 24) which in the final decades of the twentieth century created “a climate conducive to personal and societal expressions of individualism, responsibility, autonomy and freedom of choice” (p. 24). Some 13 years later, Turner (2006) noted a new methodological elasticity that accommodates social context by exploring how its elements interplay to facilitate (or frustrate) learning and autonomy. It included three distinct features. First, the move away from reductionist methodologies toward a more holistic analysis, including contextual aspects such as interpersonal relationships and community norms. Second, abandoning a view of self-regulated learning as a linear process, and focusing instead on flexible patterns in varying activities over time. Third, a greater emphasis on what people are doing and saying. Consequently, the methodologies for researching classroom learning are consistent with the teaching methodologies which shape the formative interaction. Now, both research and teaching are taking more account of learning based on active participation and dialogue as

advanced by the theory of formative assessment. In the classroom, when children participate in social interactions which make them feel respected and valued, they begin to demonstrate enhanced meta-cognitive processing that promotes the conscious use of autonomous learning strategies. Increasing mastery over these strategies (e.g. setting and prioritizing goals and sub-goals) supports individual learning across the board, helping to ensure outcome equity and facilitate lifelong learning.

Article Previews: Key Issues

The following three sub-sections provide a brief summary for each paper by highlighting the key points, and explaining their relevance to the guiding question of "How and why do 'formative interactions' support learning among K-12 students?"

Article I

The first article in the set begins with the question: "When is assessment formative?" The question enriches the guiding question by adding an additional, and integral aspect of "when". Black and Wiliam (1998b) offer a comprehensive conception which includes a succinct indication of when assessment is formative. They argue that assessment becomes formative assessment "when the evidence [of learning] is used to adapt the teaching work to meet the needs of the students" (p. 2). It should be noted that the word "conception" is used here instead of "definition" because "to seek a standardized definition of dynamic assessment is counterintuitive and unrealistic in the diverse practical settings found in thousands of unique classrooms" (Article I, p. 342). Furthermore, sharing definitions does not work because they are either too general or too narrow. In the latter case frustrating advancement by creating a stagnant learning community, and in the former, is often useless to practitioners.

Plurality and tension are important aspects of any vibrant and advancing educational process. Yet the tension between summative and formative assessment is often cited as a barrier to the successful development of formative interactions in practical educational settings. Article I presents a model that depicts the alignment of both formative and summative assessment activities within a single operating system, and places the emphasis on the *purposes* and *uses* of assessment data. It illustrates that summative and formative assessments exist as connected parts of the same overall model with differing, but complimentary purposes and uses.

Formative assessment has a lasting impact, which develops lifelong learning competencies among students (OECD, 2005; Stiggins, 2007). Advocates of formative assessment emphasize that accelerating technical and cultural revolutions, and the formation of a global society that seeks to include increasing ethnic diversity, will require citizens to become lifelong learners. Even the relative microcosm of the typical day requires children to participate in multiple communities both inside and outside of school. Demands are placed on them that require coping strategies to regulate various external inputs. These inputs often include peers, teachers, resources, management rules and requirements, parental anxieties; standards, tests with high stakes, and so on. Such circumstances require instruction of the caliber proposed by advocates of formative assessment. The starting point for the work on formative assessment was the idea of providing feedback, but not all feedback is formative. Telling students to work harder or recalculate their answer is not formative because it does not support (or scaffold) learning by telling students how to do it, or why they need to do it.

Article I places particular emphasis on the traditional theoretical tensions that exist between a plurality of theoretical perspectives. The traditional relationships between theories are re-constructed into a functional framework, which situates individual cognitive development in a

context of collective classroom activity. Dialogue is at the core of the formative interaction and influences the development of meta-cognitive thinking. Specifically, dialogue is a process that permits the articulation of otherwise concealed ideas, beliefs, and opinions. An inquiry into the question "What are high-quality interactions?" is central to the answer to the guiding question stated at the beginning of this introductory section. High quality interactions are essential to the success of any classroom structured to ensure effective formative interactions for teachers, their students and among peers. When children participate in discussions, the interaction scaffolds their practice by reinforcing the underlying principles of what was learned, and closes the gap between learners' current status and the desired learning goal. However, teachers are not typically prepared to work with students in ways which blend the elements of the formative interaction so that dialogue, questioning, and discussion become effective teaching strategies. For example, Webb and Palincsar (1996) found that students are actively discouraged from interaction, and do not develop strategies that will help them behave in ways that are productive for learning. The proponents of formative assessment seek to engage their students in peer dialogue which involves all group members in high level, task related and sustained talk which Goos Galbraith, & Renshaw (2002) called the collaborative ZPD.

Article I presents a general consensus over the proposition that academically successful students engage in high-quality interactions, typified by predictions, explanations, justifications and reasoning (Blatchford, Baines, Rubie-Davies, Bassett, & Chowne, 2006). Such learning environments engage students so that classroom management takes on a unique meaning. In the formative classroom the learning process is managed by developing practices that take account of the formative interaction by engaging learners in group discussion, effective feedback systems, and collaborative goal-setting. In addition to affective components of learning like

motivation, formative interactions foster meta-cognitive skills through tasks which engage students in sustained on-task interactions that require them to make predictions, justify and challenge their own work, and provide formative feedback to peers which tells them how and why they should improve their work.

Article II

Article II addresses the guiding question by using a case-study method which explores the challenges and outcomes of the Assessment is for Learning (AiFL) program, which took place in the Scottish region of the UK. The program began in 2002, and continued until government funding came to an end in early 2009. After this time, it became the established system in some 1500 public schools across the region. Article II focuses on the crucial implementation phase (2002-2004) of the AiFL program. The formative interaction is the core concept of an AifL school. An AiFL school is described as a place where everyone is learning together; and where assessment and learning are connected by interactive teaching strategies which neither dominate, nor marginalize children. Formative assessment is again defined, but only briefly as the definitional issues were explored in the first article in the set of three articles. Paper II does, however revisit summative assessment, and the well documented claim that teacher-fronted strategies create many disaffected K-12 students, particularly among lower achieving children (Harlen & Deakin Crick, 2003). The clear implication is that high-stakes testing environments do not support learning. Schools should downplay grades, and teachers avoid public comparison of students based on test outcomes. In contrast, supportive learning environments emphasize the process of learning, and creating the circumstances for formative interactions which promote student-centered teaching and autonomous learning. The Assessment Reform Group (ARG, 1999) found that formative assessment strategies mitigate the

psychological threats associated with high-stakes environments, and create significant increases in the level of student engagement.

Article II builds upon Article I by delineating formative assessment into Assessment *for* Learning (A*f*L) and Assessment *as* Learning (A*a*L). These are closely related sub-concepts within the 'theory of formative assessment' with differing emphases: A*f*L inclines toward teacher-facilitated learning and assessment dialogue, and A*a*L on student-lead learning and assessment dialogue. The concepts of A*f*L and A*a*L are then further delineated into their respective strategic goals. It is important to distinguish 'teacher-facilitated' from 'teacher-fronted' engagements. The latter term holds a pejorative meaning in the context of the formative classroom because it entails a closed and didactic teacher-student relationship. This kind of asymmetry may dominate many children, and diminish their motivation to learn. For dialogue to be teacher-facilitated, the student should be given learning and assessment information, and guided in its use for planning next steps in his or her own learning progression. When taken together, A*f*L/A*a*L strategic goals re-position children at the center of the learning process by ensuring formative interactions which link students directly to systems, teachers, parents/caregivers, and their peers. Peer interaction is of particular interest throughout the set of articles because both A*f*L and A*a*L encourage effective dialogue and feedback from the central participants--the students. The early sections of paper I close with an itemization of 16 formative assessment strategies (e.g. traffic lighting).

Some considerable space in Article II is devoted to four "architectural principles" which form the foundation of an A*f*L/A*a*L curriculum. There is no question that a robust and creative curriculum architecture is always required. However, an emphasis on formative interactions requires a flexible blueprint which brings high quality peer-interaction into existence. The four

principles are, coherence, progression, relevance; motivation and choice. Each principle is unpacked and explained. The aspects of the social environment are again emphasized by presenting each principle from the points of view of teachers, students, and their parents.

The remainder of Article II synthesizes key studies on the challenges and outcomes of the AiFL program. The studies were chosen for their coherent focus on the outcomes of formative assessment interventions in practical settings, and data on the extent of change in: (a) student learning, motivation and behavior; (b) student awareness of assessment; (c) attainment; (d) classroom practice; (e) teacher beliefs and attitudes; (f) teacher understanding of assessment; and (g) parental/caregiver involvement in their child's education. Article II also highlights the AiFL program as an example of a lengthy and complex process of educational change management, which brought high quality formative interactions into existence. It demonstrates that change on a national scale is an involved process requiring the strong commitment of principals and external policy makers (Fullan, 1991), and reveals the positive mind-set required by all stakeholders if a move away from teacher-fronted instruction is to bear fruit. When asked about the difficulties encountered schools identified relatively few. Nearly all participating teachers preferred to see problem solving as a positive and enriching experience. This response indicates that the overwhelming majority of teachers and principals were committed to the project from the outset.

The outcomes of the AiFL program were evaluated positively by participating teachers. For example, the emphasis on dialogue lead 95% of teachers to assign a "very successful" (VS) or ”successful" (S) rating to the extent of questioning. Furthermore, 95% of respondents awarded a VS or S rating to increasing the level of discussion; and 97% to an improved teacher focus on the learning needs of students (Hallam *et al*, 2004).

Article III

The goal of this article was to review the research and scholarship on the 'theory of formative assessment' and how it drives the acquisition of SRL. Of particular importance were, self- and collective efficacy, feedback and the issue of "context, such as… interpersonal contacts, and community norms" (Turner, 2006, p. 293) that create the conditions for SRL. The conscious use of SRL strategies by for example, regulating progress to realize timely outcomes or seeking social assistance from peers helps children to direct increasing effort toward their personal and learning goals (Harlen, 2006). Article III addresses the guiding question stated at the beginning of this introductory section by proposing that the strategic purpose of formative assessment is to promote enhanced mastery over, and autonomous use of the cognitive and social strategies required for academic success (i.e. SRL). This proposition is supported by blending socio-cultural theories (as found in the work of Vygotsky), with socio-cognition theories (e.g. Bandura, Zimmerman etc.) into a unified, and highly flexible theoretical framework called the theory of formative assessment (Black & Wiliam, 2009). In blending sometimes competing theoretical perspectives the framework demonstrates that collaborative interaction does not depend on a unity of ideas and beliefs. On the contrary, a sense of consensus around Article III's proposition depends on a plurality of perspectives that provides vital and diverse ideas. Unity of ideas and beliefs is contrary to the human personality, and to scholarship. If unity were to exist without pluralism society and classrooms would be forced, artificial, and stagnant.

Article III recognizes that society prospers when there is a diversity of identities and interests. The formative interaction supports learning when the diverse ideas of children are invited, and their misconceptions valued highly as assessment evidence. Such classroom instruction gathers assessment evidence of the highest quality from verbal interactions of the

highest quality. This article ends with a series of enquiries, and suggestions for further research into formative interactions as a basis for K-12 instruction, and lifelong learning in the twenty-first century.

The final section of the Article III poses a number of empirical questions for future research. When attending to such questions it is worth reminding the aspiring researcher that from the relative security of the ‘back office’, with opportunities to review and discuss, it is obviously possible to suggest many different, and possibly better ways of proceeding than can be thought of by the teacher on the spur of the moment. However, as the articles in the set point out, it is precisely this very challenging synchronous or microgenetic level of classroom interaction that offers the best possibilities for improving academic performance and ensuring outcome equity.

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Formative assessment: There is nothing so practical as a good theory

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In K–12 education, formative assessment is a pedagogical process gathering momentum among researchers and practitioners. It has become a common theme at educational conferences, a key Organisation for Economic Co-operation and Development (OECD) research theme since 2002 and the subject of increasingly frequent requests for government funding in various nations around the world. A school that implements formative assessment reform is engaged in a dynamic process that links instruction and curriculum with assessment in order to support individual learning in the social setting of the classroom. Formative assessment is described, with the elements and principles that direct the assessment process delineated. The importance of high-quality interactions to formative assessment is considered, as well as an evaluation of the theories that form the basis for the formative assessment process.

When is assessment formative?

Brookhart attempted to answer the question 'what is formative assessment?' in a single sentence when she wrote, 'formative classroom assessment gives teachers information for instructional decisions and gives pupils information for improvement' (2007, p. 43). Brookhart captured three key elements of the formative assessment process:

- it informs teaching practice
- instructional decisions are made based on this information
- students receive scaffolded assistance on how to improve their work.

Scaffolding is then 'best understood as involving mutual adjustment and appropriation of ideas' (Goos, Galbraith & Renshaw, 2002, p. 195). Perhaps the most accessible explanation of formative assessment was provided by Black and Wiliam (1998b, p. 2): who included a 'what' element and a 'when' element' within their conception:

- What? 'all those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged.

- When? 'Such assessment becomes "formative assessment" when the evidence is used to adapt the teaching work to meet the needs.'

It should be noted that the term 'conception' has been applied to Black and Wiliam's description of the formative assessment process, and in doing so avoids the mistaken notion that a monolithic definition is appropriate or even possible.

The reasons for this are explained below, and are central to an accurate understanding of formative assessment as an artful process as opposed to a scientific process. Black and Wiliam's article is widely regarded as seminal and, while it should be taken as a keynote in the recent development of FA in many national education systems, it is wise to avoid the doomed quest for a single 'gold-standard' definition that then determines the production of sets of standardised classroom tasks. The terms 'standardised assessment' and 'formative assessment' are diametrically opposed concepts. To seek a standardised definition of dynamic assessment is counter-intuitive and unrealistic in the diverse practical settings found in thousands of unique classrooms. Wiliam and Leahy (2007) reminded us that the fundamental need for constant readjustment means that any prescription for teacher action that seeks to define the 'best' course of action given certain conditions is impossible even in principle. No matter how elegantly we formulate definitions that seek to standardise teaching practice across classrooms, they would remain inoperable in practical settings and are somewhat reminiscent of the 'scientific management' movement of the late nineteenth century. Furthermore, simply sharing definitions with practitioners is unhelpful because 'all research findings are generalizations and as such are either too general to be useful or too specific to be universally applicable' (Wiliam & Leahy, 2007, p. 39). Baines, Blatchford and Chowne (2007) concurred, noting that there is a lack of good-quality group work in schools because not much research takes place in practical settings and what does 'provides little practical advice for teachers to use and adapt group work to particular contexts' (2007, p. 664). It is the conception of teaching as an art and the adaptation of teaching methods to meet needs in practical settings that is of fundamental importance when considering how to further student learning

It is therefore most useful to analyse formative assessment in practical settings and embed such processes in a model that depicts the alignment of both formative and summative assessment activities within a single operating system. Doing so furthers the understanding of the process and provides real context by placing the emphasis upon the *purposes* and *uses* of assessment data both inside and outside the classroom. Scotland provides an excellent example of precisely this kind of implementation in practical settings: between, 2002 and 2008 the Scottish government developed and implemented a project called 'Assessment is for Learning' (AiFL) in schools across the nation. The design of an AiFL school is shown in Figure 1.

Two key issues arise from the model. Firstly, it can be clearly seen that formative and summative assessment practices may be aligned and do not create tension within the system. Indeed the reality is that when taken together they provide key information that informs both classroom decision-making (as originally expressed by Bloom, Hastings & Madaus, 1971) and also decisions made regarding

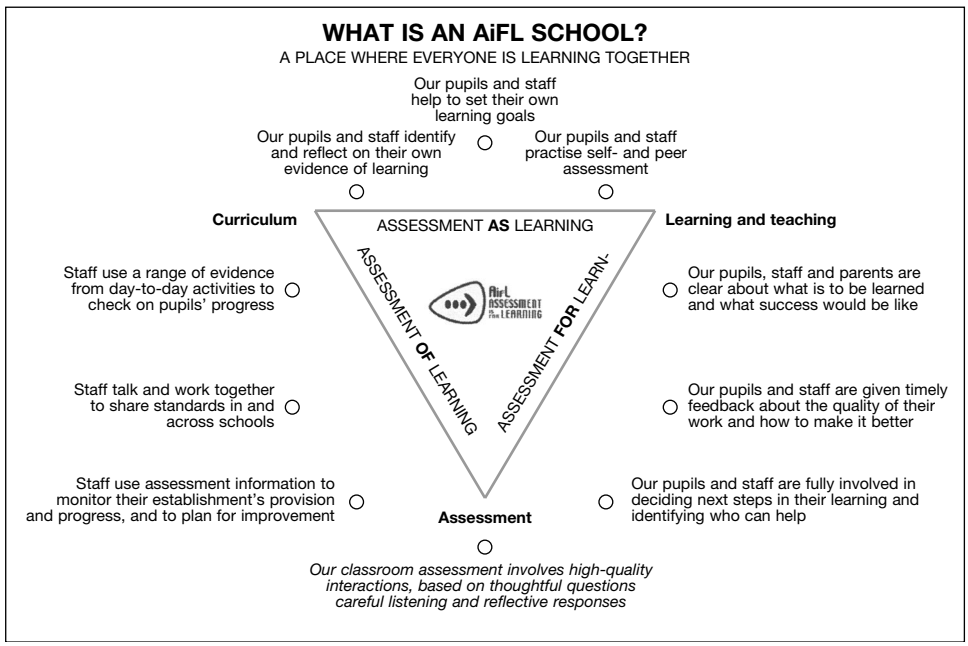

Figure 1

Source: Learning and Teaching Scotland, n.d.

the whole system (see Scriven, 1967). Secondly, the 'assessment of learning' (or summative) side of the model emphasises information used to improve the whole school system and the process of schooling across districts. We can see that information pertinent to the process of student learning appears on the remaining two sides of the model, and is therefore the main concern of the system. In summary, formative and summative assessment may be beneficially aligned within the same system but summative assessment should not be used as the primary source of data to determine the focus of any classroom intervention.

Irrelevant theoretical issues revolving around the question of 'what is formative assessment?' are given a false gravity by commercial manifestations injected into the educational domain by software publishing houses that literally package the process as a series of micro-standards against which students are to be tested. It is perhaps for this reason that Wiliam and Leahy asked the question, 'when is assessment formative?' (2007, p. 30). It is more meaningful to practitioners and administrators to discuss the process in terms of the various functions that it actually serves (Wiliam & Leahy, 2007; Learning and Teaching Scotland, n.d.). A rigid application of Black and Wiliam's (1998b) seminal explanation of the process means that feedback obtained from computer outputs may be formative if it is used to adapt the process of instruction to suit the students' needs but it is essential that practitioners, administrators and policy-makers understand that formative assessment is a process based on high-quality interactions between teacher/student and crucially between peers (the collaborative ZPD) and not between a student and a software program.

The principles of the formative assessment process

Beginning with Cronbach's seminal article (1963) on the improvement of course content and the subsequent origination of the term 'formative' assessment by Scriven in 1967, educational researchers have given the significance of emphasis to various investigations on assessment practices and how they affect the quality of student learning and motivation (Assessment Reform Group, 1999; Black & Wiliam, 1998a, 1998b, 2006a, 3006b, 2009; Bloom, Hastings & Madaus, 1971; Crooks, 1988). Arising from the proliferation of historical interest into assessment and learning, the development of formative assessment strategies has gathered momentum across the postmodern era. The current dominant concept of lifelong learning has arisen from the pressures of multiculturalism, economic change and the needs of the 'knowledge economy' (Hinchliffe, 2006). In recent years it has become increasingly clear that the accelerating technical and cultural evolution and the formation of a global society that seeks to include increasing ethnic diversity will require citizens to become lifelong learners. As such, lifelong learning can be constructed as a postmodern condition of education (Edwards & Usher, 2001). The connection between the formative assessment process and lifelong learning has been clearly established by the Organisation for Economic Co-operation and Development (OECD) among others (OECD, 2005; Stiggins, 2007). In the formative assessment classroom, students are building their understanding of new concepts and working together to assess the quality of their own and their peers' work against well-defined criteria. When students are actively engaged in such activities, they are developing invaluable skills for lifelong learning.

The starting point for the work on formative assessment was the idea of providing feedback but not all feedback is formative. Feedback becomes formative when students are provided with scaffolded instruction or thoughtful questioning that served as a prompt for further enquiry, which then closes the gap between their current level of understanding and the desired learning goal. Simply telling students to 'work harder' or 'recalculate your answer' does not possess the qualities of formative feedback because it does not support (or scaffold) learning by telling students how or why they need to do this. Feedback therefore becomes formative when learners are in these situations:

- engaged in a process that focuses on meta-cognitive strategies that can generalised to performance more generally
- supported in their efforts to think about their own thinking
- understand the relationship between their previous performance, their current understanding and clearly defined success criteria
- positioned as the agent improving and initiating their own learning.

One example of the remarkable expansion in awareness regarding the benefits of formative assessment is a 2005 OECD study that features exemplary cases from secondary schools in Canada, Denmark, England, Finland, Italy, New Zealand, Queensland (Australia) and Scotland. A key finding arising from the OECD study was that high levels of student achievement and greater equity of student outcomes

are among the goals promoted by formative assessment. The OECD study (2005) clearly delineated the formative assessment process:

- Element 1: establishment of a classroom culture that encourages interaction and the use of assessment tools
- Element 2: establishment of learning goals, and tracking of individual student progress toward those goals
- Element 3: use of varied instruction methods to meet diverse student needs
- Element 4: use of varied approaches to assessing student understanding
- Element 5: feedback on student performance and adaptation of instruction to meet identified needs
- Element 6: active involvement of students in the learning process.

Even a perfunctory analysis of these six elements reveals the powerful utility of peer interaction to support productive learning in practical settings

The formative assessment process is founded upon eight key principles that demand high-quality interactions among students, teachers and parents or carers: students need to engage in the following actions:

- to be able to understand clearly what they are trying to learn, and what is expected of them
- to be given immediate feedback about the quality of their work and what they can do to make it better
- to be given advice about how to sustain improvement
- to be fully involved in deciding what needs to be done next
- to be aware of who can give them help if they need it and have full access to such help
- to be able to build knowledge of themselves as learners, and become meta-cognitive
- to take more responsibility for their learning and participate more in the process of learning.
- The final key principle is to engage parents and carers in the learning process. The importance of parental or carer inclusion was confirmed by Townsend (1997), who believed that effective schools were those that welcomed parents by engaging them and involving them in the widest range of school activities, most crucially those concerning their child's development.

What are 'high-quality interactions'?

Askew observed that

> the characteristics of dialogue are equality, sharing, spontaneity, collaboration and reciprocity. What I found interesting is that young people do not think such experiences are appropriate for the classroom where a particular view of behaviour is perceived. (2000, p. 47)

Webb and Palincsar (1996) also argued that students are actively discouraged from interaction and do not develop skills that will help them behave in ways that are

productive for learning. The issue of ineffective classroom interaction is considered by Black and Wiliam who believed that, 'in terms of systems engineering, present policies in the U.S. and in many other countries seem to treat the classroom as a black box' (1998b, p. 1). The 'black box' is an object for vital criticism because it functions primarily as a receptive system where 'certain inputs from the outside—pupils, teachers, other resources, management rules and requirements, parental anxieties, standards, tests with high stakes, and so on—are fed into the box' (Black & Wiliam, 1998b, p. 1). As proponents of the constructivist classroom, they are persuasive in voicing their concerns about such a system that is primarily designed to receive and decode external signals. Those who advocate formative assessment seek to go beyond a merely passive congregation of students (that is, the pejorative notion of the 'black box') by encouraging cooperative and collaborative activities in the classroom. But traditional learning arrangements continue to prevail; consequently, pupils are often seen working in groups but not working as groups (Black, 2005; Galton, Simon, & Croll, 1980). Accordingly, Baines, Blatchford and Chowne observed, 'teachers typically plan for their interactions with pupils, but not for interactions between pupils' (2007, p. 664).

The proponents of formative assessment seek to engage their students in peer dialogue which involves all group members in high level, task related and sustained talk: the 'collaborative ZPD' (Goos, Galbraith, & Renshaw, 2002). As one would expect, there is a great deal of discourse within the academic community about what high-quality peer interactions look like. Gillies (2003) suggested that listening, explaining and the sharing of ideas completes a model capable of capturing those interactions that support productive learning. Despite the fundamental truth in Gillies's ideas, there is a need for a fine-grained model, one that provides practitioners with more assistance in supporting group work for high-order problem-solving skills. Kutnick and Manson (1998) suggested a learning construct in which students are expected to plan or organise their group work and to make group decisions by compromising and resolving conflict. To be effective, students must be engaged in high-quality interactions, typified by predictions, explanations, justifications and reasoning (Blatchford, Baines, Rubie-Davies, Bassett, & Chowne, 2006). Damon (1983) and Azmitia (1988) saw sustained talk as a crucial feature of effective peer interaction in the classroom. In addition, sustained dialogue is effective only if it is characterised by on-task interaction through which students may consider the perspectives of others, resolve conflicts and mediate learning during collaborative problem solving. Barron (2000) conducted a meta-analysis in order to identify group processes that relate to learning outcomes and found the following features to be most salient: explaining one's own thinking; sharing knowledge; providing critique and providing augmentation; and observation of peers' strategies. Azmitia also asserted that exposure to the strategies of peers is important, 'because partners often bring different skills to the task' (1988, p. 88).

At present the majority of classrooms exhibit a superficial culture of cooperative interaction (Black, 2005; Galton, Hargreaves, Comber, Wall, & Pell, 1999). But research carried out among more than 1500 Scottish schools during the implementation of formative assessment found that students are very responsive to the

idea of cooperating with different people in their assessment (Assessment Action Group/AiFL Programme Management Group, 2002–2008). Of particular interest among their findings is confirmation that students liked to help each other with schoolwork. It is therefore unsurprising that a key aspect of the formative assessment process is effective dialogue among the central participants—the students. Furthermore, the formative assessment process necessarily entails cooperation between all the participants in the learning process including teachers and parents/carers. The AiFL Programme Management Group found that students appreciate in-depth communication with teachers and parents or carers about their progress, and consider it to be a valuable part of the process of learning. McCroskey and Richmond stated that 'all aspects of what happens in the classroom are contingent upon eliciting cooperation from every class member by employing sound principles of classroom management' (1992, p. 44). The term 'management' in the context of a formative assessment classroom takes on a unique meaning, because it entails the effective management of the learning process by developing practices that scaffold learning through high-quality interaction, such as group discussion, effective feedback systems and collaborative goal-setting.

Advancements in practice do not come easily. Black and Wiliam found that many teachers took more than one year to engage with the idea of classroom dialogue reasoning that it, 'required a radical change in teaching style from many teachers . . . it is this aspect of formative work that teachers are least likely to implement successfully' (2006a, p. 14). After working together with teachers in the UK and US to implement formative assessment practices, they then later reflected upon this experience. They noted, 'the involvement of students both in whole-dialogue and in peer group discussions, all within a change in the classroom culture . . . was creating a richer community of learners where the social learning of the students was becoming more salient and effective' (Black & Wiliam, 2006a p. 17).

Formative assessment: A unified theoretical platform

'Over the past two decades, psychological and educational research has established beyond doubt that children have a powerful influence upon one another's intellectual development' (Damon, 1984 p. 331). Damon went on to draw parallels between a number of very credible theoretical bases, all of which point to the powerful potential of high-quality peer interaction to support learning. These are the cognitive-development psychologists in the tradition of Piaget; the social-constructivists, arising from the theories of L. S. Vygotsky and the work of the US interpersonal psychiatrist H. S. Sullivan, who found a link between peer collaboration and mental health. Damon observed that agreement between typically contrasting theoretical perspectives provides evidence that collaborative learning is a 'robust phenomena' (1984, p. 332). Instead of engaging in the traditional tensions between cognitive and sociocultural perspectives of knowledge transfer, formative assessment blends cognition and social interaction into a functional theoretical framework by situating individual cognitive development in a context of collective classroom activity. Formative assessment therefore draws theoretical vitality from cognitive theory and from a variety of sociocultural theories arising from the work

of Vygotsky. Although Vygotsky was initially interested in how children learn to think, over time the ideas of social mediation have been applied to the development of meta-cognitive skills: 'a singularly important idea in this new paradigm is that both development and learning are primarily social processes' (Shepard, 2000, p. 7).

Pellegrino, Chudowsky and Glaser clarified how to facilitate meta-cognitive strategies through effective classroom assessment when they advised:

> assessments should focus on identifying the specific strategies children are using for problem solving, giving particular consideration to where those strategies fall on a developmental continuum of efficiency and appropriateness for a particular domain of knowledge and skill. (2001, p. 3)

If problem-solving strategies are to be reconstructed successfully, then learners must have a strong understanding of the underlying principles of what was learned. In this way, they can recognise novel situations as subtle variations that relate closely to those previously encountered and deploy appropriate strategies to resolve challenges and problems across the course of their lifetime. Students should be given tasks that require them to make predictions and to justify and challenge their own work and that of their peers.

In relatively recent years, the teaching community has become aware of the social aspects of meta-cognition, specifically the meaningful dialogue between peers as a process that permits the articulation of otherwise concealed cognitive processes. The original work of Vygotsky is frequently cited in research that considers interactions that provide opportunities for meta-cognitive dialogue and makes thinking processes visible to learners in group settings. The interaction between expert (teacher) and novice (student) is described by the term 'scaffolding'—a metaphor for a jointly constructed process that supports the acquisition of new knowledge. In addition to this teacher–student interaction the formative assessment process places a strong focus on collaboration between peers; what Goos, Galbraith and Renshaw (2002) called socially mediated meta-cognition. It has already been noted that there is a deficiency of peer-interaction in classrooms (Baines, Blatchford, & Chowne, 2007; Black, 2005; Galton et al., 1999), yet high-quality interactions scaffold the learners' practice by helping students understand how they can improve their work. If done collaboratively, this facilitates meta-cognition by reinforcing the underlying principles of what was learned and closes the gap between the learner's current status and the desired learning goal. The notion of collaborative interaction was robustly expounded by Lave and Wenger (1991) through the notion of 'situated learning' and their work in the practical settings of business and commerce. They proposed that learning is social and 'this social process, includes, indeed it subsumes, the learning of knowledgeable skills' (1991, p. 29). Therefore, for learning to take place one is deeply involved in a 'community of practice'. It is the robust notion of co-participation between the members of the community that strongly relates to the Vygotskian idea of the collective. The school system, and then the classroom are examples of such a community because, 'communities of practice are formed by people who engage in a process of collective

learning in a shared domain of human endeavor' (Wenger, 2006). Communities of practice are therefore 'groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly' (Wenger, 2006).

Despite the mixed reaction to behaviourist perspectives on learning it would be remiss to omit them from am article that discusses a process that supports learning in social settings. Although largely ignored by the architects of constructivist learning interventions, behaviourist theory does present interesting notions regarding feedback in social settings because behaviourists—such as Chase and Watson (2004)—study feedback as social consequences, and 'consequences within a behavioral system are defined as reinforcing if they increase the behavior that they follow' (Chase & Watson, 2004, p. 149). Studies of feedback as social consequences reveal an interplay between the timeliness, frequency, source of feedback and the frequency and patterning of behaviour (Balcazar, Hopkins & Suarez, 1986). It was perhaps the greatest proponent for behaviourism—B. F. Skinner—who demonstrated more than 55 years ago that practice without feedback produces little learning (Skinner, 1954). Further, Kantor's (1982) invention of 'institutional stimuli' has significance to a study of student learning behaviour, subjected as it is to the rules, regulations and consequences of the school institution on a daily basis. But the domain-specific view of skill acquisition, in which transfer and reconstruction are not possible and skills must be taught only for the specific situations to which they, apply create a tradition of tension between behaviourism and proponents of constructivism in general. Consequently, behaviourism is typically omitted from the research of those who investigate classroom learning and teaching and advocate reform.

Concluding summary

Some 60 years ago Lewin remarked that 'there is nothing so practical as a good theory' (Lewin, 1951, p. 169). Formative assessment is a robust alloy of several long-standing psychological theories and a key component of effective learning systems in many diverse practical settings (OECD, 2005) but, despite increasing political momentum in the USA, the large-scale implementation of formative assessment remains something of a distant prospect. Progress in the USA is beset by 'scientific' issues, namely definitional interpretations and the lack of statistical evidence supporting the large-scale implementation of formative assessment (see Dunn & Mulvenon, 2009) in a way that is not so elsewhere in the world.

It is ironic that, in publishing their 2004 paper, 'Teachers developing assessment for learning: Impact on student achievement', Wiliam, Lee, Harrison and Black opened the door to the criticism of those who believe that the reform of educational policy is dependent upon gold-standard research design and statistical outcomes. The 2004 paper did little to further claims that formative assessment creates measureable increases in performance due to a number of concerns regarding internal validity. Wiliam, Lee, Harrison and Black (2004) did in fact concede in that same paper, 'the quantitative evidence provided here is difficult to interpret. The comparisons are not equally robust' (Wiliam, Lee, Harrison & Black, p. 62). Despite

statistical vagaries, the essential point remains that quantitative ambiguities are not sufficient to obscure or undermine the deep cognitive and meta-cognitive processes germinated by effective feedback; a point widely understood and accepted (OECD, 2005; Piaget, 1965; Sullivan, 1953; Vygotsky, 1978). In his third inaugural professorial lecture as Dean of Education at the University of Auckland, John Hattie presented findings arising from his many years of specialised work, including 'the most powerful single moderator that enhances achievement is feedback' (1999, p. 9). Formative assessment is founded upon a unified theoretical platform that emphasises high-quality interactions between teacher and student and between peers. Policy-makers should invest resources and train practitioners in how to create a classroom culture that favours such dialogue and in which thoughtful questions, careful listening and reflective responses are the norm. This may never be realised unless those who understand the challenges of postmodern society work with practitioners and administrators to conduct rigorous research to find the magnitude of the effect of formative assessment first upon school achievement and then upon lifelong learning.

Keywords

assessment	formative evaluation	academic achievement
classroom communication	teaching process	curriculum

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The Development of 'Project 1': Formative Assessment Strategies in UK Schools

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Abstract

In recent years, a growing political emphasis has been placed upon the development of transformative assessment-driven reform in schools. There is global consensus on the value of assessment activities that are carefully designed to be consistent with desired learning outcomes, and which coherently connect learning theory, the curriculum, classroom activities and assessment. The consensus ends when there is debate between those who believe that schools produce more able students when they are faced with summative assessments and those who propose the implementation of formative assessment strategies in classrooms. This article presents a literature review which investigates the large-scale transformation of classroom practice in the Scottish region of the UK, known as *Project1*. The article begins with a summary overview of *Project 1* and continues with a conceptual discussion of formative and summative assessment. The latter sections of the article delineate the key architectural principles underpinning formative assessment in practical settings before going on to present the professional evaluations of *Project 1* by participating teachers.

Keywords: *formative, assessment, curriculum, summative, Scotland, UK*

The Development of 'Project 1': Formative Assessment Strategies in UK Schools

In the past 30 years, educational researchers have given the significance of emphasis to various investigations on assessment practices and how they impact the quality of student learning and motivation, (Bloom *et al,* 1971; Crooks, 1988; Black & Wiliam 1998a, b; ARG, 1999, 2002; George Street Research, 2007). Arising from the proliferation of historical interest into assessment and learning the development of formative assessment strategies has gathered momentum on an international scale. One example of the remarkable expansion in awareness regarding the benefits of formative assessment is a 2005 Organisation for Economic Co-operation and Development (OECD) study which features exemplary cases from secondary schools in Canada, Denmark, England, Finland, Italy, New Zealand, Queensland in Australia, and Scotland. Despite widening global awareness regarding the impact of assessment strategies on learning, one review of assessment practices (in US schools) remarked that transformative 'assessment practices are not common, even though these kinds of approaches are now widely promoted in the professional literature' (Neill, 1997, p. 35-6).

Project 1: Summary Overview

There were two distinct phases to assessment reform in Scotland: Firstly, the development phase (2002-2004) of the program, which was strategically directed by the Assessment Action Group (AAG) and operationally managed by the AifL Program Management Group (APMG). Secondly, the implementation phase (2005-2008) was overseen by the APMG, which served as the main forum for liaison, encouraged cooperation and emphasized the importance of professionals working together in order to build communities of practice (SEED, Sept 2005). This article examines the crucial first phase which took place between the beginning of 2002 and the end of 2004.

The development of formative assessment strategies in the Scotland is connected by two contiguous assessment themes: assessment *for* learning (A*f*L) and assessment *as* learning (A*a*L). A*f*L focuses on the progress of the learner toward a desired goal, seeking to close the gap between a learner's current status and the desired outcome. 'This can be achieved through processes such as sharing criteria with learners, effective questioning and feedback' (AAG/APMG 2002-2008). A*a*L is about reflecting on evidence of learning. It is a process 'where pupils and staff set learning goals, share learning intentions and success criteria, and evaluate their learning through dialogue and self and peer assessment' (AAG/APMG, 2002-2008). Both themes are integrated into a nation-wide project classified by the Scottish Executive Education Department (SEED) as '*Project 1'* and stand together as the cornerstone of a wider programme known as **A**ssessment **i**s **f**or **L**earning (AifL). 'An AifL school is a place where everyone is learning together. It is a place where assessment is part of learning and teaching without dominating them ... is about supporting classroom learning and teaching. It connects assessment and learning/teaching' (AAG/APMG, 2002-2008).

The emphasis of this article is placed upon the early experiences of participating schools, which in partnership with the British Government began to develop the use of *Project 1* formative assessment strategies across many hundreds of primary, special and secondary schools. 195 schools were involved in the initial phase of AifL (2002-2003). A key feature of developments during 2003-2004 was to increase the number of schools involved in the program, with a particular emphasis on building collaborative partnerships between schools called Associated Schools Groups (ASGs). ASGs range from individual schools to large groups of schools (for instance a secondary school and feeder primary schools) that work together on practitioner-based action-research projects that support the development of professional practice in assessment. By December 2004, local authorities' reports on the number of schools involved in AifL through

ASGs had risen from 195 to 1,581 schools (approximately 56% of all schools in Scotland). The Scottish Executive Education Department (SEED) expressed the intention of making every possible effort to meet the target to 'ensure all schools are part of the assessment is for learning programme, by 2007' (June, 2005).

Formative and Summative Assessment: Concepts and Issues

New Ways of Seeing

Formative assessment is described as: 'all those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged. Such assessment becomes 'formative assessment' when the evidence is used to adapt the teaching work to meet the needs.' (Black & Wiliam, 1998b, p. 2). SEED advocate a re-thinking of the 20th century Vygotskian perspective because traditional teacher centered instructional methods designed to prepare students for frequent high-stakes summative tests were found to be ineffective when compared with collaborative learning systems which emphasize high quality interactions between teachers, students and parents/carers (AAG/APMG 2002-2008).

The notion of the zone of proximal development (ZPD) (Vygotsky, 1978) is of central relevance to the formative assessment classroom entailing a significant change in classroom culture from one that is teacher-centered (expert/novice) to one that encourages equality and mutuality between students. Goos, Galbraith and Renshaw (2002) use the term ‘collaborative ZPD’ to denote equal status interactions between peers. However, high-quality interactions between students are rarely found in classrooms. In an oft-cited study from 1980 conducted by Galton, Simon and Croll, it was noted that the students frequently work in groups but not as groups. Some 20 years later Galton, Hargreaves, Comber, Wall and Pell (1999) conducted a

replication study which found only a slight increase in peer interaction; a finding more recently reiterated by Black (2005). Baines, Blatchford and Chowne (2007) observe, ‘teachers typically plan for their interactions with pupils, but not for interactions between pupils’ (p. 664).

What is a 'Project 1' Classroom?

A *Project 1* A*f*L/A*a*L classroom is founded upon eight key formative assessment principles (AAG/APMG, 2002-2008; OECD, 2005) which demand high quality interactions between students, teachers and parents/carers. There are six key principles underpinning the A*f*L aspects of *Project 1:* students need to 1) be able to understand clearly what they are trying to learn, and what is expected of them; 2) be given immediate feedback about the quality of their work and what they can do to make it better; 3) be given advice about how to sustain improvement; 4) be fully involved in deciding what needs to be done next; 5) be aware of who can give them help if they need it and have full access to such help, and 6) to engage parents and carers in the learning process. The six principles of A*f*L combine with two further A*a*L assessment principles: students need to 7) be able to build knowledge of themselves as learners, and become meta-cognitive; 8) take more responsibility for their learning and participate more in the process of learning. When taken together A*f*L/A*a*L strategies breathe a new vitality into the concept of 'student centered learning' by re-positioning the students at the center of the learning process by building a network of constructive interactions which seek to link students directly to systems, teachers, parents/carers and their peers. In a *Project 1* classroom, students can develop a deeper understanding of their learning when they are given opportunities to discuss the learning process with their teacher as their advisor and with their peers in a climate of equality and mutuality (AAG/APMG, 2002-2008).

The quality of classroom interaction is a matter for grave consideration. Askew (2000)

observes that: 'the characteristics of dialogue are equality, sharing, spontaneity, collaboration and reciprocity. What I found interesting is that young people do not think such experiences are appropriate for the classroom where a particular view of behaviour is perceived' (p. 47). The issue of ineffective classroom interaction is comprehensively addressed by Black & Wiliam (1998b) who believe that, 'in terms of systems engineering, present policies in the U.S. and in many other countries seem to treat the classroom as a black box' (p.1). The 'black box' is an object for vital criticism because it functions primarily as a receptive system where, 'certain inputs from the outside--pupils, teachers, other resources, management rules and requirements, parental anxieties, standards, tests with high stakes, and so on--are fed into the box,' (Black & Wiliam, 1998b, p. 1). As proponents of the constructivist classroom, they are persuasive in voicing their concerns about such a system which is primarily designed to receive and decode external signals. Those who advocate A*f*L/A*a*L seek to go beyond a merely passive congregation of students (i.e. the notion of the pejorative 'black box') by encouraging co-operative and collaborative activities in the classroom. However, traditional learning arrangements continue to prevail, consequently pupils are often seen working in groups but not working as groups (Galton *et al*, 1980; Black, 2005).

At present, the majority of classrooms exhibit a superficial culture of cooperative interaction (Black, 2005). However, research undertaken by the AAG (2002-2004) and the subsequent in-service experiences reported by the APMG (2005-2008) found compelling evidence which indicates the conditions for successful cooperation exist in classrooms. It was found that students are very responsive to the idea of co-operating with different people in their assessment. Of particular interest among their findings is confirmation that students liked to help each other with schoolwork, while either actually working and learning or in terms of assessment. It is therefore unsurprising that a key technique of the A*f*L/A*a*L program is effective dialogue among

the central participants--the students. Furthermore, A*f*L/A*a*L necessarily entails cooperation between all the participants in the learning process including teachers and parents/carers. The APMG found that students appreciate in-depth communication with teachers and parents/carers about their progress, and consider it to be a valuable part of the process of learning. McCroskey and Richmond (1992) state that 'all aspects of what happens in the classroom are contingent upon eliciting cooperation from every class member by employing sound principles of classroom management' (p. 44). The term 'management' in a A*f*L/A*a*L classroom context takes on a unique meaning because it entails the effective management of the learning process by developing activities which support learning through high quality interaction such as, discussion, feedback and goal setting.

Formative Assessment Strategies in Practical Settings

Participants in *Project 1* schools were trained in the deployment of 16 formative assessment teaching strategies: Higher order questioning techniques; use of problem solving techniques; jot time (students are afforded an extended period of time to commit their ideas in writing before the beginning of an interaction); use of wrong answers; wait time; traffic lighting; group work and pair work; discussions; feedback as comments and not grades; oral feedback; sharing assessment criteria; peer assessment; redrafting of work; developing peer-peer communication skills (relational skills training); collaborative goal setting; reflective learning. A strategy worthy of some extended emphasis from the list provided here is that of traffic lighting. It may be used in various ways and is a powerful tool for self and peer assessment. For peer assessment, students may be required to traffic light each other’s explanations and justifications: green indicates work that exhibits explanations which surpass their own current level; orange indicates work that is comparable to their own, and red is used for work which is of lesser quality

than their own. All students are then required to explain why they assigned those levels of recognition and provide constructive critique and praise to each other. For example, a student may recognize that his/her partner has included an example or explanation from beyond the worksheet and award a ‘green light’. Traffic lighting also provides an opportunity for self-assessment and reflection upon one’s current status. For example, if students are required to learn certain science terms or language vocabulary they may clarify their own knowledge by assigning green to words they know and can use with confidence, orange for words in which they have some understanding and red for terms/words that they do not yet understand.

Summative Assessment Revisited

Research indicates that many of the problems with assessment arise from its summative nature (Black & Wiliam, 1998a; Harlen & Deakin Crick, 2003; ARG, 1999). A significant systemic obstacle frustrating the engagement of teachers with formative assessment strategies is the tension between the formative (assessment for learning) and summative (assessment of learning/assessment for qualifications) components of a program. This tension arises from the roles and responsibilities expected of teachers as both formative assessors, engaged in the process of student learning and as summative assessors required to behave as dispassionate judges of attainment (Knight & Yorke, 2003).

Tests are usually viewed summatively by teachers, and their formative potential is largely overlooked (Morris *et al,* 1999) and 'while teachers are usually conscientious about marking student work they often fail to offer guidance on how work can be improved' (Hallam *et al,* 2004, ¶ 2.4). The Assessment Reform Group (ARG, 1999) at Cambridge University identifies various undesirable tendencies exhibited by classroom practitioners. These may be summarized as: a) a tendency for teachers to assess quantity of work and presentation rather than the quality of

learning; b) a focus on marking and grading at the expense of providing advice for improvement, which tends to lower the self esteem of pupils; c) a strong emphasis on comparing pupils with each other which demoralizes the less successful learners; d) teachers' feedback to pupils often attempts to serve managerial and social purposes rather than helping them to learn more effectively. The ARG go on to propose that improving learning through assessment depends on five key factors: i) a recognition of the profound influence instruction and specifically assessment has on the motivation and self esteem of pupils; ii) adjusting teaching to take account of the results of assessment; iv) the provision of effective feedback to pupils; iii) the active involvement of pupils in their own learning; v) the need for pupils to be able to assess themselves and understand how to improve. Particular emphasis was placed upon the sharing of learning goals with pupils; encouraging equality and mutuality between students; involving pupils in self-assessment and providing feedback which leads to pupils recognizing their next steps and how to take them.

A consequence of summative assessment strategies is the creation of large numbers of disaffected students, particularly among lower achieving students (Harlen & Deakin Crick, 2003). This negative impact of current practice has been well documented. Both the ARG (1999, 2002) and the University of London's EPPI-Centre (2002) found that students show high levels of test anxiety when facing summative tests and much prefer other forms of assessment. High-stakes testing creates disaffection among students who do not achieve their full potential. As with all systemic phenomena, the outcomes are cyclical and reinforcing. Those students who exhibit disaffection often experience an ever-deepening spiral of self-defeating learning behavior and worsening motivational problems (Covington, 1984). The ARG (1999, 2002) found that the use of formative assessment techniques in the classroom mitigates the problems identified with summative testing and creates large positive increases in the level of student engagement.

Consequently, choices need to be made between assessment techniques which support the process of classroom learning by involving the student with the meta-process of learning and those that de-motivate students by frequently testing performance outcomes (Clark, 2008). Not only does the predominance of summative testing systems create disaffection on a wide-scale, it perpetuates its own existence - a phenomenon noted by Wiliam *et al* (2004) when they write:

> '... the introduction of high-stakes state-mandated testing, such as now exists in England and most states in the U.S.A, makes the effective implementation of formative assessment even more difficult. This is because ... attempts to maximise student and school scores appear to result in a lack of attention to the kinds of higher-order thinking involved in formative assessment' (p. 49).

However, it should be noted that there is great importance in ensuring the constructive alignment between aims, learning and teaching processes and so summative assessment methods have been emphasized as methods to ensure effective learning (Biggs, 1996). The difference between summative assessment and formative assessment is that while constructive alignment can promote success on summatively assessed learning outcomes, formative assessment is *specifically* designed to support the learning process itself.

AfL/AaL Curriculum: Four Key Architectural Principles

If wide-scale educational innovation is to be successful, the strategic aims of the curriculum should be embodied in a comprehensive blueprint: the *'curriculum architecture'*. It must also be understood that such a blueprint presents the structure of a curriculum and as such, it is an unresponsive or 'inorganic' entity. It is not designed to (and therefore does not) predict or limit the valid learning activities which arise in a classroom where formative assessment strategies are in use. While the A*f*L/A*a*L classroom system is built upon the blueprint, A*f*L/A*a*L is an organic

process and a process of continuous adaptation which seeks to meet the learning needs of the students. The A*f*L/A*a*L classroom is a place where students and teachers work together and 'feedback is used to modify the teaching and learning activities in which they are engaged' (Black & Wiliam, 1998b, p.2). The fundamental need for constant readjustment means that a prescription for teacher action, which seeks to specify the 'best' course of action given certain conditions is impossible even in principle (Wiliam, 2003). The central importance of the dynamic adaptation of instructional methods to the needs of individual students is therefore powerfully emphasized in the formative assessment classroom.

Four interdependent principals govern the construction of an effective assessment infused curriculum; 1. coherence; 2. progression; 3. relevance; 4. engagement/motivation and personalization/choice. The following sub-sections will discuss these principles of curriculum architecture and how they orient teachers and students to the learning process.

The Principle of Coherence

The first curriculum design principle is coherence, or the alignment of program content with program aims to ensure that learning activities combine to form a coherent experience. To avert a misalignment, which can cause serious issues across time, there should be clear links between the different aspects of children's learning, including carefully considered opportunities for extended activities which further consolidate learning and draw different strands of learning together. Assessment should support the learning process, not drive it and assessments should be part of a holistic and balanced learning and teaching process. Learning behaviour is determined by the kind of assessments learners are confronted by and therefore assessments 'define what specific patterns of thinking we want students to demonstrate' (Sparks, 1999). If we want students to demonstrate higher order cognitive skills they need to be engaged in assessment activities which

support that kind of learning. In order to support the learning process and realize learning goals, assessment of content should support higher order learning goals by involving learners in the processes of their own learning. The curriculum architecture should underpin the process of orchestrating high quality learning encounters that provide students with the means for achieving desired learning outcomes (Knight, 2001). As such, curriculum coherence is in part conceptualized as a 'series of encounters between students' (Parker, 2003, p. 532) in collaboration with other stakeholders in the learning process. The principle of coherence was a vital aspect of the successful development of *Project 1* in Scottish schools; it is the fundamental need for coherence the AAG/APMG refer to when they say, 'assessment is for learning *connects* assessment and learning/teaching,' (AAG/APMG, 2002-2008).

Learner: Assessment is an important part of my learning. I understand how the assessment activities I do can help me learn.

Teacher: In planning learning and teaching, I consider what information is needed to demonstrate that learning has taken place and how this evidence can be gathered from learning activities. In my planning I share assessment information with others involved in the learner's learning across the curriculum. Together we ensure learning is planned on the basis of sound evidence about skills development.

The Principle of Progression

The second curriculum design principle is progression (AAG/APMG, 2002-2008). As part of learning and teaching, evidence needs to be collected which demonstrates and promotes the full

breadth and depth of learning as experienced by learners and described by the outcomes. All children should have opportunities for a broad, suitably weighted range of experiences. The curriculum should be organised so that they will learn and develop through a variety of contexts within both the classroom and other aspects of school life. There should be opportunities for children to develop their full capacity for different types of thinking and learning. As they progress, they should develop and apply increasing intellectual rigour, drawing different strands of learning together, and exploring and achieving more advanced levels of understanding.

> *Learner: Assessment information provides me with a full picture of my learning. It shows me how much I have learned and how well and helps me to see pathways into the future of my learning both in and beyond school.*

> *Teacher: I design assessment in a way which enables the learner to demonstrate the breadth and depth of their learning. I use information on their progress and their learning goals to plan appropriate learning opportunities, building on what they have already achieved.*

The Principle of Relevance

The third principle is relevance, and may be divided into two parts a) validity and b) consistency. Many students will learn whatever is necessary to get the grades they desire. Many summatively assessed programs are based on memorizing details. In those circumstances students will usually attempt to deploy a learning strategy that focuses on the retention of facts. The development of higher order cognition is a focal instructional strategy of *Project 1* (Hallam *et al*, 2004). Formative assessment is fundamentally underpinned by dialogue (Black & Wiliam, 2006).

It is therefore an assessment process that supports learning by stressing higher order thinking skills through collaborative planning and organising of work; compromise; conflict resolution (Baines, Blatchford & Chowne, 2007); the sharing and augmentation of knowledge and feedback (Barron, 2000).

a) Validity: A range of assessment approaches are used which are fit for purpose. This means that they should be valid and reliable – they should be well designed and capture the full range of learning and skills that are being developed; particularly high-order problem solving skills.

Learner: I understand why I am being assessed and my assessment clearly reflects the learning I am trying to achieve. They provide me with valuable feedback about how much and how well I have learned so that I can plan next steps.

Teacher: In planning learning activities, I consider the learning intentions and range of evidence I will gather to demonstrate this learning. I develop valid and reliable methods of assessment accordingly.

Parent: I have accurate and succinct information about my child's learning across a wide range of learning and skills.

b) Consistency: Learners' achievements are assessed fairly and consistently across the system, based on shared and commonly understood and consistently applied standards.

Learner: I understand what good learning looks like and I know what I have to do to achieve my learning goals. Self and peer evaluation help me to develop my understanding of what I need to do.

Teacher: I know what quality in learning looks like. I share a common understanding of standards with my colleagues, and apply these with consistency across learners.

The Principles of Engagement/Motivation and Personalisation/Choice

The decision to develop formative assessment strategies in Scottish classrooms arose from the compelling research of Black and William (1998a, b) and subsequent reports on their work (ARG, 1999, 2002) which emphasized the potential of formative assessment strategies to create a large positive increase in the level of student engagement with the learning process. The principles of engagement and motivation are contiguous with those of personalisation and choice, and are highly significant features of an effective curriculum architecture. The arrangements for assessment should be responsive to individual needs and support particular aptitudes and talents in order to challenge and motivate all learners to develop to their fullest. The curriculum should recognize that learners progress in different ways and, based on their experiences go on to make different choices. Assessment should reflect these differences by giving each child increasing opportunities for exercising responsible personal choice as they move through their school career. Once they have achieved suitable levels of attainment across a wide range of areas of learning the choice should become as open as possible. There should be safeguards to ensure that choices are

soundly based and lead to successful outcomes. The effectiveness of such safeguards is dependent on the ability of individual teachers to understand the principles of assessment for learning and apply them in the classroom in order to support the fullest development of learners, while minimising distortions in learning (AAG/APMG, 2002-2008).

The notion of personalization and choice is by no means new. For more than 30 years researchers have been aware that relating new knowledge to learners' existing understandings of the world is an effective way for learners to acquire deeper meaning from new information. Since personalization of the curriculum emerged as a valid pedagogical principle, it has been discussed as a means of motivating learners by incorporating their goals and choice of topics into a curriculum, particularly for addressing values (Howe & Howe, 1975), and as a model of behaviour modification for disruptive students (Mamchak & Mamchak, 1976). Some 35 years later the *Project 1* classroom system seeks to fully value and recognize learners' achievements by acknowledging the individuality of personal experience and the accommodation of learners' needs in the instruction.

Learner: I am involved in planning my learning and setting challenging goals for myself. Assessment information helps me to see how far I have come and what I need to do to achieve my goals and motivates me to set new goals. I am assessed in ways that allow me to demonstrate and recognise the full range of my achievements. Where appropriate, I am involved in decisions about when and how this assessment will take place.

Teacher: The learning, teaching and assessment activities I plan create opportunities for

dialogue to help learners set and achieve challenging goals based on high quality feedback on their progress. In planning teaching learning and assessment, I consider the needs of the wide needs of learners. I plan an appropriate range of activities to give learners the opportunity to demonstrate their learning and provide feedback accordingly.

A Practitioner Evaluation of 'Project 1': A Literature Review

This section of the article features the findings of two separate research papers which evaluate the crucial development stages of *Project 1* (2002-2004) in UK schools: 1) Hallam, Kiston, Peffers, Robertson and Stobart (2004) investigated *Project 1*only and; 2) Condie, Livingstone and Seagraves (2005) examined the impact of *Project 1* alongside various other projects within the AifL programme. It may be of interest to note that teachers exhibited a consistently greater interest in responding to questions regarding *Project 1* than any other project included in Condie's research.

At the behest of SEED, Hallam *et al* undertook to investigate effective classroom approaches to formative assessment (October 2004). Their investigation is founded upon the earlier (and continuing) research of Black and Wiliam (1998a, b). They draw various sources of data directly from school settings: teachers' agreements, action plans, program dairies, case study reports, relevant school self-evaluations and field visits. A primary function of the early field visits was to introduce participating staff to the use of a rating scale used to quantify the perceived effectiveness of *Project 1* to a range of outcomes. All data was analyzed to consider the extent of change across the early period of the innovation in the following areas: student learning, motivation and behavior; student awareness of assessment; attainment; classroom practice; teacher

beliefs and attitudes; teacher understanding of assessment; parental/carer involvement in their child's education.

Student Learning, Motivation and Behaviour

Hallam *et al* (2004) found strong positive consensus among teachers (n=72) regarding enhanced involvement, motivation and confidence in their students. Generally, there were fewer comments regarding behavior. Hallam *et al* (2004) speculate that 'this may have been in part, because the pupils participating in the project were on the whole already well behaved (¶ 4.7.4).' A slightly later SEED commissioned study into AiFL and the effectiveness of formative assessment strategies was undertaken by Condie *et al* in December 2005. The reluctance of teachers to comment on changes in behavior was a remarkable feature here as well. Condie *et al* (2005) used questionnaires as a part of their method and issued the same basic template in two phases spaced 16 months apart. 44 teachers and 21 head-teachers participated in phase 1; 56 teachers and 26 head-teachers participated in phase 2 of the survey. In both phases, 21% of participating teachers declined to evaluate the statement: 'Pupils have shown improved classroom behavior'. A further interesting feature of Condie's research is that while 73.5% of respondents strongly agreed or agreed (SA/A) with the statement on discipline in phase one, only 46% did so in phase two (2005, ¶ 4.4). The marked decline of positive responses in phase two of Condie's questionnaire was explained by head-teachers' as an indication of the generally good discipline found across participating classes at the time, and so what may not be observed may not be reported. Condie's report did not seek to examine if the good discipline reported by head-teachers at the time of phase two was the outcome of earlier *Project 1* interventions in the classroom. The responses to the Condie *et al* questionnaire concur with the favorable indications received by Hallam *et al*, regarding learning, confidence and motivation:

Project 1 Questionnaire (Condie *et al*, 2005, ¶ 4.4)

	Phase 1	**Phase 2**
	SA/A	**SA/A**
The developments enhance the learning of all pupils	75.00%	67.00%
Pupils have increased confidence and show greater self-esteem	70.50%	72.00%
Pupils are more motivated toward learning	70.00%	*n/a*
Pupils have become more actively involved in the learning process	81.00%	82.00%

Student Awareness of Assessment

An important aspect of *Project 1* was the effect on students' meta-cognitive skills. Participating students became more aware of their learning needs and what they had to do in order to make progress (Hallam *et al*, 2004). For example, Hallam reports a strong positive reaction from students after the use of a feedback sheet designed to develop their insights into their writing skills (2004, ¶ 4.7.5). Condie solicited the perceptions of teachers on this matter:

	Phase 1	**Phase 2**
	SA/A	**SA/A**
Pupils are better equipped to assess their own learning	79.50%	78.00%
Pupils are able to set realistic targets	66.00%	66.00%
Pupils are developing skills in peer assessment	66.00%	77.00%

Attainment

Attainment was an area in which teachers were reluctant to offer comment. Hallam states that drawing conclusions about *Project 1's* impact on attainment would be premature because of the early development stage of the project. They do however report that some teachers were very positive about the impact of formative assessment strategies, while some in policy positions

(head-teachers and local government officials) were more reserved in their praise (2004, ¶ 4.7.8). Condie posed the following statement on attainment to teachers: ‘I have evidence that pupil attainment has improved through project activities.’ Only 32% of respondents in phase 1, and 28% in phase 2 strongly agreed or agreed with the statement. The low approval rating afforded to this statement is in part explained by a marked reluctance among participating teachers to commit any form of response on this issue: 44% of teachers in phase one and 42% in phase two chose to offer no response. It is therefore impossible to ascertain if they inclined towards agreement or disagreement on the issue of attainment.

Classroom Practices

'A major outcome...was the change in classroom practices which increased the active engagement of pupils, who were encouraged to take ownership of their learning rather than being the passive recipients of the delivery of curriculum' (Hallam *et al*, 2004, ¶ 4.7.1). Hallam reported that relationships with the students 'blossomed' and it became possible to bring forward difficulties without negative impact (2004, ¶ 4.7.1). Significantly, Hallam found that the students were generally positive about the impact of the project. Similarly, Condie *et al* (2005) requested that teachers respond to the following statement: ‘Pupils themselves report positive views of project activities.’ Practitioner responses were favourable, with 62.5% (in phase 1) and 65% (in phase 2) of teachers strongly agreeing or agreeing with the statement.

It can be seen that there is a consensus which runs throughout the responses to the Condie research questionnaire. Teachers consistently indicate that students are more motivated, more involved and better equipped to assess their own learning. In addition, students are positive about project activities, show greater confidence and are generally able to set realistic learning targets.

Teacher Beliefs and Attitudes

The AfL project tapped into the existing beliefs and attitudes of many participating teachers. Hallam *et al* (2004) observe that:

'The nature of the project itself with its focus on pupil learning and the enhancement of teaching resonates with teachers, taking them back to fundamental pedagogical principles...It's success in delivering improved pupil motivation and engagement provided teachers with immediate positive reinforcement for continuing development, implementation and evaluation of the strategies' (¶ 1.5.11). Indeed, 100% of respondents assigned a rating of VS/S to the project improving their motivation (Hallam e*t al,* 2004, ¶ 1.5.18). Condie *et al* reported numerous positive descriptions: 're-energised, satisfied, confident, renewed enjoyment' (2005, ¶ 4.4). It is evident that the students are not the sole beneficiary of a movement from a teacher-centered pedagogy to one which places the student and their learning needs at the heart of teaching. Teachers themselves report it to be an essential opportunity to reflect on their existing attitudes on classroom practice (Hallam *et al,* 2004). Hallam *et al* present a particularly meaningful remark from a participating teacher: 'Even in terms of where I was in education 10 years ago, you can see that is a shift, and it's almost as if now the focus is on the process rather than the product' (¶ 4.8.2). This is a very significant insight into the essential focus of formative assessment being one of process and not oriented to performance. Both Hallam and Condie gathered extensive evidence of the impact of *Project 1* on the personal and professional development of teachers, many of which used the opportunity to reflect on their past understandings of teaching and learning and compare them to their current practices.

Teacher Understandings of Assessment

Hallam's report on *Project 1* stresses the need for a careful clarification of the meaning of formative assessment, followed by the embedding of formative assessment strategies in practice.

'Teachers need to understand the underlying principles rather than have a superficial knowledge strategies' (Hallam *et al,* 2004, ¶ 1.8). Condie *et al* discovered that teachers and head-teachers participating in the initial development phase of *Project 1* were troubled by a lack of regarding the underlying theories and principles of formative assessment (2005, ¶ 4.4). Both studies elicited feedback which indicated that a much greater depth of understanding was by participating staff prior to the commencement of work in schools. However, as the phase of *Project 1* continued, teachers reported the evolving understanding of how assessment and learning connect as a very powerful learning experience (Hallam *et al,* 2004, ¶ 4.8.1). By the latter stages of project development, 100% of participating teachers in *Project 1* evaluated the project as VS/S at improving their understanding of assessments (2004, ¶ 1.5.18).

In terms of the overall effect of the project upon teachers, the Hallam *et al* report reveals the project had a significant impact and led to:

- the understandings that formative assessment takes time and requires long-term commitment;
- improved feedback to students;
- a deeper understanding of assessment;
- teachers applying formative assessment strategies beyond the prescribed boundaries of the project;
- teachers becoming increasingly aware of how students learn and their learning needs.

Parent/Carer Involvement

One of the key aims of the wider multi-project AiFL innovation is to involve parents and carers more actively in the process of their children's learning. This overall aim is therefore

equally significant when considering *Project 1* and the task of developing formative assessment strategies in schools. The importance of parental/carer inclusion is confirmed by Townsend (1997),who believes that effective schools are those which welcome parents by engaging them and involving them in the widest range of school activities; most crucially those concerning their child's development. Although a key aim of *Project 1*, the level of involvement by parents and carers by the end of the development phase was disappointing, particularly when compared

to the other more successful aspects of the project discussed above. Only 23% of teachers indicated that parental/carer involvement had increased as a result of the project (Hallam *et al*, 2004, ¶ 1.5.18). Condie *et al* found that only 38% of head-teachers reported that involvement practices had changed as a result of the project. Indeed, some schools neglected to inform the parents about the project (2005, ¶ 4.4). Condie determined six key themes by analyzing teachers' comments about the project. From a total of 410 recorded thematic references there were only 22 mentions of better links to parents and carers (2005, ¶ 4.4). It is apparent that the space between the school system and parents/carers had not been sufficiently explored by the end of the project development stage. It is to be hoped that the level of 'public engagement' exhibited by schools increases in order to create communities of practice which work together in the spirit of trust and under the agreement of mutual accountability. It is this kind of relationship which brings into existence legitimate partnerships (Marx 2000).

Project 1: Challenges Encountered in the Development Stage (2002-2004)

Instigating change in schools is a highly complex process. Any complex system can be broken down into sub-parts and various authors have sought to examine the process of educational change management in terms of categories. For example, Johnston and Neidermeier (1987) see change in terms of 3 broad categories of variables: a) structural (leadership, finance,

human resources); b) procedural (time, organization, technical assistance) and c) attitudinal, primarily relating to negative responses to top-own policy making and the existence of internal politics. Knoop (1987) suggests four key areas of change: i) administrative (policies and objectives); ii) curriculum/program; iii) human resources (staff interactions, beliefs, expectations; and iv) teaching and learning, where Knoop highlighted group interactions between teachers and students and methods of teaching pertaining to classroom relations and communication. Fullan (1991) confirms that the actual process of educational change management is a highly complex process requiring the strong commitment of principals and external policy makers. It can be seen that the factors which ensured the success of the *Project 1* (stated earlier) take these change variables into full account. The careful arrangement of consultative networks by SEED led to project success despite the reputation of teachers for being inherently stubborn when faced with innovation, in part due to their strong sense of acculturation and continuity.

Hallam *et al* report very positive attitudes by schools to the difficulties faced during the developmental stage of *Project 1*. When asked about the difficulties encountered schools identified relatively few, preferring instead to see problem solving as developmental and positive (2004, ¶ 1.5.6) – an indication that the overwhelming majority of participating teachers and principals were committed to the project from the outset. It was in this spirit that various developmental challenges were reported by participating schools. Hallam *et al* (2004) found that some teachers, even those who grasped the underlying principles of formative assessment, were unclear on what they were supposed to do in their classrooms. One teacher explains that this barrier to change exists because, 'teachers are used to attending various in-service courses where they are told exactly what to do in the classroom' (Hallam *et al* 2004, ¶ 4.6.1). Consequently,

participating teachers expressed concerns about the movement from concept to operationalization. Some felt that more direction was required on the differentiation of strategies taking into account the wide range of attainment in some classes (Hallam *et al,* 2004). These are valid concerns, not least when one considers issues of choice and equity, which are fundamental themes of any credible curriculum architecture. All students, no matter what their ability, gender, ethnicity or economic status, need to be supported equally as they gain mastery of the basic curriculum and so it is essential that schools 'identify and remove physical and programmatic barriers that produce disproportionality in academic achievement' (OSPI website). This situation must exist in such a way that students do not perceive bias or discrimination in their treatment. If it does not, it is to betray sensitivity and trust and destroy the central pillar supporting the A*f*L/A*a*L classroom: cooperation (ARG 2002). In addition, some teachers found the integration of formative and summative assessments very challenging (George Street Research [GSR], 2007). Such initial uncertainty among some teachers is not indicative of shortcomings in their preparation by SEED. Such preparations simply did not take place and traditionally precise instruction regarding the specifics of implementation were carefully avoided. Wiliam, Lee, Harrison and Black (2004) explain the rationale behind this non-prescriptive approach, 'the central tenet of the research project was that if the promise of formative assessment was to be realised, traditional research designs, in which teachers are 'told' what to do by researchers would not be appropriate (p. 50).' As the project progressed, the lack of clarity exhibited by some teachers at the beginning evolved into an advantage as they appreciated that it had compelled them to focus on their own teaching materials and devise their own action plan (Hallam *et al,* 2004) in effect they were adjusting to the atmosphere outside of the 'black box' (Black & Wiliam, 1998b). However, in a 2007 review of the entire AiFL project research conducted by

George Street Research found that awareness and understanding of AifL was not firmly embedded across teachers in Scotland and understanding was not clear by teachers in terms of the principles underpinning assessment strategies (GSR, 2007). As the government funded part of the AiFL project drew to close in late 2007 the quest for fine-grained understandings of formative assessment principles among teachers continued.

Other challenges arising from the development of formative assessment strategies included:

- Some staff and students didn't like to be videoed or lacked the technical support to expedite this process;
- Teachers spoke of the need for self awareness to avoid reverting to old habits;
- Tensions between formative and summative assessment demands;
- Concerns about funding for further development;
- Competing agenda and external accountability demands.

Many teachers identified their primary concern as insufficient time to engage in the process of strategic development (planning, preparing, reflecting, reporting) (Condie *et al,* 2005). Time was also a concern when it came to covering the curriculum, with many teachers expressing concern that the material was being covered at a slower pace. These initial concerns were to some extent mitigated by the emerging quality of work and learning as the project progressed (Hallam *et al,* 2004).

Project 1: Factors Contributing to Success

Both Hallam *et al* (2004) and Condie *et al* (2005) found the development stage of *Project*

1 to be a success from which lessons can be learned and applied to future projects which seek to develop innovative changes to classroom practice. It is clear that the development of formative assessment strategies in the classroom stimulated teachers personally and improved them professionally. Hallam *et al* attribute various factors to the success of the project:

- Participating teachers had time to plan, prepare, reflect and evaluate. This was made possible by the serious intent of SEED to instigate change at a policy level;
- Once teachers became accustomed to the idea of exploring formative assessment strategies in their classrooms, the action-research elements of the project became very meaningful;
- Head-teachers, senior management team members and teachers were committed to the project from the outset;
- Teamwork between all stakeholders in the project;
- Regular meetings and project forums to reflect upon project efficacy and to plan next steps;
- Resources (supply teachers, I.T, instructional materials, time and funding) were provided which supported the project and the strategies;
- The incorporation of the project into the school development program.

Conclusion

The development of formative assessment strategies in the Scottish region of the UK was a highly complex process that required the political commitment of government to be matched by that of participating teachers and principals. Even when this collaboration was secured and the processes of change management among stakeholders carefully planned, conceptual difficulties persisted beyond the 2002-2004 development phase of the AiFL project (GSR, 2007).

The embedding of innovative pedagogical principles is beset by challenges and tensions. As Black & Wiliam (2005) observe, the effective integration of formative and summative assessment will require a different change-management strategy depending on national circumstances, and in some cases may be very challenging indeed. Innovations in education invite such challenges and are inevitable (Fullan, 1991). From the out-set, the constructive problem-solving attitude exhibited by participating schools in Scotland was a large contributory factor to the successful development of formative assessment strategies (Hallam *et al,* 2004). A primary source of conceptual challenge associated with *Project 1* was the acculturated preference of teachers for prescriptive and precise instructions on how to implement new classroom practices (William *et al,* 2004; Hallam *et al,* 2004). Despite the challenges discussed in this article, teachers responded very positively on an evaluative rating scale: 100% of respondents reported that the project was 'very successful' or 'successful' (VS/S) in increasing teacher understanding of the role of assessment and in improving teacher motivation. Further, 91% of respondents indicated that *Project 1* was VS/S in changing classroom practices; 92% indicated the project was VS/S at changing assessment practices; 94% the extent of questioning; 95% in increasing the level of discussion and 97% of respondents assigned a VS/S rating to an improved teacher focus on the learning needs of students (Hallam *et al,* 2004).

If formative assessment interventions are to be successful on a large and long-term scale certain conditions should exist: (i) dedicated political support at all levels of government; (ii) a clear and compelling expression of the conceptual framework which underpins formative assessment and continuing support for practitioners beyond the development phase (iii) close collaboration between all stakeholders (teachers, administrators, parents/carers and students), who work together to engage students with the process of their own learning; (iv) a climate of

change management in which practitioners approach obstacles as constructive and necessary challenges; (v) the alignment of summative and formative assessment activities so that they work in concert to support and evaluate learning. Finally, at the most fundamental level formative assessment practices are characterized by positive learning interactions and dialogue. As such, an important strand of future research resides in developing fine-grained understandings about high-quality classroom dialogue between teacher/student and between peers, and how they support productive learning in practical settings.

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REVIEW

Formative Assessment: Assessment Is for Self-regulated Learning

Ian Clark

Abstract The article draws from 199 sources on assessment, learning, and motivation to present a detailed decomposition of the values, theories, and goals of formative assessment. This article will discuss the extent to which formative feedback actualizes and reinforces self-regulated learning (SRL) strategies among students. Theoreticians agree that SRL is predictive of improved academic outcomes and motivation because students acquire the adaptive and autonomous learning characteristics required for an enhanced engagement with the learning process and subsequent successful performance. The theory of formative assessment is found to be a unifying theory of instruction, which guides practice and improves the learning process by developing SRL strategies among learners. In a postmodern era characterized by rapid technical and scientific advance and obsolescence, there is a growing emphasis on the acquisition of learning strategies which people may rely on across the entire span of their life. Research consistently finds that the self-regulation of cognitive and affective states supports the drive for lifelong learning by: enhancing the motivational disposition to learn, enriching reasoning, refining meta-cognitive skills, and improving performance outcomes. The specific purposes of the article are to provide practitioners, administrators and policy-makers with: (a) an account of the very extensive conceptual territory that is the 'theory of formative assessment' and (b) how the goals of formative feedback operate to reveal recondite learning processes, thereby reinforcing SRL strategies which support learning, improve outcomes and actualize the drive for lifelong learning.

Keywords Formative assessment · Feedback · Self-regulated learning · SRL · Meta-cognition · Social cognitive theory (SCT) · Social context · Sociocultural · Lifelong learning · Collective efficacy · Self-efficacy · Achievement · Motivation · Autonomy

Overview

The paper advances the proposition that the theory and practice of formative assessment combines cognition, social, and cultural theories which guide instructional methods and drive self-regulated strategies and lifelong learning competences among learners. The first

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section, 'An Introduction to the Learning Community', presents the basic objectives for the theory of formative assessment and briefly relates how that framework actualizes self-regulated learning (SRL). The second discusses the post-structuralist foundation for the theory of formative assessment. It has been written in accordance with Alexander's (2008) observation that research is migrating "farther and farther from the initial philosophical or psychological roots" (p. 370). Therefore, it is essential to secure an early understanding of the philosophical essence from which the theory arises and to locate that essence in a relevant contemporary socio-political context. The third section discusses the major elements of feedback (formative, synchronous, and internal) which, when taken together form the core of formative assessment. Each aspect has a powerful influence over the development of the meta-cognitive functioning and the self-efficacy required for individuals to make progress in their mastery of SRL strategies. As we move to the 'center' of the paper, the fourth main section, 'Formative Assessment: Assessment Is for Self-Regulated Learning' speaks to the central thesis of the article. The section discusses how formative assessment differs from other forms of assessment and how those differences drive SRL. The second purpose of the section is to discuss the confusion and controversy surrounding the term and how, when it is misappropriated it loses all potential to develop SRL strategies among learners. Finally, this section delineates SRL and draws parallels between formative assessment and SRL as a dynamic which emphasizes active participation and recognizes the pivotal importance of feedback. The fifth section, 'Connecting Objectives, Goals and Strategies' details the goals of formative assessment before connecting them to the strategies deployed by students as they move along the SRL continuum toward autonomy. The sixth section 'Internalization, Environment, Interaction, and Experience' argues for a harmonious conception of formative assessment, one which does not engage with the traditional theoretical tensions between 'intellectual tribes'. It is reasoned that for SRL to take place these four key 'factors of knowledge production' should be understood by practitioners, administrators, and policy-makers. An analysis of literature on vicarious and participatory aspects of the theory of formative assessment are given emphasis in the seventh section: 'Theoretical Synthesis: Indirect and Direct Learning', because as learners become more skillful self-regulators they interact with the environment in various ways in order to access the informaton they need to achieve their personal and social goals. The eighth section, 'Socially Mediated SRL: the Circulation of Discursive Power' discusses mutual learning relationships, emphasizing the role of sociocultural theories in enhancing understanding of what the social and environmental aspects of the formative assessment classroom should look like if learners are to gain mastery of SRL. The final main section, 'Thematic Discussion' arises from previous philosophical and theoretical sections directly and discusses six interrelated themes of global interest on formative assessment and SRL: (1) lifelong learning, (2) self-efficacy, (3) collective efficacy, (4) persistence and stable motivation, (5) achievement, and (6) feedback and meta-cognition.

The research databases ERIC and PsychInfo were searched between 1975 and 2011 using the following terms: formative assessment, feedback, self-regulated learning, SRL, meta-cognition, Social Cognitive Theory (SCT), social context, sociocultural, lifelong learning, collective efficacy, self-efficacy, achievement, motivation and autonomy. Studies were chosen for their potential to contribute to a comprehensive theory for SLR. Of particular interest are studies which permit the comparison and contrast between differing nations which have implemented formative assessments into their policy frameworks. As such, the seminal Organization for Economic Cooperation and Development (OECD) report

'Formative Assessment: Improving Learning in Secondary Classrooms' (2005) and the proceedings of the follow up international conference 'Assessment for learning: Formative Assessment' (2008) are used as steering papers which serve to guide the selection of the research presented in this paper.

Contribution to the Field

Figure 1 represents the theory of formative assessment by expressing the outer ring as the philosophical basis (PS) from which the theory of formative assessment (TFA) arises. The diagram presents a theoretical delineation of the theory of formative assessment, explaining the 'encapsulation' of SRL through the pursuit of objectives and goals (A*a*L, A*f*L, G1…G8), which arise from SCT and sociocultural theories and therefore brings SRL into existence. It should be noted that the objectives of Assessment as Learning (A*a*L) and Assessment for Learning (A*f*L) have each been refined into four goals (G5 to G8 and G1 to G4, respectively) to which they relate and which are pursuant of SRL. Moving toward the core of the cross-section one encounters the meta-cognitive (MC) components of planning (P), monitoring (M), and reflection (R) and the affective (SE) components of ambition (A), effort (E), and persistence (Pe) required for SRL to exist. Feedback (F) is located at the center of the model. Feedback is pivotal to formative assessment and therefore to the development of SRL strategies among students. The elements presented in Fig. 1 will be discussed in a depth which expresses the dynamic nature of the figure and brings new clarity to the theory of formative assessment and stimulate new directions in research and practice.

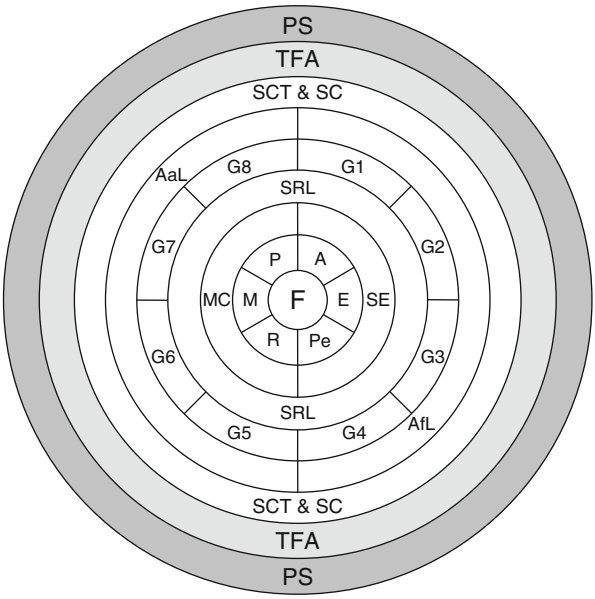

Fig. 1 The theory of formative assessment in cross-section. *PS* post-structuralism, *TFA* Theory of Formative Assessment, *SCT & SC* Socio-Cognitive Theory and Sociocultural theories, *AaL* assessment as learning, AfL assessment for learning, *G1..G8* formative goals 1..8, *SRL* self-regulated learning, *MC* meta-cognition, *SE* self-efficacy, *P* planning, *M* monitoring, *R* reflecting, *A* ambition, *E* effort, *Pe* persistence, *F* feedback

An Introduction to the Learning Community

Assessment 'for' and 'as' learning

Formative assessment is connected by two contiguous assessment objectives: assessment *for* learning (A*f*L) and assessment *as* learning (A*a*L). The purpose of A*f*L is to monitor the progress of the learner toward a desired goal, seeking to close the gap between a learner's current status and the desired outcome. "This can be achieved through processes such as sharing criteria with learners, effective questioning and feedback" (Assessment Action Group/AiFL Programme Management Group [AAG/APMG], 2002–2008). A*a*L refers to the collaborative and individual reflection on evidence of learning. It is a process "where pupils and staff set learning goals, share learning intentions and success criteria, and evaluate their learning through dialogue and self and peer assessment" (AAG/APMG, 2002–2008). Through a process of frequent community participation, learners move along a continuum of self-regulation as they acquire the skills to use learning and assessment tools [externally fabricated assessments] and eventually the technological expertise that characterizes membership in the culture as toolmakers able to co-construct learning and assessments tools (cf. Lave and Wenger). Rogoff (2003) refers to the development of expertise through guided experience as development through participation in cultural activities. As Schön (1987) states, "as she learns to design, she learns to learn to design—that is, she learns the practice of the practicum," (p. 102).

Philosophical origins

The essence of formative assessment arises from interpretations of post-structuralism based upon a principled assimilation of work by a diverse range of theorists (cf. Foucault, Bourdieu and Heidegger). Heidegger (1889–1976) saw a need for the reinvention of a society in which education plays a central role by establishing "an edifying, empowering and liberating reconnection to the world" (Thomson 2004, p. 458). Dewey (1938) is well-known for his critical evaluations on the environmental structuring found in most schools where desks are arranged in rows and students are reinforced for silence and compliance. Dewey's concerns that such methods diminish the individual curiosity to learn parallel the influential post-structuralism of Heidegger, who also recognized the challenge to authentic individuality in a world which emphasizes conformity. Dewey's critique leads to the first of two philosophical strands most relevant to the post-structuralist basis of formative assessment. One strand is the transformation of passive recipients into the active participants, who create and contribute their own meanings instead of phlegmatically receiving meanings and leaving them unquestioned. The second strand is the rebuff of 'scientism'. Scientism (e.g., as embodied in the No Child Left Behind Act [NCLB], 2002 in the US) posits that standardized testing offers a scientific and therefore superior method of measuring the quality of public schools and teacher competence. Advocates of NCLB believe that high scores on standardized tests equate to a successful learning experience including quality instruction. This is a belief widely challenged as specious because the focus on high-stakes testing trivializes learning and threatens the internal states (e.g., confidence, self-efficacy, and interest) required for the self-regulation of learning (Shepard 2000; Abrams 2007). These values underpins the need for active participation emphasized by studies on SRL and the more specific aspects of social context captured by sociocultural research which informs the theory of formative assessment. There are five additional aspects of post-structuralist thought which are elemental to understanding the theory of formative assessment: (1) the examination of the democratic values of equality,

representation, and consensus; (2) the recognition that it is the difference between individuals which create opportunities for social development by discourse; (3) it is discourse which determines how power is circulated throughout a society; (4) it is those with knowledge who have the power to determine the nature and subject of the discourse; and (5) the advocacy for viewpoints which challenge the existing order. Drawing from the post-structuralist values of representation, discourse, control, and consensus, the instructional techniques found in the formative assessment classroom reduce the formality and psychological risk associated with teacher-fronted transmission methods, the use of which negate the benefits associated with collaborative learning. The values inherent to post-structuralism set the stage for the development of SRL strategies among students. Despite the evident benefits of SRL, field research (e.g., Black and Wiliam 2006; Macintyre *et al*. 2007) has found that the circulation of discursive and procedural 'power' among students made teachers in the US (and elsewhere) feel insecure, due to a certainty in their minds that the move toward spontaneous dialogue would not actualize the legitimate learning relationships predicted by formative assessment research, instead fomenting disruptive social behavior among students. A contrasting conception of dialogue is provided by the Danish *Folkeskole* (public primary and lower secondary school system), which implements formative assessment in order to produce self-regulated and informed students. Townshend *et al*. (2005) explain the Danish system as one in which, "open dialogue and exchange between and among students and teachers are considered essential to education, and reinforce the Danish model of democracy" (p. 117). The Danish philosophy on assessment provides an interesting counterpoint to the American emphasis on standardized assessment procedures because in Denmark verbal communication is by far the most important means for collecting holistic evidence about students' learning experiences. Townshend *et al*. (2005) explain that in Denmark, "oral, rather than written, assessment is preferred because it is quick and flexible and permits students to initiate or respond to teachers. In this way it is possible to detect and correct misunderstandings and ambiguities on a timely basis" (p. 120).

Aspects of Feedback: Formative, Synchronous, and Internal

The aforementioned philosophical essence determines the value that teachers, administrators, and policy-makers place upon discourse, identity, and social power (taken together the term 'voice' seems appropriate). The notion of 'voice' impacts on how teachers structure learning interactions or feedback with and among students. Effective feedback, which forms the core of formative assessment practice and SRL, (see Fig. 1) occurs when learners are encouraged to articulate their tacit knowledge (existing motives, ideas, opinions, beliefs, and knowledgeable skills). In their Finnish study, Voogt and Kasurien (2005) emphasize the importance of tacit knowledge, "Formative assessment may consist of hard data, but more often and more importantly of 'tacit knowledge', *i.e.* knowledge that both the teacher and student obtain through discussion, reflection and experience" (p. 154).

It is clear that an important function of the "formative interaction" (Black and Wiliam 2009, p. 11) is to make the experiential tacit knowledge that is 'hidden' within the learner transparent, explicit and available (cf. Polanyi). Matthew and Sternberg (2009) emphasize that tacit knowledge is "deeply rooted in action and context, and can be acquired without awareness and is typically not articulated or communicated" (p. 530). In the formative classroom, tacit knowledge is made explicit and accessible through active participation and mutual discourse. McInerney (2002) suggests that the process of making learners' knowledge visible should not be one of "extract[ing] knowledge from within…to create

new explicit knowledge artifacts". Instead, organizations should make tacit knowledge explicit by focusing on the creation of a "knowledge culture" that encourages learning and the creation and sharing of knowledge (p. 1014; cf. Black and Wiliam). The second contention—tacit knowledge is both an outcome of experience-based learning and as a basis for continuous learning—is an important understanding that logically arises from the experiential acquisition of knowledge. The connection between experiential (tacit) knowledge and the internalization of new knowledge is discussed in detail later in this paper and is a central theme in SRL as emphasized in the Japanese literature on organizational innovation (Nonaka 1994; Nonaka and Takeuchi 1995); applied to US military and university settings (Matthew and Sternberg 2009) and as a key feature of global professional practice (Sternberg and Horvath 1999). While the literature on tacit knowledge typically arises from adult vocational settings, the theory of formative assessment applies the notion of a "knowledge culture" to schools and younger learners. This approach decreases the external risks and increases the intrinsic benefits learners associate with their learning environment; the circumstances required for learners to move toward a mastery of SRL strategies. There are three aspects of feedback which when taken account of have the potential to impact meta-cognitive and affective (self-efficacious) functioning, revealing otherwise recondite knowledge among learners which facilitate the acquisition of SRL strategies. They are discussed in three sub-sections: formative feedback; synchronous feedback, and external/internal feedback.

Formative feedback

For Black and Wiliam (2009)

> A formative interaction is one in which an interactive situation influences cognition, i.e., it is an interaction between external stimulus and feedback, and internal production by the individual learner which involves looking at the three aspects, the external, the internal and their interactions. (p. 11).

Therefore, sharing learning intentions and identifying clear assessment criteria is the *sine qua non* of formative assessment (Black *et al*. 2003; Mansell *et al*. 2009). The objective of formative feedback is the deep involvement of students in meta-cognitive strategies such as personal goal-planning, monitoring, and reflection, which support SRL by giving learners "the power to oversee and steer one's own learning so that one can become a more committed, responsible and effective learner" (Black and Jones 2006 p. 8). Looney *et al*. (2005) conducted research in two Italian secondary schools. By the third year of school, students in Italy are expected to have developed a relatively high level of autonomy, social skills and the ability to make functional decisions regarding their own development. The researchers took a progression approach by gathering evidence for the validity of formative assessment to promote SRL from the students. The respondents were generally positive about their experience of school and:

> …provided some evidence that they are indeed learning to be autonomous. As one Year 3 student declared, if she does not understand a new concept, she tries to relate it to another subject in order to understand the context better, or its relation to other ideas. In other words, she develops her own learning scheme. Ultimately, this student said, "It is up to us to learn". This sentiment was widely echoed among fellow students. (p. 66)

This view is consistent with post-structuralist philosophy in that empowering feedback is circulated among the students, which then makes learning objectives and the "features of

excellent performance" transparent (Shepard 2000 p. 11). Cauley and McMillan (2010, p. 3) observe that such practices "encourage students and give them a greater sense of ownership in instructional activities", elaborating that collaborative goal setting improves students' intrinsic motivation and, when combined with other formative assessment practices, also further supports the adoption of mastery goals. The need for transparent grading criteria and learning goals is emphasized by Frederiksen and Collins (1989) in their critique of summative tests which "subvert" teaching and lead to an emphasis on the memorization of facts and rote sequences at the expense of reasoning skills.

Feedback is described by Winne and Butler (1994) as, "information with which a learner can confirm, add to, and overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies" (p. 5740). Nicol and MacFarlane-Dick (2006) argue that formative feedback should be used to empower students as self-regulated learners, and contend that because formative feedback strategies enhance self-regulation all assessments should be restructured as formative assessments (Sadler 1989; Nicol and Macfarlane-Dick 2006). Butler and Winne (1995) underscore the centrality of feedback in regulating learning progression, "for all self-regulated activities, feedback is an inherent catalyst," (p. 246). It is worthy of note that not everything that teachers believe to be feedback is in fact formative. For example, Hattie and Temperley (2007) contribute to the corpus of understanding on feedback as a powerful instructional approach in their meta-study which derived effect sizes for different kinds of feedback. They obtain high effect sizes when students are given 'formative feedback'; that is, feedback on *how* to perform a task more effectively and far lower effect sizes when students are given praise, rewards, or punishment. Simply telling a student to 'work harder' or 'recalculate your answer' does not possess the qualities of formative feedback or promote self-regulated learning because it does not strategically guide (or scaffold) learning by informing the student how or why they need to do this. Feedback becomes formative when the evidence of learning is used to adapt teaching to meet student needs (Black and Wiliam 1998b; Sadler 1989). More specifically, students are provided with instruction or thoughtful questioning which scaffolds further inquiry and deepens cognitive processing. This instructional approach closes the gap between their current level of understanding and the desired learning goal (Vygotsky 1978; 1987). This mutual process of continual readjustment causes learning to progress at a rate which is sufficient to motivate students to self-regulate the effort required to progress further (Butler and Winne 1995). The discursive landscape is punctuated by three question categories, each of which is formative and self-regulatory in nature: (a) Feed-up: Where are we going? This concerns itself with the sharing of learning objectives; (b) Feedback: How are we doing? A question which monitors and assesses learning progression, either for a specific task or more generally; (c) Feed-forward: Where to next? This question relates to the next steps required for improvement on a specific task/project or more generally across time (Hattie and Temperley 2007).

The theory of formative assessment hinges on the strategic adaptation of instruction to meet student needs. This entails collaborative activity between adults and children as mutual partners who share responsibility and play different roles (Dewey 1938; Black and Wiliam 1998a; ARG 1999; Black and Wiliam 2009). Dewey (1938) emphasized it was the responsibility of an adult to prepare a child for participation in multiple communities by guiding children without controlling them. Crossouard (2011) studied the impact of formative assessment on students from socially deprived areas of Scotland. The study emphasized the notion of teacher "positionality"; that teachers should model forms of discourse which support the description of assessment criteria in a socioculturally responsible way and meet

the needs of the students (cf. Black and Wiliam). McCombs (1989) notes that self-regulation is not a 'fixed personality trait', and students can be taught to consciously manage their learning environment, by blending social strategies with personal strategies in order to improve their academic learning and achieve performance goals. Recent developments at the Italian Ministry of Education (*Ministero dell'Istruzione, dell'Università e della Ricerca*) have led to the enrichment of classroom instruction by a monitoring process designed to shape the conscious regulation of the learning experience. Teachers follow the development of students' personal and social strategies carefully by tracking:

> …each student's overall level of maturation, including their ability to respect rules, to establish good relationships with peers and teachers, and to engage in learning and to contribute to the class. Teachers also follow the development of students' autonomy (including their ability to organize themselves and develop good work habits), attention in class, ability to comprehend and analyze information, and to make links between subject areas. (Looney *et al*. 2005, p. 172).

Synchronous feedback

Black and Wiliam (2009) distinguish formative assessment from an overall theory of instruction and connect it to SRL when they explain, "it is clear that formative assessment is concerned with the creation of, and capitalization upon, "moments of contingency" in instruction for the purpose of the regulation of learning processes" (p. 10). The development of a 'moment' into a genuine opportunity for learning is dependent on the meta-cognitive awareness of students' and the self-belief that their efforts will result in success (self-efficacy). Of particular relevance is 'reflection-in-action'; that blend of monitoring and reflection which together permit the *reshaping* of that being worked on while working on it (Schön 1987; Harrison *et al*. 2003; Kuiper and Pesut 2004). Black and Wiliam incline toward using metaphor from electrical engineering (e.g., the 'black box'). Once again similar metaphor is employed to emphasize that these moments of contingency can be either synchronous or asynchronous.

Synchronous feedback is an important process as teachers strive to instill SRL characteristics among their students. Activities which allow students to get immediate feedback and respond actively are highly engaging; an important reason for the popularity of computer games (Malone and Lepper 1987 as cited in Brophy 2004, p. 197). Synchronous feedback has been found to enhance learning (Dihoff *et al*. 2004), be more effective at supporting higher psychological functioning, such as synthesis (Maddox *et al*. 2003; Maddox and Ing 2005). Teachers and students need to become accustomed to verbal interactions which are mutual. This means that they work together to *creat* the 'moment' and which remain focused on the task yet divergent and flexible enough to fully *capitalize* on the 'moment of contingency'. Schön (1987) describes the dialogue between interactants as: "questioning, answering, adjusting, listening, demonstrating, observing, imitating, criticizing—all are chained together so that one intervention or response can trigger or build on another" (p. 114). Black and Wiliam (2009) characterize the inherent spontaneity of formative dialogue as, "a formidable problem for teachers" (p. 13). Formidable because it: (a) exposes teachers to the many ways in which students argue, evaluate and synthesize information for problem solving purposes and (b) it often requires a radical change in their instructional approach (Black and Wiliam 2006; Black and Wiliam 2009). Whatever the challenges may be, the purpose of formative assessment is to elicit the encoded (or perhaps better understood as 'recoded') information from students and make it meta-cognitively accessible, that is to say—visible as assessment information.

Feedback is asynchronous when any of the following three conditions apply: (a) there is a time interval *between* gathering the evidence and sharing the evidence; (b) a time interval *before* gathering and sharing the evidence; or (c) the evidence has been synthesized from historical analysis. In the case first condition, asynchronous feedback may be evidence gathered from homework and used the next day. The second condition is similar, but for the need to wait for the lesson to end before the students share their understandings, which are used to plan the next lesson. The third condition includes the use of long-range asynchronous use of insights gained from students' stable misconceptions from previous years. In summary, if formative feedback is not embedded in the micro-genesis of verbal interaction then it is asynchronous because it meets one of the conditions stated above. Asynchronous feedback performs a useful function, permitting reflection on its use and it is often more comprehensive and permanently recorded assessment evidence. For example, recent research from the UAE, (Mehmet 2010) used "pedagogical documentation", described as "a *formative assessment* technique and instructional intervention designed to increase student learning by recording children's experiences" (p. 1439). The impact of recording students' learning experiences was found to have "the potential to improve children's learning, contribute to teachers' awareness of learning processes and help parents gain a better understanding of learning processes in their children's education" (p. 1439).

Internal and external feedback

Internally generated feedback is inherent to engagement and regulation. Formative assessment has the potential to reveal the internal and therefore recondite psychological and affective aspects of the learning process. Formative assessment is therefore a powerful action research methodology for the daily use of classroom teachers. The combination of meta-cognitive demands and supportive social context explains why it is a widely acknowledged process which enhances student motivation and achievement (Sadler 1989; Black and Wiliam 1998a, b; Irving 2007; Cauley and McMillan 2010). Formative assessments are specifically aimed at generating feedback, both internal and external which inform learners how to progress learning and meet standards (Sadler 1989). In the context of formative assessment and SRL, Chinn and Brewer's (1993) review indicates that considering feedback merely in terms of the information it contains is too simplistic. The decoding, encoding, and retrieval of meaning cannot be reduced to a superficial analysis of semiotic 'content', delivered like a parcel to a mailbox. Accordingly, Corner (1983) remarks that the encoding and decoding of information "are socially contingent practices which may be in a greater or lesser degree of alignment in relation to each other but which are certainly not to be thought of… as 'sending' and 'receiving' linked by the conveyance of a 'message' which is the exclusive vehicle of meaning" (p. 267–8). Students interpret external feedback according to reasonably stable beliefs concerning subject areas, learning processes, and the products of learning. Butler and Winne (1995) observe that, "student beliefs about their learning experience influence the generation of internal feedback" (p. 254). Butler and Winne (1995) contend that learners use formative feedback to monitor their engagement with tasks and the key meta-cognitive process of monitoring generates internal feedback. Self-regulated learners differ from their non-self-regulated peers by generating more internal feedback, responding positively to external feedback, and increasing efforts to achieve learning goals (Bose and Rengel 2009). External feedback may, "confirm, add to, or conflict with the learner's interpretations of the task and the path of learning" (Butler and Winne 1995, p. 248). Students' tacit knowledge (experiences, beliefs, opinions) influences the processing of externally provided feedback and may even distort the message that feedback is intended to carry (cf. Corner 1983). Individuals differ in the sensitivity of self-reactive judgment to external

feedback which impact on conation. Conation (from the Latin *conatus*, in English 'effort') is of particular importance when considering the internal states of learners. Conation is synonymous with self-efficacy, referring to the personal, intentional, planful [sic], deliberate, goal-oriented, or striving component of motivation, the proactive (as opposed to reactive or habitual) aspect of behavior (Baumeister *et al*. 1998). Bandura and Cervone (1983) found that the increase in effortful behavior following feedback on substandard performance is greater for individuals who are high in conation and self-efficacy than in their non-self-regulated counterparts. It follows from this finding that if instructional feedback is to contribute jointly to self-regulation and achievement, teachers should carefully plan for how they will use questioning and feedback which supports the self-efficacy of the student, i.e., scaffolds their learning so it is the student who believes that s/he is leading the discussion and solving the problem. If this is done regularly, the learner will generate internal feedback which makes them more engaged, effortful, and self-regulated. A self-regulatory concept of high relevance to formative assessment is volition. Volitional strategies are defined in Boekaerts and Corno's (2005) model of SRL as "metacognitive knowledge to interpret strategy failure and knowledge of how to buckle down to work" (p. 206). Black and Wiliam (2009) explicitly connect volition to their theory of formative assessment because volitional self-regulation is essential if a learner is to remain persistent and overcome threats to self-esteem that may cause the student to divert resources away from their active participation in the learning process ('growth track') and expend resources on efforts to avoid interaction and withdraw from the situation ('well-being track'). If students are to actively participate in their own learning progression it "is important to help students to acquire positive volitional strategies so that they are not pulled off the *growth* track onto the *well-being* track" (Black and Wiliam 2009, p. 14).

An issue common to both the internalization of external feedback and the generation of internal feedback resides in the ontology of the individual. The Vygotskian developmental level of ontology—the accumulated life experiences and cultural antecedents of a learner—may be analogized as a background 'operating system' in which the long-term memory (LTM) of the learner is located. The process of "formative interaction" provides new information to the operating system on the micro-genetic short-term memory level as teachers and students interact spontaneously, taking advantage of "moments of contingency" (Black and Wiliam 2009) to exchange ideas and information that enable learners to cross the zone of proximal development (ZPD) (cf. Vygotsky).

Heritage (2007) speaks on the validity of formative interactions to support learning, "the purpose of formative assessment is to promote further learning, its validity hinges on how effectively learning takes place in subsequent instruction" (Heritage 2007). This means that it is the extent to which formative interactions are successful in supporting the internalization and synthesis of new meanings that determine the "consequential validity" (Heritage 2007) of formative feedback strategies. Social and cultural antecedents determine the manner in which formative feedback influences the attainment of future learning goals. In particular, what goals are considered appropriate and how they can be achieved depends on the tacit knowledge of the human participants (Rogoff 2003). Butler and Winne (1995) emphasize the internal monitoring of a current state in a task as a continuous process, which operates as the trigger for SRL. After implementing strategies, learners monitor their progress toward goals, thereby generating internal feedback about the success of their efforts (Schunk 1998; Winne and Stockley 1998). Monitoring the outcomes of their effort provides grounds for reinterpreting elements of the task and their engagement with it, thereby directing subsequent effort and engagement with the learning process. Students may modify their engagement by setting new goals or adjusting extant ones; they may re-examine tactics

and strategies and select more productive approaches or simply stop making the effort and give up (Butler and Winne 1995).

Formative Assessment: Assessment Is for Self-regulated Learning

Formative assessment encapsulates SRL (Part 1)

A theory of particular importance to SRL is Bandura's (1986) Social Cognitive Theory which emphasizes meta-cognition and self-efficacy as fundamental to the development of SRL. The overarching target of formative assessment not only parallels SCT, but 'encapsulates' the fundamental goal of SCT as expressed by Bandura: "a fundamental goal of education is to equip students with the self-regulatory capabilities that enable them to educate themselves" (1997, p. 174). When SCT is taken together with studies by cultural and social context theorists arising from the work of L.S Vygotsky they combine to create the theory of formative assessment and comprehensively explicate how SRL strategies can be encouraged among students. Perhaps the most significant aspect of SCT is the proposition that individuals can consciously deploy self-regulatory strategies which mediate the internalization of external stimuli (Bandura 1986, 1997; Zimmerman 2002; Pintrich 1999, 2004; Black and Wiliam 2009). There is a strong reciprocal causality in play: individuals have some meta-cognitive and motivational qualities with which to regulate their environment while at the same time, the classroom (and home) environment either facilitates or frustrates the acquisition and use of self-regulatory characteristics (Bandura 1997; Zimmerman 2002).

Dimensions of self-regulated learning

Irving (2007) remarks that "students may benefit from formative assessment by developing self-regulated learning (SRL) behaviors in the classroom" (p. 13). In SRL, students undergo a recursive (but not necessarily linear) triptych: (1) planning phase—analyze tasks, set goals, and plan behaviors; (2) performance phase—monitor and control their behaviors, emotions, and motivation; and (3) evaluation phase—self-reflection based on feedback (Zimmerman 2000). The evidence obtained by both teachers and students from formative assessments is intended ultimately for student reflection who use it as 'take-home' information for self-management/control. Such data exposes the abstruse internal learning processes, making their thinking visible, and therefore invaluable to students as they participate in an enhanced learning process during which SRL strategies are internalized and put into practice (Schraw and Moshman 1995; Zimmerman 2000; Irving 2007). Bandura (1986, 1994, 1997) argues that self-regulated learning arises where strong perceptions of *self-efficacy* and transparent (formative) *feedback* co-exist. Bandura's ideas concur with those of Schunk (1998) and Butler and Winne (1995) who see feedback as 'pivotal' to SRL, and Black and Wiliam's (1998a, b, 2006, 2009) core notion of feedback as the material to be refined into the meta-cognitive processes required for self-regulation.

Despite the absence of a paradigmatic unity among SRL models, Pintrich (2000) establishes a consensus fundamental to an understanding about how formative assessments facilitate the acquisition of SRL strategies: (a) "learners as active constructive participants in the learning process" (p. 452); (b) "learners can potentially monitor, control, and regulate certain aspects of their own cognition, motivation, and behavior as well as some features of their environment" (p. 454); (c) "there is some type of criterion or standard (also called goals or reference value) against which comparisons are made in order to assess whether the process should continue as

is or if some type of change is necessary," (p. 452); and (d) self-regulatory activities mediate a three-way dynamic between personal and contextual characteristics and performance (p. 453). Karoly (1993) offers a further note on SRL as a process:

> Self-regulation refers to those processes, internal and/or transactional, that enable an individual to guide his/her goal-directed activities over time and across changing circumstances (contexts). Regulation implied modulation of thought, affect, behavior, or attention via deliberate…use of specific mechanisms and supportive metaskills. (p. 23)

In summary, SRL is "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition," (Pintrich and Zusho 2002, p. 250). Self-regulated students are meta-cognitively, socially, motivationally, and behaviorally active in problem solving processes. Students who are advanced self-regulators typically deploy meta-cognitive strategies: (self)-verbalization (overt verbalization from self as self-instruction or from others who model the procedure), self-evaluation, and self-consequences (self-provided rewards or punishments) in order to successfully decode (comprehend and interpret) and encode new information which generates internal feedback.

Pintrich (1999) and his colleagues (Pintrich and Zusho 2002) elaborate, presenting four areas or dimensions of learning that can be regulated to support learning and realize performance goals. One area is cognitive and meta-cognitive requiring three learning strategies: (a) monitoring and controlling the use of rehearsal (recitation of information); (b) organizational (selecting, outlining, and organizing the main ideas); and (c) elaboration (explaining ideas to peers and others) strategies (Weinstein and Mayer 1986 as cited in Pintrich 1999). A second dimension that students can self-regulate is their participatory behavior. Students who are academically unprepared and unmotivated exhibit weak time-management strategies and may be tardy and unprepared to make an active and effortful contribution, even to the point of hostility towards authority. Motivational states are a third dimension that learners can self-regulate. There are many strategies that students deploy to support and sustain their own motivation. They include self-consequences, self-verbalization, and inventing new strategies which may transform task content; for example making learning activities into a game. These strategies put the process of learning under the student's personal control and so improve the perceived importance or usefulness of material (Wolters 2003). The fourth and final dimension of learning that Pintrich (2004) identified as a potential target of students' regulation is the Vygotskian, and therefore sociocultural notion of context or environment; including the aspects of task, classroom community, and cultural environment. Students might structure their environment to support learning by monitoring the noise, lighting, and temperature. In addition, this important dimension of SRL encompasses help-seeking and peer engagement strategies. When students know who to ask and act on this knowledge the social assistance they receive regulates students' learning by actively engaging them with teachers, parents, peers, or 'significant others' (Vygotsky 1978; Zimmerman and Pons 1986; Pintrich 1999, 2004; Pressick-Kilborn and Walker 2002; Black and Wiliam 2006).

The gathering interest in social context is indicative of a relatively recent transformation in SRL research methodology. By 1997 Bandura himself had affirmed that "cognitive development, of course is situated in sociocultural practices", declaring such proclamations to be "no longer newsworthy" (p. 227). The gradual change in perspective shifts the methodological angle view in a number of ways: (a) the move away from reductionist methodologies toward a more holistic analysis including contextual aspects such as interpersonal relationships and community norms; (b) away from a view of SRL as a linear process, to a focus on flexible patterns in varying activities over time, "the dynamic view of student activity and regulation is both theoretically

interesting and practically useful for both teachers and for curriculum design" (Turner 2006, p. 295); and (c) greater emphasis on what people are *doing* and *saying*. Winne and Perry (2000) point to the fact that studies on self-regulation generate little knowledge about what individuals are thinking or doing. Therefore, "we need better mechanisms that provide a deeper understanding of how monitoring and regulation occurs within specific tasks" (Lajoie 2008, p. 471).

The theoretical elasticity of SRL has across time been extended to new lengths by the momentum away from reductionist perspectives and toward the holistic study of social context (i.e., *collective efficacy*); discourse; and perceptions of power and identity relevant to education in a twenty-first century 'knowledge economy'. Such elements are, for social learning theorists at least, inherent to the theoretical frame of formative assessment. In fact, it will be seen in subsequent sections that the theory of formative assessment draws considerable energy from research which emphasizes mutual learning relationships, positive interdependence and a more open classroom which values the active and spontaneous (cf. Vygotsky and Polanyi) use of everyday tacit knowledge.

Differentiating formative assessment

Formative assessment is a quite different form of assessment which unlike other forms drives SRL strategy acquisition among learners. A number of relatively recent studies have related formative assessment to SRL directly (e.g., Nicol and Macfarlane-Dick 2006; Bose and Rengel; 2009; Black and Wiliam 2009). Linking formative assessment with the process of SRL further differentiates formative assessment from other forms of classroom assessment. Formative assessment is not a test or a tool (a more fine-grained test) but a *process* with the potential to support learning beyond school years by developing learning strategies which individuals may rely on across their entire life-span. Formative assessment is not a measurement instrument; it is not designed to provide a summary of attainment at pre-determined intervals. Instead it is designed to continuously support teaching and learning by emphasizing the meta-cognitive skills and learning contexts required for SRL; planning, monitoring and a critical yet non-judgmental reflection on learning, which both students and teachers use collaboratively to guide further learning and improve performance outcomes. The 'big question' then, is one of whether formative assessment attains "consequential validity", that is, "validity [which] hinges on how effectively learning takes place in subsequent instruction" (Heritage 2007, p. 143). Key measures of validity are the level of autonomy, effort and engagement exhibited by students. Certainly a significant corpus of qualitative meta-studies exist which validate claims that formative assessment actualizes SRL, including Ruthven (1994) the OECD/CERI (2005, 2008), and the Assessment Reform Group (ARG 1999; Mansell *et al*. 2009).

Benchmark and interim assessments have been adopted by many school districts in the US to help monitor progress during the school year toward meeting state standards and NCLB performance goals. Typically these assessments are formal and provide teachers with information about the strengths and weaknesses of individual students against content standards. Wiliam (2004) calls such information "early warning summative", and Shepard (2005b) remarks that the individual profile data from these assessments are not directly formative because (a) the data available are at too gross a level of generality and (b) feedback for improvement is not part of the process. Further, while there is debate about the value of immediate versus delayed feedback, there is consensus in the assessment community that learning benefits are more evident when "test results are available quickly enough to enable teachers to adjust how they're teaching and students to alter how they're trying to learn" (p. 86). Indeed, even the best that interim and benchmark assessments have to offer in this area is pedestrian when one considers the opportunities to gather evidence of student learning through "spontaneous" and "scaffolded" dialogue

(cf. Vygotsky). Certainly the immediacy of continuous classroom feedback is a critical feature of formative assessment which delineates it from assessment tools designed to provide grades as summaries of achievement. The misunderstanding regarding the functions and goals of formative assessment is partly attributable to the marketing efforts of publishers and consultants, who contend that interim or benchmark assessments are formative (Popham 2006). Popham shares his personal experience of a dubious practice designed to sell tests to pressured and desperate educators, "more than one test company official has confided to me that companies affixed the 'formative' label to just about any tests in their inventory" (2006, p. 86). To package non-formative instruments (e.g., interim or benchmark assessments) as formative assessments even raises a legal contention because to label non-formative assessment as formative is to render such assessments "unfit for the purposes for which goods of the same description would ordinarily be used" (United Nations, 1980, Part III, Chapter II, Article 35). The ARG (Mansell *et al*. 2009) in their paper entitled 'Assessment in School: Fit for Purpose?', reported on the confusion among assessment experts from Canada, the US, UK, continental Europe, Australia, and New Zealand, who met at a conference to discuss the issues facing teachers as they worked to establish assessment and learning relationships which create legitimate partnerships with their students. There was a consensus among the delegates that the term 'formative assessment' lacked clarity, and that the confusion is "exacerbated by some policy-makers appropriating and using it in ways that contradict its true intentions" (Mansell *et al*. 2009, p. 23). The delegates focused on the problem of determining how to close the gap between current status and desired outcome, noting that many policy-makers believe that the *sine qua non* is not sharing standards and criteria as the OECD, ARG, and others assert but is in fact frequent summative testing. The premeditated subversion of the assessment process, however well intentioned or well planned is perhaps the paramount concern among those researchers who advocate for formative assessment. Heritage (2010) cautions that:

> …we already risk losing the promise that formative assessment holds for teaching and learning. The core problem lies in the false, but nonetheless widespread, assumption that formative assessment is a particular kind of measurement instrument, rather than a process that is fundamental and indigenous to the practice of teaching and learning. This distinction is critical, not only for understanding how formative assessment functions, but also for realizing its promise for our students and our society. (p. 1)

In their discussion of the practical value of formative assessment, Dunn and Mulvenon (2009) include the metaphor of a "hammer" to represent 'the assessment tool'. The purpose of such a tool can be understood without any ambiguity by assigning an agreed upon definition which makes clear the intended use for that particular tool without any need to discuss its purpose:

> It is easier to simply ask for and receive a hammer than to provide a description of the intended use (i.e., if you ask for an item that can make a hole in the wall, you might receive a sledge hammer in lieu of a hammer). (p. 3)

For Dunn and Mulvenon therefore, one must place quotation marks around 'formative assessment' until it has been assigned a definitive label which expresses its intended purpose with rigid precision. Such perspectives are understandable in political climates of scientific rationalism, where certain sections of the research community may quite correctly regard formative assessment as "ethereal" (Dunn and Mulvenon 2009) and "fuzzy" (Dorn 2010). A good example is provided by the research taking place at the Educational Testing Service (ETS) in the US, where some project scientists would like to reduce formative assessment to a single agreed upon definition which explains how it designs order into the parts of the 'instructional system' (Bennett 2011). Such scientific definition makes it possible to measure

and predict the exact behavior of any physical system across the long time horizons required by policy-makers. Consequently, attempts continue to define formative assessment as a cognitive 'tool' (Bennett 2011). The inquiry into how formative assessment designs order into the parts requires the mapping of the 'cognitive architecture' associated with formative assessment by disassembling the process into a specific number of component parts. These parts are then categorized, coded and reassembled, allowing the research scientist to identify and then manipulate specific aspects of the process and which permits the measurement of the effect each manipulation has on learning outcomes. Policies that support the use of methodological reductionism also lead to the packaging of formative assessment (often literally as test booklets) as a skillfully made artifact to be used as prescribed, e.g., to be taken twice daily after recess and lunch. While this may be an improvement upon the assessment practices found in many classrooms it is still not directly formative.

Political considerations aside, methodological reductionism does not adequately address the study of complex, non-linear, nested, and multi-dimensional social systems. In general terms, human behavior cannot be assumed to be predictable or repeatable. In specific terms, assessment takes place in an "indeterminate zone of practice", which requires teachers and students to regulate learning by "thinking on their feet" (Schön 1987). Consequently, not only do the outcomes of reductionist methodologies fail to deal with complex social realities, they also lack external validity and may not be generalized across populations. The work of the social constructionist is more complicated than that of a paleontologist, who can take a bone or two of a dinosaur and reconstruct the whole animal. When non-linear systems interact with the environment emergent properties cannot be predicted, because non-linearity leads to instability and uncertainty, hence the need for a theoretical framework which includes methodologies which explicitly investigate the grain of non-linear systems, e.g., discourse analysis, (Mercer 1995, 2004; Black and Wiliam 2009; Rex and Schiller 2009). Some in the scientific community have recognized the problem of reductionist methodologies and have started to question its credibility, "during the past few decades, more and more scientists have concluded that this and many other of science's traditional assumptions about the way nature operates are fundamentally wrong" (Freedman 1992, p. 30). Freedman (1992) suggests that reductionism remains rooted in nineteenth century scientific methodology, which posited a neat correspondence between cause (experimental manipulation) and effect (learning outcome), for example Newton's laws of motion. It should of course be carefully noted that there are many other aspects of assessment research taking place at the ETS which hold agreement with Freedman and rebuff the nineteenth century notion that order is designed into the parts of a system (Wylie, 2011, personal communication). Studies which assume a holistic approach focus on how order emerges from the interaction between those parts as a whole. Twenty-seven years ago, White (1984) observed:

> To proceed holistically is to see things as units, as complete, as wholes, and to do so is to oppose the dominant tendency of our time…Analytic reductionism assumes that knowledge of the parts will lead to an understanding of the whole, a theory which works very well with machinery or other objects, but less well with art forms or life forms. (p. 400)

Sampson (2004) refers to the potential of discourse to "reshape" reductionist policies. Accordingly, in more recent years various empirical studies have revealed the profound impact of carefully structured opportunities for participation and discourse in communities, finding that it is crucial to activate holistic social relationships and achieve community consensus to realize and sustain achievement (Bandura 1993; Sampson *et al*. 1997; Sampson 2004; Black and Wiliam 2006; Putney and Broughton 2011). Both analytical reductionists and social holisticists exhibit considerable interest in formative assessment, the goals of which explicitly seek to support individual learning outcomes by encouraging SRL strategies

among students. When their work is synthesized into a functional framework (as the theory of formative assessment is designed to do) it operates to triangulate the understandings of the research community in different and newly valid ways.

An issue of global relevance

There is a very significant corpus of international research interest in formative assessment and the development of autonomous lifelong learning competences. Germany provides a good example of a nation with a long tradition of philosophers and educational reformers who proposed alternatives to teacher-centered instruction (*Reformpädagogik*) as a more appropriate approach to teaching that meets students' needs for competence, autonomy, and self-determination. German studies have emphasized the role of feedback and that teachers should become more aware of how they provide feedback to students; specifically, the kinds of interactions which determine the internalization of environmental stimulus (the "formative interaction") which may either promote or diminish autonomy (Köller 2005). The work of innovators; Montessori, Freinet, Kerschensteiner, and Steiner have been very influential in advancing the proposition that formative practices are more effective as cues for SRL than teacher-fronted methods of instruction. For example, Herrmann and Höfer (1999) introduced the use of diaries (*Lerntagebücher*) into the daily routine of a German secondary school. As students became more skilled in the use of this new 'technology' they were found to "provide opportunities for students to reflect on their own learning processes and to detect and correct deficits over time. Diaries thus serve as a tool for autonomous and self-regulated learning" (Köller 2005, p. 268).

In the global context formative assessment, autonomy, lifelong learning, and SRL are of paramount importance (OECD/CERI 2005, 2008; Black and Wiliam 2005). Research consistently finds that when students are effectively formatively assessed, they participate actively in their own learning progression by consciously monitoring and regulating product-oriented learning processes (Black and Wiliam 1998a, b, 2006, 2009; Zimmerman and Pons 1986; Assessment Action Group/AiFL Programme Management Group [AAG/APMG], 2002–2008; Wolters 2003; Pintrich 1999, 2004). The OECD's (2005) Centre for Educational Research and Innovation (CERI) based in Paris, France conducted extensive international case studies across eight nations which had incorporated formative assessments into their national policy frameworks (Canada, Denmark, England, Finland, Italy, New Zealand, Queensland in Australia, and Scotland). The OECD/CERI case study approach provides a broad spectrum of classroom-level data derived from observations, interviews and artifact analysis which illuminates current understandings of how practitioners may use formative assessment to support learning in practical contexts. Ruthven (1994) reviewed 50 papers presented at the invitational 2nd International Congress on Mathematical Instruction (ICMI) seminar collected across two volumes called: *Investigations into Assessment in Mathematics Education* (Niss, 1993a) and *Cases of Assessment in Mathematics Education* (Niss, 1993b). Presentations from European, North American, Caribbean, Asian, Oceanian, and Middle Eastern scholars consistently indicated that a most productive trend in mathematics research entails, "increasing the integration of processes of teaching, learning and assessment" (Ruthven 1994, p. 433). After reviewing the content of the papers thematically, Ruthven discovered a number of recurrent themes regarding the positives of formative practice, which operate to delineate it from traditional forms of assessment:

> [i] performance on external tests was improved by the close involvement of students in the assessment process through self- and peer-assessment…[ii] given the complexity

> of the teacher's task, it may be more realistic, and ultimately more productive, to enhance the student role in the formative assessment process…[iii] The implications of acknowledging students' personal knowledge from a constructivist orientation, and their personal goals from the perspective of critical education, call for the promotion of the student from the status of object of assessment to that of subject shaping the process of assessment …[iv] Learners must be given the means of changing their sense of control and responsibility for their learning, and their attributions of success and failure…[v] Other effects were, improved student capacity to evaluate their work, and reduction of anxiety about assessment. (p. 448)

French research studies consistently emphasize interactive formative assessment, between teacher and students and among students, affirming that the theory of formative assessment "constitutes a framework of social mediation that fosters the student's increasing capacity to carry out more autonomous self-assessment and self-regulated learning" (Allal and Lopez 2005, p. 241; Doyon and Juneau 1991; Doyon 1992). The international consensus on the findings support the contention that formative assessment practices place certain demands on students, requiring them to become self-regulated learners.

Connecting Objectives, Goals, and Strategies

Before discussing the relational dynamic between the goals of formative assessment and the acquisition of SRL strategies; that is, how formative assessment encapsulates and 'drives' SRL and how SRL environments are inherently formative, it is necessary to bring focus to what some studies (e.g., Dunn and Mulvenon 2009; Dorn 2010; Young and Kim 2010; Bennett 2011) have criticized as a shapeless theoretical *gestalt*. In their seminal work, Black and Wiliam (1998b) provide an explanation of formative assessment as "all those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they are engaged" (p. 2). Black and Wiliam place the emphasis on modification of teaching and learning strategies and the inclusion of students as 'agents' in shaping their own learning experience. The description of formative assessment is completed by a procedural element, identical to the Vygotskian notion of scaffolding—that classroom assessment becomes formative only when it is used as evidence, which teachers and students use to adapt instructional content in a way which addresses emergent misconceptions, scaffolds partial understandings and so on.

SRL: taxonomy of strategies and characteristics

The strategies and characteristics which appear in Table 1 are those that self-regulated students use to bring self-influence to bear on their learning experiences. They are drawn from the work of Bandura (1986, 1997), Zimmerman and Pons (1986), and Pintrich (1999, 2004).

An important aspect to this article is the claim that formative assessment encapsulates SRL and further, that there exists a bi-directional dynamic between the goals of formative assessment, (which foster SRL strategies among students) and the strategies deployed by self-regulated students, (whose learning strategies are pursuant of formative assessment goals). In the opening section, 'Introduction to the Learning Community' the theory of formative assessment was given early shape by two objectives: assessment for learning and assessment as learning. The forthcoming section

Table 1 SRL characteristics and strategies

Characteristic	Strategy
These are students who:	Students actively participate by:
Self-evaluate	Assessing quality or progress, e.g., checking work
Keep records and monitor learning	Taking discussion notes or compiling a list of errors
Seek help from adults	Seeking social help from teacher or parents/caregiver
Self-verbalize	Generating overt or covert prompts to guide learning
Adapt and invents new learning strategies	Using evidence to adapt and improve learning
Set goals and plan learning progression	Setting and prioritizing goals and sub-goals
Structure the learning environment	Choosing conditions which make learning easier
Manage time	Regulating progress to realize timely outcomes
Engage in peer learning	Seeking social assistance from peers
Use non-classroom resources	Seeking information, e.g., libraries, Internet, contacts
Are persistent and complete what they started	Maintaining activity despite difficulty or distraction
Regulate progress by using self-consequences	Giving self-rewards or sanctions based on outcomes
Memorize and rehearse information	Using recursive strategies designed to improve recall
Are self-aware	Being non-judgmentally aware of own shortcomings

('formative assessment encapsulates SRL [Part 2]') decomposes the objectives into individual goals as derived from a number of coordinated sources (ARG 1999; Black and Wiliam 1998b; Sadler 1989; OECD 2005; Cauley and McMillan 2010) and connects them to the SRL strategies presented in Table 1

Formative assessment encapsulates SRL (Part 2)

A*f*L (see Fig. 1) directs classroom practitioners to work together with students in four goal areas: *Goal 1*: *Communicate to students the goals of the lesson and the criteria for success*. As noted earlier, while differing models of SRL exist, however Pintrich establishes a consensual foundation of SRL as a process in which learners set goals for their learning and then attempt to monitor, regulate, and reflect on their cognition (Pintrich 1999; Pintrich and Zusho 2002); *Goal 2: Engage students in discussions about study habits and strategies which sustain improvement.* Students move toward greater self-regulation by developing effective work and study habits, such as time management, seeking help, and engaging peers (Zimmerman and Pons 1986; Pintrich and Zusho 2002), using feedback (Schunk 1998; Bandura 1997), and planning, monitoring, and evaluating schoolwork (Butler and Winne 1995; Bose and Rengel 2009); *Goal 3: Involve students in previewing and planning forthcoming work.* Planning, particularly global planning, is thought to be an important sub-process of meta-cognition and one used by experts (Schraw and Moshman 1995); *Goal 4: Inform students of who can give them help if they need it and permit full access to such help.* Help-seeking, peer engagement, and the inclination to access non-classroom resources are characteristics inherent to SRL (Zimmerman and Pons 1986). A*a*L (see Fig. 1) focuses on the social context and on self and peer assessment activities: *Goal 5: Provide opportunities for students to become meta-cognitive and build knowledge of themselves as learners* by encouraging students to evaluate and reflect on the quality or progress of their work. Bruce (2001) suggests that students gain the most benefit from individual activities when they are encouraged to check their work before turning it in. Checking work for errors is the

self-evaluation of cognitive quality and progress and considered in many SRL studies as the basic construct for planning, monitoring, and reflecting upon cognition (e.g., Zimmerman and Pons 1986; Pintrich 1999; Bandura 1997); *Goal 6: Create a non-comparative, productive environment free of risks to self-esteem founded upon cooperation and dialogue*. Bandura (1997) and Nicol and Macfarlane-Dick (2006) caution that negative psychological states may lower efficacy beliefs which in turn impact students' self-regulatory dispositions and lead to poor performance; *Goal 7: Support students as they take more responsibility for their learning*. For Zimmerman and his colleagues, self-regulation enables students to develop a set of constructive behaviors that can positively affect learning (Zimmerman and Pons 1986; Zimmerman 1989; Zimmerman 2000; Zimmerman and Pons 1986; Schunk and Zimmerman 1997). Aspects of self-responsibility include a collaborative approach to: adapting or inventing learning strategies; keeping records, and monitoring; rehearsing and memorizing; time management; and goal setting and planning. These strategies are required if students are going to become responsible for decisions about their own learning and performance; in perhaps the clearest statement of constructivist principle *Goal 8* directs teachers and students to*: Provide opportunities for frequent participation in the process of learning with their teacher as their advisor and with their peers in a climate of equality and mutuality*. Effective SRL focuses on helping students become independent and autonomous thinkers; "through critically examining others reasoning and participating in the resolution of disagreements, students learn to monitor their thinking in the service of reasoning about important [mathematical] concepts" (Artzt and Yaloz-Femia 1999 as cited in, Pape *et al*. 2003, p. 181). Importantly, research also shows that any student, even those 'at risk', can learn to become more self-regulating (Pintrich and Zusho 2002; Black and Wiliam 2006).

Across the last 10–15 years many nations have explicitly recognized the potential of formative assessment practices to actualize the SRL strategies described above (OECD 2005, 2008). For example, The Finnish National Board of Education has formulated the guiding principles for student assessment in public comprehensive schools. Most relevant to an inquiry into SRL is that: (a) assessment should be individual and versatile; (b) feedback should act to support self-knowledge and motivation; (c) lifelong learning competencies should be encouraged among student by showing them how to set realistic learning goals; and (d) assessment is considered to be a process that exists to support learning and develop students' self-assessment skills. Voogt and Kasurien (2005) reiterate the way in which national philosophy determines educational policy, "the focus on self-evaluation also reflects a more general philosophy in the Finnish educational system that it is more important to focus on development than comparison" (p. 150).

Internalization, Environment, Interaction, and Experience

By drawing from socio-cognitive and sociocultural theories, a theory of formative assessment was forged which took account of these four essential 'factors of knowledge production'. The theory of formative assessment unifies a diverse corpus of research on: (a) the internalization of new environmental stimulus; (b) the interaction between the internal and the external; and (c) the prior knowledge of the learner.

An area of pivotal importance to effective SRL strategy acquisition and "at the heart of both socio-constructivist perspectives and cognitive psychologist perspectives on learning, is the significance of prior knowledge" (Myhill and Brackley 2004, p. 264). Students are constantly internalizing new information and bringing their own everyday, spontaneous

(cf. Vygotsky) and tacit (cf. Polanyi) conceptions and misconceptions into the classroom. The concept of schematic knowledge, first proposed by Bartlett (1932), "provides the overall perspective which enables us to integrate what we hear with what we already know, and to fit individual bits of information into a coherent argument" (Cook-Gumperz 1986, p. 66). Thus, the learner produces meaning and understanding through an internal process of interchange between new knowledge and previous knowledge during which new meanings are continuously evolving out of prior understanding. The amended schemata of meanings are stored in the LTM, to be retrieved, expanded, and modified in the light of new and changing experiences or understandings: "knowledge is constructed by the individual knower, through an interaction between what is already known and new experience" (Edwards and Westgate 1994, p. 6). This expresses the *internal* aspect of Black and Wiliam's (2009) notion of "a formative interaction" as an "interaction between external stimulus and feedback, and internal production by the individual learner" (p. 11). This, state Black and Wiliam (2009) involves looking at the three aspects, the external, the internal, and their interactions. The remaining two parts of Black and Wiliam's (2009, p. 11) conception of a formative interaction: the *external* and the *interaction* between the internal and external raise the question: Do practitioners really understand how experience facilitates (or frustrates) the creation of new schematic knowledge from a sociocultural perspective? Anderson *et al*. (2007) assert that, "situative and other sociocultural perspectives on learning construe knowing as fundamentally social (Gutiérrez and Rogoff 2003; Lave and Wenger 1991) and view participation in discourse, for example, "as the primary characterization of learning and knowing" (pp.1724–5). For socioculturalists the creation of meaning is embedded within the interaction component. Meaning is socially constructed because "human thought is consummately social: social in its origins, social in its functions, social in its form, social in its applications" (Geertz cited in Bruffee 1993, p. 114). In this epistemology learning is inevitably embedded in language, itself embedded in human discourse; experience precedes pattern and pattern precedes meaning; "whether we are talking about unicorns, quarks, infinity, or apples, our cognitive life depends on experience" (Eisner and Peshkin 1990, p. 31). For Rogoff (2003) and Mercer (1995), knowledge is a process of guided construction (cf. Dewey) and so new meanings are acquired as part of "a developmental process in which earlier experiences provide the foundations for making sense of later ones" (p. 33). Put simply, the theory of formative assessment holds that learning and development occur more successfully when individuals interact indirectly (through observation) and directly through active participation with the conscious intention of regulating their own learning progression.

When discussing learning and development it is important to understand that they are not synonymous. A point well made by Black and Wiliam (2009), "Vygotsky drew a clear distinction between learning and development. The latter [development] requires changes in the psychological functions available to the learner, while learning involves the acquisition of new mental capabilities, without changes in the available psychological functions" (p. 19). Delineating 'learning' and 'development' as separate terms with distinct meanings impacts upon the description of probably the best known fundament of socioculturalism, Vygotsky's zone of proximal development:

> The zone of proximal development (ZPD) is not, therefore, just a way of describing what a student can do with support, which might be simply learning, it is a description of the maturing psychological functions rather than those that already exist. A focus in instruction on the maturing psychological functions is most likely to produce a transition to the next developmental level and "good learning" is that which supports the acquisition of new psychological functions. This careful distinction between

> learning and development is a central feature of Vygotsky's work that is often overlooked. (Black and Wiliam 2009, p. 19).

For both learning and development the prior knowledge of the participants either retrieved during self-reflection or elicited by teachers or peers provides the starting point for the pursuit of formative assessment goals which advance SRL strategies among students. Yin *et al*. (2008) draw from David Ausubel's (1968) robust *'subsumption theory'* which strongly emphasizes the value of existing knowledge when they more moderately contend that "the presence and persistence of alternative conceptions, the restructuring or reorganization of existing knowledge, or conceptual change, has become a very important component of teaching and learning" (p. 338). Clearly then, the starting point for conceptual change is to discover what the learner already believes to be true.

In addition to locating learning and development within the ZPD, Vygotsky (1987) rejected reductionism and expressed the inseparable unity between the individual and social and cultural context when he observed that in order to understand how water extinguishes a flame one does not attempt to reduce it to its elements. The scientist will "discover, to his chagrin that hydrogen burns and oxygen sustains combustion. He will never succeed in explaining the characteristics of the whole by analyzing the characteristics of the elements" (Vygotsky 1987, p. 45). An analogy also used by Wolfson (1977) to illustrate the inseparability of thinking and feeling. In combining similar theories with differently weighted emphases, formative assessment attains theoretical synergy by acknowledging that the regulation of cognitive development is determined by reasonably stable internal values and beliefs (Butler and Winne 1995; Efklides 2011), which are challenged or reinforced by external feedback arising from active engagement with a collective or community (Vygotsky 1978; Bandura 1997). A central and distinguishing thesis in this approach is that the structure and development of human psychological processes, which support the development of SRL emerge through participation in culturally mediated, historically developing, interpersonal activity involving cultural practices and tools (Cole 1996). As such, "self and other is not a duality, because they go so together that separation is quite impossible" (Kelley 1962 p. 9). Luria (1979) makes a consonant observation:

> The origins of higher forms of conscious behavior were to be found in the individual's social relationships with the external world. But man is not only a product of his environment; he is also an active agent in creating that environment. (p. 43)

Lajoie (2008) remarks that, "it is the interaction between the mind and environment that presents the most interesting questions in terms of the active nature of learning" (p. 471). The reciprocal interaction between the environment, which stimulates individuals' regulatory responses and the minds of individuals', which trigger subsequent judgments or evaluations is captured by Bandura (1977, 1986) concept of *'reciprocal determinism'*. For Bandura, when people reflect upon the outcomes of their behavior (verbal and social interactions) they may consciously adapt internal personal factors (cognitive abilities, tacit opinions, attitudes, and beliefs) which cause changes in the environment. Bandura (1986) called this agentic three-way interaction a '*triadic reciprocality'*—a notion comparable to Black and Wiliam's (2009) aforementioned conception of "a formative interaction" (p. 11). The process of active agency is well expressed by Kirsh and Maglio (1995), who use the term "epistemic actions", i.e., conscious self-regulatory actions, such as social interaction (e.g., discourse) and environmental structuring (e.g., adjusting noise or temperature), allowing individuals to access the information they need to more effectively achieve learning outcomes.

Processing assessment information

As already noted, the *sine qua non* for formative assessment is the provision of clear assessment information (standards and criteria) to students (Black *et al*. 2003). The connection between data, information, knowledge and agency (the distinction between self and others) is one which further describes the importance of sharing formative feedback. Recalling that "the main unit of the analysis of cognition arguably is the on-going interaction between the agent and the context of action" (Brinck 2007, p. 409), then cognition (i.e., processing assessment information) "equally results from the dynamic interplay between agent and context" (Brinck 2007, p. 407; cf. Vygotsky and Luria). Put a different way, cognition is grounded in agency and agency is situated in a broader social and cultural context. According to the *International Encyclopedia of Information and Library Science*, information is, "best seen as holding the place in the spectrum between raw data and knowledge" (Feather and Sturges 1997, p. 492). Data becomes information only when it is put into a context from which it draws particular situated meanings (Feather and Sturges 1997). How then does information become schematic knowledge? For cognition theorists, *reflection* on new information is a key process which links 'knowledge to an analysis of the relationship between current experience and future action' (McAlpine and Weston 2002, p. 69). For social learning theorists, the answer resides in the formation of new knowledge schemata by capitalizing upon opportunities to access environmental information. A recent Taiwanese study Hwang and Chang (2011) drew from both cognitive and social learning theories in order to investigate 'mobile learning'—a form of formative assessment designed to meet the demands of the 'knowledge economy' by using information and communications technology to embed learning in the real-world context. Computer-based learning environments (CBLEs) utilize a range of computer tools—visual, textual, and auditory formats—that can be blended to support individuals in learning for a specific educational or vocational purpose (Winters *et al*. 2008). In Hwang and Chang's study mobile learning was described as a learning context in which students participate "via mobile devices without being limited by space and time; in particular, the students can be situated in a real-world scenario associated with the learning content" (p. 1023). Upon giving an incorrect answer student learning was scaffolded with hints and encouraged to reflect on their reasoning, instead of simply being given the correct answer. It was found that a formative approach to mobile learning stimulated SRL and revealed higher learning motivation and better learning achievement. It was concluded that "the approach has provided a more challenging learning environment that encourages students to solve the problems on their own" (Hwang and Chang 2011, p. 1031). Hwang and Chang's study parallels the work of Lajoie (2008) who discusses Bandura's notion of *'reciprocal determinism'* in light of the continuous interaction between the individual mind and the environment supported in technology-rich learning contexts. Lajoie (2008) contends that, "computers as cognitive tools afford the learner richer opportunities for the types of interactions that would support metacognition and SRL" (p. 471).

For formative assessment researchers both cognitivists and socioculturalists are correct. As Dretske (1981) theorizes, "in the beginning there was information. The word came later. The transition was achieved by the development of organisms with the capacity for selectively exploiting this information in order to survive and perpetuate their kind" (p. vii). Dretske's 'evolutionary' perspective explains that in order for individuals to be successful they require a formative environment; one in which they first have access to the information, second consciously select information and finally use the information strategically in order to regulate learning and achieve desired performance outcomes.

A general overview on how the theory of formative assessment explains the individual acquisition and integration of new knowledge into an existing schema, one might lead to the conclusion that, "it is here that cognitive science most directly borders fields like sociology and cultural studies" (Anderson 2003, p. 110–1). In metaphorical terms the capacity of formative assessment to develop SRL is located in a theoretically extensive, resource rich 'borderland' located between cognitive science and socioculturalism, co-existing with each intellectual tribe in a spirit of content (in both senses of the word) neutrality. Anderson *et al.* (2007) provide further areas of relevant diplomatic neutrality shared by "the two intellectual tribes": (a) that learning need not be bound to the specific situation of its application and that instruction can often generalize from the classroom to 'real world' situations; (b) knowledge can transfer between different tasks; thus science education may be reconstructed in the mathematics classroom; (c) abstract instruction which promotes generalization and reflection is very effective. It is clear that socio-cognitive theorists no longer see the development and refinement of SRL as an intra-psychological process unconnected to the social plane (Bandura 1997; Andersen, Reder and Simon 1997; Turner 2006). Instead they try to understand the social through its residence in the mind of the individual. This inevitably involves understanding the great deal of social knowledge that resides in the mind and how the person has learned to construct and interact with the social and physical environment (Andersen *et al.* 1997). Bandura (1997) concurs with the advocates for formative assessment who argue that teachers should, as the starting point, de-emphasize social comparison and de-personalize feedback, "construal of low attainments as indicants of inherent personal deficiencies erodes a sense of efficacy" (p. 118). The erosion of self-efficacy may put students into a downwardly spiraling pattern of disaffection, which diminishes students' potential to meet standards.

Theoretical Synthesis: Indirect and Direct Learning

The title of the article makes the direct claim that formative assessment brings SRL into existence. Therefore if students are to acquire SRL strategies, instructional practices must be consistent with the theoretical framework of formative assessment. The theory of formative assessment brings SRL into existence by respectfully disregarding the traditional tensions between cognitive and social theories on learning and the distinctions between the various sociocultural theories on SRL. The theory of formative assessment therefore blends cognition and a range of social theories on interaction into a functional theoretical framework. Black and Wiliam (2009) in presenting their theory of formative assessment explicitly state that they have no interest in traditional paradigmatic issues:

> Our general point is not that a cognitivist view is any less valid than the sociocultural one (from which the tradition of Wenger would be seen), rather that there will be quite different interpretations of the role of assessment, including formative assessment in each case. (p. 498)

The theory of formative assessment therefore, draws from both SCT and sociocultural theories which advocate for active participation in the educational process. SCT accepts that a person's own reality is formed by the dynamic connection between the environment and individual cognitive functioning. Therefore, Vygotsky's sociocultural perspective and Bandura's SCT agree on the broad principle of how a child's cognitive development occurs. However, it is inevitable that there will be differing emphases. Bandura's SCT argues for the importance of indirect learning or '*vicarious* learning' which takes place when individuals

internalize the performance(s) they observe in their social environment. Bandura's 'Bobo Doll' (1961) study is a well-known contribution, which he claims has implications for television's influence over human behavior. In this way the observer may encode or learn large amounts of new information quickly and explore new situations which would usually be beyond reach. The 'Bobo Doll' study is significant because it departs from behaviorism's insistence that all behavior is directed by reinforcement or rewards.

Vicarious or observational learning is given significant emphasis by formative assessment researchers. The teacher's traditional function of 'role-model' takes on a specific character as they are observed to, "engage the students in productive discussion, drawing from previous lessons and asking for other experiments which parallel the phenomena observed" (Ayala 2005, p. 47–8). Such discussions also serve as a model which students may use in their own scientific discussions, so they sound more like practicing scientists. Black and McCormick (2010) reiterate the central role of teachers as models when they emphasize interaction: "skilled teachers can serve as models, by the way in which they interact with students, for students' own interactions with one another in peer-groups". Black and McCormick go on to note that, "students need training, supported by examples, to help them work effectively in collaborative groups, in order to secure the benefits of peer learning, including peer-assessment" (p. 497; Looney *et al*. 2005). A central feature of student learning is reflection (McAlpine and Weston 2002; Kuiper and Pesut 2004). Black and McCormick (2010) contend that the teachers assume a central role in the process of modeling reflection and that teachers should "encourage pupils to reflect on the skills they are developing and, through the modeling of reflection, to take responsibility for their own learning" (p. 125). Heritage (2007) focuses on the importance of embedding the "safety norms" into a learning community:

> Above all, teachers will need the skills to model the 'safety' norms of the classroom in their own behavior… the teacher must model…so that students see that they are collaborators with their teacher and peers in developing a shared understanding of their current learning status and what they need to do to move forward. (p. 144)

Schunk and Zimmerman (1997, 2007) formulated a phased socio-cognitive model for the development of self-regulation, which includes both indirect and direct aspects of learning:

> [We] postulate four levels of development—observational, emulative, self-controlled, self-regulated—that begin with social sources and subsequently shift to self-sources. Although there is some overlap, the first two levels (observational, emulative) rely primarily on social factors, whereas the second two (self-controlled, self-regulated) depend more on influence by the learner. (2007, p. 10)

This is a close approximation to Vygotsky's social development theory which contends that social interaction precedes the development of individual psychological functions which permit the conscious self-regulation of cognitive and affective strategies. Students who are novice formative assessors learn general approximations of appropriate learning strategies by observing experienced teachers explain and demonstrate the norms of the formative assessment community (Schön 1987; Lave and Wenger 1991; Black and Wiliam 2006; Heritage 2007). This is necessary before students may progress to the emulative phase. At this point students begin to use the strategies; to move toward mastering them in order to adapt (to) the learning environment and support their own individual learning needs. They begin to understand that the relationship between themselves and their environment is reciprocal and as such they should continuously act in ways which achieve the optimal balance between personal needs and environmental constraints. In the early stages of Schunk and Zimmerman's SCT model, the teacher plays the role of guide, (cf. Dewey) who scaffolds

the development of students towards the self-regulated phase of the model (cf. Vygotsky). In addition to teacher modeling, Bandura (1986) contends that when students who convey a strong sense of efficacy are observed by their peers, they may influence the learning strategies of the observers. In extending the multiple-phase model of self-regulatory strategy development to peer modeling, Bandura paralleled the work taking place in the sociocultural field on peer collaboration and assessment (e.g., Webb *et al*. 1986). It is not surprising that in the same year in an attempt to differentiate his theory from the social theories on learning and development flourishing at the time, Bandura amended the name of his theory from Social Learning Theory to Social Cognitive Theory.

A specific form of discourse implied in Schunk and Zimmerman's (1997, 2007) multi-phase model of SRL and explicitly emphasized in sociocultural theory is 'scaffolding' (Vygotsky 1978). Scaffolding is a collaborative process which differs from other forms of classroom talk because it should occur only when there is clear evidence that the learner is unable to progress without assistance. According to Zimmerman (2002), it is probable that untimely interventions trigger the generation of negative internal feedback because students may interpret it as attempts at unjustified control or an unwarranted assumption about their ability. If the intervention is a timely one the learner may cross the conceptual spectrum of achievement known as the 'zone of proximal development' (Vygotsky 1978). Mercer *et al*. (2004) remark that, "for educational researchers, sociocultural theory highlights the role of teachers in helping children develop new ways of describing and conceptualizing experience" (p. 361). The focus is now placed upon the direct interaction *among* the participants as they vocalize their thoughts in an attempt to attain inter-subjectivity with respect to the task and to build synergies by sharing their experiences as they co-construct the outcome. The theory of formative assessment expresses the need for sustained phases of peer engagement. Although the learning activity which mediates the collaboration is the same for each participant, each interactant possesses unique tacit knowledge (cf. Polanyi) as a result of their different life trajectories. During open and spontaneous discussions, which make their thinking visible students more readily integrate 'formal' knowledge gained through direct instruction into existing tacit knowledge (Bartlett 1932; Yin *et al*. 2008). The Hungarian born scientist and philosopher Michael Polanyi (1891–1976) and Donald Schön (1930–1997), write on the personally empowering nature of tacit knowledge, "it is personal, in the sense of involving the personality of him who holds it…but there is no trace in it of self-indulgence…His act of knowing exercises a personal judgment in relating evidence to an external reality, an aspect of which he is seeking to apprehend" (Polanyi 1967, p. 24–5). The personal nature of tacit knowledge motivates students because in a formative assessment classroom, their personal beliefs, opinions, and even their guesses are valued. This creates a strong sense of self-efficacy; one of two main requirements for SRL among students (Bandura 1986; Zimmerman 2000, 2002). The social context edifies them and personalizes the learning experience for each student. Schön (1987) expresses the same idea slightly differently, noting that learners relate to academia when they are guided to realize that they too, hold opinions and theories on similar themes, "they tend to think differently about the theories offered by researchers when they realize that they hold comparable tacit theories of their own." (p. 324). Polanyi (1967) and Schön (1987) emphasize the formative and reflective purpose of discourse in a social context characterized by an open community where ideas and opinions are exchanged and differences are seen as opportunities to co-construct shared meanings. It is the variability in their experience that makes it possible for students to scaffold each other's understandings in at least some aspects of the activity. Viewed in this light, it is clear why Vygotsky emphasized the role of joint activity in development, and wrote of its potential to enable learners "to go beyond themselves" with the assistance of more expert others.

Socially Mediated SRL: The Circulation of Discursive Power

Mutual learning relationships

The theory of formative assessment holds that SRL may exist only in environments where individuals are "meta-cognitively, motivationally, and behaviorally active participants in their own learning process" (Zimmerman 1989, p. 4; Black and Wiliam 1998b, 2006, 2009). Active participation is a fundamental element of the SRL construct (Zimmerman 1989, 2000; Wolters 2003; Pintrich 1999, 2004; Bandura 1986, 1997). However, socio-cognitive theories do not typically dwell upon the grain of the cultural, ontological, and situated social contexts which promote or negate self-regulation among students. The contextual and environmental aspects of learning are, to a notable extent, the domain of the socioculturalist. Fox and Riconscente (2008) point out that "the significance of others in the development of self-regulation is explicit in the seminal work of both Piaget and Vygotsky" (p. 217). Schunk (2008) and Volet *et al*. (2009) identify how learners internalize external examples of formative practice and SRL into their self-regulatory systems as a theme which has "critical implications for educational practice" (Schunk 2008, p. 466). Explanations of the gradual appropriation of self-regulatory control processes are theoretically grounded in the Vygotskian (1978) view of socially mediated learning and development. Volet *et al*. (2009) note that from a Vygotskian perspective the individual appropriation of regulatory control processes is viewed as taking place through structured interactions with a more able other (e.g., Palincsar and Brown 1984) or through collaborative problem solving with peers (e.g., Artzt and Armour-Thomas 1997).

For sociocultural researchers the *active* participation required for the internalization of regulatory control processes begins with the process of 'scaffolding', which closely approximates the 'formative feedback' required for formative assessment to exist (Shepard 2005a). Models of scaffolding and formative feedback pay close attention to what the student knows in order to gather evidence used to adapt instruction to address misconceptions and partial understandings (cf. Ausubel). Shepard (2005a) assumes a neo-Vygotskian perspective, emphasizing that both 'scaffolding' and formative assessment is "a collaborative process and involves negotiation of meaning between teacher and learner about expectations and how best to improve performance" (p. 67). There is consensus among theoreticians that *mutuality* is a key pre-requisite for interaction to occur which, 'wakens a whole series of functions that are in a stage of maturation lying in the zone of proximal development' (Vygotsky 1987, p. 212). Shepard's conception of formative assessment is supported by the research of sociolinguists (Gebhard 1999; Storch 2002) who emphasize that effective peer learning requires more than merely placing students in groups, an observation made by Dutch (Kreijns *et al*. 2003), Australian (Storch 2002), British (Mercer 2000, 2004), and other international studies on peer group learning. Mercer (2000) suggests that in addition to a Vygotskian teacher-expert/novice-student conception of social learning "we should also try to explain children's development as interthinkers" by examining how experienced community members act as "discourse guides" as they guide novices into "ways of using language for thinking collectively" (Mercer 2000, p. 170). Storch (2002) found that students demonstrated higher levels of linguistic performance when they took on carefully defined collaborative relationships, indicating that peer-learning process may be optimized in the pursuit of desired outcomes. When students take on collaborative roles in an interaction, they are assisting each other mutually and equally while attempting to solve a particular challenge or problem. Goos *et al*. (2002) applied the term "collaborative zone of proximal development" to their research into mathematics education. To Goos *et al*. (2002) the internalization of knowledge is a process of scaffolding "involving *mutual* adjustment and appropriation of ideas" between students (p. 195). Ideally, every occasion of joint activity provides an opportunity for

development on the part of all participants (Rogoff 2003). It is the intention that the discourse found in collaborative groups will scaffold numerous opportunities for individuals to refine and enrich their knowledge and their use of meta-cognitive strategies. Pressick-Kilborn and Walker (2002) suggest that learning relationships characterized by equality and mutuality stimulate interest in the task and promote sustained on-task interactions. This view was also expressed in the earlier work of Damon and Phelps (1989) that highlighted equality and mutuality as critical dimensions for effective collaborative learning. For socioculturalists mutuality is a critical feature and one which must exist if the formative classroom is to promote the active participation required for SRL to exist.

There are areas of substantive agreement between Social Cognitive Theory and socio-cultural theories, which together bring coherence to the construct of formative assessment. For example, Albert Bandura, Paul Pintrich, and Barry Zimmerman (cognition); Lev Vygotsky, Barbara Rogoff, and Michael Cole (cultural); and Paul Black, Dylan Wiliam, and Lorrie Shepard (formative assessment) publish on the importance of experience, feedback, observational learning, and social context in advancing SRL. McCaslin (2004) posits that learning identities, which support SRL form when on-going social influences act, either positively or negatively to shape individual motivational states. Wing-yi Cheng, *et al*. (2008) found that "the quality of group processes played a pivotal role because both high and low achievers were able to benefit when group processes were of high quality" (p. 205). As one would expect there is a great deal of discourse in the sociocultural research community on what high-quality interactions, which satisfy the standard required for collective, interdependent learning look like in practice. Gillies (2003) suggests that listening, explaining, and the sharing of ideas completes a model capable of capturing those collaborative interactions which support the realization of individual goals. Kutnick and Manson (1998) recommend a learning construct in which students are expected to plan and organize their group work then share the responsibility for group decisions by compromising and resolving conflict. Barron (2000) conducted a meta-analysis in order to identify group processes that relate to individual learning outcomes and found the following features to be most salient: explaining one's own thinking; sharing knowledge; providing critique and providing augmentation; and observation of peers' strategies. Blatchford *et al*. (2006) in their empirical study into science education conclude that high-quality interactions are typified by predictions, explanations, justifications, and reasoning. Mercer (2004) uses sociocultural discourse analysis as the methodology for researching the quality of classroom talk, which he calls "exploratory talk". Examples of exploratory talk include: "if", "because", "I think", and "agree"' (Mercer 2004, p. 164).

Meaningful collaborative discourse does not occur spontaneously between students. Teachers need to be trained and become skilled in social organization if attempts at structuring an open classroom environment are not to be frustrated by inappropriate student behavior based, for example on tacit social prejudices arising from demographic stereotypes. Putney and Broughton (2011) conceive of the teacher as a powerful agent, in developing collective classroom efficacy by modeling "safety norms" (Heritage 2007) and structuring active participation in appropriate social learning experiences. In the role of *community organizer* the teacher is concerned with: "developing self-improvement capabilities, constructing a self-directing collective, while continuing to promote unity and motivate interdependence" (Putney and Broughton 2011, p. 101). Putney and Broughton showcase the 'Visible and Invisible Walls' project, which over the course of a month investigated the meaning of tolerance by examining the acts of intolerance represented by real walls (e.g., Berlin Wall) and conceptual walls (e.g., 'Nelson Mandella Wall'). The teacher of these 5th grade students shared the philosophy guiding the instructional practices observed in the classroom:

> It is a place that encourages autonomy, respect, and accountability through active participation with our diverse environment. [My classroom] values what one thinks, cares how one feels, and supports student learning experiences. . . . Let the children develop the life skills authentically…The ones I really insist they have from day one are respect, responsibility, cooperation, and caring (Putney and Broughton 2011, p. 99).

The emphasis on social context and social mediation completes the SRL construct by emphasizing high-quality learning roles and relationships and the impact of discourse. Ultimately, it is discourse, both on-task and off-task (e.g., peer chatter; teacher social/management moves) which will belittle or extol their attempts at participation and determine if internal feedback is efficacious. Classroom cultures which emphasize mutuality and de-emphasize comparison stimulate what Pressick-Kilborn and Walker (2002) call 'situational interest'. The theory suggests that situational interest arises when interest is triggered by the environment. If the social message is internalized, transformed, and integrated it penetrates the personal core of the self and becomes an authentic personal interest. The emphasis on collaborative learning found in the formative classroom is substantiated by SRL studies which find that high achieving students rely more heavily on social sources of assistance. For example, Zimmerman and Pons (1986) found that of the high-achievers interviewed, 50% asked for feedback from peers and 35% from adults (teachers and parents). In contrast, the key SRL strategy of social engagement was rarely pursued among low achievers with only 23% seeking assistance from peers and 8% from adults. The message seems clear; classroom environments should be *co*-constructed in a way which strengthens perceptions of self-efficacy and increases the level of participation in formative assessment activities. In classrooms that emphasize open dialogue and transparent feedback it appears more probable that even 'at risk' students will feel motivated to seek social assistance more often. By observing their teacher and actively participating in the community they begin to actualize the unitary objective of formative assessment—self-regulated learning (Schön 1987; Black and Wiliam 1998b; Bandura 1997; Rogoff 2003; Ayala 2005). The SRL research of Zimmerman and Pons (1986) implicitly supports the use of formative assessments as they conclude with the statement: "The present results suggest that theoretical conceptions of students as initiators, planners, and observers of their own instructional experiences have empirical and practical merit" (p. 626). Schraw *et al.* (2006) concur and suggest providing comprehensive "informational feedback" to students. In*form*ational feedback is synonymous with *form*ative feedback because it should not only inform the student about the quality of the work, but "provide as much information as possible about how to improve subsequent performance" (p. 116). Feedback which informs the student of their current status and how to improve can boost self-efficacy and achievement, even after students experience initial difficulty performing the skill (ARG 1999; Schraw *et al*. 2006).

Thematic Discussion

The six sub-sections to follow arise directly from the philosophical and theoretical discussions of the article, investigating themes of global interest in the twenty-first century: (1) lifelong learning; (2) self-efficacy; (3) collective efficacy; (4) persistence and stable motivation; (5) achievement; and (6) feedback and meta-cognition. These themes have been selected because of their centrality to the resurgence of interest in autonomous learning. According to Karoly (1993) the rise of self-regulatory learning strategies, "has multiple roots, including the demise of logical positivism" and has coincided with "cultural, economic, and political forces" which in the final decades of the twentieth century have created "a climate conducive to personal and societal

expressions of individualism, responsibility, autonomy and freedom of choice" (p. 24). The momentum of autonomous learning increased into the twenty-first century as formative assessment became what Hutchinson and Hayward (2005) describe in their Scottish study as the "quiet revolution" taking place in the policy frameworks of a number of nations (OECD 2005, 2008). Self-regulated learning has been linked to the current dominant concept of lifelong learning by a number of recent studies (Deakin Crick *et al*. 2004; OECD 2005, 2008; Hoskins and Fredriksson 2008). SRL is therefore a key lifelong learning 'meta-competence' required to adapt to the accelerating technical and cultural evolution and the formation of a global society that seeks to include increasing ethnic diversity. As such, formative assessment, SRL, and lifelong learning competences can be constructed as postmodern conditions of education (Edwards and Usher 2001). Hinchliffe (2006) refers to the twenty-first century (or 'post-Fordist') economy as the 'knowledge economy'. The knowledge economy is defined here as the:

> …production and services based on knowledge-intensive activities that contribute to an accelerated pace of technical and scientific advance, as well as rapid obsolescence. The key component of a knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources. (Powell and Snellman 2004, p. 199)

The key difference from the past is that skills and competences relevant to the 'knowledge economy' are no longer passed down from one generation to the next (Hoskins and Deakin Crick 2008). This understanding "does not function in the rapidly changing technological and globalized world of today where it is not possible to establish which type of knowledge is needed in the next 5 or 10 years let alone a lifetime" (Hoskins and Fredriksson 2008, p. 11). The six thematic discussions to follow are grounded in the context of the theory of formative assessment. They begin with a contextual overview of lifelong (autonomous) learning, before going on to discuss essential aspects associated with the development SRL.

1. Lifelong learning

Kaplan (2008) concluded that meta-cognition and SRL "are not distinct concepts. Rather, they are subtypes of the same general abstract phenomenon of self-regulated action" (p. 483). This article offers a wider conception of meta-cognition, SRL *and* self-regulated action as components of lifelong learning.

Taylor (1987) draws from the influential post-structuralist perspectives of Heidegger when he remarks:

> Even to find out about the world and formulate disinterested pictures, we have to come to grips with it, experiment, set ourselves to observe, control conditions. But in all this, which forms the indispensable basis of theory, we are engaged as agents coping with things. (p. 432–3)

The typical day requires students to participate in multiple communities both inside and outside of school, which places demands on their coping strategies as they regulate various external inputs (Black and Wiliam 1998b; Rogoff 2003). These include: peers; teachers; other resources; management rules and requirements; parental anxieties; standards; tests with high stakes, and so on (Black and Wiliam 1998b; McCaslin 2004). If such external inputs exercise overt control over how children think and behave, then the motivation to actively participate in and autonomously regulate their own learning experience will diminish (Bandura 1986, 1994, 1997). Accordingly the theory of formative assessment explicitly recognizes that young learners need to acquire a strong sense of self-efficacy and the meta-cognitive skills with which to regulate the inputs that affect their progress toward their

personal learning and life goals. The unitary objective of formative assessment is therefore: to prepare students for college and life by equipping them with the self-regulatory strategies they need to exercise some self-control over environmental inputs (Black and Wiliam 1998b; ARG 1999; cf. Bandura 1997). The objective of formative assessment is entirely consonant with Bandura's (1997) perspective on the purpose of education: "a fundamental goal of education is to equip students with the self-regulatory capabilities that enable them to educate themselves" (p. 174). Bandura (1986) originated Social Cognitive Theory; a socio-cognitive theory of particular significance to self-regulated learning and therefore to the discussion on the theoretical framework of formative assessment. Bandura (1997) emphasizes the lifelong utility of SRL in a world characterized by rapid technological change, cultural fragmentation and ecological responsibility. For Bandura and his colleagues, SRL provides the inner drive for lifelong learning necessary if "people are to survive and prosper under increasingly competitive conditions" (p. 227). The construction of the Twenty-First Century Competencies (21CC) framework emerged out of efforts to improve and reform educational systems in order to better prepare students to be effective workers and citizens in the future (Partnership for 21st Century Skills 2009). The 21CC framework stressed meta-cognitive and motivational factors as not only essential for effective learning in school, but also as a necessary basis for productive functioning in contexts beyond school. Lifelong learning competences are therefore apprised as "a highly valued outcome at the individual and societal levels in terms of an overall successful life and a well-functioning society". They are therefore an "instrument for meeting important, complex demands and challenges in wide spectrum of contexts" and "important for all individuals" (Rychen 2003, p. 66–67).

The discrepancy between the 'life thinking skills' students need and those that are emphasized in the reality of US state standards documentation, was partially revealed by Kendall *et al*. (2008). Kendall and his colleagues produced a report called twenty-first century skills: What do we expect of students? After reviewing the standards documents of 7 US Central Region states (Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, and Wyoming), they reported that the documents consistently failed to profile meta-cognitive and motivational strategies among its standards. Standards documentation, "has a varying but indisputable impact on the curriculum in the schools of each state"' (Kendall *et al*. 2008, p. 5). However, the potential of formative assessment practices which circulate discursive power, support students' identity as capable learners, and provide transparent feedback which facilitates SRL is overlooked. The American ethic has always been grounded in self-determination and self-affirmation, yet the ethic is not 'taught' in public school classrooms because such values are not included in the standards documents. The consequence is the consistent neglect of processes which support the development of lifelong learning strategies among students (Cornford 2002; White and Frederiksen 2005). Developments (or the lack thereof) in the US contrast with those in the European Union (EU). A notable development took place in 2000 when the leaders of EU member states met to discuss goals and strategies for the future, known as the 'Lisbon strategy'. The summit led to the development and piloting of several measurement inventories designed to assess lifelong learning competences among students. For example, the Effective Lifelong Learning Inventory (ELLI) (Deakin Crick *et al*. 2004), developed in the UK, is an instrument used to gather data on the 'learning power' of individual students. After 112 field trial items and through a lengthy testing of this instrument it was refined to 65 items and produced the seven learning power scales, summarized as follows: (a) *growth orientation* (changing and learning) establishes the extent to which learners regard the process of learning is itself learnable; (b) *critical curiosity* demonstrates learner's desire to find out new things; (c) *meaning-making* affirms the extent to which learners are on the lookout for links between what they are learning and what they already

know; (d) *dependence and fragility* finds out how easily learners are disheartened when they get stuck or make mistakes; (e) *creativity* establishes the learners' ability to look at things in different ways; (f) *relationship/interdependence* (learning relationships) establishes the learners' ability to manage the balance between sociable and individual approaches to learning; (g) *strategic awareness* finds out learners' awareness of their own learning processes (Deakin Crick *et al*. 2004). One of the interesting aspects of this instrument is that it is "a tool that can be used diagnostically by teachers and others to articulate with their students what it is to learn."(Deakin Crick *et al*. 2004, p. 267). After the first studies the instrument has been used by a number of schools, between 2003 and 2007, "over nine thousand learners between the ages of 7 and 21 have used the learning power profiles in formal learning contexts, usually schools" (Deakin Crick 2007, p. 144).

Butler and Winne (1995), see SRL as a developmental process that unfolds step-by-step and continues to evolve across the span of the learner's lifetime. Stiggins (2002; Black and Wiliam 2006; Black and Jones 2006) connect the meta-cognitive cycle of planning, monitoring, and evaluation central to formative assessment to lifelong learning, "students come to understand what it means to be in charge of their own learning—to monitor their own success and make decisions that bring greater success. This is the foundation of lifelong learning," (p. 764). Lifelong learning is given primacy in a key Organization for Economic Cooperation and Development [OECD] (2005) report on formative assessment, which presents case studies from secondary schools in eight nations. The report relates that, "each of the national and regional governments participating in this study promotes formative assessment as a means to meeting goals for lifelong learning" (p.22). The report identifies strategies of active concept building; placing new ideas in larger contexts and self and peer assessment against well-defined goals and criteria as "skills that are invaluable for learning throughout their lives" (OECD 2005, p. 24).

2. Perceived self-efficacy

Self-regulated students exhibit a strong sense of perceived self-efficacy (Bandura 1994, 1997; ARG 1999; Zimmerman 2000, 2002; OECD 2005). Self-efficacy is defined as beliefs about capabilities to produce designated levels of performance that exercise influence over meaningful events (Bandura 1994). It is therefore the belief that one's efforts will result in desired outcomes. The 'theory of formative assessment' emphasizes the need for a supportive learning environment because negative emotional states "can lower efficacy beliefs; the lowered beliefs, in turn, weaken motivation and spawn poor performance" (Bandura 1997, p. 113). Bandura (1997) connects a high sense of self-efficacy with a forward looking outlook and the tendency to set personal goals. As an individual's perception of their self-efficacy becomes more definite the goals become higher and are more persistently pursued as realizable opportunities. Zimmerman described by Bandura (1997) as "a leading exponent in an expanded model of self-regulated learning" (p. 228), found that academic self-efficacy was more predictive of achievement than a person's estimation that a given behavior will lead to certain outcomes (outcome expectancies) (Zimmerman 2000). For example, Shell, Murphy, and Bruning (1989, as cited in Zimmerman 2000) measured (a) self-efficacy as self-belief in their ability to perform various reading and writing activities; (b) outcome expectancies were assessed as the value they attached to reading and writing in attaining various beneficial outcomes (e.g., employment, social pursuits, family life). For reading perceived self-efficacy and outcome expectancies jointly predicted 32% of the variance, with perceived efficacy accounting for nearly all the variance. For writing, self-efficacy beliefs were the only significant predictor of performance.

Students who believe that they are capable learners are ready to assess their own work, identify their current strengths and weaknesses and be productive and persistent in planning the next steps they need to take to make improvements. Zimmerman (2000) found that students who held a strong sense of self-efficacy choose more challenging tasks; are more productive; more persistent; and resistant to stress, anxiety, and depression. Bandura (1997) presents essential insights into how efficacy influences cognitive processing speed. Efficacy beliefs determine the cognitive speed at which students test, evaluate, retain, or reformulate their ideas and also the rate at which they acquire new knowledge - "beliefs of personal efficacy to master computers were predictive of early adoption of the computerized system" (Bandura 1997, p. 460). In addition, extant research which suggests that self-awareness, persistence, and self-efficacy are connected. For example, Teasdale *et al*. (1995) suggest that self-awareness which promotes negative internal feedback, e.g., self-judgment and self-criticism, diminishes persistence because negative feelings undermine self-efficacy and therefore frustrate SRL (Bandura 1997; Nicol and Macfarlane-Dick 2006). In contrast, a purposive and neutral self-awareness instills a sense of power over such self-critical thoughts or frustrations, allowing negative internal feedback to dissipate.

3. Collective efficacy

Although research on SCT has emphasized individual-level mechanisms (e.g., self-efficacy) and outcomes, "the theory is also concerned with how people work together within teams and other social units" (Lent *et al*. 2006, p. 74). SCT has extended the concept of individual agency to collective agency (Wing-yi Cheng *et al*. 2008) to the point where there is little difference between the methodology of recent research into collective efficacy and the social interactions investigated in sociocultural studies (e.g., Putney and Broughton 2011). Sampson (2004) remarks on the promise of collective efficacy theory in this area: "It reaffirms the importance of thinking about social ways to approach social problems" (Sampson 2004, p. 112). Bandura (1997) defines *collective efficacy* as "a group's shared beliefs in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainment" (p. 477). Students form characteristics supportive of SRL when the environment operates to promote 'positive interdependence' among students (Johnson and Johnson 1975; 1998). When established successfully, positive interdependence results in students recognizing that their individual success is inextricably linked to the success of every other member of the group. Wing-yi Cheng, *et al*. (2008) remark on the growing requirement for the interdependence of human functioning. When students begin to recognize this, it erodes a major environmental barrier to effective learning—the *competing needs* of other individuals. Consequently, learning relationships evolve and come to support the *collaborative needs* at the group level. The evidence suggests that achievement takes place when individuals engage in carefully considered forms of collaborative group interaction (e.g., Storch 2002). Consider, Choi, Nam, and Lee's (2001) study ($n=133$). Over 9 weeks the 67 middle school girls in the experimental group were given, "detailed feedback about the solution, teachers' comments about the results and relevant references" (p. 28). The remaining 66 girls in the control group were given only the correct answer as 'feedback'. To assess changes in achievement a pre-test/post-test design was used, with the post-test being identical to the pre-test except for a small number of modified questions. It was concluded that "formative assessment, with detailed feedback seems to be a necessary component of effective science teaching and learning" (p. 28). Hattie (1999), after many years of field research into the effects of feedback on learning behavior confirms that, when feedback is used formatively it is, "the most powerful single moderator that enhances achievement" (p. 9).

"Collective efficacy brings further definition to the term 'collaborative learning' because it involves group members' judgments of the group's capabilities as a whole, not simply an aggregation of each individual's self-efficacy" (Wing-yi Cheng *et al*. 2008, p. 208). Wing-yi Cheng and colleagues (2008) go on to explain that "a talented person with very high self-efficacy can have low collective efficacy if he cannot cooperate effectively with other group members" (p. 208). Similarly, Lent *et al*. (2006) tested SCT assumptions that collective efficacy reflects more than just aggregation of team members' individual self-efficacy beliefs, and is a better predictor of team performance where outcomes depend on joint effort. Advocates of formative assessment would contend that while learning need not always be a joint process, learners will more readily achieve full potentiality if their learning experience is socially constructed (cf. Vygotsky 1978, 1987). Lent *et al*. (2006) reported: "That collective efficacy was strongly related to team cohesion, while self-efficacy produced a small correlation with cohesion, supports the validity of the social cognitive conception of collective efficacy as a group focused construct" (p. 81). The findings of Wing-yi Cheng *et al*. and Lent *et al*. have implications for those in the educational community who believe that learning is most effective when students develop relational skills which facilitate the acquisition of knowledge in group contexts. The findings also provide empirical support for Bandura's differently emphasized definitions of self- and collective efficacy: Self-efficacy focuses on individuals' "management of prospective situations" (1986, p. 389), whereas collective efficacy focuses explicitly on group processes and outcomes, i.e., "a group's shared beliefs in its conjoint capabilities to organize and execute the courses of action required to produce given levels of attainment" (1997, p. 477).

However, simply sharing such definitions with practitioners is unhelpful because "all research findings are generalizations and as such are either too general to be useful or too specific to be universally applicable" (Wiliam and Leahy 2007, p. 39). To understand collective efficacy in practical situations it is necessary to pinpoint the key "causal mechanism" in collective efficacy theory as "social control enacted under conditions of social trust" (Sampson 2004, p. 108). In this epistemology, collective efficacy in schools "is a task-specific construct that draws attention to shared expectations and mutual engagement by participants" (Sampson 2004. p. 8). That is, the social engagement of students, teachers and other stakeholders in co-regulating the learning process. Sampson (2004) echoes post-structuralist values of social discourse, consensus, and democracy which underpin formative assessment, when he observes, "the success of a collective efficacy approach to governance is tied to the equitable implementation of "voice" in building legitimate community authority" (p. 111). Sampson continues, "communities are, after all, socially constructed, and so the process of constructing them should form the building block of our theories and policies" (p. 113).

The emphasis on "conjoint capabilities" found in Bandura's definition is enriched in Black and Wiliam's (2009) expanded strategic model which emphasizes that both teachers and students together are "jointly and severally liable" (p. 7) for any failure to meet the following strategic responsibilities (p. 8): (1) clarifying and sharing learning intentions and criteria for success (teacher driven); (2) engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding (teacher driven); (3) providing feedback that moves learners forward (teacher driven); (4) activating students as instructional resources for one another (peer-group driven); and (5) activating students as the owners of their own learning (individual learner driven).

Lent *et al*. (2006) note that, "collective efficacy has proven to be a very flexible group level explanatory construct, finding application to groups of diverse size, function and organizational context" (p. 74). Collective efficacy is therefore of paramount interest to

advocates of formative assessment as a flexible social learning theory "reliably linked to" such outcomes as: (a) team cohesion (Paskevich *et al.* 1999); affective outcomes (e.g., task satisfaction) (Jex and Bliese 1999) and group performance outcomes (Bandura 1997; Johnson and Johnson 1998; Goddard 2001; Wang and Lin 2007; Wing-yi Cheng, *et al.* 2008; Keshtan, *et al.* 2010). It has been shown that groups with high collective efficacy exhibit high conation and so contribute more effort to the group endeavor, have greater persistence in the face of challenges and distraction and produce greater group accomplishments.

Keshtan, *et al.* (2010) conducted a study in the domain of athletic training: "collective efficacy and team performance" (p. 4). Keshtan and colleagues examined data from self- and collective efficacy questionnaires (α=in excess of .79) and found that "ANOVA and Tukey post hoc comparison revealed that collective efficacy was positively correlated with team performance. Athletes from successful teams rated higher collective efficacy than less successful teams and athletes from less successful teams rated higher collective efficacy than unsuccessful teams" (p. 4). Several earlier studies indicate the potential for high-quality collaboration to support learning and improve attainment. A study by Stajkovic and Lee (2001) found that the mean correlation between collective efficacy and performance was 0.45; collective efficacy therefore accounted for 20% of the variance in group performance, representing a moderately strong effect size. Gully, Incalcaterra, Joshi and Beaubien (2002) found similar relationships (mean correlation of 0.41) and confirmed the finding that high-interdependence groups produce larger collective efficacy performance relations. Stajkovic, Lee, and Nyberg (2009) conducted a recent meta-analysis which showed that collective efficacy has a strong positive relationship with group performance (r=0.35), so replicating the results of the earlier 2002 meta-analysis by Gully *et al*. Collective efficacy also provides important implications for teacher training and continuing professional development. For example, Bandura (1993) did a collective efficacy study with staff in 79 schools. It was found that the stronger the collective belief in their instructional efficacy, the better the school performed academically. Goddard (1998) confirmed the potential of collective teacher efficacy, finding that it explains approximately 50% of between-school variance in mathematics and reading achievement. Contemporary educational research should afford particular consideration to Goddard, Hoy and Woolfolk's (2000) reflection on Bandura's 1993 study; "Bandura's conclusions are powerful ones that offer great hope to schools struggling to increase student achievement and overcome the association between socioeconomic status and achievement" (p. 497). Indeed the ramifications of collective efficacy extend beyond the school, having profound implications for community restructuring creating remarkable improvements in the social and physical conditions of 'at risk' neighborhoods (Sampson, Raudenbush and Earls 1997; Sampson 2004). The emphasis on this potentially very powerful collective social concept (at the heart of the theory of formative assessment) is partly explained by improving understandings arising from SCT and sociocultural that achievement requires interdependent efforts from individuals in collaboration.

4. Persistence/stable motivation

When students are provided with formative feedback, they are better equipped to regulate cognition, meta-cognition and affect, which sustains their persistence during learning tasks (Butler and Winne 1995; Schunk 1998; Zimmerman 2000; Nicol and Macfarlane-Dick 2006; Black and Wiliam 2009). As Nisan (1992) observed, for students to become deeply involved with a task only when intrinsically motivated would mean the neglect of most schoolwork: "In short, intrinsic motivation cannot constitute a sufficient and stable

motivational basis for schooling in general and a pre-designed curriculum in particular" (p. 129–130). The key to stable motivation to learn depends on a student's capacity to deploy self-regulatory strategies which strengthen their engagement with tasks that they may not find intrinsically interesting (Brophy 2004). This strongly suggests that students' persistence with regard to academic tasks is a function of their perceived self-efficacy—the motivational aspect of SRL. Perceptions regarding one's self-efficacy as either strong or weak are determined by self-conceptions of ability and the nature of the task (e.g., level of interest and challenge). Efklides (2011) devised the 'meta-cognitive and affective model of self-regulated learning' (the MASRL model) which distinguishes two levels of functioning in SRL: the Person level and the Task × Person level. The Person level addresses "more or less stable person characteristics, such as cognitive ability and meta-cognitive task knowledge, which are independent from the particular task to be carried out" (Efklides 2011, p. 10). At the Person × Task level the learner's perception of self-efficacy is enriched by additional components of affect, and regulation of affect and effort which emerge as they perform the task. The MASRL model explains that:

> motivation arises in response to the meta-cognitive and affective experiences triggered by actual task demands, the content of the task (topic), the familiarity with the task, the situational/context factors that trigger interest in the expectancy-value considerations specific to the task. (p. 13)

A third and very significant aspect which impacts upon a learner's level of self-efficacy is peer interaction. It is consistent with both sociocultural theories and SCT that when students are learning together effectively they are being collaborative and therefore collectively efficacious. Jex and Bliese, (1999) found that when students are positively interdependent, they exhibit greater task persistence in the face of challenges that may have led to their withdrawal from the learning process if attempted alone or in an unsupportive social environment. The neuroscientists Rilling and colleagues (2002) found that different parts of the brain activate depending on whether individuals identify their partners as human or as computers. The work of Rilling *et al*. demonstrates that while CBLEs create opportunities for SRL (Lajoie 2008; Winters *et al*. 2008) they are relatively ineffective at motivating people to work and learn together, as found by Rilling and his colleagues who note that, "mutual cooperation was the most common outcome in games played with presumed human partners" (Rilling *et al*. 2002, p. 396). Follow up with interviews revealed that "mutual cooperation was typically considered the most personally satisfying outcome" (Rilling *et al*. 2002, p. 399). The study presents strong scientific evidence that learners are internally motivated to learn collaboratively by a neural reaction which provides a chemical reward upon the successful completion of a collaborative task.

5. Achievement

Butler and Winne (1995) underscore the significance of SRL as a "pivot" upon which student achievement turns: "theoreticians seem unanimous - the most effective learners are self-regulating" (p. 245). Zimmerman and Pons (1986) provide empirical evidence for the theoretical claims regarding SRL, finding that students who used SRL strategies displayed substantial correlation with academic achievement: "the most impressive evidence of the size of the relationship was the finding that 93% of the students could be correctly classified into their appropriate achievement track group through knowledge of their self-regulation practices" (p. 625). Perels, Dignath, and Schmitz (2009) designed an SRL training program for mathematics students in Germany that included efforts to improve students' planning and goal setting; monitoring strategies; perceived self-efficacy; and critical reflection. The goals of Perels' *et al.*

training program are entirely consonant with the goals of A*a*L and A*f*L. Findings show that students who complete this training exhibit improved mathematical problem solving compared to students who got the same training in problem solving but without the SRL components. Students' understanding and performance in science has also been improved with interventions founded on a model of SRL (Cleary *et al.* 2008). There is considerable empirical support for the overall conclusion that characteristics supportive of SRL can be developed by interventions in core content areas, and that improving SRL can increase the students' ability to learn core content knowledge and skills.

6. Feedback and meta-cognition

While students with a strong sense of self-efficacy may be motivationally disposed to plan, monitor, and evaluate their learning, they need to be given assessment information which is so "transparent that students can evaluate their own work will in the same way that their teacher would" (Shepard 2000, p. 11). Various research affirms that transparent feedback is inherent in and a prime determiner of processes that constitute SRL (Bandura 1986, 1994, 1997; Butler and Winne 1995; Zimmerman and Pons 1986). The objective of formative assessment is to actualize SRL strategies among students by sharing verbal feedback and written assessment documentation (e.g., rubrics, briefing papers). The level of transparency required of the assessment documentation motivates students by providing them with the information they need to understand themselves as learners. The transfer of control to students is a structured and supervised process which gradually acclimatizes students to the new "learning contract" (Black *et al.* 2003, p. 21). Traditionally found in the domain of adult learning theory, learning contracts may become physical documents, used formatively in schools to help students set daily and weekly work goals, monitor performance against evaluation criteria and provide teachers with a detailed record of each student's progress.

The independent use of high-level feedback provides students with the opportunity to "develop an overview of the work, so that they manage and control it; in other words, they develop their capacity for meta-cognitive thinking" (Black and Wiliam 2006, p.15). By gaining an awareness and control of their thinking they become self-regulated learners (Schunk and Zimmerman 1997). Schraw and Moshman (1995) propose that meta-cognition includes at least three components, which may be presented as three overlapping regulatory meta-processes—planning, monitoring, and evaluation, each containing some aspect of the other. The first, planning, involves strategy selection, goal-setting, the application of background knowledge, and time management. Schraw, Crippen, and Hartley (2006) highlight global planning (e.g., prioritization of work) as an important self-regulatory strategy found among experts. The second, monitoring, requires students to use their work as a running record of their progress relative to expected standards. Butler and Winne (1995) note that, "as learners monitor their engagement with tasks, internal feedback is generated by the monitoring process" (p. 246). For Schunk (1998) and Butler and Winne (1995), monitoring is the 'pivotal' process which triggers SRL: "Monitoring is the hub of self-regulated task engagement and the internal feedback it generates is critical in shaping the evolving pattern of a learner's engagement with a task" (Butler and Winne 1995, p. 275). The final meta-cognitive component is evaluation. Evaluating requires a critical reflection on past work and the extent to which strategies facilitated or frustrated the realization of learning goals. Harrison, Short, and Roberts (2003) and Kuiper and Pesut (2004) found that, once mastered, reflective reasoning stimulates the use of self-regulated learning prompts as well as the development of meta-cognitive insight. These reported results indicate that a key outcome of reflective learning is a student who is able to take control of and self-regulate his or her own learning. Reflective thinking has been found to

be a "key ingredient in the commitment to lifelong learning" (Kuiper and Pesut 2004, p. 382) and is widely recognized in the literature as a concept of interest at the global level. Such findings prompt Bose and Rengel (2009) to claim that, "self-reflection is the heart of self-regulation" (p. 32). The question of whether it is monitoring or which reflection acts as 'the pivot' or 'the heart' of SRL is understandable. It arises from the inter-relationship between these sub-processes of meta-cognition and even as I write this paper I am both monitoring and evaluating.

Conclusion

Self-regulated students hold a strong sense of self-efficacy which supports the acquisition of effective study habits: they plan and monitor time; structure a productive work environment; and use social resources effectively. Pintrich (1999, 2004) and others (Zimmerman 2000; Wolters 2003; Bandura 1986, 1997) construe SRL as a meta-process dependent on students' active engagement before, during, and after the completion of academic work. To many practitioners, the notion of the self-regulated student may appear to be a distant ideal. However, it is certainly a realistic possibility for any student, including those considered to be 'at risk' due to their social and cultural antecedents or economic circumstances. Collective efficacy and collaborative learning have the potential to effectively neutralize the connection between SES and attainment and have particular utility for low achievers and the socially disadvantaged (Bandura 1993; Black and Wiliam 1998b; Goddard, Hoy and Woolfolk 2000; Goddard 2001; Crossouard 2011), promote higher-order cognition (Wang and Lin 2007) and improve academic achievement (Bandura 1997; Black and Wiliam 1998a, b; Johnson and Johnson 1998; Goddard 2001; Wang and Lin 2007; Wing-yi Cheng, *et al*. 2008; Keshtan, *et al*. 2010). The empirical challenge to the traditional connection between demographics (e.g., SES) and attainment empowers teachers *and* students to take back teaching and learning (Looney and Poskitt 2005).

An increasing number of administrators at national, state, and district level have discovered the potential of formative assessment to make thinking processes transparent, so that it is "now recognized in the research literature as one of the most powerful ways to enhance student motivation and achievement" (Cauley and McMillan 2010 p. 1; ARG 1999; OECD 2005). The analysis of the contents of a particular feedback message as 'pure', as if transmitted in a vacuum, free from environmental 'particulates' which distort the message does not adequately explain how and why formative feedback has the potential to engage students in the process of learning (Corner 1983; Chinn and Brewer 1993). The goal of this paper was to review the 'theory of formative assessment' and how it drives the acquisition of SRL. Of particular importance are, self- and collective efficacy, feedback and the issue of "context, such as… interpersonal contacts, and community norms" (Turner 2006, p. 293; Sampson 2004; Heritage 2007) which create the conditions for SRL. It is perhaps an important review for no other reason than self-regulation enables effort to be directed to improve performance (Harlen 2006).

Efforts to build self-regulation and autonomy begin with learners' partnership in the assessment and learning process (Bandura 1997; Townshend *et al*. 2005; Voogt and Kasurien 2005; Black and Wiliam 2009; Putney and Broughton 2011; Crossouard 2011). The fundamental objective of the theory of formative assessment is to equip students with self-regulated learning strategies which sustain stable motivation (Nisan 1992; Brophy 2004), improve attainment (Black and Wiliam 1998a, b; ARG 1999; Zimmerman and Pons 1986; Bandura 1997), and precipitate the inner drive for lifelong learning (Bandura 1997; Stiggins 2002; OECD 2005). For SRL to exist as a meta-characteristic among learners the environment should be designed to promote strong perceptions of self- and collective efficacy among students and

support learning through the co-construction of more powerful meta-cognitive strategies (Bandura 1986, 1994, 1997; Zimmerman and Pons 1986; Frederiksen and Collins 1989; Butler and Winne 1995; Zimmerman 2000; Brophy 2004; Sampson 2004; Harlen 2006; Black and Wiliam 1998a, b, 2006, 2009). The more influential force in creating SRL is meta-cognition. Applying the sub-processes of meta-cognition (planning, monitoring, and evaluation) to any task will generate internal feedback (Butler and Winne 1995), which is shaped by discourse and the social context (Sadler 1989; Black and Wiliam 2006, 2009; Black and Jones 2006; Shepard 2000, 2005a; Turner 2006). When students are engaged as active participants in their own learning progression they believe that they are capable learners who use goal setting strategies and independently regulate their efforts as they apprehend desired outcomes (Polanyi 1967; Butler and Winne 1995; Schunk and Zimmerman 1997; Schunk 1998; McAlpine and Weston 2002; Harrison, Short, and Roger 2003; Kuiper and Pesut 2004; Black and Wiliam 2006; Schraw et al. 2006). Engaging students in the meta-cognitive activities of planning, monitoring, and critical reflection (Schraw and Moshman 1995; Stiggins 2002), requires creating and sustaining mutual learning relationships (Storch 2002; Goos *et al*. 2002; Putney and Broughton 2011), positive social interdependence (Johnson and Johnson 1975, 1998; Barron 2000; Mercer; 2004; Putney and Broughton 2011) and the circulation of transparent formative feedback among learners (Frederiksen and Collins 1989; Shepard 2000; Black and Wiliam 2009). After reflecting upon the work undertaken together with teachers in the US to implement cooperative practices, it was noted, "the involvement of students both in whole-dialogue and in peer group discussions, all with a change in classroom culture… was creating a richer community of learners, where the social learning of the students was becoming more salient and effective" (Black and Wiliam 2006, p. 17). There is a wide scope for further research which links the goals and practices of formative assessment to the actualization of SRL characteristics and strategies. Including, but certainly not limited to how teachers design the learning environment, model safety norms, and prepare for the effective use of formative assessments. Specifically, how does existing tacit knowledge explicitly relate to pupil learning (Tannen 1993)? What is the substance of the mutual interactions which capitalize on "moments of contingency" to create a spontaneous and responsive environment (Mercer 2004; Ayala 2005; Black and Wiliam 2009)? The grain of synchronous evidence gathering is an important area for further research because many assessment criteria are inherently "fuzzy"; for example, creativity and originality (Sadler 1989). There are two further directions for review and research of particular salience: First, in what circumstances do learners more effectively internalize external examples of formative practice and SRL into their self-regulatory systems. Schunk (2008) emphasizes "research that investigates how to facilitate internalization at various developmental levels would have critical implications for educational practice" (p. 466). Second, much recent research call attention to the questionable level of confidence and ability teachers possess in order to *use* evidence of student learning formatively to plan for the next steps in students' learning progression (Macintyre, Buck and Beckenhauer, 2007; Herman, Osmundson and Silver 2010). It is crucial to remember that assessment does not become formative until evidence of learning is used for the adaptation of instruction with the explicit goal of meeting the needs of the students (Black and Wiliam 1998b).

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Conclusion

Each of the three articles included emphasizes that every occasion of mutual interaction holds the potential to create opportunities which further learning, and that where mutuality does not exist the opportunity to learn diminishes significantly. The theoretical potential of formative assessment practices to support learning and improve learning outcomes inside, outside and beyond school is now a conventional wisdom. However, recent studies suggest that there is a general lack of competence and confidence among teachers to perform formative assessments effectively. If teachers are to support learning in school, and provide the basis for lifelong learning competences they must develop the skills required to gather and use evidence of student learning to plan the next steps for individual students. By doing so teachers, students and parents/caregivers support learning *within* children by closing the gap between their existing knowledge and the desired level, and also *among* children by ensuring equity of outcomes.

In recent years, various empirical studies have revealed the beneficial impact that carefully structured opportunities for participation and discourse have on communities and the individuals who participate in them (Bandura, 1993; Black & Wiliam, 2006; Putney & Broughton, 2011; Sampson, 2004; Sampson, Raudenbush, & Earls, 1997). These studies found that it is crucial to activate holistic social relationships and achieve community consensus to realize desired learning outcomes and sustain improvement. Both analytical reductionists and social holisticists express considerable interest in the potential of formative assessment for supporting individual learning outcomes by encouraging autonomous learning strategies among students. When diverse theories are synthesized into a functional conceptual framework (i.e. the theory of formative assessment) it becomes possible to triangulate understandings on assessment

and instruction in different and innovative ways that are more appropriate for the 21st century knowledge economy.

Formative Assessment: Assessing the Work, or Wasting Time?

Pryor and Torrance (1996) question whether formative assessments attend to the cognitive processes of learning, or merely provide a social comfort zone which protects the child from cognitive conflict. They hypothesized that teachers would reduce assessment demands, and instead interact with children in ways that diminish the cognitive demands required for learning and development to occur. They found that the teacher in their study seemed "concerned to 'manage' the interaction rather than intervene in the learning process" (p. 217), and noted that the teacher lacked theoretical understanding which resulted in "more social than professional or reflective" (p. 217) interaction. Pryor and Torrence (1996) also suggested that practitioners should reflect upon their contention that "the 'theoretical resource…seems to be a generalized commitment to child-centred 'gentleness', coupled with behaviorism, rather than an understanding of the relationship of assessment to learning" (p. 217).

Reshaping practitioner attitudes toward classroom assessment is complex and challenging. Remesal (2011) explored the perceptions of 50 primary and secondary level teachers toward assessment along the four dimensions of (a) teaching, (b) learning, (c) certification of learning, and (d) accountability of teaching. She emphasized that the "four dimensions are interwoven to construct a conception; they can hardly be considered separated from each other, if assessment and school systemic functions are truly to be taken into account" (p. 479). Remesal suggests further that perceptions of formative assessment depend on whether teachers hold assessment to be either a societal conception (SC) or a pedagogical conception (PC). Those with the PC perception value formative assessment, whereas teachers who ascribe to

the SC category regard qualitative assessments, such as formative assessment, as potentially harmful. Summaries of teachers' beliefs grouped for each dimension are presented too. For example, for the *teaching* dimension PC teachers believe that substantial changes in assessment are required if diverse individual needs are to be met. SC teachers counter this belief with the perspective that assessment is disruptive and only school level interventions are useful (e.g. student grouping, classroom assistants etc). For the *learning* dimension, PC teachers believe that assessment has a positive effect on the learning process because it compels students to be active in the design and development of assessment. SC teachers contest on the assumption that assessment has no real influence on learning; it may even provoke irritation and anxiety. When considering the *accreditation of learning* dimension, PC teachers believe that students' individual progression must be the basic reference criterion for assessing their overall performance. In contrast, SC teachers view quantitative grading of achievement as a higher form of student progress than any qualitative assessment of the learning process. For the final dimension of *accountability*, PC teachers believe that families must be accurately informed about their children's learning in order to promote collaboration between the school and the family. The importance of parental and caregiver inclusion is confirmed by Townsend's (1997) investigation of Australian schools and a large-scale review of the English-language literature for the British government conducted by Desforges (2003), which found that effective schools welcomed parents and caregivers by engaging and involving them in a wide range of school activities, most crucially those concerning their children's development. In contrast to these perspectives on familial roles SC teachers agree that families have a fundamental right to progress reports, but rebuff the notion that they should be actively involved.

Remesal (2011) advises against a structuralist or dichotomous distinction between societal and pedagogical conceptions of assessment because teachers do not fall neatly into one category or the other. In addition, their opinion on one dimension cannot be used to predict their opinion of any other because

> in many cases, the interviewed teachers manifested contradictory beliefs about how assessment affects teaching and learning. As a matter of fact, beliefs related to a positive monitoring of teaching by means of assessment often did not come together with beliefs concerning positive effects of assessment on the monitoring of learning. (p. 479)

For some teachers then, teaching, learning, and assessment are not aligned. Remesal (2011) also noted that "it is remarkable [but not surprising] that most of the teachers present mixed conceptions rather than pure ones" (p. 479). This attests to the complexity of the assessment issue in schools. However, Remesal made a second and more refined observation about societal conceptions. She stated that

> the most frequent conception is the mixed societal conception… the prevalence of societal conceptions reveals the dominance of an 'assessment of learning' approach in the teachers' conceptions, over an approach of 'assessment for learning' that would be more likely to improve the teaching and learning process. (p. 479)

Remesal also noted that primary school teachers were inclined towards pedagogical conceptions of formative assessment, whereas secondary school teachers exhibited a marked tendency toward societal conceptions. This finding was confirmed by a OECD (2005) report which noted the concerns of secondary school teachers over formative assessment being a waste of valuable time. Such concerns are refuted by advocates of formative assessment who contend that schools

minimize lost learning opportunities and are more successful at promoting achievement when they implement formative assessments (OECD, 2005; Desforges, 2005; Black & Wiliam, 2009).

How should the essence of the teacher-student relationship in teaching and learning be described? A rigid application of Black and Wiliam's (1998b) seminal explanation of the process means that feedback obtained from computer outputs may be formative if it is used to adapt instruction to suit students' needs. However, it is essential that practitioners, administrators and policy-makers understand that formative assessment is a process based on high-quality *social* interactions between teachers and students not solely a cognitive interface as between a student and a software program. Goos, Galbraith and Renshaw (2002) applied the term "collaborative zone of proximal development" in their research into mathematics education. To Goos et al. the internalization of knowledge is a process of scaffolding "involving *mutual* adjustment and appropriation of ideas" between interlocutors (p. 195). In learning environments which support mutuality, every occasion of joint activity has the potential to create opportunities for development on the part of all participants (Rogoff, 2003). The discourse in collaborative groups scaffolds numerous opportunities for individuals to refine and enrich their knowledge and their use of meta-cognitive strategies. Pressick-Kilborn and Walker (2002) suggest that learning relationships categorized by equality and mutuality stimulate interest in the task and promote sustained on-task interactions. This was expressed in the earlier work of Damon and Phelps (1989) that highlighted equality and mutuality as critical dimensions for effective collaborative learning. For socioculturalists mutuality is an essential feature that must exist if the formative classroom is to promote the active participation required for learning to take place. The notion of mutuality therefore expresses the depth and the extension of reasoning required to form new and more accurate understandings.

It is widely acknowledged that the collection, and use of evidence arising from spontaneous interaction are very challenging tasks, (Tiknaz & Sutton, 2006; Macintyre, Buck & Beckenhauer, 2007; Parr & Timperley, 2008; Grossman, Hammerness & McDonald, 2009; Volante, Drake & Beckett, 2010; Herman, Osmundson & Silver, 2010), taking the teachers who participated in Black & Wiliam's (2006) study more than a year to adopt with any consistency. Nevertheless, Black and Wiliam (2009) emphasize "that formative assessment is concerned with the creation of, and capitalization upon, 'moments of contingency' in instruction for the purpose of the regulation of learning processes" (p. 10). The development of a "moment" into a genuine opportunity for learning is dependent on the meta-cognitive awareness of the participants. Schön (1987) identified a particularly important meta-cognitive skill which he calls reflection-in-action. It is a process best described as a blend of monitoring and reflection that permits the *reshaping* of something being worked on while working on it (Schön, 1987; Harrison, Short & Roberts, 2003; Kuiper & Pesut, 2004).

Black and Wiliam (2009) also found that synchronous interaction is an important process because it systematically reveals hidden beliefs, opinions and ideas (i.e. tacit knowledge) of students. Activities which encourage spontaneous interaction are highly engaging, and is an important reason for the popularity of computer games (Malone & Leper, 1987). Teachers and students need to become accustomed to verbal interactions which are mutual, so creating a focused learning "moment" that is divergent and flexible enough to fully capitalize on the opportunity. Schön (1987) described mutual interaction as unpredictably dynamic that includes "questioning, answering, adjusting, listening, demonstrating, observing, imitating, criticizing - all are chained together so that one intervention or response can trigger or build on another" (p.

114). Black and Wiliam (2009) also recognize this complexity and characterize the inherent spontaneity of formative dialogue as, "a formidable problem for teachers" (p. 13). It is formidable because it exposes teachers to the many ways in which students argue, evaluate and synthesize information for problem solving purposes, and it often requires a radical change in their instructional approach (Black & Wiliam, 2006; 2009). Whatever the challenges may be, the purpose of formative assessment and the important mission that practitioners must accept is to make students' tacit knowledge accessible - that is to make their beliefs, opinions, and ideas (whether right or wrong) visible as valuable assessment information (Shepard, 2000; White & Fredericksen, 2005).

As the research base of formative assessment moves from theoretical validity to practical implementation the difficulty that many teachers experience when collecting and using evidence productively has been recognized by a number of recent empirical research studies (Black & Wiliam, 2006; 2009; Tiknaz & Sutton, 2006; Macintyre, et al., 2007; Parr & Timperley, 2008; Grossman, et al., 2009; Volante, et al., 2010; Herman, et al., 2010). Many teachers believe that the most effective ways to gather evidence necessitates a one-way (non-mutual) process of extraction. McInerney (2002) suggests that the process of making learners' knowledge visible should not be one of "extract[ing] knowledge from within…to create new explicit knowledge artifacts" (p. 1014). Instead, individuals and organizations should make tacit knowledge explicit by focusing on the creation of a "knowledge culture" that encourages learning and the creation and sharing of knowledge. Accordingly, the theory of formative assessment explicitly contends that *all* feedback should be embedded within the process of instruction. By doing so the theory prompts mutual interaction between teacher and students which has the potential to close the gap between students' existing knowledge and desired levels. The essential points to note here are (1)

gathering evidence of student learning is by definition a formative process; (2) however, the process is not a formative process unless the evidence is used to adapt teaching to meet the needs of the students (cf. Black & Wiliam); and (3) one-way interactions do not exist inside the formative classroom (other than for non-formative management purposes) because the instructional dynamics arise in part from the socio-cultural notion that every occasion of joint activity provides an opportunity for development on the part of all participants (Cole, 1996; Rogoff, 2003). In this way the limited time available during a typical school day is used most effectively.

Questioning and Feedback

Classroom interaction, and feedback often takes the form of questioning. However, not all questioning may be considered formative. The ‘quiz-show’ questioning style (or synchronous summative) is notable for its high speed and high level of teacher control. Teachers who adopt this style are not being interactive, and consciously avoid scaffolding learning and providing formative feedback. There may be inequitable demands placed upon the more verbose students, while the others sit in relative silence. Opportunities for furthering learning are consistently missed as the teacher frequently interrupts, or otherwise maintains control by discouraging student initiative. However, such situations are highly complex, and do include evidence of some good practice at the fundamental level. For example, teachers may make very concerted attempts to understand what the students know before moving forward into more complicated areas. This is a fundamental strategy, employed in accordance with David Ausubel’s (1968) robust "subsumption theory" which strongly emphasizes that teachers should ascertain what their students already believe to be correct knowledge. Similarly, Parr and Timperley (2008) draw

from the work of Ausubel and Vygotsky in explaining the importance of students' existing knowledge. They note that

> Knowing a student's present level allows a teacher to work on learning goals just a little ahead of independent performance, in the region of sensitivity where the skills and knowledge are perhaps in embryonic form, to build on what the learner is just starting to do (Parr & Timperley, 2008, p. 57).

Grossman, Hammerness and McDonald (2008) recognize the importance of establishing the existing knowledge of students by way of discourse, which they describe as "a core practice for learning about student understanding [that] involves *eliciting student thinking during interactive teaching*" (p. 280). Careful attention should be paid to the word "interactive". According to Grossman et al. "interactive" is synonymous in meaning with mutuality. It is therefore very unlikely that the 'quiz-show' style of assessment is what Grossman and colleagues had in mind. Instead, they contend

> A teacher needs to know what questions to ask the student, and how to phrase them, in that moment – which may be in the middle of a larger class discussion or in a small group – in order to find out what the student is thinking when he or she makes such an observation. (Grossman et al., p. 280)

In a foundational study on questioning and discussion, Bridges (1988) framed his analysis of classroom interaction with the question, "What evidence is there here (i.e. in the transcripts) of a concern for the development of the understanding of those participating in the session?" (p. 17). Bridges divides "development of understanding" into two strands, enrichment and refinement. Enrichment entails fuller elaboration, reflection, and plurality, achieved through mutual interactions which lead to an appreciation of other people's ideas, "especially those

which offer different perspectives to one's own" (p. 18). By comparison refinement builds upon enrichment by making that understanding more precise, rational and correct. Refinement brings clarity to the concepts under discussion and facilitates "the elimination of logical inconsistency and contradiction of coherence and consecutiveness" (p. 18).

Therefore, the use of questioning, as a part of formative assessment, is a complex matter for consideration, and goes far beyond the tone, pace and vocabulary routinely used by many teachers. The use of questioning to elicit evidence of learning, has itself been questioned. In a number of studies Dillon (1988; 1990; 1991) advocated the use of non-questioning methods based on his findings that teachers' questions foil high-quality interaction and dialogue, whereas non-question alternatives foster it. Dillon (1991) also found that, "students respond more to nonquestion alternatives than to questions of any type on topics of every kind—*and* show enhanced cognition, dynamics, and group process" (p. 163). Among alternatives to questioning Dillon (1994, pp. 77-85) suggested (1) *a reflective statement* - restatement of the student comment; (2) *a statement of mind* - reflection of one's own views on the topic; (3) a *declarative statement* - a thought that occurs as a result of what the speaker was saying; (4) a *statement of interest* - expressing an interest in a person's views; and (5) *speaker referral* - referring to a previous statement of a speaker. Dillon's taxonomy serves to remind us that where a direct questioning strategy may work for one student, it may not work for another. Therefore non-questioning approaches may improve the process of evidence gathering by revealing a great deal more of students' tacit knowledge. This is an essential principle for the A*a*L and A*f*L strategies and methods which arise from the 'theory of formative assessment', and which hold that teachers must adapt instructional methods in order to reveal more of students' tacit knowledge as assessment evidence (Black & Wiliam, 1998a; 1998b; 2009) .

Finally, the fundamental empirical questions raised throughout the three articles presented earlier may be re-stated as:

- How effectively do teachers collect evidence of student learning in both small group and whole class situations?
- Do teachers capitalize on "moments of contingency" (Black & Wiliam, 2009) by providing "synchronous" feedback which scaffolds student learning on a moment-to-moment basis?

Recent empirical studies which investigated the collection and use of evidence have found that many teachers exhibit weaknesses in both areas (Black & Wiliam, 2006; Grossman, et al., 2009; Herman, et al., 2010; Macintyre, et al., 2007; Parr & Timperley, 2008; Remesal, 2011; Tiknaz & Sutton, 2006; Volante, et al., 2010). However, while collection of evidence presents its own set of formidable challenges, it is the use of evidence to plan the learning progressions of individual students where teachers have the most difficulty. Further research is required to identify the sources and causes of these weaknesses so they may be corrected by educational practitioners, administrators, and policy makers.

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