

The Impact of Formative Assessment on High Achievers and Low Achievers – A Systematic Review

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Abstract. Assessments are vital tools for evaluating what a student has learnt and to determine if a learning objective has been achieved. The effectiveness of either formative or summative assessment as an evaluation tool has been debated over decades around the world. This article presents a systematic review of the impact formative assessment on academically high or low achieving students. The related studies were identified through online searches of the educational journal databases: Science Direct, Web of Science and Springer Link. Fourteen published articles were identified as the most relevant to this study and the content and findings were analysed. The benefits and implications of this study on the educational system are further discussed in this article. Based on the Systematic review, tables are provided to summarise the research findings. Both groups; high and low achievers benefitted from implementing formative assessment in the classroom. There are two main domains where both groups specifically benefitted from; the cognitive and the affective. The limitations of the study include the small number of articles that relate to the impact of formative assessment in science-related disciplines. This review also focusses on the effects on formative assessment but there is no emphasis given on how formative assessment can be implemented effectively to have a meaningful impact.

1. Introduction

Assessment is defined as any appraisal of a student's work or performance . In educational systems, assessment is important because it helps students learn. Throughout the years, students had been assessed summatively through standardized exams or formatively through classroom learning .

In contrast with summative assessment, concentrated on summarizing and reporting students' achievement at the end of a course [1], formative assessment focused more on continuously assessing them through planned rubrics and providing feedback throughout the learning process. According to [2], formative assessment, also known as classroom assessment is aimed to reflect teachers' teaching and learning.

In recent years, more educators and educational stakeholders, are turning their heads towards formative assessment as a better assessment tool to be implemented in elementary and lower secondary education. Formative assessment is favoured among students and teachers because it reflects the learning process immediately before completing the learning cycle. Usually, a classroom consists of students with different levels of intelligence from slow, average to fast learners. A teacher needs to adapt the teaching methods to cater to all the students' achievement without bias [3]. However, a question arises when considering if there is any achievement gap or difference when it is implemented in a diverse group of students in terms of their academic achievement and also motivational level [4].

According to The Cambridge Dictionary, a high achiever is defined as a person who achieves more than an average person in their work. A low achiever is a person who achieves less than average. In the past years, assessment results were used to pick the best students to be promoted for

the advanced level but currently, in many countries around the world, continuous assessment has begun viewing as a tool to promote all students' successes in schools [3]. This study focuses on the impact of formative assessment on students with different academic achievement level.

2. Problem Statement

This study aims to identify if there is any difference in the impact of formative assessment when used as an assessment tool in two groups of students, low achievers, and high achievers. The types of impact and the aspects of formative assessment that contributes will also be investigated.

Based on the aim of the study, the following research questions were addressed:

1. What is the impact of formative assessment on high and low achievers?
2. What is the aspect of formative assessment that contributes towards the impact?

3. Method

A systematic review was conducted to screen, select and review articles related to the effectiveness of formative assessment on students. The search and selection process were followed by reviewing articles and data analysis. The method used to conduct this Systematic review was discussed in detail below, divided into four phases.

3.1 Phase 1: Article Search

Articles were searched within the following selection criteria: Full text related keywords, year of publication, relevancy to the topic and focus was given to the studies conducted in elementary and secondary schools. Several keywords were identified through an initial random reading of articles related to the topic online. The primary keywords used to search articles included "assessment", "impact", "effect", "student". Using the keywords, related articles were then searched using three main educational journal databases: Springer-Link, Web of Science and Science Direct.

Initially, the researcher intended to search for as many studies done locally, but there were no local studies found via the online search. Therefore, the scope widened to studies done internationally. The years of studies were refined from 2013 to 2018, to retrieve studies in recent years, since educational policies keep changing in worldwide countries according to political and socio-economical needs of a particular nation. Therefore, refining the search to recent studies seem to be more relevant. The number of articles was further narrowed down by adding additional keywords. The additional keywords used were: "formative", "high achiever", "low achiever". The search further narrowed down by refining the type of publications into research papers and publication titles related only to the educational field.

3.2 Phase 2: Selection Process

From the total of 146 articles retrieved from the keyword search, the titles and abstracts of these articles were screened through. During this process, articles that contain keywords like formative assessment, classroom assessment, achievement, performance, motivation, or other related keywords to the impact of formative assessment, either in the title or abstract, were selected and downloaded for reading. The full text of downloaded articles was read through. Only articles that focussed on the implementation of formative assessment and impact on students, were included to be further analysed in this review. The number of selected articles is summarised in Table 1.

Table 1: Articles Selected by Keyword Search

Database	Number of Articles		
	Impact of “Assessment” on “Student”	Impact of “Formative Assessment” and “Low Achiever” or “High Achiever”	Downloaded to Read
Springer Link	234	41	15
Web of Science	593	55	10
Science Direct	Impact of “Assessment” and “Low Achiever” or “High Achiever”	Impact of “Formative Assessment” and “Low Achiever” or “High Achiever”	
	406	50	21
TOTAL	1233	146	46

Phase 3: Analysis of Data

After downloading, all the selected articles were read and reread several times to extract the main points. A few elements of particular focus while reading the articles were: the focus of the study, the respondents involved in the study, subjects involved, research design, findings related to the effects on high/low achiever, student or teacher perception and limitation and recommendations. All the extracted data were then organised into a Systematic review table (Table 2) for easier analysis.

Table 2: Summary of the Systematic Review

Author /year	Research focus	Respondents	Subject	Methodology	Effects on high/low achievers	Student/teacher perception	Recommendation by researcher
[5]	effects of technology-enhanced formative assessment on the grammar learning of pupils in primary schools in England	Year 5 classes in 16 schools in England with previous experience of using handheld LRDs	English	Quantitative	There were no significant effects of the use of the self-paced devices for high achievers , compared to equally high achievers in the control group. lower-achieving pupils and reluctant writers benefitted most and pupils performing at expected levels also seemed to make better than expected progress.	opportunity to have more than one attempt at allowing pupils to work at their own pace completion of task	Additional professional development to facilitate more immediate interpretation and synthesis of data to inform the explicit identification of future learning targets and teaching strategies would be beneficial.
[6]	Different aspects of fairness: involving students' opportunities to learn and demonstrate learning, transparency, the classroom environment,	six purposefully selected teachers in Ontario, Canada.	English	Qualitative	Not discussed	Teachers: there is a need for honest and balanced feedback on student effort	Fairness in assessment should be researched continuously

Author /year	Research focus	Respondents	Subject	Methodology	Effects on high/ low achievers	Student/ teacher perception	Recommendation by researcher
	critical reflection, and the tension between equal and equitable treatment in assessment to support learning						
[7]	The types of actions teachers, internal coaches, principals and parents want to perform with the use of test results	Four different kinds of users within Dutch primary schools. teachers, internal coaches, principals and parents (n=158)	-	Mixed method	create action plans for high performing students individual action plans for low performing students and the placement of students into groups To give feedback to students to formulate their own learning goals To adapt instruction to educational needs	-	-
[8]	Perception of teachers and Students of feedback and assessment	56 teachers and 234 students from 3 Iceland secondary schools		Quantitative	feedback as being useful for further learning and as providing information on what is expected of them?	how to implement formative assessment with quality results.	What are the strategies used by teachers and how students interpret it?
[9]	Identifying Student-Focused Intervention Programmes through Discrimination Index of assessment questions	-	Design study	Quantitative	Using discrimination index as the item of analysis, able to differentiate between the high achiever from the lower achiever group to propose appropriate intervention programmes to enhance students' knowledge.	-	-
[10]	Effect of STEM project-based learning (PBL) activities on students who had varied performance levels and to what extent students' factors influenced their mathematics achievement.	836 students enrolled in three small, urban, low socio-economic high schools in Texas,USA from 2008 to 2010.	Mathematics	Quantitative	better performance in mathematics from students in low-performance groups, rather than in the high and middle performing groups.	-	Researchers should investigate why students of different performance levels showed differently growth rates and how student individual factors functioned with diverse components of STEM PBL.
[11]	students' conceptions of assessment approaches and purposes	599 (7,8,9 th grade) students from 11 schools of Cyprus		Mixed method	that FA helps teachers track student progress, determining how much they have	students appreciated alternative approaches of	Policymakers should invest more in developing teacher knowledge and skills needed

Author /year	Research focus	Respondents	Subject	Methodology	Effects on high/low achievers	Student/teacher perception	Recommendation by researcher
					learned from teaching and check their progress against achievement objectives and standards	assessment, mainly the ones that make them feel like active learners, such as projects and assignments	to engage in the process of formative assessment.
[12]	The connections between standards-oriented classroom assessment, formative assessment and rubrics	Students in four 5th grade primary classes (n = 67) in two Swiss cantons	Mathematics	Quantitative and qualitative	Rubrics improve motivation because they encourage students to aim at reaching a higher level. Students feel more secure using the scoring grid because they knew which competence level they achieved and what knowledge and skills they gained	The teachers indicated that the instrument supported diagnosing students' competence levels and assisted in defining helpful feedback.	
[13]	Comparative effect of online summative and formative assessment on EFL student writing ability	130 Iranian English as foreign language (EFL) junior university students	English	Quantitative	students gained more responsibility for their learning. Student performance was improved through technology enhanced learning environment.	-	Education technology designers can design and produce technologies that promote collaborative learning through accounting for interactional practice as well as individual accountability.
[14]	impact of formative assessment on the self-regulation, self-efficacy, and motivation of students	695 students and 31 teachers from 17 elementary schools in the Netherlands	English	Quantitative	students who participated in formative assessments of writing assignments scored significantly better on self-regulation than students who conducted writing assignments as usual. The assessment led students to gain personal interest in a subject and feel motivated to develop competence.	-	Further research needs to be conducted to verify which specific elements (e.g., planning, or providing feedback) of the intervention were most effective.
[15]	the effect of teachers' written, descriptive comments followed by an evaluative score on students' performance and learning	60 Singapore secondary school students: 33 students from secondary-one and 27 students from secondary-four	Chemistry and Mathematics	Mixed method	The feedback provided with a delay in revealing scores was crucial in enabling participants to rethink their mistakes and to stay focused in the self-correction process.	-	the study proposed that teacher gives descriptive comments of students work in class first and still release the numerical score result later upon completing the learning cycle.
	Effect of	60 students	Social	Quantitative	The difference	-	Practical training

Author /year	Research focus	Respondents	Subject	Methodology	Effects on high/ low achievers	Student/ teacher perception	Recommendation by researcher
[3]	Continuous Assessment Techniques on Students' Performance	from 8 th grade studying at public sector girls secondary school of Lahore	studies		between the means of the low achievers of both groups is greater than the mean difference between the high achievers of both the groups. It means that the low achievers were benefitted more from this approach. Continuous assessment techniques promote a better understanding of the content and it develops confidence and self-evaluation attributes.		in using continuous assessment should be provided to teachers. For this, appropriate guidance should be provided to all teachers at every institution.
[16]	Effects of Feedback Type and Quality on Academic Performance, Metacognition, and Motivation in High School Students	53 high school students (68% female) attending an inter-district magnet school in Hartford, Connecticut.	World history	quantitative	The feedback helped students improve cognitive performance but no difference in motivation		feedback needs incorporate each element cognitive, motivation and metacognition to show effects

3.4 Phase 4: Thematic Analysis

In phase 4, articles were categorised into two groups, based on two main themes. The Impact of formative assessment was coded into two main themes: a) cognitive and b) affective. After the articles were grouped according to their themes, they were then analysed further, focussing on determining the elements of formative assessment that contribute to cognitive or affective changes in students. The thematic analysis is summarised in Table 3 and Table 4.

4. Result and Discussion

4.1: The Impact of Formative Assessment on High or Low Achievers

The findings from all fourteen selected articles indicate that formative assessment gives a positive impact in both groups of learners: high achievers and low achievers. However, some articles show evidence that low achievers benefit more from formative assessment when compared to high achievers. For instance, in a study conducted by [5] among year five students in English grammar learning, using technology, enhanced with formative assessment, it was found that low achievers, especially reluctant writers, benefitted more from formative assessment compared to high achievers. Similar findings were reported by [3], in a study of eighth-graders in social studies. [10] also discovered that formative assessment applied in project-based learning yielded better achievement in mathematics of high school low achievers.

A second finding that answers the first research question is that both high and low achievers benefitted from formative assessment both cognitively or affectively (in terms of motivation). Some studies only discuss the cognitive improvement [7]; [8]; [9]; [11]; [16] while others focused on the improvement in students' motivation [5]; [10]; [12]; [13]; [14]; [15].

For example, in terms of cognitive achievement, [8] revealed that the feedback given during formative assessment in the form of providing them information on their learning outcomes has helped students to continue their learning. This finding is supported by results from another study conducted by [7] to determine what are the test results used for by teachers, parents and students. For the aspect of motivational impact, all the studies agreed that formative assessment helped boost

learning motivation among both groups of students. These assessments were to encourage them to continuously learn through feedbacks and consequently improve their performance. A study to propose changes in assessment methods in project-based learning (PBL) revealed that students, especially low achievers, showed significant improvement in motivation in technology-based PBL learning. Most of the researchers who discussed motivational impact, have shared the same arguments on how motivation enhanced learning by improving motivation because students feel more responsible for their learning process and are encouraged to correct their mistakes by self-regulated learning. In studies by [13] and [14], both conducted among English learners, proves this statement. The results of a study conducted by [15] among form one and form four chemistry and mathematics students also supports this statement, revealing that students use the feedback from formative assessment to stay focused and self-correct their mistakes.

When analysed thoroughly by focusing on the similarities of the findings and points used to discuss the findings, it can be deduced that improvement in cognition is directly proportional to the improvement in motivation. Firstly, through formative assessment, motivation is improved where students feel more responsible in achieving their learning goals and self-regulate their learning by correcting their mistakes. By self-regulating their learning, students are more focused and engaged in the entire learning process resulting in better performance in related subjects. This argument is proven to be true by the findings shared by [13] and [14].

4.2: The Aspects of Formative Assessment that Lead to an Improvement in Motivation and Cognitive Performance

By analysing the data from the articles grouped in their respective themes, similarities in terms of the elements of the formative assessment leading to the cognitive or motivational domains were identified. These elements will be further discussed in the following unit.

4.2.1 Elements of Formative Assessment that Leads to Improvement in Motivation

There are two elements of formative assessment that promote motivation among low and high achievers. Technology-enhanced feedback (computer-based learning) and assessments embedded in project-based learning had played a major role in enhancing motivation among students, especially among low achievers. When using technology-enhanced feedback, students' motivation level increased because computer-based assignments allow them to work according to their capacity by providing them chances to try more than once to answer the question [5]. [13] reveals that technology-enhanced learning makes students feel more responsible for their learning.

The second element that promotes motivation especially among low achievers, is assessment integrated into project-based learning. When involved in project-based learning, students feel engaged in accomplishing a given task and challenged to think creatively to solve interdisciplinary problems [17], "... to think outside the box...". [10] also agree that PBL improves low achiever's motivation and performance compared to high achievers, but they failed to determine the reason for their results.

4.2.2 Elements of Formative Assessment that Lead to an Improvement in Performance (Cognition)

Two aspects of formative assessment have been identified as factors that support learning and help students improve their performance in achieving learning goals: test results or grading scores and feedback given throughout the learning process. These effectively enhance students' understanding of concepts and/or learning objectives. Students use test results for self-regulated learning, to plan and set learning goals at their own pace [7]. [9] found that teachers use test results to group students based on their achievement levels so that they can design appropriate instructional intervention.

On the other hand, some studies highlighted feedback as an important element that promotes learning. Feedback is an important tool that should aid students to overcome their preconceptions and promote their understanding of the content in question [18]. Feedback is used by students to correct their mistakes and to reflect on what they have learnt [8]. However, because the findings of a study reveal that feedback has only helped to improve students' performance but has not impacted significantly on their motivation, [16] suggests that feedback should incorporate cognitive, motivation and metacognitive domains to be effective enough. In a different study conducted by [6], some of the respondents who were teachers suggested that honest and balanced feedback is important to avoid negative implications.

Table 3: Thematic Analysis: Cognitive impact

Author/ year	Research focus	Respondents	Factors
[5]	effects of technology-enhanced formative assessment on the grammar learning of pupils in primary schools in England	Year 5 classes in 16 schools in England with previous experience of using handheld LRDs	Technology-enhanced feedback
[17]	To promote low achieving learners cognitively and emotionally by changing assessment methods for project-based learning activities in a computerized environment	34 students (grade 10 to 12) from five schools in the northern peripheral region of Israel	Technology-enhanced feedback & PBL
[10]	Effect of STEM project-based learning (PBL) activities on students who had varied performance levels and to what extent students' factors influenced their mathematics achievement.	836 students enrolled in three small, urban, low socio-economic high schools in Texas, USA from 2008 to 2010.	PBL
[12]	The connections between standards-oriented classroom assessment, formative assessment and rubrics	Students in four 5th grade primary classes (n = 67) in two Swiss cantons	Rubrics
[13]	Comparative effect of online summative and formative assessment on EFL student writing ability	130 Iranian English as foreign language (EFL) junior university students	Technology-enhanced learning
[14]	impact of formative assessment on the self-regulation, self-efficacy, and motivation of students	695 students and 31 teachers from 17 elementary schools in the Netherlands	Not determined
[15]	the effect of teachers' written, descriptive comments followed by an evaluative score on students' performance and learning	60 Singapore secondary school students: 33 students from secondary-one and 27 students from secondary-four	Feedback
[3]	Effect of Continuous Assessment Techniques on Students' Performance	60 students from 8 th grade studying at public sector girls secondary school of Lahore	Not determined

Table 4: Thematic analysis: Affective impact (motivation)

Author/ year	Research focus	Respondents	Factors
[5]	effects of technology-enhanced formative assessment on the grammar learning of pupils in primary schools in England	Year 5 classes in 16 schools in England with previous experience of using handheld LRDs	Technology-enhanced feedback
[17]	To promote low achieving learners cognitively and emotionally by changing assessment methods for project-based learning activities in a computerized environment	34 students (grade 10 to 12) from five schools in the northern peripheral region of Israel	Technology-enhanced feedback & PBL
[10]	Effect of STEM project-based learning (PBL) activities on students who had varied performance levels and to what extent students' factors influenced their mathematics achievement.	836 students enrolled in three small, urban, low socio-economic high schools in Texas, USA from 2008 to 2010.	PBL
[12]	The connections between standards-oriented classroom assessment, formative assessment and rubrics	Students in four 5th grade primary classes (n = 67) in two Swiss cantons	Rubrics
[13]	Comparative effect of online summative and formative assessment on EFL student writing ability	130 Iranian English as foreign language (EFL) junior university students	Technology-enhanced learning
[14]	impact of formative assessment on the self-regulation, self-efficacy, and motivation of students	695 students and 31 teachers from 17 elementary schools in the Netherlands	Not determined
[15]	the effect of teachers' written, descriptive comments followed by an evaluative score on students' performance and learning	60 Singapore secondary school students: 33 students from secondary-one and 27 students from secondary-four	Feedback

Author/ year	Research focus	Respondents	Factors
[3]	Effect of Continuous Assessment Techniques on Students' Performance	60 students from 8 th grade studying at public sector girls secondary school of Lahore	Not determined

5. Conclusions and Limitation

In this analysis, a number of articles were retrieved and reviewed systematically with the focus of what impact does formative assessment have on low and high achievers. From the analysis, it can be concluded that formative assessment has a positive impact on high achievers and low achievers providing motivation for learning and also enhancing their knowledge in learning. It is also learnt that improvement in performance is directly proportional to the level in the motivation. Analysis of the elements of formative assessment that contribute to the improvement in motivation reveals that technology-enhanced assessment and project-based learning helped students to feel motivated and encouraged to accomplish their task by self-regulation. Meanwhile, test results or grades and feedback given during classroom learning have been highlighted as contributing factors in enhancing students' performance. However, several limitations have been identified while conducting this study. Firstly, there are few articles about the impact of formative assessment in science-related disciplines. Most of the reviewed articles were done among students from the linguistic, social science and mathematics fields. The findings from these articles cannot be generalised since the nature of science learning might be different from the subjects from other disciplines. Although some of the findings revealed that there was a difference in the degree of the impact on low and high achievers, the discussion about what causes the difference had insufficient detail. This survey also mainly focussed on the effects on feedback on students' cognitive improvement but there was no emphasis given on how to make the feedback to be effective enough to achieve greater results in both domains.

6. Implication of the study

The findings from the articles suggest that there is a need for more research on the impact of formative assessment on science-related subjects. Future research is also recommended to reveal why the performance rate of low achievers is higher compared to high achievers when they are engaged in project-based learning [10]. Besides future research, several recommendations can be drawn to help educators who implement formative assessment in their teaching practices. Firstly, teacher training programmes should consider giving more emphasis to providing sufficient knowledge and skills for teachers on how to implement formative assessment effectively in classrooms. Additionally, teachers also should be trained to give constructive feedbacks [15] that incorporate the cognitive, motivation and metacognitive domains.

7. References

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