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Assessment of Transversal Skills

Research Report on Innovative Assessment for Learning Approaches

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Innovative Assessment for Learning Approaches

Authors:

Christodoulos Tasouris

Editor:

Anastasia Economou

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Introduction

Education is often referred to as the engine of economic and social growth. As such, it cannot be remoted from the rapid technological developments and the changes taking place in the digital economy and society. In this context, the need of innovation and change in the education system, appears to be inevitable.

Innovation might be regarded as an "agent" for economic and social change in the countries (Perrotta, 2014). In the countries where innovation is minimal, their society is likely to face economic and other difficulties at some stage. The rapid development of Information and Communication Technologies (ICT) and the use of new technologies in education increases the prospects for innovation. Following the recent trends in learning and assessment, it is important to promote innovative assessment approaches and tools and discuss assessment *of*, *for* and *as* learning.

Summative assessment focuses on information of students' achievements at the end of a specified learning period (e.g. final exams, chapter tests, and project's outcomes). In many education systems this is the type of assessment witnessed in classrooms. Recent literature in the area of assessment and learning, considers summative assessment as the assessment *of* learning, due to the emphasis on the end-product of learning rather on the process of learning.

Recent trends in education however (Looney, 2009; Redecker and Johannessen, 2013; William, 2014), have demonstrated a shift in the pedagogy of assessment, emphasizing the learning process rather the end-product. Assessment *for* learning, uses assessment as part of the learning process, in addition to providing a measurement of learning outcomes after the completion of a task. Assessment *for* learning is commonly used as formative assessment; an assessment strategy which emphasizes on learning itself, provides students the opportunity for reflection, promotes self-regulated learning and key skills development. An essential element of formative assessment is feedback. As Redecker and Johannessen (2013) emphasize, learners need substantial, regular and meaningful feedback, based on which learning can be designed and re-designed.

Assessment *for* learning is sometimes considered to have limited validity and consistency (Shute & Zapata-Rivera, 2010), as it is often implemented in a non-standardized form and objectivity is not always supported. In today's digital society, however, transversal skills are an integral part of

learning and their assessment needs more complex assessment approaches to include both the learning process and the product. Assessment *for* learning, is student-centered; uses assessment during the learning process of the students' and provides students with additional opportunities for further constructing knowledge and developing key skills. Stobart (2008, p. 150), refers to the assessment *for* learning as "an active, social process, in which the individual makes meaning and which is best done by building on what is already known". Traditional teaching and learning approaches might be considered as "knowledge transmission" approaches, where teachers is the knowledge authority, transmitting knowledge in a range of ways. Assessment *of* learning seems to reflect a more traditional approach during which the teacher receives assessment information after the completion of a major testing event (quiz, test, final exams).

This report aims to introduce the reader in new designs of assessment, which are aligned with the needs of the learners and the advance of education itself. In the first section a rationale is discussed for educational measurement and assessment; how assessment links with particular learning approaches and how the nature and purpose of assessment fits into the current educational era. In the second section, a range of assessment strategies are described, which incorporate features of modern assessment practices and have the potential to lead the shift in pedagogy in terms of assessment design and practice.

Defining assessment

Assessment was always a crucial component of teaching and learning and these days it has become an important key element to the improvement of students' learning and classroom practice. Therefore, it is very important to demonstrate how assessment is defined and also how it differentiates from measurement and evaluation.

Assessment is at the heart of education as test scores are used to gauge students' academic strengths and weaknesses (Ojerinde, 2009). Traditionally, for many teachers and students, assessment is likely to refer to a quantitative process, which provides a numerical description of the degree of the individual progress. In other words, it refers to a measurement, which uses numbers to portray how much learning was achieved by the learner. In a sense, measurement is the collection of numerical data regarding students' understanding. The use of quantitative data for assessment might be often named educational measurement and it is focused on tests, which provide information about the individual, as well as identification of strengths and weaknesses. Wood (1986) indicates that educational measurement deals with the individual and its

achievements and aims to identify the best student performance while following state rules and regulations regarding tests. Furthermore, Gipps (1994), refers to the traditional definition of validity as the extent to which a test measures what is was designed to measure. If it does not measure what it purports to measure, then its use is misleading while "reliability is concerned with the accuracy with which the test measures the skill or attainment it is designed to measure" (p.67).

However, assessment seems to be much more than the use of quantitative data of standardized tests. The term "assessment" refers to any process that aims to collect information about students' achievements, development of skills and attitudes and also to provide support for further improvement. Glaser (1990) reports that the process of assessment must be used in support of learning than just to indicate current or past achievement. In the same spectrum, Nitko and Brookhart (2007), indicate that educational assessment is the process of collecting information for making decisions about students, curricula, programs and educational policy.

According to Unesco (2011) assessment is "the process of obtaining information that is used to make educational decisions about students, to give feedback to the student about his or her progress, strengths and weaknesses, to judge instructional effectiveness and curricular adequacy, and to inform policy". The use of assessment is a critical component of learning and clearly there is a strong correlation between learning outcomes, projects and tasks, and the experiences provided through assessment. The process of assessment should shed light on students' difficulties, to provide valuable information on students' performance in terms of understanding and skills development and also to inform parents regarding their child's performance. As Epstein et al. (2004) indicate, assessment could be defined as three continuous steps: 1) collection of information, 2) synthesis of information, and 3) interpretation of information. These three processes have the same goal, which is to improve classroom practice. Simply put, assessment should be a portrait of learner's performance regarding the quality of a task; providing simultaneously evidence of support received and the achieved improvement.

Assessment often involves measurement as a process to gather data, during which a range of measurement instruments are employed; it is, however, the process of assessment that is responsible to organise the data, to synthesise data combined with additional educational information and consequently to seek an interpretation of the retrieved information so as to support students' learning.

Evaluation on the other hand is the analysis of both quantitative and qualitative data at a particular time. It is not a systematic process and it takes place so as to determine whether and to what extent particular learning outcomes were achieved by the individual. In other words, evaluation might be viewed as the final stage of the assessment process; the result of an evaluation it might be used as the judgement of the effectiveness of students' learning.

According to Crooks (1988), evaluation is integral to the teaching-learning process; he reports, however, that it is needed to emphasise more on the role of assessment in helping students to learn, rather than grading evaluation and teachers' judgement of students' work. Furthermore, he indicates that grading evaluation and judgement might result to a "social" comparison and competition in the classroom reality, which might cause problems to many students.

Clearly, measurement, evaluation and assessment are related and this is why teachers might be confused whether and how to incorporate one or all of these processes into their practice. Recent trends in education however (Looney, 2009; Redecker and Johannessen, 2013; William, 2014), have demonstrated a shift in the pedagogy of assessment, leading to an assessment model, which supports learning through the assessment process, rather than just providing a measurement, an evaluation and a judgment for learner's success after the completion of a task. In this case, assessment *for* learning, contributes on the measurement of students' achievement and at the same time supports their learning in the current complex contexts.

Nature and Purpose of Assessment

Expectations about what all students should learn—and, by implication, what they should be tested on—have changed in response to social, economic, and technological changes. All students are now expected to demonstrate the kinds of reasoning and problem-solving abilities once expected of only a minority of young people. Assessment is expected to gauge these aspects of student competence.

In reference to the work of the Assessment Reform Group (2009), every assessment is to be constructed based on three interconnected elements:

1. A theory of what students know and how they develop competence in a subject domain – *cognitive stage*
2. A range of tasks or situations used so as to collect evidence about students' performance - *observational stage*
3. A method for coming to conclusions based on those observations - *interpretational stage*

Furthermore, Mansell and James (2009), describe the following aspects for the use of assessment:

- The use of assessment to help build pupils' understanding, within day-to-day lessons
- The use of assessment to provide information on pupils' achievements to those on the outside of the pupil, teacher relationship: to parents (on the basis of in-class judgments by teachers, and test and examination results), and to further and higher education institutions and employers (through test and examination results)
- The use of assessment data to hold individuals and institutions to account, including through the publication of results which encourage outsiders to make a judgment on the quality of those being held to account

These three elements might function as a framework for thinking about the foundations of assessment and their interrelationships. Clearly, assessment does not exist in isolation and should not be kept separately from the educational system. Assessment should be closely aligned with the goals of curriculum and instruction. This alignment should be consequently leading to a detailed model of how students learn, based on cognitive findings and educational research and therefore serve as a unifying element; a pedagogical catalyst, which lends cohesion to curriculum and instruction.

Assessment and Accountability

Assessment generates needed information, based on which decision making can take place. Accountability involves using some of this information to encourage and to validate or change students' and teachers' behaviour. Assessment is an essential ingredient of accountability in education; hence assessment process is in a sense dropped into the educational terrain to retrieve data regarding what has been learned and consequently providing data about student learning.

Testing and other assessment processes have an effect on teaching, particularly in terms of curriculum coverage. However, the provision of a report of the obtained test results represents a basic form of accountability. Assessment and accountability policies can provide clear direction for teachers and principals in terms of student outcomes and can become a positive impetus for instructional and curricular changes (Kelley, Odden, Milanowski &nHeneman, 2000; Goertz, 2000). However, an assessment designed for a particular scope is expected not to fit for another purpose and perhaps this is why assessment practices require a thoughtful design prior classroom implementation. While considering that assessment should be a supportive agent for students' learning, it seems that governmental bodies and society need to have information regarding the performance of students and school education itself.

Assessment in the Learning Context

Assessment *of* Learning – Summative Assessment

Assessment of learning, occurs when teachers use the assessment results as an evidence of students' learning, supporting their judgements on student achievement against decided learning goals and governmental standards. Usually, the Assessment of learning is formal and occurs at the end of a unit, providing a summary of students' achievement. In a learning context, this type of assessment has a summative use, showing how students are progressing against the Standards, and a formative use providing evidence to inform long term planning. This is why assessment of learning often refers to the Summative assessment.

According to Hanna and Dettmer (2005), summative assessment takes place after the learning has been completed and provides information and feedback that sums up the teaching and learning process. Other researchers (Bloom, Hastings, & Madus, 1971; National Research Council [NRC], 2001; Sadler, 1989; Shavelson, 2006) have also reported that summative assessment focuses on summing up or summarizing achievement of students, classes, schools, etc.

A representation of summative assessment as an approach for assessment of learning, is presented in Figure 1 below.

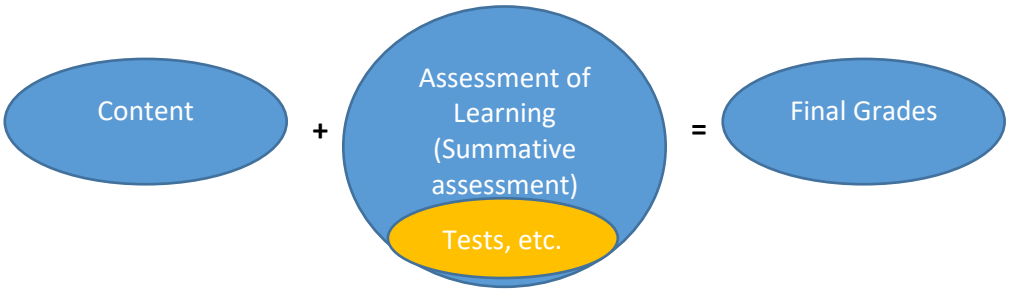


Figure 1: Summative Assessment

Assessment of learning or summative assessment is often under discussion, as:

- the information revealed about students' performance is provided at the end of the unit (Popham, 1999)
- it is disengaged from actual classroom practice (Shepard, 2001)
- it is problematic as it "constructs underrepresentation" (Messick, 1989), meaning that one assessment at the end of unit, cannot in any way demonstrate the full content area; thus, some areas are not assessed, and hence, are likely not to be taught or receive the needed attention
- it lacks "consequential validity" (Messick, 1989), meaning that the test results are used in an inappropriate way

However, summative assessment has the potential to provide critical information regarding the overall learning level of the students and also to shed light on the quality of classroom practice, especially when additional information regarding teaching and learning practice is obtained.

At the same time, assessment usually serves the teaching approaches that are used. Thus, for a traditional instructional approach, where teaching is often characterised as involving "direct transmission" of knowledge with little attention paid to student developing skills for "learning to learn" (Looney, 2009), assessment approaches are aiming to capture the acquisition of knowledge alone. It seems that transmission teaching practices tend to be teacher driven with learners being told how things are, with the intention that they assimilate given knowledge (Klien, 1996). For example, in Mathematics students can be often restricted to practicing rules and procedures, while in Physics, students tend to memorise formulas and approach every question in the same way with no critical and analytical thinking.

The assumption made in the traditional, (behaviourist testing/ learning) model is that one can specify and measure all important learning objectives, and furthermore that mastery on the test items implies mastery of the intended skills and concepts (Gipps, 1994).

Consequently, any assessment following "traditional teaching" to measure student achievement is focused on the scoring data of tests and normally occurs at the end of a series of teaching sessions.

Bloom (1971) indicated three types of assessment: Diagnostic, Formative and Summative. Broadly speaking, assessment might be categorised into three types:

- *Diagnostic* – A diagnosis/assessment of what a student knows or can do. Equally important, it is all what they do not know or cannot do.
- *Formative* - An assessment which provides feedback on what a student knows or can do and what they need to do for further development in terms of subject knowledge and skills.
- *Summative* - A snapshot of what a student knows at a certain point in time, usually expressed in a numerical form.

Following Bloom's viewpoint, it is clear that "traditional teaching" (behaviouristic) and the knowledge transmission is linked with summative assessment; the grading of a final product of a particular assessment process (e.g. tests, final examinations). Focusing on the traditional model of teaching to the curriculum, there is obviously a distinct and detailed body of information, which

must be transmitted to the learner. Hence, the processes of assessment, are employed in order to check whether the information transmitted has been received.

Assessment *for* Learning - Formative Assessment

Michael Scriven (1967) firstly used the term "formative," to describe evaluation processes that "have a role in the on-going improvement of the curriculum". He also pointed out that evaluation "may serve to enable administrators to decide whether the entire finished curriculum, refined by use of the evaluation process in its first role, represents a sufficiently significant advance on the available alternatives to justify the expense of adoption by a school system" (pp. 41-42), suggesting "the terms 'formative' and 'summative' evaluation to qualify evaluation in these roles" (p. 43). Traditionally the use of assessment is like a tool for making summative judgments of student achievements. Increasingly, these days, assessment is seen more like a tool for learning. Looney (2009) reports that assessment, in this view, plays a "formative" role – allowing teachers to identify gaps in student learning and to adapt teaching appropriately. This approach fits well with goals of OECD countries to promote lifelong learning (which relies upon skills for learning-to-learn, including skills for self-assessment).

Formative assessment is concerned with how judgments about the quality of student responses (performances, pieces, or works) can be used to shape and improve the student's competence by short-circuiting the randomness and inefficiency of trial-and-error learning (Sadler 1989 p. 120). Glaser (1990) indicated that assessment must be used in support of learning rather than just to indicate current or past achievement. "Assessment should display to the learner models of performance that can be emulated and also indicate the assistance, experiences and forms of practice required by learners as they move towards more competent performance" (p. 480). Furthermore, a review from Black and Wiliam (1998), demonstrated that classroom-based formative assessment, when appropriately used, can positively affect learning. According to the results of this review, students learn more when they receive feedback about particular qualities of their work, along with advice on what they can do to improve. In this way, formative assessment seems to serve learning at first and therefore improve students' understanding, meaning that it takes place for the sake of learning itself. In classrooms, formative assessment refers to frequent, interactive assessment of student progress and understanding to identify learning needs and adjust teaching appropriately. In the same spectrum, the Assessment Reform Group in the UK (2002) defined the process of seeking and interpreting evidence for use by

learners and their teachers to decide where the learners are in their learning, where they need to go and how best to get there.

Gipps (2009) recent work in cognitive and constructivist psychology, highlights the importance of the learning process, during which reorganizing and restructuring of student learning occurs. Formative assessment is needed to capture the learning process and at the same time to support learning.

In the context of the constructivist approach (Brooks & Brooks, 1993, Yager, 1991; Cobb et al., 1992), assessment needs to gauge the progress of students in achieving:

- Conceptual understanding
- Abilities to perform scientific inquiry (pose questions)
- Understanding inquiry

To a great extent, teachers who follow constructivist approach are likely to encourage students to constantly assess how the activity supported the construction of their understanding. In this way, students are engaged in the learning and assessment process simultaneously. Constructivist approach to assessment is formative rather than a summative. Its purpose is to support student learning and consequently improve the quality of learning and not to provide for evaluation and grading. In order to provide a clear view of the link between constructivist approach and formative assessment, Brooks and Brooks (1993) stated that rather than saying "No" when a student does not give the exact answer being sought, the constructivist teacher attempts to understand the student's current thinking about the topic. Through nonjudgmental questioning, the teacher leads the student to construct new understanding and acquire new skills. In this sense, the assessment process should be able to respond to the particular classroom needs and characteristics, including the teacher, the students and subject's content.

Theoretical Grounding for Formative Assessment

According to Black (1993), an assessment can be considered formative only if it results in action by the teacher and students to enhance student learning. Specifically, the distinguishing characteristic of formative assessment is that the assessment information is used, by the teacher and pupils, to modify their work in order to make it more effective. (Black, 1995). Furthermore, Gipps (1994) defines formative assessment as the process of appraising, judging or evaluating students' work or performance and using this to shape and improve students' competence.

In 1998, Black and William published a synthesis of research findings regarding classroom based assessment. Their research work followed prior reviews (Crooks, 1988; Natriello, 1987) and as

Shepard (2009) reported, it incorporated teachers' assessment practices, students' self-perception and achievement motivation, classroom discourse practices, quality of assessment tasks and teacher questioning, and the quality of feedback. Research studies (Black & Wiliam, 1998a, 1998b; Cowie & Bell, 1999; Sadler, 1989) highlighted the following critical aspects regarding the use of formative assessment in the assessment for learning processes:

1. Effective feedback
2. Active participation and responsibility
3. Assessment evidence informs teaching
4. Motivation and students' confidence
5. Self-assessment

Wiliam and Thompson (2007) considered Ramaprasad's (1983) three key processes in learning and teaching, conceptualizing these elements within a framework where the processes and the agents are involved (Table 1).

<table>
<tr><th>Agents</th><th>Where the learner is going</th><th>Where the learner is right now</th><th>How to get there</th></tr>
<tr><td>Teacher

Peer

Learner</td><td>1. Clarifying learning intentions and criteria for success

Understanding and sharing learning intentions and criteria for success

Understanding learning intentions and criteria for success</td><td>2. Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding</td><td>3. Providing feedback that moves learners forward</td></tr>
<tr><td></td><td></td><td colspan="2">4. Activating students as instructional resources for one another</td></tr>
<tr><td></td><td></td><td colspan="2">5. Activating students as the owners of their own learning</td></tr>
</table>

Table 1: Aspects of Assessment (Wiliam & Thompson, 2007)

The Role of Effective Feedback

According to Hattie & Timperley (2007), "Feedback is one of the most powerful influences on learning and achievement, but this impact can be either positive or negative. Its power is frequently mentioned in articles about learning and teaching, but surprisingly few recent studies have systematically investigated its meaning."

As the field of assessment put into learning practice evolved, the increase of interest in the assessment for learning practices demonstrated the need for alignment and link between of assessment and learning. An approach of which promotes learning and modern assessment for learning practices is the use of feedback, which is a tool that has the potential to engage students in meaningful activities and provide opportunities for reflection. Specifically, Dochy, Segers and

Sluijsmans (1999) report that this approach promotes integration of assessment and feedback and engages student as an active learner who assumes responsibility, reflects, collaborates and communicates dialogically and continuously with teacher. This shift, requires also changes in the goals of assessment; therefore, the approach to assessment need to be transformed so as provide new directions rather remaining linked with the traditional assessment of learning and summative practices alone.

Hattie and Timperley (2007) report that feedback is the information provided by an agent (e.g. teacher, self, peers, etc.) involved in the learning process regarding aspects of one's performance or understanding. In most cases, a teacher can provide the corrective information or a peer can provide an alternative strategy; however in some cases even a book or a parent could act as an agent providing ground for clarification and further encouragement. Following these supporting practices, the learner has the opportunity to focus, re-consider, evaluate and consequently provide a better response on the activity, and perform better. From this standpoint, feedback can be conceptualized as a result of the total performance of a learner, portraying his/her commitment and active engagement in the learning process.

According to Ramaprasad (1983) and Sadler (1989), feedback when given as part of formative assessment enables learners to recognise gaps between desired goals and current knowledge level, understanding and skills and guides them through actions required for the achievement of their goal. Even though feedback has the potential to enhance learning, feedback has no effect on the learner when there is not learning context. In this case, the learner is likely not to engage in the process for providing constructive feedback. "If the material studied is unfamiliar or abstruse, providing feedback should have little effect on criterion performance, since there is no way to relate the new information to what is already known" (Kulhavy, 1977, p. 220).

Clearly, the learner needs transparent initial instructions so as to be smoothly guided towards feedback sharing activities and therefore to the task completion. Hence, it is important to explore models of feedback, which might serve as a framework to understand feedback potential and how and why particular types of feedback enhance learning while others have less impact.

Models of Feedback

Model 1 - Reducing the Discrepancy Between Current and Desired Understanding

In this model, the feedback aims to reduce discrepancies between current understanding, performance and goal. Different strategies of effective feedback can me more or less effective in terms of discrepancy decrease; thus, it is needed to appreciate how and why these strategies

result in different outcomes. The questions for Effective feedback process (Hattie & Timperley, 2007) are: (1) Where am I going?, (2) How am I going there? and (3) Where to next? Each question portrays the stages of the learning process related to the effective feedback. In the first stage, the learner is required to define the goals (following teacher's instructions) and next to appreciate and evaluate his/her progress towards the achievement of the set goals. At the end, the learner is required to recognise his/her strengths and weaknesses and therefore to construct thoughtfully the next personal learning goals while taking into account the areas that need further improvements. Figure 2 represents the model suggested by (Hattie & Timperley, 2007).

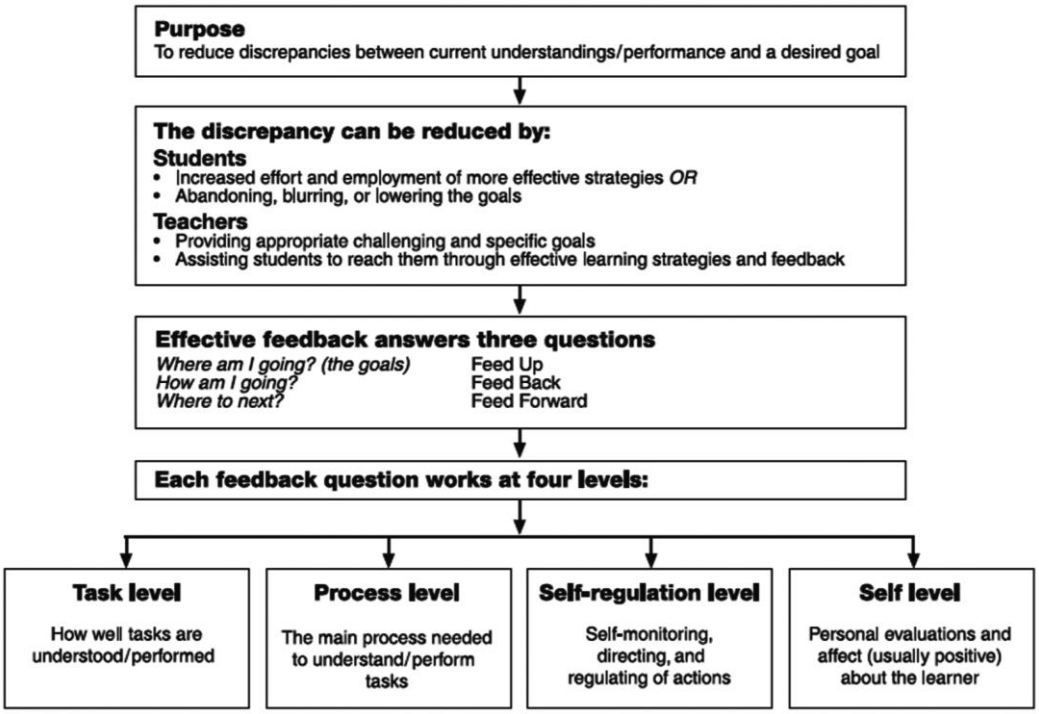


Figure 2: Model of Feedback to Enhance Learning (Hattie & Timperley, 2007)

Model 2 – Self-regulated Learning and Feedback

Self- regulated learning might be conseptualised as a cognitive process during which, the learner is responsible for his/her learning; therefore he/she is required to accomplish set goals while structuring and re-structuring the process of learning, monitoring engagement and responses.

Pintrich and Zusho (2002) provided the following working definition of self-regulation: "Self-regulated learning is an active constructive process whereby learners set goals for their learning and monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features of the environment." (p64).

If we consider feedback as a way (1) to engage student in the learning process, and (2) to transform him/her to an active learner who assumes responsibility, reflects, collaborates and communicate, then it seems that self-regulated learning is a process aligned with opportunities for

effective feedback provision, which both together construct another framework for feedback. Figure 3, shows a conceptual model of self-regulation and feedback suggested by Nicol and Macfarlane-Dick (2006).

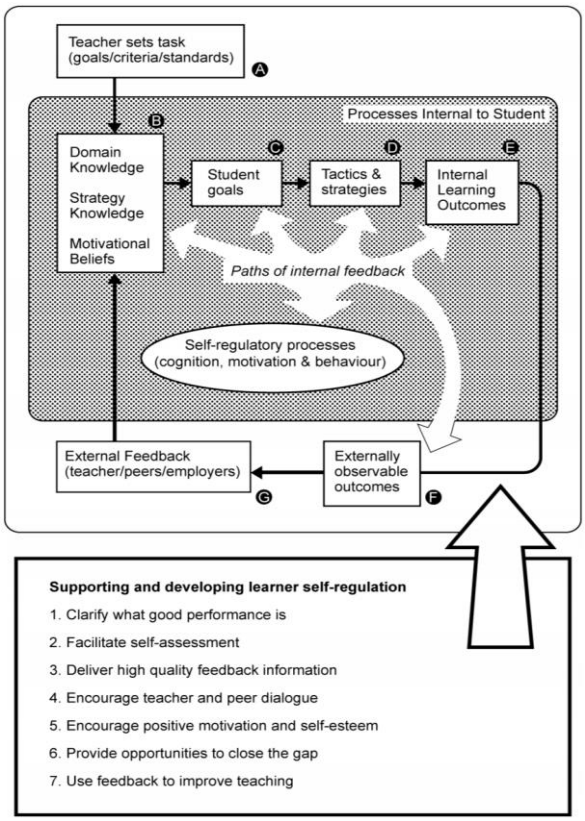


Figure 3: Conceptual Model of Self-regulation and Feedback (Nicol and Macfarlane-Dick, 2006)

This model requires a task set by the teacher and then an assignment is the trigger for self-regulatory processes. Any kind of learner's engagement, clearly requires prior understandings and experiences. The engagement is likely to result to a particular interpretation of the task and therefore the learner is expected to conceptualise his/her goals based on the given task.

Afterwards, the learner is likely to start constructing strategies for the completion of the task and the achievement of the set goals. This on-going process is expected to initiate a compare-contrast process between current level of achievement and desired goal; consequently this process acting as the ignition for self-regulatory process of feedback for prior knowledge, set goals, learning strategies and learning outcomes. Following this process, the learner has the opportunity to adjust his/her learning process. In the same time, the teachers or parent or peer (the agent), is responsible to provide constructive feedback based on the observed outcomes. At the end, the learner is likely to take into account the different forms of feedback so as to enable them to improve and accomplish his/her desired goals.

This model and the literature focused on formative assessment highlight some principles of good feedback practice. These principles follow the idea that any feedback practice is good if it has the potential to enhance students' regulating skills. The following principles report that good feedback practice (Nicol & Macfarlane-Dick2006):

1. helps clarify what good performance is (goals, criteria, expected standards);
2. facilitates the development of self-assessment (reflection) in learning;
3. delivers high quality information to students about their learning;
4. encourages teacher and peer dialogue around learning;
5. encourages positive motivational beliefs and self-esteem;
6. provides opportunities to close the gap between current and desired performance;
7. provides information to teachers that can be used to help shape the teaching.

Both models of feedback highlight the power of feedback and indicate that feedback can be provided by the different agents involved in the learning process and the learner itself. Each type of feedback can be related to different kinds of learning activities based on the fact that each stage of learning process requires different agents and learners to be engaged. Hence, the feedback might be differentiated based on who provides the feedback. Is it an internal feedback, where the learner is engaged with a self-assessment process? Is it an external feedback, where the learner receives feedback as a result of a peer-assessment process? Each one of these processes involves effective feedback provision for the different stages and scopes of the learning activity; therefore, self-assessment and peer-assessment might be regarded as independent effective feedback approaches.

Self-Assessment

"Self-assessment by pupils, far from being a luxury, is in fact an essential component of formative assessment. When anyone is trying to learn, feedback about the effort has three elements: recognition of the desired goal, evidence about present position, and some understanding of a way to close the gap between the two. All three must be understood to some degree by anyone before he or she can take action to improve learning … If formative assessment is to be productive, pupils should be trained in self-assessment so that they can understand the main purposes of their learning and thereby grasp what they need to do to achieve." (Black & Wiliam, 1998, p. 143).

Klenowski (1995, p146) reports that self-assessment is "the evaluation or judgment of 'the worth' of one's performance and the identification of one's strengths and weaknesses with a view to

improving one's learning outcomes". According to MacBeath (2001, p. 140), self-assessment framework has four main principles:

1. Learning is part of the human nature
2. The development and change is an internal need
3. The response is important for personal learning and the evolution
4. People are focused on their own constructions

The focus of this framework is learning and it conceptualizes self-assessment as a critical component of the learning process and therefore it approaches self-assessment as a pre-requisite for learning improvement.

The self-assessment process is a process during which the student is responsible to judge him/herself. In this perspective, self-assessment might be regarded as the process for reviewing the quality of one's work following indicators and pre-defined criteria. This process aims to support the student to improve and consequently to have better results in the future. In the same spectrum, self-assessment can act as agent for the improvement of certain skills, such as critical thinking and organizational skills.

Ross et. Al. (1998a) reported four stages regarding students' development on skills related to self-assessment. These stages are:

1. **Students are actively involved with the definition of criteria**, which will be used for their performance assessment. Allowing students participate in this process, enables students to think, to negotiate, to present and communicate their own ideas. Furthermore, it allows students to be more aware of the criteria, as well as to be likely more dedicated. The increase of students' dedication enables teachers to employ a more student-centered learning approach during which students are guided and supported for their own learning.

2. **Students are learning how to use the defined criteria.** In the case where students worked to define the criteria, the outcome will be a synthesis of personal and learning goals linked with teachers' instructional guidance. As the goals are shaped by the teacher, students might request examples so as to fully understand the goals meaning. These examples will therefore clarify what the criteria mean and how might be met.

3. **Effective Feedback through the self-assessment process** is a way to support students for realizing the criteria. Normally, at the early stages students are not fully aware of what the most criteria are for and how they might be met. In this case, the teacher is responsible to

provided effective feedback so as to assist students in understanding the criteria or to enable them to reconsider some aspects of criteria and therefore in some case re-shape their own personal goals. Following the effective feedback provision by the teacher, students are expected to understand much better the criteria and how their own learning goals can be achieved.

4. **Students working for the development of new goals and learning** strategies is the most difficult part. In this stage, the teacher is needed to think, to design and to implement strategies on how students should use information retrieved from self-assessment process so as to enable the students to set new goals. Without teachers' assistance, students are likely to feel not sure whether their goals were accomplished. For this reason, the teacher is expected to establish a link between students' performance and strategies implemented in order to help the students to realise the relationship between effective efforts, strategies implemented and overall performance. In order for this to be viable, teachers are required to help students to set reasonable learning goals and functioning – comprehended learning strategies.

In her research work, Ross et al. (1998c) observed three types of enhancement that self-assessment can offer to students working on narrative writing. The first one is related to the development of narrative writing skills. Students can become better writers when they define on their own criteria for their learning and then apply them to assess their own writings. This situation has more positive effects on students, which are considered to have less good writing skills. The self-assessment process supports the group of students that are less capable because these students normally feel insecure about what appropriate writings are and the process allows them to realise the pre-requisites of good writing. Generally, all the students are enhanced from the process of defining criteria as they become more aware of what is needed. The second enhancement is related to the motivational aspect of self-assessment process. The students who are often involved with self-assessment processes are more confident to work with complex learning activities. This group of students is likely to feel more secure with their skills and therefore more competent to take responsibility and tackle difficult tasks. The third enhancement is related to the students' attitudes towards assessment itself. Students often consider assessment practices as processes which aim to uncover their weaknesses (traditional assessment practices) rather to provide them areas of improvement. In the case of self-assessment however, students are active participants of the learning and assessment process (criteria definition, use of examples,

effective feedback provision); therefore the students are likely to establish a more positive attitude towards assessment in general. This positive attitude is even more strengthen when self-assessment is reliably and accurately taken into account for their final results of assessment (summative assessment).

Students are likely to appreciate self-assessment more compared to other assessment practices. Perhaps this is the case because self-assessment helps students:

1. to think and decide their personal goals and their expectations
2. to appreciate and use effective feedback
3. to increase self-confidence
4. to accept and appreciate final results (objectivity of results)
5. to improve the quality of their work

Boud (1995, pp. 208-209) in his work provides a table of good and poor practices in self-assessment. This table is important, as it provides valuable practical information why and how self-assessment matters.

Good Practice in Self-assessment	*Poor Practice in Self-assessment*
The motive for its introduction is related to enhancing learning	It is related to meeting institutional or other external requirements
It is introduced with a clear rationale and there is an opportunity to discuss it with students	It is treated as a given part of course requirements
Student perceptions of the process are considered prior to the idea being introduced	It is assumed that processes which appear to work elsewhere can be introduced without modification
Students are involved in establishing criteria	Students are using criteria determined solely by others
Students have a direct role in influencing the process	The process is imposed on them
Guidelines are produced for each stage of the process	Assessments are made impressionistically
Students learn about a particular subject through self assessment which engages them with it.	Self assessment is only used for apparently 'generic' learning processes such as communication skills
Students are involved in expressing understanding and judgement in qualitative ways	Assessments are made on rating scales where each point is not explicitly defined
Specific judgements with justifications are involved	Global judgements within recourse to justificatory data are acceptable
Learners are able to use information from the context and from other parties to inform their judgements	The activities do not draw on the kinds of data which are available in authentic settings
It makes an identifiable contribution to formal decision-making	No use is formally made of the outcomes
It is one of a number of complementary strategies to promote self-directed and interdependent learning	It is tacked on to an existing subject in isolation from other strategies
Its practices permeate the total course	It is marginalised as part of subjects which have low status
Staff are willing to share control of assessment and do so	Staff retain control of all aspects (sometimes despite appearances otherwise)
Qualitative peer feedback is used as part of the process	It is subordinated to quantitative peer assessment
It is part of a profiling process in which student have an active role	Records about students are produced with no input from them
Activities are introduced in step with the students' capabilities in learning-how-to-learn	It is a one-off event without preparation
The implications of research on gender differences and differences of presentational style are considered.	The strategy chosen is assumed to work equally for all
The process is likely to lead to development of self assessment skills	The exercise chosen relates only to the specific needs of the topic being assessed
Evaluation data are collected to assist in improvement and for determining its contribution to student learning	Evaluation is not considered or is not used

Table 2: Features of Good and Poor Practices in Self-assessment (Boud, 1995, pp. 208-209)

In a similar spectrum, Ross et al. (1998b) indicate that students have a better attitude towards self-assessment because it is more about themselves, their goals and expectations and also about the growth of the excellence of their work.

Although, self-assessment is likely to have the potential to provide learning opportunities for students during which can develop certain critical skills, there are also critical issues which need to be taken into account very carefully.

Ross (2006) in his work on the reliability, validity and utility of self-assessment, provided the following key findings of his research:

1) Student self-assessment tends to be higher than teachers' assessments
2) Not always self-assessment is aligned with the one of their peers and teachers
3) Involvement in the classroom assessment processes can increase student engagement and motivation
4) Students tend to decide unrealistic personal goals and use ineffective learning strategies

Self-assessment might be more effective when it is not directly linked with high stakes examinations and therefore information retrieved by the self-assessment process might be more effective when used as a learning improvement tool. In particular, self-assessment has the potential to be more accurate when the complete assessment process is clear, provides descriptions of learning indicators and when it is related to authentic experiences (authentic assessment). However, the main strength of self-assessment process is the learning experiences linked with motivation, self-regulation and critical thinking. In order to get the most out of the self-assessment approach, teachers are required to tackle the issues of unrealistic self-assessment, assessment alignment with decided goals, students' engagement and dedication.

Peer Assessment

According to Falchikov (2007), "Peer assessment requires students to provide either feedback or grades (or both) to their peers on a product or a performance, based on the criteria of excellence for that product or event which students may have been involved in determining" (p.132). Black et al. (2004), consider peer assessment to be an important complement to self-assessment and really valuable, as the students are more likely to accept feedback from their peers rather than from their teacher, while the language used is expected to be better understood.

During peer assessment processes, students are required to take responsibility and assess their peers following the decided assessment criteria. The students are therefore engaged with the

effective feedback provision to their peers as a formative assessment approach and in some cases to provide even grades to their peers (moderated by the instructor). In this way students are likely to act as assessors and therefore understand assessment criteria and appreciate their teachers' supportive role at the same time.

Peer assessment is an opportunity for students to give each other important feedback and therefore they are expected to learn from and support each other. In this way, peer assessment increases the importance of assessment and learning, as it adds another dimension to the learning process; it provides the opportunity to the students to present and communicate their work, to discuss it, to explain and defend their work. Hence, peer assessment is likely to increase the students' responsibility, to support the development of collaborative and communication skills, and also to enhance critical thinking skills.

Principles for Successful Peer Assessment

For a successful peer assessment practice, Black, Harrison, Lee and William (2002) reported that the following elements are required and should be appreciated accordingly:

1) Concrete and transparent assessment criteria
2) Students' collaborative skills
3) Students' encouragement for alignment regarding assessment goals and actual work
4) Understanding of peer assessment educational value regarding students learning

Students most of the times are not aware of assessment criteria, either because they do not pay attention or the criteria are blurred. In such case, the teacher should encourage students to discuss and decide on the criteria to be used for the peer assessment. In this way, the students are likely to appreciate the assessment criteria, feel responsible for their implementation and have a clear view of what is needed for achievement.

Authentic Assessment

Through the evolvement of learning pedagogies, there is a shift from teacher centered approaches to student centered ones, where strong emphasis is given to the process of learning and not the learning product alone.

Vygotsky (1978), considers thinking as a social activity, which is located in people's interaction, gradually adopted and appeared at a later stage as an individual achievement. The process of cognition derives and develops mainly in dialogue and interaction with others. The social activities of everyday life are the processes during which the individual addresses his/her views, attitudes

and beliefs to other people. These processes support the idea of "learning by understanding" and consequently it is likely to promote Piaget's idea of "conceptual assimilation"; the use of existing knowledge to a following cognitive level. Perhaps "learning by understanding" is supported mainly when individuals are asked to explain, to edit and defend their ideas to themselves and other individuals. As Brown and Palinscar (1989) indicate, when an individual attempts to explain his/her ideas, the individual is likely to incorporate and frame existing knowledge based on his/her new ways.

As learning approaches are evolving, assessment practices are inevitably affected. Learning requires students' active participation through different collaborative activities, during their assessment process as well, which traditionally was teacher's responsibility.

In this context, "authentic assessment" was developed and its main arguments are the following (MacBeath, 2001 & Seebauer & Hellus, 2002):

1. Assessment is a joint responsibility between the teacher and the student
2. Students' ability of applying knowledge and skills are assessed in as much as possible "authentic" conditions/problems

According to Darling-Hammond (2000) authentic assessment has the following features:

1) Actual knowledge, skills, and teachers' dispositions are demonstrated in teaching and learning contexts

2) Integration of multiple types of knowledge and skill is required

3) Multiple sources of evidence are used; evidence is collected over time and in diverse contexts

4) Pre-determined professional standards are used for evaluation purposes

Grant Wiggins (1993) reported that the assessment process is authentic when the assessment is focused on students' knowledge and skills based on meaningful, conceptual and everyday activities. The authentic assessment provides the student with the opportunity to realise his/her own knowledge and skills, which are developed in a defined realistic framework. Traditional ways of assessment such as examinations and tests provide just evidence of students' memorization and repetition; evidence which is likely produced without analytical thinking. J. Huot (1997) highlights that students' performance should mainly demonstrate his/her ability to frame and use knowledge in an authentic framework. Hence, the authentic assessment process should:

1. have the characteristics of discovery learning
2. use high-order skills (critical thinking and conceptual understanding)

3. allow the recall of existing knowledge and skills
4. use knowledge and skills for existing situations and authentic problems
5. encapsulate and take into account the different stages of learning
6. allow students to decide how to use the acquired knowledge

The keystone of authentic assessment is that it is focused on how students work within different frameworks during the school year. Hence, the authentic assessment is concerned with authentic teaching and learning. Students are requested to apply their knowledge and skills, so as to accomplish a particular task, which in turn will be the final product of the learning process. These final products are the result of particular well defined and structured learning goals, and are addressed to teachers, parents and students accordingly. In this way, the teacher has an authentic view of students' progress at every stage and therefore he/she is able to take critical decisions regarding teaching and learning based on students' progress and achievements.

Portfolio-based Assessment

Porter and Cleland (1995, p. 154) define portfolio as a collection of artifacts accompanied by a reflective narrative that not only helps the learner to understand and extend learning, but also invites the reader of the portfolio to gain insight about learning and the learner. Paulson, Paulson, and Meyer (1991, p. 60) provided and expanded the definition of a portfolio as "A purposeful collection of student work that exhibits the student's efforts, progress, and achievements in one or more areas. The collection must include student participation in selecting contents, the criteria for selection, the criteria for judging merit, and evidence of student self-reflection".

Portfolio assessment is an approach which provides a way to track students' participation and results in a range of activities; therefore to record students' progress and to assess students' process and final product. In other words, portfolio-based assessment is not only used for a collection of evidence that learning has taken place but also an approach in which students' progress is captured through peer, self-assessment and reflective practices.

Theoretical Background for Portfolio Assessment

The idea behind this alternative form of assessment is to allow students to take responsibility of their own learning, to become autonomous and assess themselves. The portfolio is a very important approach for the students as the collection of their work is likely to portray their progress either in terms of knowledge or skills. A portfolio provides a comprehensive view of student performance and the student is a participant in, rather than the object of assessment.

Specifically, the approach provides opportunities for students to understand themselves and their skills, to develop a range of needed skills and to showcase their working progress through school and future expectations. It is a process, during which the student takes responsibility and performs autonomously, developing certain skills and acquiring subject knowledge.

Portfolio assessment is related to a constructivist learning approach (Biggs & Tang, 1998), following the idea that meanings are constructed by the individuals through their participation in their learning activities. Students are therefore expected to provide evidence of the whole process, from the early start to the final completed learning product; a process which will likely demonstrated their knowledge constructions and learning achievements. Clearly, as assessment is a sociocultural activity, it is interactive, dynamic and collaborative; therefore context should be taken into account.

Existing assessment practices cannot represent the actual student knowledge and skills. According to Hammond (1994) the tests generally do not reflect the actual tasks educators and citizens expect students to be able to perform, nor do they stimulate forms of instruction that are closely connected to development of performance abilities. Therefore, alternative assessment approaches are needed to enable students demonstrate understanding and knowledge acquisition, to apply existing skills and to develop skills for the future. Following the portfolio approach, students are likely to acquire knowledge, to develop certain skills and to represent their progress and learning outcomes in different ways. Venn (2000, pp. 530 - 531) reports that the goal is to help students assemble portfolios that illustrate their talents, represent their writing capabilities, and tell their stories of school achievement. In a similar spectrum, Belanoff (1994) indicates that portfolio approach provides opportunities for participation and autonomy; students choose the content, design and complete the work in which they are expected to be assessed, they reflect on their work, they revise their work based on self- and peer-assessment and consequently they take actual control of their learning. In this way, it seems that the process of assessment is more about growth and improvement rather than the acquisition of a mark.

Literature review indicates that self- and peer assessment are critical components of portfolio assessment (Farr & Tone, 1994). In self-assessment practices students are responsible to judge themselves; hence self-assessment is students' own process for reviewing the quality of their work following indicators and pre-defined criteria. Clearly, this process aims to support the students to improve understanding and accomplishments and consequently, to support students' growth and have better results in the future. During peer assessment practices, students are required to take

responsibility and assess their peers based on pre-decided assessment criteria. Following this, the students are therefore requested to provide constructive feedback to their peers as a formative assessment approach and in some cases to provide even grades to their peers (a process which is moderated by the instructor).

For this reason, the use of portfolio has the potential to provide an effective approach that supports the development of students' learning. Even though, both summative and formative of assessment are regularly employed in portfolio assessment, this clearly depends on the actual type and purpose of the portfolio. Different types of portfolios have different goals and therefore have different scope and value in terms of learning.

Types of Portfolios

Literature review (Porter, Cleland, 1995, Paulson, Paulson, Meyer, 1991, Belanoff, 1994) provides an understanding of what portfolio assessment approach is and how it can be defined. Clearly, the portfolio definitions are linked with the following key principles:

- Collect (collections of evidence); *Collecting portfolio*
- Analyse (selection and process of information); *Working portfolio*
- Show (completion of learning product and reflection); *Showcase portfolio*

Each one of these principles is a particular type of portfolio but the three portfolio types can be used as a three stage process for a complete portfolio approach during which the student collects information, analyses information, shares and show learning products, refines his/her work and reflects on it.

Collection Portfolio

The portfolio itself is a container of students' working content and completed products. Perhaps this is the "traditional" portfolio, in which students just collect the evidence of their work. For example, when a student completes a project collects that evidence and keeps it in his/her portfolio. There is no evidence of the process of learning and the assessment relies on the completed learning product.

Working or Process Portfolio

The portfolio in this form is a workspace where the student organises the collected evidence and following a range of activities of: self-assessment, collaboration, peer-assessment, feedback and reflection works to progress towards the set goal. According to (Cole, Ryan, Kick, 1995, p. 9) a process portfolio is ''a systematic and organized collection of evidence used by the teacher and student to monitor growth of the student's knowledge, skills and attitudes''.

These processes are definitely student-centered and completely focused on students' progress; therefore, students' learning development is at the centre of this type of portfolio. Obviously, the portfolio process is developed in a certain way so as to capture students' learning processes over time and therefore provide thorough information regarding students' work.

Showcase Portfolio

The showcase portfolios are developed by the students in a certain way so as to demonstrate their final work. In its simplest form, showcase portfolio provides evidence of students' best work. However, the case for critical element of the showcase portfolio is that students are responsible to use the collected data (collecting portfolio), to refine their work based on peer and self-assessment (working portfolio) so as to develop a final learning product align with the scope and assessment criteria (showcase portfolio). In other words, this form of portfolio enables the students to share their own "story", to portray their learning product in a particular way so as to provide evidence of learning. According to Abrami and Barrett (2011), in this type of portfolio the student documents his/her achievements in different ways and then reflects on the achievement of specific outcomes, goals or standards.

From portfolio to ePortfolio

These days technology creates new opportunities for the collection of vast information, for collaboration, sharing, feedback provision and also many ways to demonstrate and publish one's work. Portfolio-based assessment is perhaps already shifted due to the use of new technologies; therefore, ePortfolio or digital portfolio is probably at the heart of the portfolio assessment practices.

From a technological perspective, ePortfolio is a digitized collection of artifacts; the work of a paper-based portfolio is transformed to a digital version. However, the use of technology opens up a range of additional opportunities and enhances practices used in a "traditional" portfolio. The collection of evidence in an ePortfolio can now be stored online and tracked, and also can have many forms: text-based, graphics, multimedia, websites, etc. Self and peer assessment practices are strengthened through the use of technology, with students having more opportunities to accomplish and track these forms of assessment using ICT tools. The table below shows the shift from paper portfolio to digital Portfolio.

Paper portfolio →	Digital portfolio
Can deteriorate over time, susceptible to environmental degradation –moisture, sunlight, etc	Enduring
Often time-bound and discontinuous	Provides continuity and can be lifelong
Not easily mobile, transport can be difficult	Totally mobile
A reproduction can be very time consuming and inevitably will not look as good	Freely and easily reproducible
Table of contents and possibly an index, requires physical presence. Can be slow to cross reference instances of a given 'term'	Fully searchable – instantly and always available to be searched
Not easily and certainly not simultaneously	Enables collaborative work
Could be a limited and time-bound resource	Can be a 'live' resource for others
Needs to be physically present	Easily reviewable by anyone, anywhere, anytime
Needs to be copied and then distributed to enable multiple viewers or markers	Can be read, peer reviewed, or marked by multiple viewers simultaneously. i.e. it has a feedback loop
Fixed layout and format	Allows different organisational 'views' of the one set of core resource material
Different layouts are difficult to produce and are always (paper) media bound or may also contain discrete additional media samples	The views represent different functions for the ePortfolio: progression, process, showcase, competencies, etc
Structure is fixed	It may be linear, or hierarchical in structure, or neither, or both
Not unless done within the classroom	Allows learner/teacher interaction
Impersonal – generally does not reflect feelings and emotions	Provides student voice – feelings and emotions
Improves finger dexterity in turning pages	Improves the learner's ICT literacy skills
Not easily editable	Easily and always available for editing
Expensive to do so – needs copied and transported	Easily communicated to any size, type and location of audience

Table 3: New Zealand's Ministry of Education, SMS Services Team (2011, p.4)

Three Levels of ePortfolio

Similarly to its paper-based version, there are different levels/types of ePortfolio based on the purpose as well. According to Abrami and Barrett (2005) these ePortfolio levels are:

- *1st level - Collect or Storage:* is the space where collecting evidence of learning or collecting information related to the task takes place; students can use this information later in the other levels.
- *2nd level – Process or Workspace:* is the space where all the learning and assessment processes take place; students are involved in different learning activities: sharing feedback, collaborating, self and peer assessing.
- *3rd level – Showcase:* is the space where all the processes and information are combined so as the students to demonstrate their best learning product providing also evidence of the previous ePortfolio levels.

EU Classroom EUfolio project (2013) training booklet provided examples of the three levels using also screenshots from Mahara platform, a tool used for the ePortfolio development.

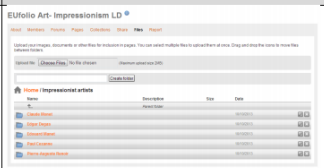
ePortfolio level	Features	Image
as Storage / Repository	• Storage of documents, video, audio, links etc. • Organization of material • Accessible material online at anyplace	
as Workspace	• Discussion forums (communication) • Journal (reflection) • Website creation • Peer-assessment • Social network (groups)	

Figure 4: ePortfolio as a Storage and Workspace

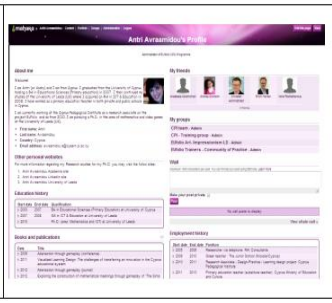
as Showcase	• Personal goals / profile • CV • Pages • Achievements • Artifacts • Sharing of final products	

Figure 5: ePortfolio as a Showcase

Portfolio assessment and in particular the use of ePortfolio can have a huge impact on the learner. This is because, the use of this form of assessment, allows the learners to reflect on their strengths and weaknesses (Gillespie et al., 1996, p. 482). Furthermore, the students who are engaged with the portfolio assessment process are totally transformed from passive observers to active participants and learning owners. Following these steps, students can be more responsible for their own learning and therefore take much more time to think about tasks and work.

Technology Enhanced Formative Assessment (TEFA)

Frequent formative practices within the classroom provide good indicators to the teacher and the student regarding learning achievements and thus it has an impact on the learning process and the learning itself (Black and Wiliam, 1998, 2009). The rapid developments in the new technologies and the incorporation of ICT in the learning process have shed light on the opportunities for formative assessment practices using new technologies, such as in video or audio form and generally in computer-assisted form. In light of these developments, Technology Enhanced Formative Assessment (TEFA) has been developed, putting an emphasis on the use of technology for formative assessment.

Defining TEFA

According to Beatty (2007), "Technology-Enhanced Formative Assessment (TEFA) is a pedagogical approach for using classroom response technology to conduct effective, interactive, student-centered instruction in classes with anywhere from a dozen to hundreds of students. It has been tested in multiple science disciplines, and to a lesser extent in mathematics and social sciences, at both university and secondary school levels."

Technology enhanced formative assessment has four key principles (Beatty, 2007; Beatty and Gerace, 2009):

- *Question driven instruction* meaning that the teacher provides to the students rich and meaningful questions as catalytic element for meaningful learning.
- *Dialogical discourse* meaning that students are responsible to participate in constructive discussions regarding the questions posed at the prior stage. Students have to articulate their ideas and express themselves using the scientifically right language.
- *Formative assessment practices* meaning that students should receive effective feedback from their teacher and to be guided accordingly so as to attain the expected learning achievements.
- *Meta-level communication* meaning that the teacher should assist the students to discuss, to think and to re-frame their learning activities so as the students to become more productive in the learning process.

Each one of these key principles is linked with science instruction and the iterative question cycle (Beatty, 2007). Figure 6 below, shows the use of computer response systems as part of the project "Assessing to Learn Physics" (A2L).

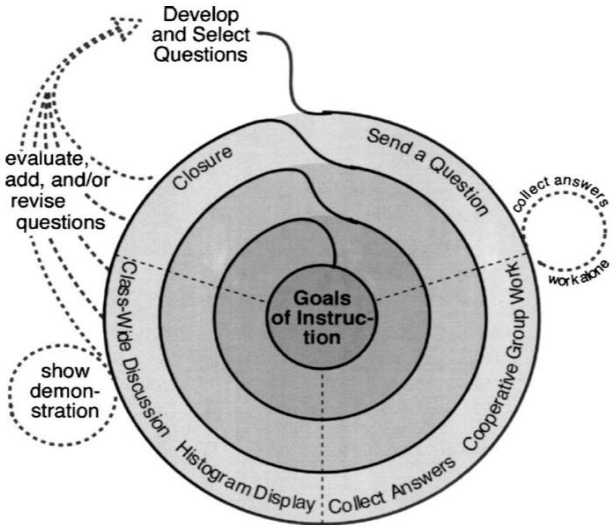


Figure 6: Question Cycle for Question-driven Instruction with a Classroom Response System ((Beatty, 2007)

Theoretical Aspects of Technology Enhanced Formative Assessment (TEFA)

The recent developments in personal devices CRS (Computer Response Systems) of any form such as Clickers and Computer Communication Systems, led to their use at a great extent in classrooms. Even though there is little evidence on their impact, there is a growing consensus that TEFA is grounded in constructivist and sociocultural pedagogies related to the use of formative assessment practices for learning.

Specifically, Beatty and Gerace (2009) indicated that technology enhanced formative assessment is both theoretically and empirically grounded. Regarding theory, it is grounded in a range of educational research perspectives; regarding empirical practice, it is grounded in the combined experience of past years through the use of computer response systems. They also report, that TEFA "was conceived, grown, and refined over time in the crucible of an ongoing interaction between practice, research, and encounter with the findings and thoughts of other researchers and instructors" (p. 4).

Clariana et al (2000) and Kulik and Kulik (1998) indicate that formative assessment feedback can improve knowledge acquisition and students tend to be more engaged when the assessment weight is greater. As more and more technology is used in classroom activities, the potential of ICT to support and augment assessment practices is greater. Specifically, the use of ICT has the potential to contribute to assessment practices either in its simplest form such as on-line tests or in a more complex feedback and feedforward system.

Learning Analytics

The design of learning in order to provide meaningful learning experiences towards the learning goals is usually based on a given curriculum along with the use of information, gathered through assessment and evaluation processes. With the changing learning environments through the use of new learning technologies and the opening up of educational horizons through the use of web technologies, information about learning can be more easily available compared to traditional settings where information was limited and less immediate. In this context, Learning Analytics is an emerging field in education, aiming at the potential to provide the needed information for the improvement of the learning design and process.

In the recent years, there is an explosion of data through the use of the web and the new technologies. A plethora of social platforms through their use in computers or other smart devices

are providing massive loads of data; this new reality has put an emphasis on the data retrieval technologies. Data driven companies (e.g. Google, Facebook, Yahoo, etc.) have developed strategies on how to retrieve and use the data for marketing and further developments. Retalis et al. (2006) and Johnson et al. (2011) reported that data in combination with the use of information retrieval technologies are not only the basis for the emergent data economy but also for new horizons of education itself.

The retrieval of data has illuminated a new educational field; a field in which the data provided through the web and the new technologies is used for the analysis of learning and therefore for the enhancement of learning itself. An example of the use of such data is the personalization of learning with the use of information retrieval technologies, in terms of personalized learning support and the differentiation of teaching approaches based on the learner's data. The educational vision for the use of a "business" model data retrieval in the learning process, is the development of an improved learning experience during which the learner is definitely at the centre of attention and the activities employed are certainly meaningful. Such a learning experience has the potential to increase the rate at which the learner is acquiring knowledge and develops certain key skills while collaborating in a 21st century learning environment.

Defining Learning Analytics

The increasing interest in the use of interactive learning environments, learning management systems, content managements systems, ePortfolio platforms, etc. have established the need for tracking, measuring and analysing students' action in these or related learning environments. Although, these environments keep students' data, their use for learning is still limited. Following this reality, Learning Analytics have taken advantage of the massive data sets stored and focused on how the retrieved information might shed light on the learning process.

According to Siemens (2011), "Learning Analytics is defined as the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs."

Learning Analytics in the educational terrain is actually a multilevel process, which has certain stages for certain scope. More specifically, Learning Analytics refer to the measurement, the analysis, the arrangement and demonstration of data related to the students for:

- Understanding how learning occurs
- Understanding how learning process might be improved
- Understanding how the learning environment interacts with the students

The Horizon report (2011) mentioned that Learning Analytics promise to harness the power of advances in data mining, interpretation, and modeling to improve understanding of teaching and learning and to tailor education to individual students more effectively. From this standpoint, it seems that learning analytics have established new possibilities for:

- Decision making in terms of learning design and process
- Appropriate planning
- Learning resources allocation
- Teaching effectiveness
- Knowledge acquisition optimisation
- Key skills development optimisation
- A shift in learning interventions

Arnold (2010) spoke of Learning Analytics as a tool whereby institutions would "have the potential to create actionable intelligence on student performance, based on data captured from a variety of systems. The goal is simple -improve student success; however, it might be defined at the institutional level. The process of producing analytics, frequently challenges established institutional processes (of data ownership, for example), and initial analytics efforts often lead to additional questions, analysis, and implementation challenges."

Furthermore, Long and Siemens (2011) defined Learning Analytics as "the use of intelligent data, learner-produced data, and analysis models to discover information and social connections, and to predict and advise on learning".

Learning Analytics either used as a tool or as an approach for assessment and learning or both, have the potential to transform learning environments, by shifting their data driven nature to learning actions driven spaces. From this perspective, the use of learning analytics following a structured model for their application and data analysis, can constitute a valuable strength of the integration of new technologies for assessment and learning.

Learning Analytics Models

Learning Analytics models seem to incorporate the following steps: (1) Selection of Data, (2) Collection and Track of Data, (3) Aggregation and Report of Data, (4) Synthesis and Analysis of Data, (5) Use and Refinement of Data, and (6) Sharing of data.

Three examples of Learning Analytics Models and Frameworks are described below, in an effort to understand further how they are used.

The Greller and Drachsler framework

A proposed framework by Greller and Drachsler (2012) for the domain and application of Learning Analytics, consists of six critical dimensions (Figure 7): 1.Stakeholders, 2.Objectives, 3.Data, 4.Instruments, 5.External constraints, 6.Internal limitations.

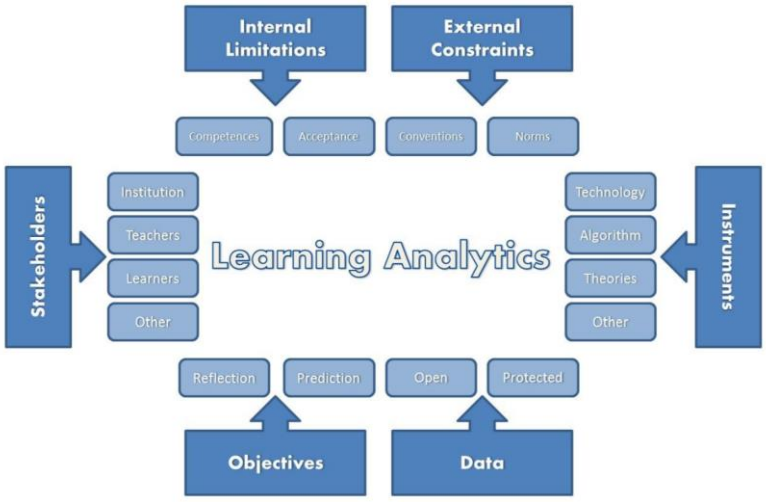


Figure 7: Critical Dimensions of Learning Analytics (Greller, W. and Drachsler, H., 2012)

Based on this framework, learning actions driven spaces have the potential to capture pedagogic behaviour and report pedagogic consequences, as shown in Figure 8, below.

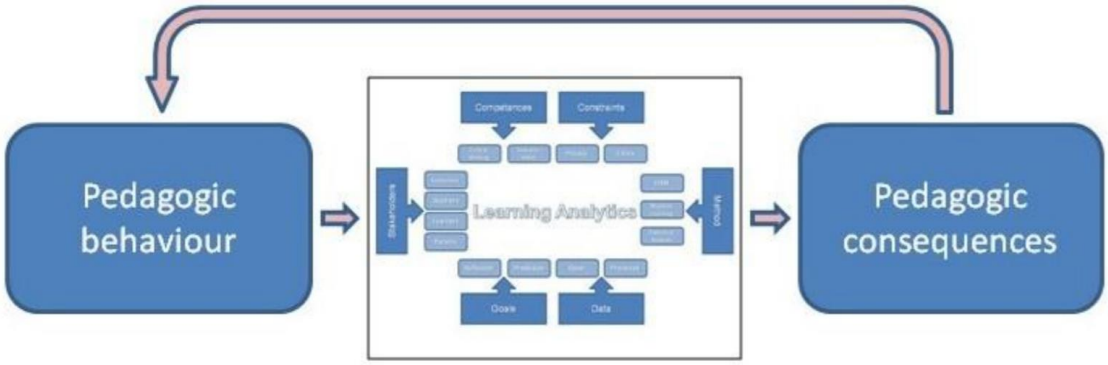


Figure 8: Learning Analytics and Pedagogy (Greller, W. and Drachsler, H., 2012)

With the use of Learning Analytics, the teacher has the opportunity to immediately explore data regarding students' learning actions and at the same time re-consider his/her own behaviour. In such a case, the teacher explores pedagogic consequences and decides whether to adjust prior learning design/ practice or to apply an alternative learning approach. Table 4, demonstrates an example from Dawson et al. (Dawson, 2008; Macfadyen & Dawson, 2010), in which students participated in a forum and a social network analysis of students' discussion was employed. The example illustrates the purpose of the framework and use of each domain.

Dimension	Values
Stakeholders	*Data subjects*: a group of learners. *Data clients*: tutor, discussion moderator.
Objective	*Reflection*: Analyse student interactions in a forum discussion, identify network connections between students, and identify isolated students to bring them back into the discussion.
Data	*Protected dataset*: Student interactions and posts in the discussion forum of the LMS. *Relevant indicators*: Posts published, posts replied to. *Time scale*: what time frame is applied to the analysis?
Instruments	*Pedagogic theory*: socio-constructivist, hypothesis is that active participants in a discussion show better learning outcomes. *Technology*: Social Network Analysis (SNA), statistics. *Presentation*: network diagram visualisation, stats table.
External limitations	*Conventions: (1) Privacy*: is the analysis in accordance with privacy arrangements, are the students properly informed? *(2) Ethics*: What are the dangers of abuse/misguided use of the data? *Norms*: Are there e.g., legal data protection or IPR issues related to this kind of use of student data? *Time scale*: will the students still be able to benefit from the analytics outcome? Is the analysis post-hoc or just-in-time?
Internal limitations	*Required competences*: *(1) Interpretation:* Do the data clients have the necessary competences to interpret and act upon the results? Do they understand the visualisation or presentation of the information? *(2) Critical thinking:* Do they understand which data is represented and which data is absent? How will they use this information?

Table 4: A Forum and a Social Network Analysis (Dawson, 2008; Macfadyen and Dawson, 2010)

Knowledge Continuum Model

In the Knowledge Continuum Model, Baker (2007) used raw data at the bottom of his model. The raw data on its own has no value as there is no meaning in the data. However, when meaning is attached to the data, then the data is transformed to information. In this case, information has minimal value as the questions, which can be answered are not of a great value. In order the information to become valuable and useful for learning, synthesis and analysis should be applied. Following the synthesis and analysis process, the information becomes knowledge and it can answer more complex questions (e.g. Why? How?). The final stage is the transformation of knowledge to wisdom through the application of knowledge in certain situations.

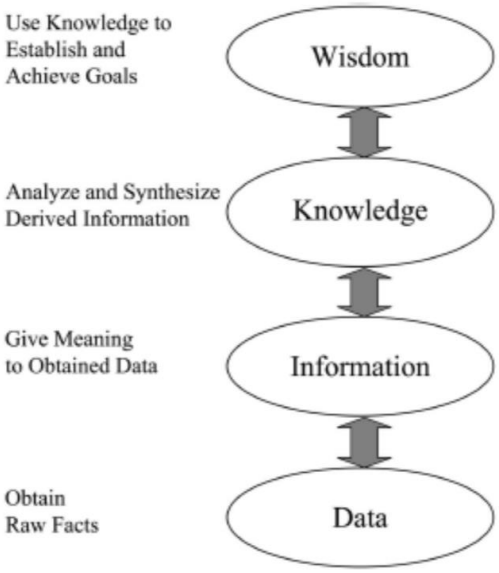


Figure 9: Depiction of the Knowledge Continuum (Baker, 2007)

Evidently, the Knowledge Continuum Model indicates that it is the particular process of data, which adds actual meaning to it, transforming massive loads of data to great potential resources for students' assessment and learning. For example, the tracked data can inform future student or teacher actions, which might shape learning design and therefore put emphasis on certain knowledge domains. Additionally, it might inform policymakers and academia for future development or shifts in pedagogical trends.

Collective Application Model

The Collective Application Model by Dron and Anderson (2009) defines the processes of Learning Analytics. Specifically, the model has five layers divided into three cyclical phases (Figure 6). The researchers explain their work in this way: "If we do not re-present actions to the crowd through an interface that affects similar actions, it is just data mining for some other purpose. This is not a knowledge discovery cycle." (p.369).

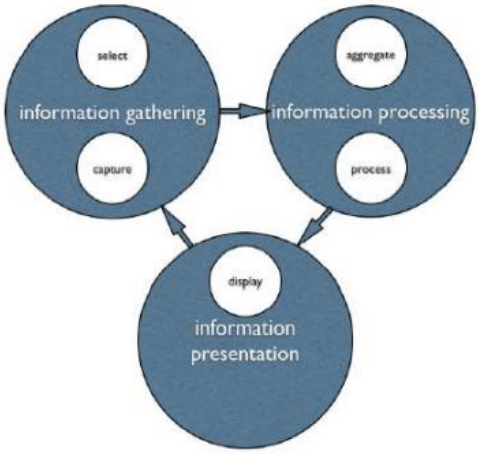


Figure 10: Collective Application Model (Dron and Anderson, 2009)

The model is focused on the continuous process of refinement and improvement through the following stages:

1. Data collection – Gathering
2. Knowledge Process - Processing
3. Knowledge Application – Applying

Each stage has its own value and the learning analytics through the application of these stages attempts to reach to an improved system.

Rubrics and Learning Analytics

Rubrics are scoring tools, which provide a representation of the performance expectations for a learning task. The rubric has different components and each component has a detailed description, which is also linked with particular levels of quality (performance scale), based on the set characteristics of the components of the learning task. Andrade (2000) reported that a rubric is a scoring tool that lists the criteria for a piece of work, or 'what counts' (for example, purpose, organization, details, voice, and mechanics are often what count in a piece of writing. Furthermore, it articulates gradations of quality for each criterion, from excellent to poor (Goodrich 1997; Popham 1997).

From this standpoint, rubrics can act as either scoring or grading guides and can provide effective feedback for the support of the learning process. However, a more substantial educational value of rubrics, entails the students' involvement in the whole process, during which the students themselves take the responsibility to collaborate and formulate the elements of a rubric. In such a case, the students are expected to have a deeper understanding of the assessment process, while at the same time they are developing skills, like critical thinking and reflection.

Rubrics can contribute to the learning and assessment in different ways. According to Wolf and Stevens (2007):

1. Rubrics make the learning goals visible and understandable
2. Rubrics guide instructional design and delivery
3. Rubrics make the assessment process more accurate and fair
4. Rubrics provide students with a tool for self-assessment and peer feedback
5. Rubrics have the potential to advance the learning of students of color, first generation students, and those from non-traditional settings

Additionally, Stiggins (2011, p.1) highlights the formative and student-centered approach of rubrics and indicates that has the potential to enable students develop skills for judging the quality of their work. Thus, is seems that rubrics can be part of an assessment for learning process, during which the students are active participants in peer and self-assessment processes, so as to acquire knowledge but also to develop certain key competences.

The design of a rubric should have appropriate and sensible standards, which are thoughtfully aligned with the curriculum being delivered. Among other tools developed with the aim to support such efforts, a learning analytic tool, the "Learning Analytics Enhanced Rubric" (LAe-R), was

developed as a Moodle plug-in. LAe-R, takes advantage of learning analytics approach to support rubrics with the aim to help "teachers to assess a number of key students' skills and competencies using an enhanced version of the existing 'classic' rubric method" (Petropoulou et al., 2014). In particular, the LAe-R tool provides opportunities for the teacher to design a rubric using learning and interaction indicators, which are aligned with the content delivered and the learning activity appointed. The new feature of LAe-R is the provision of indicators, which are associated with learners' participation and interactions in the learning environment.

Summary

Clearly, Learning Analytics have much to offer to the learning process; however, their meaningful adoption in education is not a solution per se. Learning Analytics on their own cannot constitute significant shifts in pedagogy; the teachers are the ones who are needed to explore the learning actions provided by the learning analytics so as to actually shape learning and assessment processes.

Many stakeholders are required to participate in the integration of a Learning Analytics framework. Teachers who are expected to integrate and use the Learning Analytics technology should be aware of learning theories and pedagogies, and ready to transform existing practices in favour of their students and the future. Additionally, the use of Learning Analytics requires a huge investment in specific technologies and also in teacher training and development.

Impact of Assessment *for* Learning Practices

Assessment influences all aspects of students' education (Brown, Rust & Gibbs 1994; Gibbs, 2006) and therefore comprises a critical component for the learning process. Currently, in most cases in schools, the assessment approach that is more visible and recorded is summative assessment. The use of summative assessment is focused on:

- What the learner has achieved in terms of learning at the end of a particular section
- How and to what extent has the learner met the required standards for certification reasons or for leaving certification reasons
- The final grade which is the key for learners' access for further education

However, new pedagogical trends look at assessment as part of the learning process. Glaser (1990) reported that assessment must be used in support of learning rather than just to indicate

current or past achievement. The main role of assessment is to facilitate and promote learning; hence students' engagement in the assessment process is a step towards learning itself.

Through the existing literature, it seems that there is an agreement for the positive effects of formative assessment approach for teachers and learners. Black and William (1998) reviewed the literature and reported that the use of formative assessment has the potential to improve learning following specific strategies – adjustments. Specifically, Black and William (1998) reported that learning could be improved through assessment depending on five critical factors. These factors are:

1. Provision of effective feedback to students
2. Involvement and responsibility of students for their own learning
3. Adjustment of teaching following the results of assessment
4. Appreciation of the assessment's influence on students' motivation and self-esteem
5. Provision of students' opportunities for self-assessment

More recently, Baird et. al. (2014), accomplished a literature review for the Norwegian Knowledge Centre for Education and reported that the vast majority off research work on Assessment for learning are small-scale action research designs. Specifically, their research work highlights that there are but a few quantitative studies published for Assessment for learning; there are, however, many small-scale studies, which can provide valuable insights for future research.

The body of literature indicates that Assessment for learning is a great tool for the increasing students' learning (Black & Wiliam, 1998a, 1998b; Crooks, 1988; Natriello, 1987; Shute, 2008; Wiliam, 2007). Mainly the literature is concerned with the way students can use the feedback and formative assessment practices to improve personal learning. In particular, these practices involve to a great extent their peers and teachers. There is however the opportunity for the students to interact with people outside their classroom, for example with an expert, with other students from other parts of the world, etc. The assessment practices linked with the Assessment for learning are self-assessment, peer assessment, and reflection. In order for these practices to have a positive effect there is a requirement; to be of high quality, regular and honest. Otherwise, the students are likely to become passive participants, providing poor work and consequently providing misleading results for their learning, which will decrease their personal achievement and outcomes.

Even though there is discussion across the existing literature regarding the Assessment for Learning approach as a way to improve learning and transform assessment practices to learning

tools, there are but a few large-scale research studies, which provide rich evidence to support it. It seems that most of the evidence derives from piloting professional programmes and projects, which might lead to a question whether these results are target biased, since they are based on participating teachers with high level of willingness and interest for incorporating the Assessment for learning approach and are more likely to have already positive attitudes towards assessment for learning practices.

Given the requirements and difficulties for implementing the Assessment for learning, policymakers and practitioners should consider the following (Florez and Sammons, 2013):

- Design of dissemination strategies
- Careful amendments to other related policies
- Educational and public community awareness on assessment
- Contextual flexibility
- constant monitoring of the implementation
- Whole-school engagement with the Assessment for Learning approach
- Constant support to the teachers
- Space and time for teachers for further discussions
- Innovation requires time, patience and resources
- Agreement regarding existing grading system and Assessment for learning process

It is however important to continue working towards a better understanding of the Assessment for Learning approach, so as to develop concrete large-scale implementation studies, which could provide evidence on the real value of the assessment practices linked with the Assessment for Learning approach. For future work, previous research studies (Ball, Maguire, & Braun, 2012, Florez and Sammons, 2013) have uncovered factors to be considered:

- External testing
- Teachers' resistance regarding
    - Peer assessment
    - Self-assessment
    - Change in terms of teaching and learning
- Commitment
- Teachers' understanding of assessment
- Teachers' understanding of Assessment for learning practices
- Teachers' subject knowledge

Further investigative research work is needed so as to examine the different components of the Assessment for learning approach. Each research work will need to clarify how the components interact with teachers, students and the existing educational system. In this way, the results will likely shed light on the different aspects, such as students' engagement and motivation, self-regulated learning, achievement and key skills development; aspects which are expected to be critical regarding the smooth integration of Assessment for learning and consequently will provide insights regarding the measurement of the impact on students' learning and outcomes.

Discussion

Assessment is considered as a central element of teaching and learning, as well as the curriculum itself; hence it can be assumed as a key aspect of an educational system. Assessment in a sense is responsible:

- to frame the way students develop personal understanding and achieve the expected learning goals
- to capture the process in which the students were involved
- to check whether curriculum goals and standards were met
- to provide information regarding on-going and final students' progress
- to provide information and data for supporting teachers' judgement
- to transform the learning experience while being aligned with teaching, learning and curriculum standards
- to foster deep learning and critical thinking
- to facilitate the development of transversal skills
- to provide the needed certification for the future
- to prepare students to enter the job market of the future

In order the assessment practices to establish a basis for the achievement of the mentioned key responsibilities, a schema should be embraced with the following merits regarding assessment:

- assessment should be acknowledged as a learning activity
- assessment and learning should be aligned and unified
- assessment should provide authentic, valid and trustworthy representation of students' achievements
- assessment should increase students' engagement
- assessment should promote productive and meaningful learning

- assessment should be authentic to a great extend
- assessment should regularly incorporate high quality effective feedback regularly (informative, supportive, constructive)
- assessment should transform teachers and students to working partners towards the learning goal
- assessment should promote honest judgement for further developments
- assessment should prepare students for future assessment system (e.g. Universities, Business firms)
- assessment should highlight new areas of improvements for teachers as well

These merits are open for discussion and further development, so as to be established in the future as the features of the modern assessment practices, and to act as the transforming agents for the design of learning and assessment activities for a greater impact on students' learning and transversal skills.

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