

DEVELOPING STUDENTS' INDEPENDENT SKILLS THROUGH THE USE OF ASSESSMENT FOR LEARNING STRATEGIES: HOW DOES THIS AFFECT ENGAGEMENT?

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Developing students' independent skills through the use of Assessment for Learning strategies: How does this affect engagement?

Abbreviation	Meaning
AFL	Assessment for Learning
ARG	Assessment Reform Group
BERA	British Educational Research Association
CCSSO	Council of Chief State School Officers
CUREC	Central University Research Ethics Committee
CPD	Continuing Professional Development
DCSF	Department for Children, Schools and Families
DfES	Department for Education and Skills
EEF	Educational Endowment Foundation
EFA	Embedded Formative Assessment
GCSE	General Certificate of Secondary Education
IQ	Intelligence Quotient
OFSTED	Office for Standards in Education
PLTS	Personal Learning and Thinking Skills
TLC	Teaching and Learning Community
QCA	Qualification and Curriculum Authority
UK	United Kingdom
USA	United States of America

Abstract

In this study, I aimed to explore how I could implement AFL strategies to enable my Year 8 students to develop their independent learning skills in mathematics and to help them develop significant competent skills that will help them prepare for the next stage of their education. A small-scale practitioner research approach was adopted through which various AFL interventions including self-assessment, peer feedback, peer teaching and group work presentations were implemented. The sample used for this study was a Year 8 top-set class consisting of 30 students. At the beginning of the study, a prequestionnaire was administered to serve as a benchmark for assessing how well the research objectives have been achieved. The research tasks included real-life problems and activities intended to increase students' engagement and motivation in mathematics. Observation of students' interactions, field notes, postquestionnaire and semistructured interviews were also utilised in data collection.

The evidences collected suggest that AFL strategies have a strong potential in enhancing the development of students' independent skills. However, the rate at which these skills were developed was found to vary among individual students and was dependent on a number of factors (such as the type of AFL techniques and tasks implemented). Results from the postquestionnaire also found that 89% of the students agreed that AFL strategies have helped them become more engaged in mathematics lessons. This was found to be enhanced by peer feedback through effective collaborative learning; which aided in shifting power from the teacher to individual students.

Contents

Chapter 1: Introduction	7
1.1 Rationale of the study	7
1.2 Department development priorities	10
1.3 School development priorities	12
Chapter 2 Literature Review	14
2.1 Background of independent learning.....	14
2.1.1 National priority over the development of independent skills.....	15
2.1.2 What problems exit in the definition of independent learning ?	16
2.1.3 Independent learning: What is it?.....	17
2.1.4 What are the characteristics of independent learners?	18
2.1.5 Why should students develop independent skills?.....	20
2.1.6 What is the role of the teacher in the independent learning process?	21
2.2 Formative Assessment	22
2.2.1 Is there any evidence that formative assessment can enhance independent learning?....	23
2.2.2 What then is Formative Assessment?	25
2.2.3 What strategies of assessment are classified as formative?.....	28
2.3 AFL strategies and students' engagement.	32
2.3.1 Engagement (what exactly is it?)	33
2.3.2 What are the types of engagement?.....	34
2.4 Summary and research questions	38
Chapter 3: Methodology and Methods.....	40
3.1 Research design.....	40
3.1.1 School demographics	41
3.1.2 Participants.....	41
3.2 Data Collection	42
3.2.1 Questionnaire.....	42
3.2.2 Interviews	43
3.2.3 Field notes	46
3.3 AFL strategies used.....	46
3.3.1 Engineering effective classroom discussions	47
3.3.2 Activating students as instructional resources for one another	48
3.3.3 Activating students as owners of their own learning.....	50
3.4 Ethical Consideration.....	51
3.5 Collaboration	53
3.6 Process of data analysis.....	54
Chapter 4. Results and Discussion	55

4.1 Team work skills: Pre and post questionnaires responses.....	55
4.2 Effective Participation: Pre and post questionnaires responses.....	58
4.3 Most developed skills.....	61
4.4 Least developed skills.....	64
4.5 The impact of AFL Techniques.....	65
4.6 Does the AFL technique matter?.....	67
4.7 The impact of AFL strategies on engagement.....	72
4. 7. 1 The disparities in engagement	76
4.8 Summary of findings.....	78
4.8.1 Research question 1	78
4.8.2 Research question 2	79
4.8.3 Research question 3	80
Chapter 5: Conclusion	82
5.1 Recommendation	82
5.2 Reflection and Evaluation	83
REFERENCES	86
APPENDICES	95
Appendix 1: Appendix 1: Pre and post questionnaires	95
Appendix 2: List of predetermined interview questions.....	99
Appendix 3: Students’ personalised targets.....	103
Appendix 4: Sample of lesson plan and research activities	104
Appendix 5: Two stars and a wish	106
Appendix 6: Students’ self-evaluation form.....	107
Appendix 7: CUREC letter to head teacher	108
Appendix 8: AFL techniques glossary	110
Appendix 9: AFL Cartoons	111

List of Tables

Table 1: Characteristics of independent learners.....	19
Table 2: The five key strategies of formative assessment.....	30
Table 3: Linking research questions with the data collection method.....	42

List of Figures

Figure 1: Feedback for learning.....	31
Figure 2: Types of engagement and self-regulation process.....	35
Figure 3: The numerical change between the pre and post teamwork skills.....	56
Figure 4: The numerical change between the pre and post participation skills.....	60
Figure 5: Most developed independent skills.....	62
Figure 6: Least Developed independent skills.....	64
Figure 7: The Impact of AFL techniques on independent skills.....	66
Figure 8: The change in students' perception about AFL techniques.....	68
Figure 9: Peer support	72
Figure 10: Teacher support.....	74
Figure 11: The Impact of AFL strategies on engagement.....	74

Chapter 1: Introduction

1.1 Rationale of the study

In the modern, knowledge-based economy where a high premium is placed on lifetime skills, students must engage in meaningful learning experiences ‘that have genuine value and relevance for them personally and their communities’ (Scott, 2015, p. 2).

I believe that students have the natural desire to learn and the innate ability to explore any opportunity offered to them. However, with the rapid changes in the education system and the increasing demand on schools to ‘achieve decent league table positions’¹, it is absolutely no mistake to think that exam results are prioritised over the development of lifelong skills in many secondary schools. In other words, while it sounds theoretically fine that schools are preparing students for the future, what is actually being practiced in reality raises a question as whether or not the outcome of such practices reflects the claims (Claxton, 2007).

With the growing establishment of the educational framework (DfES, 2005), coupled with various literature that emphasise the need for schools to prepare their students to be equipped with skills that can contribute to the development of learning experiences, both within and beyond GCSE (Claxton, 2002; Claxton and Lucas, 2013; DfES, 2006; James and Pollard 2006; Meyer et al., 2008), I would have expected a paradigm shift in the preparation of students’ readiness in facing life beyond GCSE. However, evidence from recent studies suggest that nothing much has changed and that the gaps between the knowledge they receive in school and the skills that they are expected to demonstrate in college or in entry-level jobs have been

¹ <https://www.channel4.com/news/league-tables-show-poor-performance-but-does-it-matter> [Accessed 22 March 2017]

incredibly disappointing². For example, recent research conducted by the Career Colleges Trust, which sampled 1,001 secondary school students across the UK, found that 76% of students felt that their schools only prepared them to pass exams instead of equipping them with the lifelong skills needed to thrive in the 21st century. Students in Australia had a similar sentiment when they attributed their unpreparedness and psychological distress at the university to the degree of “spoon-feeding” at school (Field et al., 2014). This is not different from the findings of a study conducted in the United States over a decade ago³. As it stands now, it is evident from both national and international studies that the proportion of school-leavers, who feel unprepared to face the turbulences in the current world because of a lack of basic independent skills, has been shockingly alarming.

Developing independent skills is important for a number of reasons. Meyer et al. (2008) found evidence that independent skills not only increase students’ confidence but also help them identify their limitations and enable them to manage such limitations. Davis (2015) highlighted that engaging students in such learning experiences helps them construct meaning in their own learning, thus fostering a development of a crucial aspect of learning internalisation which Barkat (2014) calls self-significance. Such skills, when developed, not only create positive disposition and habits for lifelong learning but also provide a new range of criteria against which students evaluate their own progress in learning⁴.

² <http://careercolleges.org.uk/2015/08/19/young-people-do-not-feel-prepared-for-the-world-of-work/> [Accessed 31 March 2017]

³ <http://www.ccrscenter.org/products-resources/resource-database/rising-challenge-are-high-school-graduates-prepared> [Accessed 31 March 2017]

⁴ http://www.nicurriculum.org.uk/docs/skills_and_capabilities/training/TSPC-Guidance-KS12.pdf [Accessed 31 March 2017]

In the UK, despite the overwhelming research evidence that reveal the benefits of independent skills and the essential steps that the government and educators (DCSF, 2010) have been taking to support its development across maintained schools, there is very little evidence that teachers practically and explicitly explore different ways of teaching (Field et al., 2014) or incorporate teaching the development of such skills alongside subject knowledge (Davis, 2015).

As a classroom practitioner, I have always been tempted to teach my students to the test because of the prescriptive nature of the school curriculum and, possibly, the progressive demand on teachers to increase academic grades. However, I have found that such a teaching strategy is not effective in genuinely preparing my students for the future, as the majority of materials taught to these students are for exam purposes only; most of it will not be remembered or used again after the students have sat their GCSE. Thinking about the current trend of uncertainties in the globalised economy, I deemed it important to use my expertise also as a Lead AFL Practitioner to explore different ways of teaching where my students will be engaged in meaningful learning practices (Scott, 2015) which could provide them with academically and practically balanced experiences within and beyond the formal curriculum (Claxton and Lucas, 2013). My aim is to enable my students to develop significant independent skills that will contribute in making them capable of: working confidently in a collaborative environment; effectively developing and communicating ideas; setting targets and reflecting and evaluating their own learning. This is because

[a]s proponents of the 21st century point out, we have no way of knowing what challenges tomorrows' young people will face, and still less what jobs will exist for them to apply. The best education can hope to do is to equip students with sufficient transferable skills to be able to respond to whatever the future holds (Economist Intelligence Unit, 2015, p. 6).

I have always desired to be the best I can be for myself and for my students. In light of this, I have been constantly thinking of how I can develop an area of interest in my own professional

context to adapt and take on new challenges that will be of great importance not only to my professional development but also to the enhancement of my students’ learning, and this project, I believe, is my way of fulfilling that desire.

1.2 Department’s development priorities

As our head of mathematics puts it, ‘maths is all about independent learning’. As a department, we are committed to ensure that our students are not only taught to work resiliently to achieve the highest possible grade but also supported to develop skills that will make them “self-assured learners” who are adequately prepared for the next stage of their education.

Assessment and Progress Log for Maths

Name: Set 5/ma 1

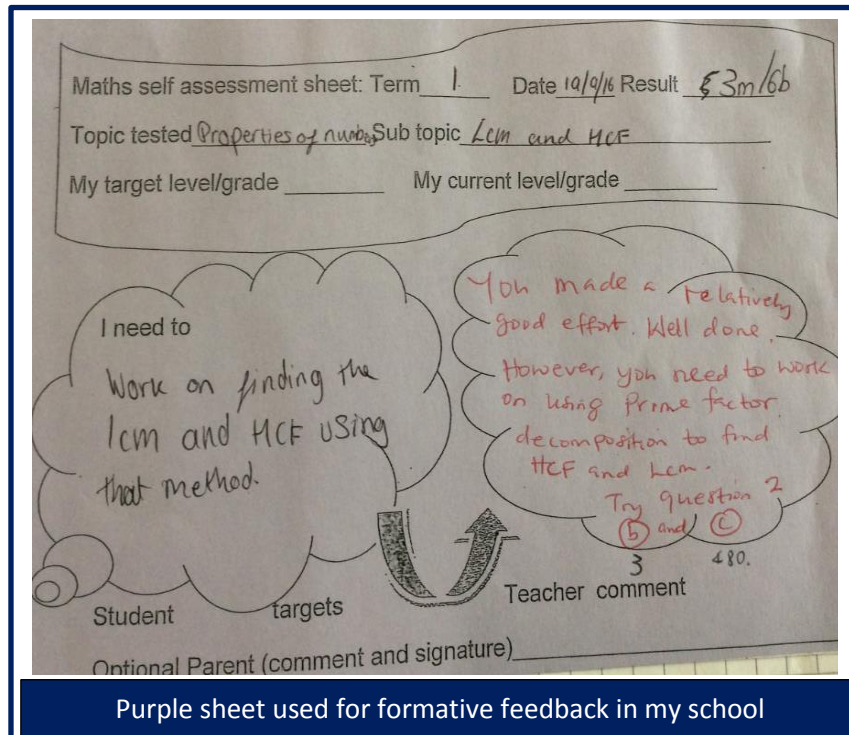
Prior data Key stage 2 level: Key stage 3 level: EOI target: 3u

Term	Date	Topic	Result/out of	Level/grade
1	19/04/16	Properties of numbers	30/34	3m
1	12/10/16	Enlargement	18/18	3u
2	11/01/17	Main Test	46/60	3L
2	11/01/17	Extension	17/30	3L
2	29/03/17	main test (spring)	53/60	
2	29/03/17	Extension	18/30	

Assessment log to record progress in mathematics

This is partly reflected in the implementation of the assessment log and purple sheet policy where all students in the department are expected to record and monitor their own academic progress through fortnightly topic-specific tests conducted by respective teachers while also providing them with the opportunity to identify the areas they need to improve.

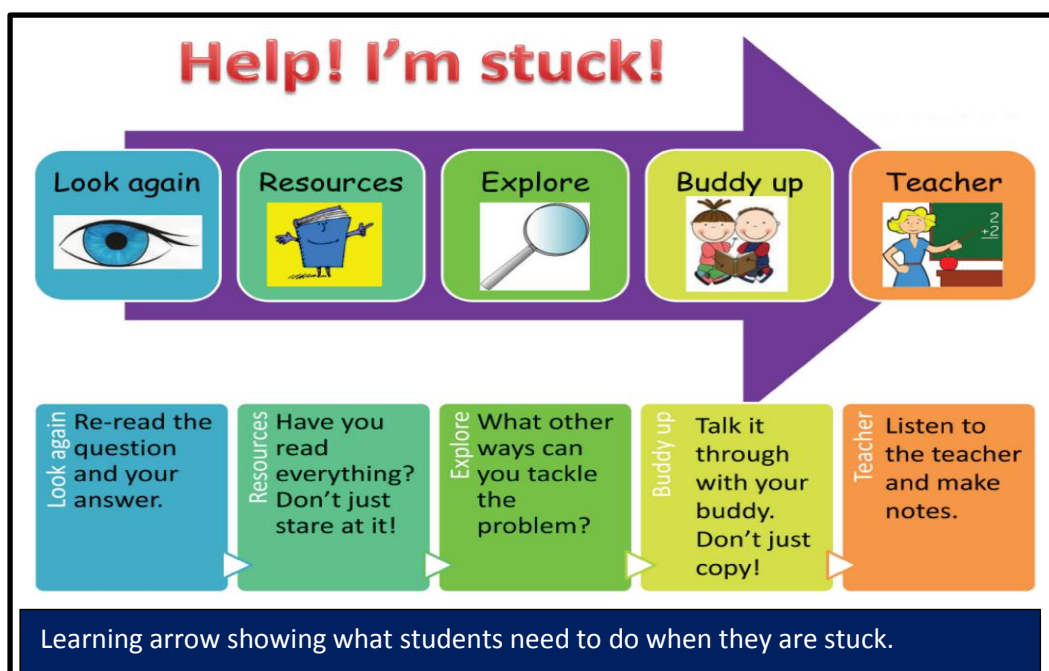
The evolution of the EFA project, which forms part of the wider school professional development priorities, has also changed how formative feedback can be used by both teachers and students to improve learning outcomes and to promote students' autonomy in the department.



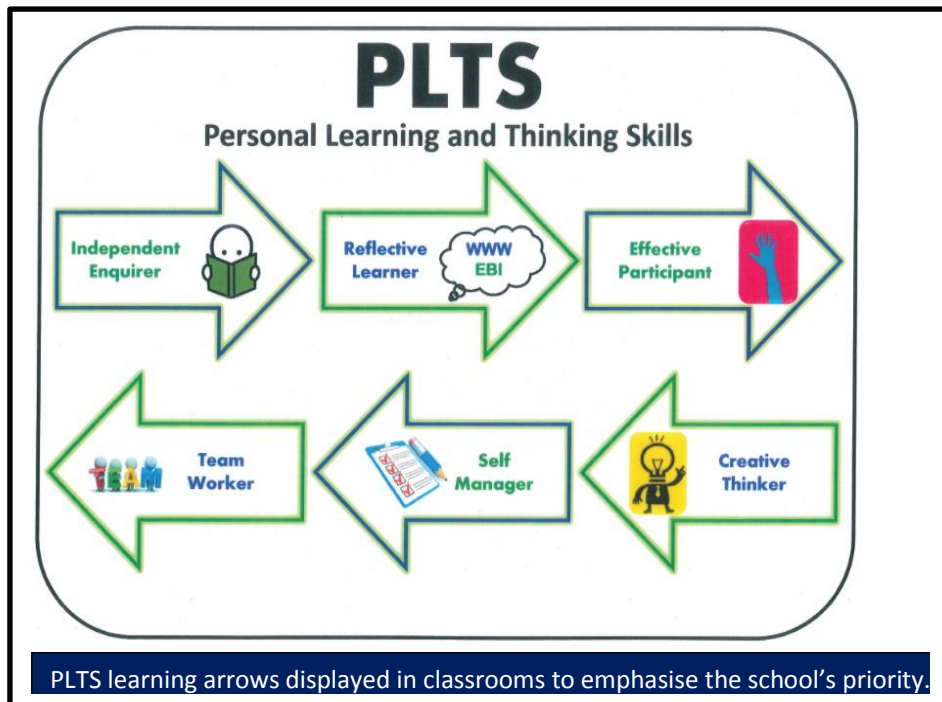
However, despite all the measures that the department has put in place to ensure that our students can effectively manage their own learning through feedback, students continued to struggle with the development of some crucial independent learning skills. This called for a study to deeply explore how other AFL strategies can help develop these skills. Thus, this study also contributed to the department's improvement priorities aiming to equip students with skills to take charge of their learning where they will be able to work collaboratively and actively participate in class discussions.

1.3 School's development priorities

Developing students' independent skills, engagement and learning in general has been one of the school's top 10 priorities for this academic year. In light of this, whole staff teaching and learning strategies such as 'Help I'm Stuck' and 'PLTS learning arrows' are displayed in every classroom to reinforce the school's vision of developing competencies in students alongside their academic knowledge.



Furthermore, to enable all teachers across the school to adopt a consistent approach in helping improve the learning of all students, particularly in developing students' independent skills and engagement through AFL strategies, eight TLC groups are created. These groups consist of an average of 15 teaching staff and are created through an increase in CPD-directed time.



Thus, my research not only contributes to the overarching priorities of the school, but it also serves as a pioneer research-based inquiry and a potential source of insight which other teachers could use to improve their respective professional practices. Above all, the study also provides an opportunity for other members of a TLC to observe my lessons, thereby contributing to the wider aim of showing of best practices and promoting the impact of coaching and sharing.

Chapter 2. Literature review

2. 1. Background of independent learning

Recent findings from a considerable amount of national and international literature suggest that teaching instructions are not well adapted to address the new challenges in the educational system (Scott, 2015). As a result, creativity and critical thinking skills are suppressed, and most students are unable to adapt and apply their learning to new situations (Gimbuta et al., 2017). In the United States, for example, studies reveal that schools and universities are under intense scrutiny for their failure to equip students with the critical skills to build up their capacity for lifelong learning and make them efficient in the 21st century (McLaughlin et al., 2014). The situation is not different in Australia, as noted earlier, where a significant amount of Australian first-year university students are reportedly going through bouts of depression and anxiety because of lack of crucial independent skills required for higher education (Stallman, 2012). A study led by Larcombe, which examined the psychological well-being of the students, revealed that students in various institutions experience one or another form of psychological distress. It also emerged from the study that, out of a total 327 students who responded to the survey, 27% were found to be experiencing depression symptoms ranging from moderate to extreme while a further 30% of the respondents were found to have been experiencing symptoms of anxiety ranging from moderate to extreme (Larcombe et al., 2013). To combat the impact of psychological distress on students' well-being as well as the quality of their learning, Field et al. (2014) advocate for a radical change in the existing expertise where the teaching of independent skills will be brought into the formal schools' curriculum. Field et al. further argue that curriculum of all disciplines must be intentionally designed to 'include instruction on the

development of independent learning skills’ (p. 1). This, they believe, will provide an early intervention in fostering and promoting the physiological well-being of students, which in effect helps reduce the risk of any psychological distress that they may encounter in the next stage of their career.

2.1.1 National priority over the development of independent skills

The concept of independent learning and the principles of its application were commonly practised in the United States (Meyer, 2010). However, with the recent development of educational initiatives and policy documents, independent learning has been identified as a pivot of the personalised learning tools needed to promote social cohesion and equity (Blandford and Knowles, 2011). In the UK government’s commitment to address the alarming concerns over the lack of independence skills in education, the PLTS framework was published in 2007 by QCA. The framework, which aims to empower students to develop the appropriate degree of ownership in their learning, consists of six groups of interconnected skills: team workers, effective participants, creative thinkers, self-managers, reflective learners and independent enquirers, each of which delineates a coherent and distinctive skill.

Similar to Field et al.’s (2014) notion about the provision of early-stage intervention in the development of these skills, this framework also stresses that schools must support their students to develop and ‘apply skills from all six groups in a wide range of learning context from ages 11 to 19’ (QCA, 2007, p. 1). According to the authors, this will enable students not only to develop but also to acquire important fundamental concepts such as the ability to organise themselves, manage change, take responsibility and build up resilience in their learning process.

To deepen its support for the development of independent skills across in the UK, in 2008, the DCSF also commissioned the Learning and Skills Network to conduct a rigorous review to examine the different aspects of independent learning and explore how these aspects could affect students' learning. The review, which synthesised evidence from both UK and international literature, found 'teaching based on coaching' rather than 'whole-class directive' as the key element in promoting sustainable independent learning (Meyer et al., 2008, p. 5). The review, therefore, stressed on the development of skills required to help students to function effectively in their thinking skills, through which more emphasis was laid on teaching affective skills, cognitive skills and metacognitive skills. In this sense, the authors of the review advocated a robust implementation of strategies where students' attitudes towards learning will be developed through constant evaluation of their interest level and understanding.

2.1.2 What problems exist in the definition of independent learning?

A review conducted by Sebba et al. (2007, p. 18) has identified that although the government's priority to help support the development of independent learning skills has been embraced by many schools, its conceptual understanding still remains a challenge to many schools, as widespread uncertainty in the definition of independent learning by some participants was found. This was supported by Meyer et al.'s (2008) extensive literature review, which found that the term independent learning is most often associated with other terminologies such as learner autonomy, personalised learning and student-centred learning. In the same sense, some call it self-directed learning (McLaughlin et al., 2014), and others call it learning how to learn (Oxford, 2011). Wang (2016) found that teachers' cognitive dimensions can affect how they understand and interpret the concept, and this, in effect, can affect the implementation of strategies required to support students to become independent learners. In his study, which explored how independent learning is interpreted in a Chinese private school, it was revealed that teachers

who have a deep understanding of independent learning devise effective instructions in developing those skills in their students while the actions of teachers who have an 'ill-defined interpretation' of the concept constrain their students' autonomy (Wang, 2016, p. ii). Similar to the findings of studies conducted in the UK (e.g., Stockill, 2011), Wang found that the independent learning is misconstrued and that the difficulties encountered in understanding and interpreting its meaning appear to radiate from administrators to teachers.

2.1.3 Independent learning: What is it?

Despite the problems encountered in the consensus definition of independent learning, some researchers have offered their own. According to Knight (1996, pp. 35-36),

Independence . . . is not the absence of guidance, but the outcome of a process of learning that enables learners to work with such guidance as they wish to take, whether . . . from peers, or from electronic media, or from tutors.

For Gibbs (1992, p. 39), independent learning happens when approaches to teaching offer students the opportunity to 'take over many of the traditional tutor role and supervise each other and themselves in an atmosphere of freedom.'

All these definitions delineate similar concepts; thus, a shift in responsibility where students are guided to become co-constructors of knowledge as well as have the awareness, understanding and the ability to take control of their own learning (Pritchard, 2005). The most prominent idea that the various definitions reflect, however, is the concept of 'self-regulating learning' (Meyer et al., 2008, p. 1). Zimmerman (2002) defines self-regulating learning as a 'directive process by which learners transform their mental abilities into academic abilities' (p. 65). This, according to Zimmerman, includes not academic performance skills but rather those skills that students acquire to generate thoughts, behaviour and feelings geared specifically towards goal

attainment. In this sense, he added, 'learning will be viewed as an activity that students do for themselves in a proactive way rather than a covert event that happens to them in reaction of teaching' (p. 65). In this way, students become what Wang (2016) describes as autonomy learners – where the teacher is seen as a facilitator of learning giving control and guidance and the students taking control and the necessary actions to own their learning.

Lakin (2013, p. 39), linked the idea of ownership to that of deep learning (that is, an ability to use higher-order thinking skills to analyse, interpret, and evaluate and solve problems) and argued that 'the idea that deep learning is internally motivated suggests a degree of ownership on the part of the learner'. However, she pointed out that limitations do exist in the use of the term "ownership". This is because some students can be given or accept ownership of a particular aspect of their learning and yet not do anything about it. Therefore, for students to effectively take ownership of their learning, similar to Gibbs' notion, Lakin suggested that the learning process must be active and that opportunities must be offered where students can reflect on their assumed responsibilities. According to Thomas (2014), such responsibilities can be undertaken by students either with peers or on their own or outside normal school hours without direct input from the teacher but which are tailored to contribute to the learning outcome.

2.1.4 What are the characteristics of independent learners?

To explore the characteristics of independent learners, Meyer (2010) and Meyer et al. (2008) made a distinction between dependent and independent learners. They contended that the notion of independent learning develops in a continuum which stretches from a dependent learner to an independent one. Dependent learners are not active in taking control of their

learning; their reactions towards learning are based on the teacher's guidance. Dependent learners are 'passive recipient of knowledge', and they see the teacher as an expert (Meyer, 2010, p. 11; Boekaerts, 1997). Independent learners, on the other hand, are active and see themselves as experts in their learning process. In this sense, Holec (1981) describes independent learners as students who are self-motivated and have the ability to choose appropriate methods to complete tasks, set targets and use appropriate criteria to evaluate its success. Similar to the characteristics offered by Holec, Lakin (2013) extended it to include a spectrum of characteristics of independent learners ranging from taking ownership to demonstrating reflective and analytical learning.

Characteristics	Spectrum of examples			
	Taking ownership	Taking responsibility guided and facilitated by teacher	Demonstrating autonomy	Demonstrating reflective and analytical learning
Able to improve work – can act on feedback	Can use feedback to improve work	Self-assessing	Self-/peer-assessing and able to provide constructive feedback	Able to reflect on their work to know what to improve
Able to find information	Can construct their own questions	Know where to look	Know how to find information	Able to decide on which information is useful
Able to work independently without help or structured guidance	Can work solely but with teacher guidance	Student-led learning	Direct their own learning	Able to correct their own mistakes
Able to work collaboratively with peers	Input from peers and teacher	Work within an assigned group	Contribute to the success of group task	Able to evaluate the group task and suggest ways for further improvement
Able to direct learning – solely or partly	Work with some direction	Use own initiative but ask for help	Direct their own learning	Manage and direct their own learning

Table 1: Characteristics of independent learners

According to Meyer (2010), to demonstrate these characteristics, students must reach a certain stage in their cognitive development where they will have the ability to

- ❖ articulate their thinking and interpret information – cognitive skills
- ❖ identify how to learn and how other agents can support them in their learning process – metacognitive skills
- ❖ manage and control their feelings – affective skills. This is stimulated by internally intrinsic and extrinsic motivation factors, of which the ability to delay gratification is also considered as a crucial element (Hendricks, 2016).

2.1.5 Why should students develop independent skills?

Give a man a fish, and you will feed him for a day, teach him how to fish, and you feed him for a life. —Chinese Proverb

Designing strategies to develop students' independent skills is crucial, and this popular Chinese proverb sums up the priority of my research project. A considerable number of studies have highlighted its benefits on the enhancement of academic performance (Higgins, 2007) as well as its potential to enact lifelong learning skills (William and Hodgen, 2006). According to Field et al. (2014), such skills when developed not only provide opportunity for students to enhance their intrinsic motivations but also help in stimulating the students' responses to extrinsic motivations. McCarthy (2000), on the other hand, examined the impact of such learning experience in relation to its social benefits. He noted that when these skills are developed in an enabling environment, cooperation and trust are built, and as a result, the student-teacher relationship is nurtured. This increases the confidence of the students (Black, 2007) and enables them to set realistic goals and develop resilience for further studies and beyond (Henrick, 2016).

2.1.6 What is the role of teacher in the independent learning process?

The important role of the teacher in facilitating the development of independent learning skills is stressed by a number of researchers (Knight, 1996; Meyer et al., 2008). Wang (2016, p. 30), for example, argues that to facilitate the development of these skills, the teaching instruction must be adapted through shift of controls in order to allow space to enhance the development of independent skills in the classroom. Wang, therefore, provides four stages in the 'shifts in control' process which, he believes, can stimulate students to become independent learners:

- ❖ Creation of awareness (allowing space for independent learning) stage: teachers giving control to students.
- ❖ Metacognitive knowledge and awareness stage: teachers guiding students to take control.
- ❖ Learning by doing (individually or in pairs) stage: using enhancing materials: students taking control in doing.
- ❖ Thinking after doing stage: students reflecting on control and taking action.

This way, the role of the teacher is shifted from a mere transmission of knowledge to a more effective approach where students are guided to become co-constructors of knowledge. This does not mean less guidance but rather a provision of focused guidance tailored to foster students' independence (Hendrick, 2016). The role of the teacher, therefore, is to provide a useful metaphor – scaffolding, where initial support will be provided to the students when a task is first introduced and then reduced to ensure that the students continue to manage their own learning (EEF, 2017, p. 1).

In sum, it is clear from the literature that students cannot develop independent skills on their own. However, it is also clear that the role of the teacher in facilitating the development of such

skills goes beyond the traditional teaching strategy where summative assessment – assessment used for the ‘purposes of grading and reporting’ – is the predominant strategy (ARG, 1999, p. 2; Hendrick, 2016). Rather, it requires an active, interactive and dynamic classroom culture where there is space for thoughtful and reflective teacher-student dialogue, self and peer assessment and where the teacher uses feedback to scaffold instructions (Black and Wiliam, 1998; Lakin, 2013; Heritage, 2010), all of which point to the concept of formative assessment.

In the subsequent sections, I will discuss formative assessment and how it contributes to the development of independent skills. I will then develop the discussion by focusing on how teachers and students can work together in the formative assessment process to enhance students’ engagement.

2.2 Formative assessment

Formative assessment has received growing concern from academic researchers and in a body of literature in recent decades. Since its evolution in the 1960s, research (McMillan, 2011; Hattie and Timperley, 2007; Sadler, 1989) has shown that formative assessment has become an integral part of teaching and learning. Its potential to enhance independent learning (Clark, 2012; Magno, 2010; William and Leahy, 2015) and teachers’ professional development (Magno and Lizada, 2015) was highlighted by the Assessment Reform Group in the 1990s (ARG, 1999). From then on, many researchers and educators, specifically in the UK and the United States, have made significant contributions to the practice (Grant and Gareis 2015).

2.2.1 Is there any evidence that formative assessment can enhance independent learning?

Several studies have highlighted the potential of formative assessment in enabling students to become independent learners. However, as Meyer (2010) notes, 'there is a shortage of literature on the role and impact of assessment on independent learning' (p. 22). Meyer believes that the shortage on literature may be attributed to the difficulties in linking assessment to independent learning. Perhaps Meyer's assertion can be justified by Black et al.'s failure to construct an instrument to relate AFL to independent learning. However, in concluding the findings, Black et al. stressed that in fostering independent learning in classrooms, 'emphasis should be placed on practices, in both individual and collaborative contexts, that seem to have potential to promote pupils' autonomy in learning', as this, they believe, seems to provide 'the most secure foundation for lifelong learning' (Black et al., 2006, p. 130).

Despite these limitations, some national and international studies (Creighton et al., 2015; Meyer et al., 2008; Paris and Paris, 2001; Wiliam and Leahy, 2015) have found that AFL has a substantial impact on independent learning. For example, in Sebba et al.'s study, which surveyed participants from 2,838 schools, consisting of 208 special schools, 91 Pupil Referral Units, 1,800 primary schools and 739 secondary schools across the UK, to investigate into respondents' perception about personalised learning and what strategies schools have put in place in response to the concept, it was revealed that in situations where AFL strategies were effectively implemented, students took more responsibilities for their learning. The acceptance of such responsibilities by the students, as noted by the researchers, is not automatic. While it may be argued that what seemed to trigger the students' effort to take such ownership can be attributed to factors other than AFL strategies, the evidence presented in the findings showed that out of the 1,615 primary and secondary schools that responded to the survey, 92% were

found to use an individual target-setting approach while 94% adopted an individual feedback approach in supporting their students to become independent learners. The study also found that in situations where the implementation of the AFL strategies required the students to engage in work-related activities and discussions, the whole classroom atmosphere was characterised by a great sense of students' participation and engagement (Sebba et al., 2007, p. 27). This is not different from the findings of the study conducted by Cook-Sather (2010), which found that engaging students in such learning experience not only enhanced engagement but also enabled them to 'reconceptualise accountability' (p. 14).

Perhaps the recent study conducted by Barkat (2014) provides additional insight into how AFL can impact independent learning. The study, which explored the 'theoretical construct around ownership practices' (p. 4), also found that effective implementation of the formative assessment process not only helped the students gain interest in learning but also offered them the skills to assess their own learning against the success criteria rather the feedback from the teacher alone. And such an impact, according to Barkat, can be experienced regardless of IQ, level, social background or the gender of the students (2014, p. 145).

It is clear from the literature that the impact of implementing formative assessment is very high, but its achievement can be problematic since it requires a shift of roles from teachers to students (Black et al., 2004; Black and Wiliam, 1998). Thus, for students to succeed in this approach, they must develop a sense of understanding of what it takes to become an independent learner and actively involve themselves in the formative assessment process (EEF, 2017, p. 1).

2.2.2 What then is formative assessment?

As formative assessment has become a subject of interest among schools, researchers and educators, many definitions have been proposed during recent years (Grant, 2015). Black and Wiliam (1998, p. 2), for example, define ‘formative assessment’ as:

[a]ll those activities undertaken by teachers, and by their students in assessing themselves, which provide information to be used as feedback to modify the teaching and learning activities in which they engaged.

In other words, for any assessment to become “formative”, Black and Wiliam stress that teaching work must adapt to meet the needs of the students. This act of adaptation, according to Popham (2008, p. 6), is a planned process in which such assessment should generate the potential for teachers to adjust their ongoing instructional procedure or adjust the current learning tactics of the students.

After reviewing the work of Black and Wiliam (1998), the ARG (2002, p. 2), a group funded by the British Education Research Association to evaluate and develop formative assessment practices, also defined formative assessment as:

[t]he 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.

The various definitions, however, depict some common characteristics of formative assessment, which are outlined below:

Process: First, formative assessment is identified as a continual process. In other words, this kind of assessment is not a one-off test or activity that is given to students to assess their learning or

to report progress and achievement (ARG, 2006). As McManus argues, 'there is no such thing as formative test'. She goes on to suggest that any implementation of formative assessment must incorporate informal conversations and observations that are purposefully planned and designed to elicit evidence of learning (McManus, 2008, p.3).

Students' and Teachers' Involvement: Again, while teachers seek to implement the activities in formative assessment, these activities, according to Creighton et al. (2015), should seek to engage students to regulate their own learning. To achieve this, Wiliam (2011) stresses that learning intentions and success criteria must be shared with students to enable them to monitor their own progress.

Feedback: Finally, the various definitions noted that the implementation of formative assessment should not only aim to elicit evidence to help adjust instructional needs of teachers, but also such evidence must enable students to know what they need to do to close the gap between where they are in their understanding and where they should be. Brookhart (2008) agrees and adds that this kind of regular feedback not only helps teachers create opportunities that enhance the chances of learning but also enables students to master the key concepts and skills of the subject area.

In 1999, however, the ARG (1999, p. 4) provided a further distinction between the terms 'assessment for learning' and 'assessment of learning'. Similar to the characteristics listed above, the researchers argued that for any learning to be improved through assessment, the teacher must ensure that:

- ❖ assessment provides effective feedback to the student
- ❖ students are actively involved in their own learning
- ❖ teaching is adjusted to take account of the results of assessment

- ❖ assessment activities are designed to trigger students' engagement, motivation and self-esteem
- ❖ there is opportunity for students to assess themselves and understand how to improve

Thus, whereas the purpose of 'assessment of learning' is to test students' knowledge on what they have learnt, 'assessment for learning' seeks to contribute to and develop cultural and social intellectual skills of the students (ARG, 1999; Heritage, 2010; Garies and Grant, 2015; Shepard, 2000).

Linking these features of formative assessment, the CCSO identified five attributes which, they believe, make an assessment formatively effective. These were learning progression, learning goals and success criteria, descriptive feedback, self- and peer assessment and collaboration. Though these attributes are similar to the five elements developed by the Assessment Reform Group in the UK, here, more emphasis is laid on collaboration. With this, CCSO emphasise that the classroom environment must be situated in a way that will encourage students to feel confident that they are partners in the learning process. In other words, for teachers to actively involve students in the formative assessment process, the classroom culture must be 'characterised by a sense of trust between and among students and their teachers; by norms of respect, transparency, and appreciation of differences; and by a non-threatening environment' (McManus, 2008, p. 5). The role of the teachers, therefore, is to recognise the rights and values of the students in the assessment process and, through interactions, demonstrate the positive values and behaviour expected of students.

2.2.3 What strategies of assessment are classified as formative?

The common distinguishing feature of formative assessment from the various definitions is its potential to provide information that can be shared by both teachers and students to support learning (Clark, 2012). The gathering of such information, which enables teachers to adjust their teaching and students to understand the steps to develop and secure their continuing progress, are underpinned by a variety of strategies (Leahy and William, 2015). Heritage (2007, p. 141) categorised such strategies into three broad types:

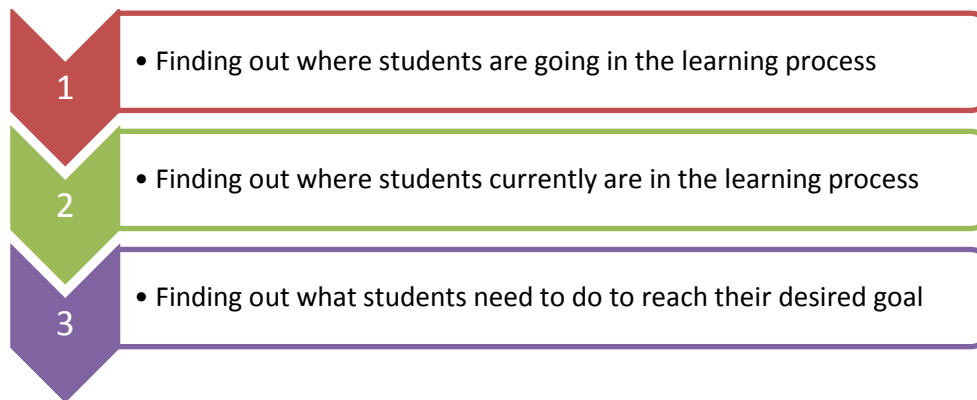
On-the-fly assessment: Assessment that occurs spontaneously during the lesson. A ‘pop up’ lesson is designed to address students’ misconceptions before proceeding to the planned sequence of the lessons. For example, when a teacher hears that a student or group of students are expressing misconception about a topic in mathematics, a quick recap can be provided within the lesson to address the misconception before moving on to the next stage of the planned lesson.

Planned-for interaction: This kind of formative assessment occurs when teachers plan the questions they will ask during the lesson. Such planned questions enable students to explore ideas and also help elicit valuable assessment information. In other words, teachers decide beforehand how they will elicit students’ thinking during the instruction.

Curriculum-embedded assessment: An assessment incorporated in an ongoing curriculum by teachers and curriculum developers to get feedback at key points in the teaching and learning process and agents that are part of ongoing classroom activities.

Essentially, the evaluation of these assessment information must seek to provide feedback that aims to involve students to identify and close gaps in their learning to enhance their progression

(Heritage, 2007). Wiliam (2011, p. 46), therefore, identifies three crucial processes of teaching and three core agents involved in this process. He describes the process as follows:



To bring this to life, Wiliam points out the significant role that the three core interconnected agents, namely teachers, learner and peers, have to play in the formative assessment process. The teachers' role in this process, therefore, centres on sharing the learning intentions and the criteria for success with the students. This is also emphasised by Creighton et al. (2015, p. 7), who added that setting, clarifying and sharing learning goals serve as indicators that help all the agents in the formative assessment process to assess whether or not learning is taking place. This incorporates other interrelated activities such as designing and implementing tasks that elicit students' understanding and engagement (Edwards, 2014) and providing feedback that enhance learning progression (Creighton et al., 2015). The role of the learner and peers, on the other hand, involves understanding the learning intention and the success criteria and assessing themselves in relation to the learning outcome (DfES, 2006).

Integrating the process with the roles, Wiliam provided a 'three-by-three grid of nine cells' which outlines the five key strategies of formative assessment, shown in Table 2:

	Where the learner is going	Where the learner is right now	How to get there
Teacher	1. Classifying learning intentions and success criteria	2. Engineering effective classroom discussions through designing and implementing tasks and activities that elicit evidence of learning	3. Providing constructive feedback that enhances learning progression
Peer	Understanding and sharing learning intentions and success criteria	4. Activating students as instructional resources for one another	
Learner	Understanding learning intentions and success criteria	5. Activating students as the owners of their learning	

Table 2: The five key strategies of formative assessment (Adapted from Wiliam, 2011, p. 46).

Similarly, upon comparing and critically analysing experts' definition of formative assessment, Heritage also proposes eight components of the formative assessment process. Similar to Wiliam's proposition, she identifies teachers, learners and peers as the main agents of the formative process.

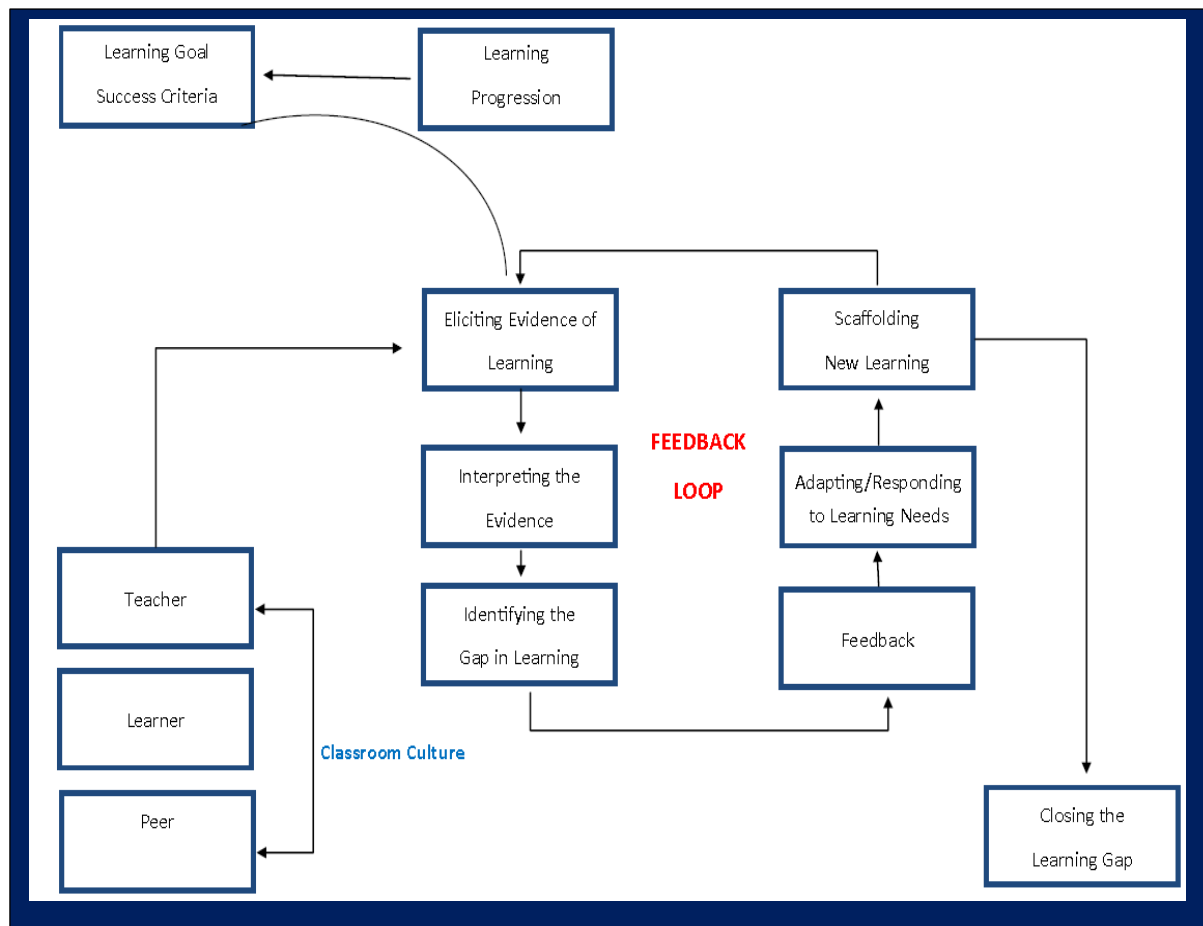


Figure 1: Feedback for learning (Adapted from Heritage, 2010, p. 80).

However, even though the first five elements of the process are similar to the assessment strategies offered by Wiliam (2011), her proposal lays more emphasis on the final stage of the cycle, ‘closing the learning gap’, where the gap is closed between where students are in their learning and where teachers and students want to be at the end of the lesson (Heritage, 2010, p. 10). The other two components of the process, adapting and responding to learning needs and the scaffolding of new ideas, were also incorporated in the ‘feedback loop’ (see Figure 1). The former stresses the appropriate intermediate techniques that teachers adopt to engage students in self-assessment while the latter focuses on the support that students should receive from teachers and peers to move forward.

Here, Heritage (2010) contends that for formative assessment strategies to work effectively, teachers must create a conducive environment that provides the opportunity for students not only to receive but also to give advice to other students on how they could improve. To do this, Heritage suggests that, 'teachers must establish normative values, standards, and practices in the classroom that support distributed power, feeling of safety, and trusting, collaborative relationship' (p. 100). This, according to Perrenoud (1991), involves reconstruction of both teaching and learning contracts to counteract the habits acquired by the students so that identifying and taking actions to close the gap between students' current learning status and the intended learning goal will be a joint project (Shepard, 2000) between the agents in the formative assessment process. This means that teachers must model the kind of norms and behaviour expected of students and establish practices that reflect that 'power does not solely reside with teachers, but it also shared with students' (Heritage, 2010, p. 100).

2.3 AFL strategies and student engagement

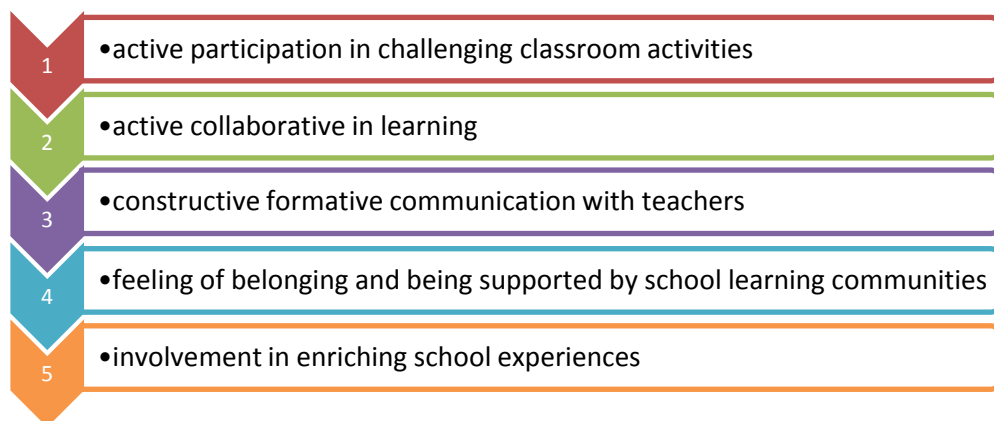
Edwards contends that academic success consists of two critical aspects of learning. The first centres on the student's ability to master subject-specific knowledge while the second stresses the students' capacity to take control of their own learning (Edwards, 2014). Studies show that students can master the subject knowledge and experience high achievement and academic outcomes while not being highly engaged in lessons. For example, in their work, Skilling et al. (2015) found a situation where highly achieving students, despite their ability to perform well in mathematics, were identified as 'disengaging' from mathematics (p. 7). This led me to deduce that just because students can understand a particular subject and achieve high grades does not necessarily mean they are highly engaged or can regulate their own learning.

For the purposes of this study, I will focus my attention on the aspect of learning which requires teachers to use instructive strategies to engage students to be in charge of their own learning (Edward, 2014).

2.3.1 Engagement: What exactly is it?

Coates (2007, p. 122) defines ‘student engagement’ as ‘a broader construct intended to encompass salient academic as well as certain aspects of the student experience’.

It includes:



According to Reschly and Christenson (2012, p. 3), engagement is ‘the glue, or mediator that links important contexts – home, school, peers, and community – to students and, in turn, to outcomes of interest’.

These two definitions of ‘student engagement’ are broad and go beyond the classroom setting, as they encompass the collaboration of the teachers, parents, school and the community in influencing the students’ learning outcomes (Ellis et al., 2016). However, because this study focuses on examining how AFL strategies can affect student engagement, I will adopt the

definition of 'student engagement' that centres on the operations within the classroom context.

This kind of student engagement is defined by the Glossary of Education Reform⁵ as

[t]he degree of attention, curiosity, interest, optimism and passion that students show when they are learning, or being taught, which extends to the level of motivation they have to learn and progress in their education.

In other words, students are engaged when they are intrinsically motivated by desire, interest, enjoyment (Jablon and Wilkinson, 2006) and show the willingness to participate in the learning process, which leads to improved learning outcomes (Bandaranaike and Willison, 2011). This can be task-specific engagement, which involves the amount of time interacting with activities, their teachers and peers (Ridley et al., 2000) or their active involvement in the learning process (Reeve, 2013). According to Uden et al. (2014), this occurs when students remain focused in lessons and are attracted to and complete their work even if there are distractions. In mathematics, it is driven by effective formative feedback as well as critical reflection (Bandaranaike and Willison, 2011), which consequently stimulate the students to stay on tasks, think hard and participate effectively in learning mathematics (Attard, 2015).

2.3.2 What are the types of engagement?

Scholars (such as Fredricks et al., 2004; Uden et al., 2013; Skilling and Stylianides, 2015) have identified three types of engagement: (a) emotional engagement, (b) cognitive engagement and (c) behaviour engagement. These three types of engagement are not independent of each other (Uden et al., 2014); they are interconnected and operate together (Skilling and Stylianides, 2015). After examining different theories of engagement, Rimm-Kaufman et al. (2014) found dynamics within the engagement system (as illustrated in Figure 2). They noted, for example, that behaviour engagement can also be stimulated by emotional engagement, and outside the

⁵ <http://edglossary.org/student-engagement/> [Accessed 18 February 2017]

engagement system, social factors like classroom environment can also affect behaviour engagement (p. 4).

Emotional Engagement: This refers to students’ ‘affective reactions’ (Fredricks et al., 2004) to classwork and other achievement-related activities in their schools. This encompasses the feeling of boredom, anxiety, happiness and interest that students demonstrate within the classroom context (Skinner and Belmont, 1993). Davis et al. (2012), on the other hand, call it *relational engagement* and define it as ‘the quality of students’ interactions in the classroom’ (p. 22). The multiple facets of the theory of this type of engagement, however, are underpinned by the theory of self-determination and motivational factors (Warwick, 2008).



Figure 2: Types of engagement and self-regulation process (Adapted from Skilling and Stylianides, 2015).

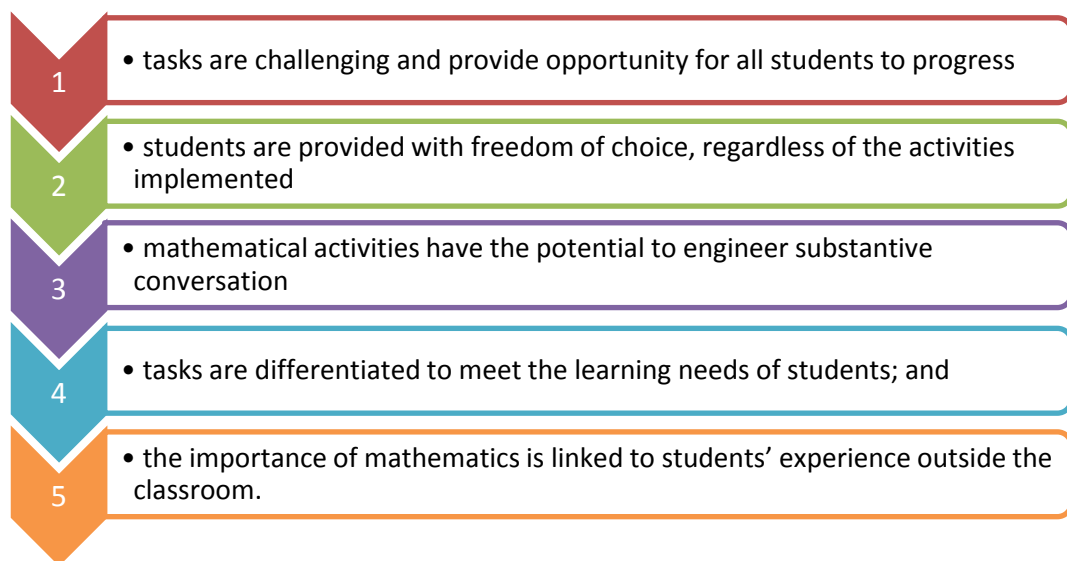
Behaviour Engagement: Educational researchers describe this as including students' effort, concentration in a given task and participation in lessons (Davis et al., 2012; Uden et al., 2013). Behaviour engagement, according to Warwick (2008), is observable and is comprised of the effort that students put into completing tasks, how they relate to peers and teachers as well as their eagerness to ask for help.

Cognitive Engagement: Skilling and Stylianides (2015, p. 1280) define cognitive engagement as 'students' approaches to academic tasks as well as their psychological investment in, and willingness to, master complex concepts.' This means that to be cognitively engaged, students must be willing to put in necessary effort (Fredricks and McColskey, 2012) to seek understanding, share ideas during whole class discussions as well as adopt rigorous strategies to engage themselves fully in the learning process. This kind of mastery learning is triggered by goal orientation and enhanced by motivational factors (Taylor and Wolters, 2012).

It is important, therefore, to note that effort is used in the definition of both behavioural and cognitive engagement. In this sense, Fredricks et al. (2004, p. 64) stress that a clear 'distinction needs to be made between effort that is primarily behavioural, a matter of simply doing the work, and effort that is focused on learning and mastering' the tasks. Davis et al. (2012), for example, noted that students can be behaviourally engaged and yet not cognitively engaged. In other words, just because students appear to exert effort on instructed tasks does not mean they are learning (Davis et al. 2012, p. 23). Students' engagement varies between lessons. This is because engagement is dynamic (Rimm-Kaufman et al., 2014) and an ongoing process, and its duration may be specific depending on the students' willingness to invest effort on a particular task. However, the intensity of engagement determines the students' degree of willingness to invest or commitment to engage (Skilling et al., 2016, p. 3). Skilling and Stylianides (2015) found this to be influenced by the classroom environment and the quality of student-teacher interactions (emotional engagement). 'This means that what teachers do or say can influence

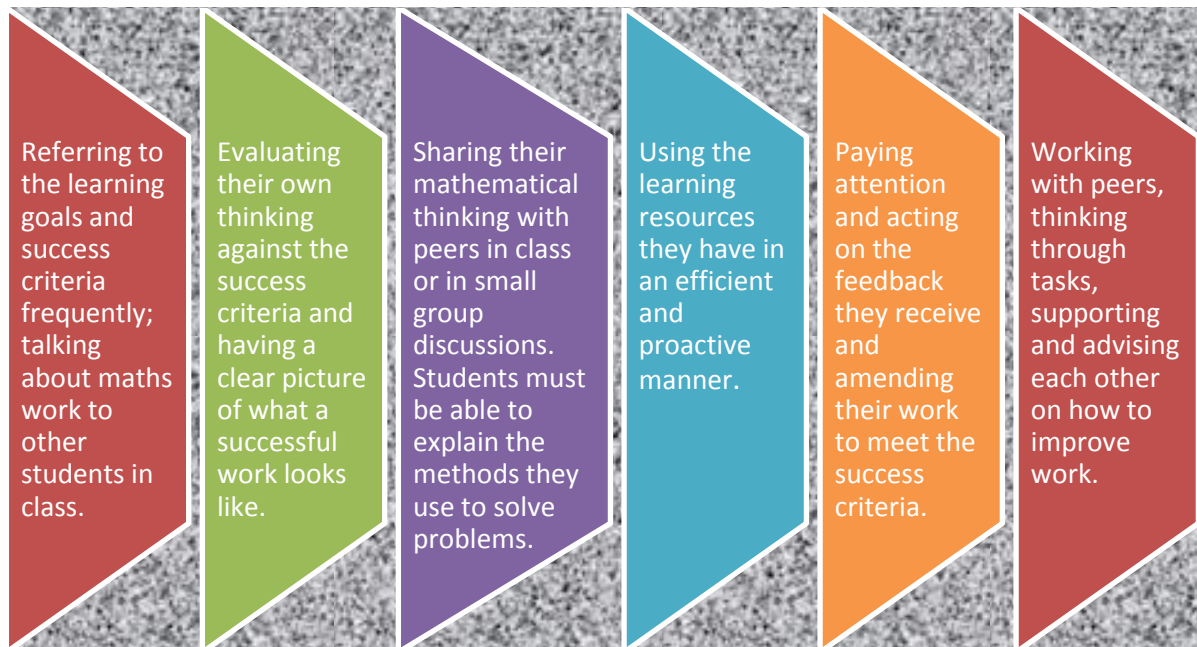
students and mediate the use of self- regulatory process’ (Skilling and Stylianides, 2015, p. 1281).

To effectively respond to this, Skilling et al. (2016), suggest that teachers must possess the knowledge and skills needed to implement instructional strategies tailored to stimulate and promote students’ engagement within lessons. According to Heritage (2010), this requires teachers to develop an extensive repertoire in adapting classroom contracts to the needs of the students. In maths classrooms , Attard (2015, p. 1) provides ‘pedagogical repertoires’, critical elements of engaging pedagogies that she recommends teachers to adopt to stimulate engagement within lessons. She describes pedagogical repertoires to comprise a classroom culture where:



Attard concludes that engagement can be stimulated through substantive conversation. This, she reiterates, is done when teachers encourage collaboration through investigations and problem-solving and when students are encouraged to reflect on their work regularly.

Creighton et al. (2015, p. 2) also provide a list of specific actions that teachers can take to help students not only to be engaged in lessons but also to stimulate them to become self-regulatory learners:



Wiliam and Leahy (2015) also add that to engage students in a learning experience to develop their self-regulatory ability through AFL strategies, teachers must create a classroom environment where students will be willing to ask for clarification and share their thinking in lessons. They believe that whether in a small group or a whole class discussion, even ‘relatively unstructured dialogue’, guided by the teachers’ expertise, can reshape the thinking of the students and thereby enhance their engagement (p. 64).

2.4 Summary and research questions

The literature has highlighted the framework of independent learning and has stressed its importance in enabling students to acquire fundamental skills for lifelong learning. In the review, I have explored the role of the teacher in scaffolding instructions to help students develop

independent learning skills. This has enabled me to gain insight into the kind of support and guidance I need to provide in this study. For example, I am aware that for my students to become independent learners, my teaching instructions must be tailored to encourage active and thoughtful teacher-student interaction through effective formative feedback (Black and Wiliam, 1998; Black et al., 2006). The review also highlighted the potential of AFL strategies to enable students to become independent learners. However, despite this potential, successions of OFSTED reports have reiterated that teachers do not seem to have a clear knowledge of how and when it is appropriate to use AFL strategies during lessons (OFSTED, 2011, 2013). In some situations, the reports described the approach and strategies used by some teachers as 'overly bureaucratic' (OFSTED, 2013, p. 14). In mathematics, Hodgen and Wiliam (2006), for example, have observed that the teaching of the subject and the assessment strategies of teachers to elicit evidence of learning do not provide the opportunity for students to transfer and connect skills acquired in the classroom into other real-life situations. As a result, students are not well-resourced for further study or skilled employment (DfES, 2005, p. 54). In light of this, I formulate my research questions as follows:

- ❖ To what extent can AFL strategies help develop students' independent skills in mathematics?
- ❖ What specific AFL techniques can help develop students' independent skills in mathematics?
- ❖ To what extent can AFL strategies affect engagement in mathematics?

In the next chapter, I will discuss the context of the research design, data collection methods and the AFL strategies and techniques I used to explore these questions. I will then discuss the collaboration process undertaken as well as the professional ethical guidelines that were considered at each stage of the process.

Chapter 3: Methodology and Methods

3.1 Research design

In order to examine how different AFL strategies can help develop the independent skills and engagement of my students, a critical consideration was made with respect to choosing the research method that offers the opportunity to be critical, reflective, and analytical in my practice (Ford, 2015). Action research and practitioner research were contemplated upon, as they both enable the exploration of an area of interest in my own classroom, enabling me to be systematic (Cochran-Smith and Lytle, 1993) and thoughtful (Stremmel, 2007) in using my observations and reflections to make sense of what I see and experience (Henderson et al., 2012). However, since this study only required me to implement individual AFL strategies and techniques to examine how they could affect the development of independent skills as well as engagement of my students, practitioner research was deemed more appropriate. This is because the impact of each AFL strategy or technique could be assessed even in a given single lesson without necessarily having to undergo cycles of diagnosing, planning, taking and evaluating actions.

However, in order to best examine the effectiveness of AFL strategies, a mixed-methodology approach was adopted. This facilitated the collection of both qualitative and quantitative data (Cohen et al., 2011; Johnson and Onwuegbuzie, 2004). To achieve this, questionnaires were administered in conjunction with interviews and researcher field notes. The triangulation of data in this sense facilitated the data collection from different methods. This enhanced the internal validity, dependability and reliability of the data (Zohrabi, 2013).

3.1.1 School demographics

The school used for this study is a nonselective comprehensive girls school, with a mixed sixth form, in South West London, which prides itself in educating successful women of the future. The school is driven by an overarching vision to ensure that all students can take full and equal places as women who assume responsibilities in a changing global economy. The school consisted of 1,272 students from 68 different countries, of which about a third are from white, mixed white or other white background. In addition, the proportion of students from a minority group is above national average. The school is very diverse, consisting of 17 ethnic groups with 82 different languages. The majority of the students originally come from Germany, Spain, Pakistan, Poland and Bulgaria, with the top five first languages being Bengali, Arabic, Tamil, Polish Urdu, excluding English.

3.1.2 Participants

The class chosen for this study was a Year 8 top set consisting of 30 students. This class was mainly comprised of students who attained between grades 2M (level 5b) and 3U (level 6a) in the summer term of Year 7. I have taught this class since the beginning of Year 7, and having identified that the majority of this cohort lacked some of the crucial fundamental independent skills as outlined in Table 1, I deemed it appropriate to implement more structured and different teaching strategies to enable them to develop these skills alongside the subject-specific knowledge.

3.2 Data collection

The research questions have been linked with the data collection method to illustrate how each question will be answered.

Research question	Method of collecting data
To what extent can AFL strategies help develop students' independent skills in mathematics?	Questionnaires and literature review
What specific AFL techniques can help develop students' independent skills in mathematics?	Questionnaires, interviews, literature review
To what extent can AFL strategies affect engagement in mathematics?	Questionnaires, interviews, literature review and field notes.

Table 3: Linking research questions with the data collection method.

3.2.1 Questionnaire

In order to make critical comparisons and a reflective evaluation of the intervention on the development of students' independent skills and engagement, pre and post questionnaires were administered (Cohen et al., 2005).

The independent skills questionnaire had 18 closed statements (see Appendix 1). I distinguished team work skills (5 items) from effective participant skills (4 items), self-management skills (4 items) and thinking skills (5 items). The engagement questionnaire, on the other hand, consisted of 15 closed statements. Each item provided the success criteria upon which each independent skill and the students' engagement was assessed. A five-point Likert scale was used, with responses ranging from 1 (never) to 5 (always). A separate questionnaire was also administered regarding students' perception about AFL techniques employed in class prior to the study. This consisted of four closed questions with a space provided for students to justify their responses.

After the study, the same questionnaires were administered. However, eight questions were added to elicit information on how AFL strategies and techniques have affected the development of their independent skills. To elicit information about how AFL strategies have affected students' engagement in mathematics lessons, again a four-point Likert scale was used with responses ranging from strongly disagree to strongly agree. The use of Likert scales allowed generation of numbers and facilitated a degree of differentiation and sensitivity in the responses (Cohen et al., 2005, p. 253).

In order to ensure reliability and validity of the findings, I adopted the questionnaires used by Marshall (2012), who conducted a similar study to examine the 'perceptions of students in the development of independent and critical thinking skills' (pp. 89–90). These questionnaires were adapted to the research questions and were subjected to critical scrutiny by two experts in my school. This was to ensure that questions are not biased towards my beliefs of what AFL is and how its strategies could impact on the development of independent skills as well as the engagement of the students in mathematics lessons.

3.2.2 Interviews

To obtain information on the participants' perceptions and experiences of AFL strategies 'in a way that can be expressed in the form of answers' (Flick, 2014, p. 222) to become accessible to interpretation, reflection and evaluation (Rabionet, 2011; Smith, 2011), student interview was adopted. This allowed flexibility in the face-to-face interaction between the researcher and the participants (Edwards and Holland, 2013, p. 3) while facilitating a follow-up in unexpected results obtained from the pre and post- questionnaires.

A semistructured interview, however, was utilised. This facilitated the use of predetermined open-ended questions (see Appendix 2) while also allowing further probing. The difficulties encountered in using this type of questions, however, arose from the coding and extraction of common themes from the interview transcript (Flick, 2014). However, in this approach, the participants were not restricted to predetermined answers. The responses provided, therefore, increased the validity of the findings (Turner, 2010). The initial plan was to interview five students who would volunteer to talk to me about their experience on the AFL strategies. However, having realised that such approach may not necessarily offer me the valuable information I needed for the study, careful consideration was paid to the selection of the participants (Creswell, 2007) following the data collected from the pre and post- questionnaires. The selection process therefore included two students who were disengaged and two students who were highly engaged in lessons before the study while also providing the opportunity to include the five students who originally volunteered. This was to ensure an open and honest sharing of experiences or information (Creswell, 2007).

A mix of individual and group interviews was utilised. In all, four separate interviews were conducted in four different days during the scheduled interview period. The first interview consisted of a group of two students, and the second interview consisted of a group of five students. However, the other two students decided to do it individually. The individual interview was adopted to avoid group pressure. In this sense, the responses were not affected by an individual or a group who may be dominating the conversation. This helped prevent any form of 'group-think bias'⁶. The group interview approach, on the other hand, was also incorporated to minimise panic and nervousness. It also allowed a naturalistic approach where the participants

⁶ http://www.csr-bos.com/value/research/QS_1106.pdf [Accessed 20 April 2017]

talked in groups. This made them more confident and comfortable in elaborating and developing the ideas of their peers, thereby enhancing the quality and increasing the validity of the information (Mitchell and Jolley, 2013). This then helped overcome the risk of researcher bias – which is associated with individual interviews. However, in using group interview, I was also aware of how the validity of responses can be affected by participants giving false answers to impress their peers⁷. To resolve this, further probing questions were asked to elicit personalised information from individual students.

Also, being the class teacher and the interviewer, however, I was aware of how my social interaction with the participants may cause them to give favourable responses. To resolve this, the participants were encouraged to give convincing examples, either from their personalised targets (see Appendix 3) or exercise books, to justify their responses. This helped reduce the risk of researcher bias (Turner, 2010) and enhanced the validity of the findings. All the interviews were conducted during lunchtime, was restricted to ten minutes and were conducted in my classroom. In this juncture, there was less distraction, and the participants felt more comfortable (McNamara, 2009). The interviews were recorded and the audio later transcribed (see Appendix 2). Audio was recorded to reduce distortion and loss of vital information during the interview process (Cohen et al., 2005).

⁷ <https://www.simplypsychology.org/interviews.html> [accessed 20 April 2017]

3.2.3 Field notes

To discover any factor which may be considered significant for understanding of the research problem but was unknown to me when the study was designed (Mack et al., 2005), field notes method was utilised. Many researchers (Bryman and Bell, 2015; Wynn, 2012) have identified the inconsistency between participants' self-reports during interviews and what they actually do when they are being observed. With this in mind, in observing the participants' behaviour, particular attention was paid to the responses that needed further consideration in the research questions or follow-ups in the interview (Mack et al., 2005).

During the research, I circulated across the classroom and took notes of the participants' attitudes, interactions with peers and their general engagement in the activities. These were recorded in my planner. However, the complexity of this method of data collection arose when I was teaching and taking notes within the same lesson, as the amount of information that I could jot down relied solely on memory (Merriam and Tisdell, 2015). This could make the reporting of what was observed subjective and incomplete (Collis and Hussey, 2013). To reduce the risk of researcher bias in this situation, one of my collaborators – a PGCE student – observed some of my lessons and also recorded the participants' interactions. After each lesson, the two of us met after school to discuss and review our observations. The outcome of such meetings provided a basis upon which some of the initial interview questions were reconstructed, which, consequently, aided data interpretation (Emerson et al., 1995; LeCompte and Schensul, 2013).

3.3 AFL strategies used

To develop the independent skills of my students through AFL strategies and examine how these would affect engagement, I decided to employ three of the five AFL strategies (as discussed

below). The other two strategies, sharing and understanding learning intentions and success criteria and feedback, however, were incorporated to make the intervention strategies fall in place. In other words, they were utilised as complementary rather than main strategies to develop the skills delineated in my research. Also, only the relevant AFL techniques were utilised. A clear distinction, however, needs to be made between AFL **strategies** and **techniques**. In this study, a *strategy* is defined as the territories of AFL⁸ or the overall plan of action purposefully designed to achieve a specific goal while *techniques* are the tools or procedures that can be used ‘to enact the strategies in the classroom’ (Wiliam and Leahy, 2015, p. 16).

3.3.1 Engineering effective classroom discussions through implementing tasks and activities that elicit evidence of learning and promote effective participation

This intervention was enacted to develop students’ participation and thinking skills through implementing cognitively demanding tasks and questions. During the first three weeks of the study, four main research activities (see outline of lesson plan, Appendix 4) were taught. During the implementation of these activities, students explored ideas individually, in peers and in groups. However, since the active involvement of students was my focus within the implementation of this strategy, when eliciting evidence of learning, I decided to use randomised AFL techniques to select students to respond to questions. This is because, as Wiliam (2011, p. 81) notes, if the objective of questioning is to assess the learning of students while developing the participation skills of students, then selecting students who raise their hands to respond to questions makes little sense in this study. Randomised AFL techniques, thus, facilitated active involvement and participation of the students in their learning process.

⁸ www.dylanwiliam.org/Dylan_Wiliams...files/Cambridge%20AFL%20keynote.doc [Accessed 30 March 2017]

The randomised techniques included 'No hands up', 'Basketball discussions' and 'Lollipop sticks' (See AFL techniques Glossary). However, in implementing those techniques, I was aware that there was no guarantee that all students will get the chance to involve themselves in class discussions. Also, other students may also try to avoid participation by responding 'I don't know' when selected at random to respond to questions (Wiliam, 2011; Leahy and Wiliam, 2015, p. 68). To address these issues, students were encouraged to raise their hands if they want to seek clarification or ask questions. Also, a classroom contract was established where "opt out" was not an option.

3.3.2 Activating students as instructional resources for one another

This intervention method was also utilised in the subsequent three weeks of the research to develop teamwork and thinking skills while offering the opportunity to develop the other two skills delineated in the study. Peer assessment, thereby, became the benchmark during the implementation of this strategy. During the first week, sequences of three lessons were taught. In these lessons, students were paired to assess the work of their peers and to facilitate peer discussions. Students who participated in lessons were frequently paired with those who never or rarely participated. The lessons were taught for 50 minutes where students supported each other, discussing and sharing ideas when the activities were announced. In the remaining 10 minutes of each lesson, students used the 'Two stars and a wish' sheet (see Appendix 5) provided to give formative feedback to their peers. On the sheet, I provided sentence starters such as 'I like the way you . . .', 'The best part of your work is . . .' and 'To improve further, you need to . . .'. This was to guide the students on what sort of comment they needed to write (Wiliam and Leahy, 2015, pp. 145–146).

To enhance engagement, increase participation and also help students articulate their thinking through collaborative learning, group work was also utilised. Because of the purpose of my research and the nature of the tasks, I decided to adopt friendship groups rather than grouping based on ability. This allowed students to feel confident in sharing ideas within their groups and also to support each other (Davies, 2009; Lee, 2006). In the subsequent two weeks of implementation, students were organised in two groups of four, two groups of five and another two groups of six. Here, attention was not paid to group size because the number of students in a group does not necessarily affect the success of the group (Hamilton, 2014, p. 33). During the group work, three topics were provided, together with their corresponding success criteria (see Appendix 4), and students were asked to work in their respective groups to plan, design and deliver a revision lesson to rest of the class. However, while students were allowed to choose their own group, I directed the groups to choose the topics, taking into account the ability of the students within each group. Two groups worked on the same topic. This was to facilitate comparison of different independent skills that groups can develop over a specific period. These lessons were planned and designed over two one-hour lessons and were delivered by the various groups in the subsequent weeks. Here again, 'Two stars and a wish' was utilised where students gave formative feedback to the groups. Here, I created peer assessment forms such as self-evaluation and group evaluation forms (see Appendix 6) to facilitate both individual and group accountability (Johnson and Johnson, 1994).

Peer feedback possesses limitations that could create emotional discomfort because of power relations among students. Some students 'often dislike having power over their peers or their peers having power over them' (Liu and Carless, 2006, p. 9). To resolve this, it was reinforced that students did not have to stick their feedback sheets in their books if they thought they were not useful (Sujannah and Cahyono, 2017).

3.3.3 Activating students as owners of their own learning

During the implementation of this strategy, the development of self-management became the main target. Self-assessment, thus, was the main AFL focus. After the administration of the prequestionnaire, students were asked to identify and select at least one element of skills under the four strands of independent skills delineated. This became their personalised targets and skills that they anticipated to develop during the research. This also served as a checklist against which they assessed themselves in each of the research activities implemented. These targets were checked and revealed with students weekly to identify further intervention actions. Setting personal goals in this context allowed them to gain personal significance, which consequently stimulated them to understand why it is important to take ownership of their own learning (Barkat, 2014, p. 42).

Furthermore, to engage the students to reflect on their progress in relation to both their academic knowledge and their personalised skills-development targets, the 'Traffic lights' technique was utilised. In addition, whether working in groups, pairs or individually, 'traffic lights' was also used to encourage students to ask for help. This was done during the implementation of the research activities when students displayed 'Traffic lights' cards on their desks: 'red cards' if they were stuck, 'yellow cards' if they had questions and 'green cards' if they understood what they were doing (Wiliam and Leahy, 2015, p. 174).

Finally, during the study, an hour of weekly homework was set and the 'homework help board' technique was utilised. This was to facilitate time management while promoting peer support.

3.4 Ethical considerations

Denzin (1989, p. 83) highlights that 'the lives and the stories that we hear and study, are given to us under a promise' that we protect those who have shared them with us. BERA (2004, p. 5) further stresses that all educational research should be conducted within a framework of respect for quality of knowledge, respect for democratic value and respect for participants. In view of this, this study was conducted consistent with the strict guidelines provided by BERA (2004, 2011).

Prior to the commencement of the study, CUREC approval was granted. A written consent was sought from the head teacher of the school under study (see Appendix 7), and approval was consequently granted for the research to be conducted in the school. Also, since the interview was audio recorded, parents' permission was sought in line with CUREC-approved procedure numbers 15 and 25. In this study, the respect for the participants was my priority (Denzin, 1989), and for that matter, informed consent became an integral part of the whole process. Before the start of the study, its nature and purpose were communicated to the participants, and all of them consented verbally (LeCompte and Schensul, 2013). The participants were also made aware that taking part in the study was voluntary and that they were free to opt out at any stage. At the end of each questionnaire, participants were asked to tick a box (see Appendix 1) to indicate that their consent has been given for the information they have provided to be used.

Also, to respect the democratic value of the participants (BERA, 2004, 2011), all the research questionnaires were completed on paper and within my lessons. This was to allow all participants to have equal and easy accessibility. The completion of the questionnaires was restricted to 10 minutes. This was to allow enough time for the participants to provide as much information as they wanted without feeling being pressured or rushed while also ensuring that

much of the lesson time is not lost. Furthermore, since the interviews were conducted during lunchtime, I provided an interview booking form where students were asked to book for the day and state the time that would suit them within the interview period. Also, in a lesson prior to each interview day, the purpose of the interview was explained, and predetermined interview questions were shown to the participants. This was to give them enough time and chance to decide whether or not they would participate in the interview process based on the explanation and the kind of questions that would be asked at the interview. The format of the interview was also explained to them (McNamara, 2009). Students were made aware that they were not obliged to respond to the interview request, and only those who were happy to talk about their experiences were interviewed. All the students were informed that their participation or nonparticipation in the research would not affect their learning.

To maintain a human element in my dissertation, while ensuring the confidentiality and anonymity of the participants, pseudonyms were used. As the research also required the participants to complete questionnaires in hard copy and engage in interviews, the data collected were held confidentially and kept in line with the current Data Protection Act. The audio tape recorder used for the interview was provided by my school, and it was securely protected by a personalised password. The audio was kept on the same recorder, and the data was not transferred over any network or portable media. Pseudonyms were utilised again in transcription, and this was done on a password-protected laptop. The sample of the students' work were made anonymous. Any data collected during the study, including the questionnaires, field notes and interview audio tapes, was stored in a locked cabinet in my classroom. At the end of the study, all the paperwork will be shredded, and the audio tapes will be deleted after I submit my work.

3.5 Collaboration

Since my research aims to contribute to wider school improvement priorities, I collaborated strongly with the assistant head teacher in charge of AFL, Paul (pseudonym). This was done right from the beginning to the end. Actually, he helped me with the initial choice of the research title before my supervisor offered further suggestions. My supervisor contributed in helping reword the title from 'developing leadership skills' to 'developing independent skills'. This facilitated a clearer area of focus, considering the time frame of the research. With his expertise in educational research, I collaborated with him in finding the right research questions. Before the research started, we went through all the questionnaires, interview questions and peer assessment evaluation forms. This was to ensure that the right activities are implemented to meet the objectives of the research and to allow validity of research methods. We also met regularly to discuss the progress of the research and identified any necessary changes.

Also, since the research was conducted within my department, the head of mathematics and other colleagues were in the loop. Before the research, we went through the tasks and the research activities to ensure they were appropriate for the research questions and objectives. We also planned piloted activities, and I used different groups to address some of the possible challenges during the AFL interventions. Upon identifying any such problems at the piloting stages, we met after school and adopted some of the tasks and activities. One PGCE student who got interested in my research and wanted to learn more about how she could implement AFL strategies effectively in her lessons also collaborated effectively in the study. On one occasion, she volunteered to teach one of my lessons. This helped me focus more on notetaking and facilitated effective observation of student interaction during the activities. Moreover, during data representation, I collaborated with one ITC teacher who helped me with a graphic of

the change in students' perception about AFL techniques. This is a significant ICT skill that I have learnt during this research.

3.5 Process of data analysis

After all the data has been collated, Microsoft Word 2010 was used to tabulate the responses. This helped provide a very simple comparison between the baseline responses and the postquestionnaires. Microsoft Excel 2010 was also used in processing and representing the data. This facilitated easier visualisation (Kraus, 2014), summarisation and comparisons (Winston, 2016) of the questionnaire data. The questionnaires administered in the study were coded. To allow students to rank their preferences in accordance with their own understanding and perceptions, ordinal values were assigned to attributes on the Likert-scale responses – '1 = Never', '2 = Rarely', '3 = Sometimes', '4 = Usually', '5 = Always' – for the skills the study aimed to develop. The same values were used when eliciting their thoughts about their engagement in mathematics lessons. However, when the study sought to explore how the AFL strategies have affected students' engagement and learning in general, 'Strongly Disagree', 'Disagree', 'Agree', and 'Strongly Agree' were used. The interviews, on the other hand, were transcribed for easier presentation and interpretation. They were coded to identify themes linked with the questionnaire responses (Cohen et al., 2011).

The use of the percentages and numerical values in interpreting the data was to facilitate easier comparison of the data from the pre and post questionnaires. The sample size for the study remained the same throughout. This means none of the students opted out at any stage of the study.

4. Results and discussion

In analysing the results obtained from the study, an inductive approach was utilised. This means that results have been discussed around the questionnaire responses. This provided a 'simple, straightforward approach for deriving findings in the context of focused evaluation' of the individual questions on the questionnaires (Thomas, 2006, p. 237). They are also presented with the interview data to ensure that greater insight is gained from the data to inform the research questions. However, the key points will be brought together to summarise the findings of the study.

4.1 Teamwork skills: Pre and post questionnaire responses

The pre questionnaire results showed that 23% of the students never or rarely felt confident when working in groups. Also, it was found that 33% never or rarely took a leadership role when working in groups. The number of students who never or rarely gave advice to other members on how to improve, on the other hand, was found to be relatively higher, representing about 40% of the respondents. More strikingly, while an average of 37% indicated 'Sometimes', only 17% (approximately 5 students) answered 'Always' across the five items on the team work skills upon which success was measured. This suggests that even though group work was used in lessons (prior to the study), the majority of these students lacked the confidence to share ideas or give constructive feedback to their peers.

The post questionnaire, however, saw a relative change in the perception of the students towards the technique. As shown in Figure 3, after the intervention, the proportion of students who said they never or rarely felt confident in group work decreased by 20% compared with the

pre questionnaire data. This means that out of the seven students who initially indicated that they felt less confident when working in a group, six enjoyed increased confidence after the intervention.

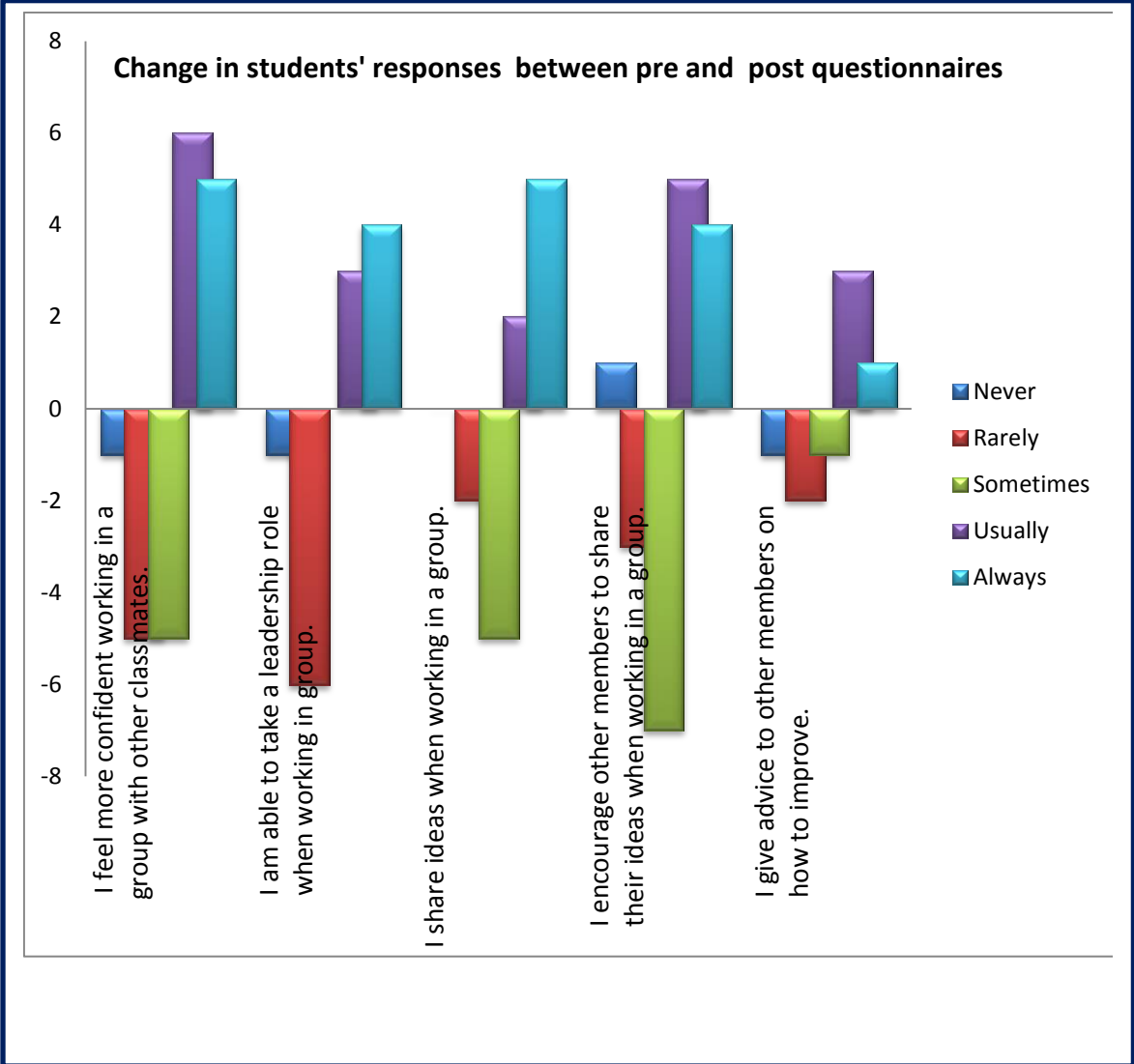
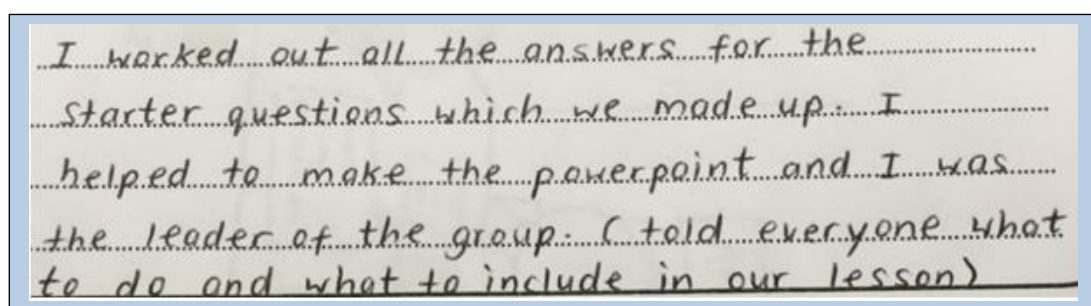


Figure 3: The numerical increase or decrease between the pre and post teamwork skills questionnaire responses for each statement on the Likert scale.

Remarkably, the students’ ability to share ideas and opinions when working in groups portrayed an ostensible ‘paradigm shift’ in their attitude towards group work. This is perceptibly evident in the figure above, where the number of students who indicated ‘Usually ‘or ‘Always’ increased by 7, indicating an increase of approximately 34%. In contrast, the study saw relatively little

change in the number of students ($n = 4$) who answered 'Usually' or 'Always' to the statement 'I give advice to other members on how to improve'. This is almost half as many students who indicated the same responses for sharing ideas in a group. This suggests that while the students became more confident and could share ideas, there was still a gap in their ability to give advice to others. This raises a question about how teachers can support students in peer assessment. It was also noted that while some students were able to provide some constructive feedback in the form 'Two stars and a wish' (see Appendix 5), others struggled with what they needed to write. I would suggest that to have a good knowledge of giving feedback to their peers, students must undergo training where the teacher would provide examples of good feedback and modelling the process of their own feedback. In this sense, a provision of sentence starters could be appropriate as suggested earlier by Wiliam and Leahy (2015).

Surprisingly, leadership ability surfaced as one of the notable elements of teamwork skills developed in the study. In the pre questionnaire, while 10 students indicated that they 'never' or 'rarely' took a leadership role when working in groups, this number decreased ($n = 3$) after the study. This means that, as the research evolved, not only were the students able to work in groups, but their ability to take up roles and initiate ideas within their groups was also enhanced (Barkat, 2014). This was perhaps facilitated by the individual and group accountability measures instituted in the group work activities, as evidence was found when I sought to find out the individual students' contribution towards their group work tasks. When asked 'Describe what you contributed to your group task', one student – Mariam T – who led her group, wrote:



I worked out all the answers for the starter questions which we made up. I helped to make the powerpoint and I was the leader of the group. I told everyone what to do and what to include in our lesson)

The development of such skills provides an overwhelming insight into how power and responsibility for students' learning process can shift from the teacher to individual students in a collaborative learning environment – something that Meyer et al. (2008) also found.

More generally, the study saw a continuous decrease in the number of students who indicated either 'Never', 'Rarely' or 'Sometimes' on the pre questionnaire, resulting in a positive change in the number of students who indicated 'Usually' or 'Always' in various elements of the teamwork skills. This, I believe, was enhanced by the new opportunities offered to students as one student pointed in the interview:

We used more strategies to help us learn. (Delia)

4.2 Effective participation: Pre and post questionnaire responses

Throughout my career as a classroom practitioner, I have observed that in their learning process, most students lack the ability to actively participate in classroom discussions. For some students, learning is an act where their primary function is 'consumer of knowledge'. In this sense, and in every class discussion, there are particular groups of students who always hope to 'remain invisible' and escape the teacher's attention. In other words, there are students who always try, in any way they can, to avoid participation. It was evident from the pre questionnaire responses that the students in this study were no exception. Even though they generally worked diligently in mathematics, showing great determination to learn and continuing to show their natural aptitude for the subject, involving themselves and participating in whole class discussions were major challenges. This became more evident in the pre questionnaire where 2 students stated emphatically that they never took part in class discussion. 12 other students, on the other hand, responded 'Rarely' while a further eight students answered 'Sometimes'. In sum, it was striking

that 22 of the students were not usually or always taking part in class discussion. This suggests that, before the study, the number of students who forgone the opportunity to develop their participation skills in the subject was proportionally higher.

The post questionnaire, however, provided greater insight into how this challenge began to change over time. Compared with the pre questionnaire data, the number of students who indicated 'Never' reduced from 2 to 1. Surprisingly, the study also saw a change in the number of students who stated 'Rarely' in the pre questionnaire data. This was reduced from 12 students to 5. This means that 7 more had begun to participate in class discussions. There are factors that could account for this change. Perhaps their eagerness to participate in discussions was driven by extrinsic motivational factors (Taylor and Wolters, 2012), or it could be attributed partly to the confidence they had developed earlier (Lakin, 2013).

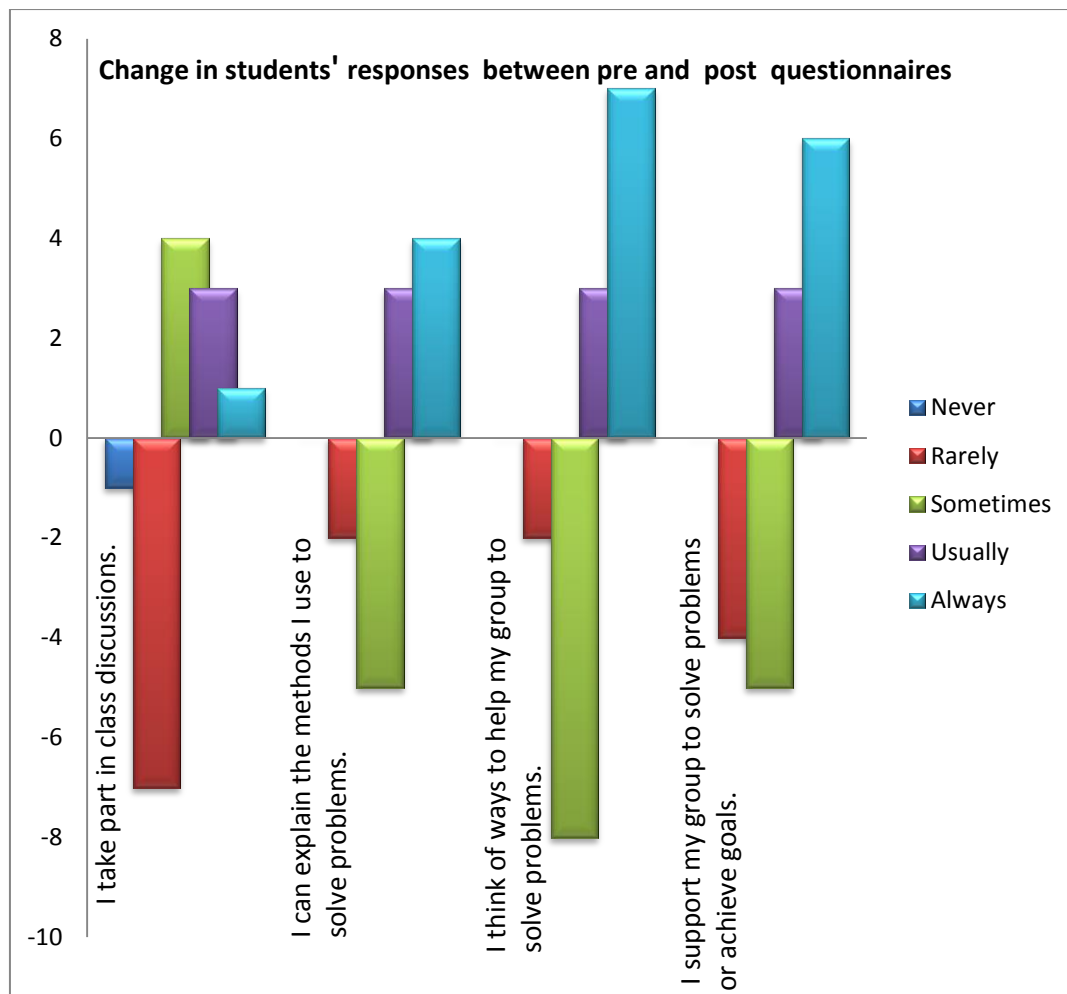


Figure 4: The numerical increase or decrease between the pre– and post–participation skills questionnaire responses for each statement on the Likert scale.

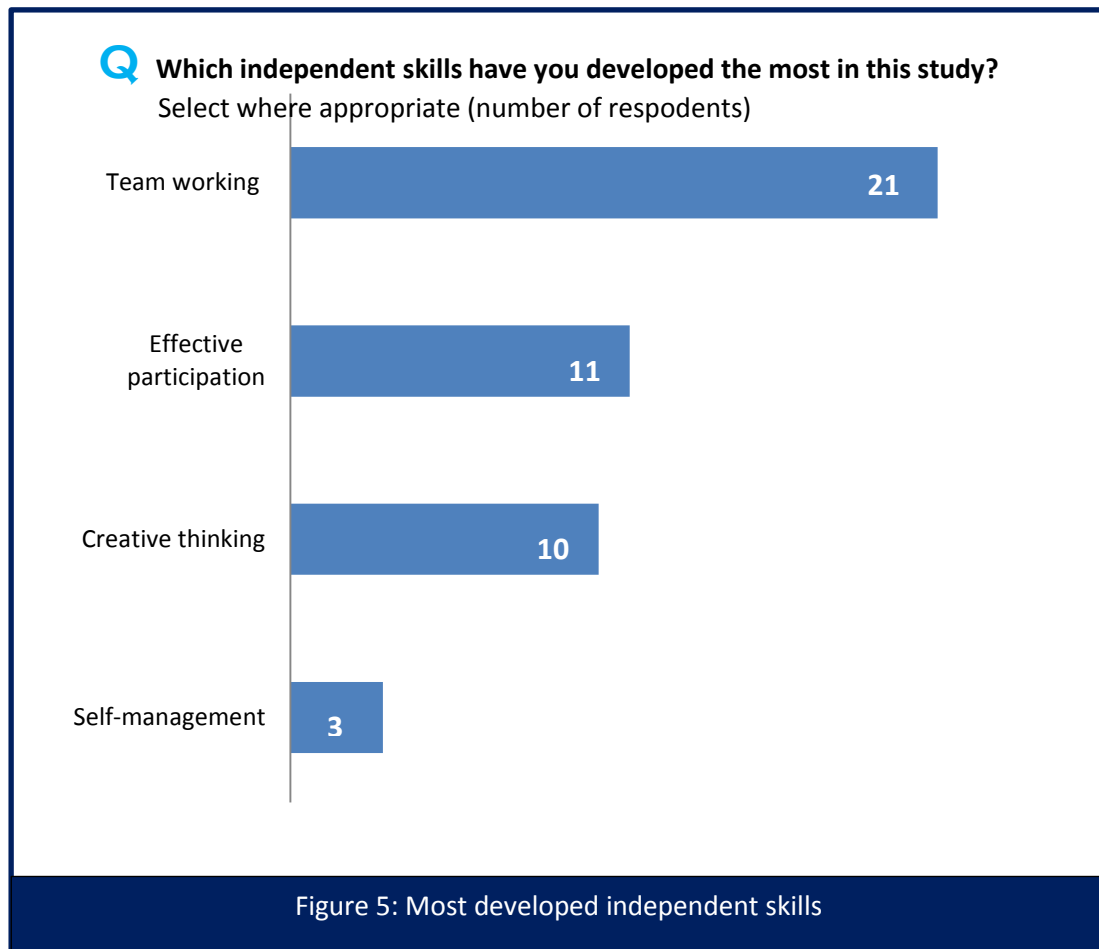
However, although the study saw a reasonable change in the attitude of the students towards classroom participation (Coates, 2007), putting together the number of students who responded 'Never', 'Rarely' and 'Sometimes', more than half (60%) of the respondents were not usually or always taking part in class discussion. This means that, during the study, only 40% usually or always participated actively in discussions. Nevertheless, this was slightly higher than the comparable proportion (27%) recorded in the pre questionnaire data.

Notably, it was observed that students' willingness to participate in the learning process is not automatic. More importantly, when participation is affected by confidence, similar to what

Skilling and Stylianides (2015) suggested, stimulating instructional strategies as well as extrinsically motivational incentives must be implemented.

4.3 Most developed skills

Having collected data to examine how AFL strategies employed in the study affected the development of the four spectra of independent skills delineated, the study further sought to explore the most developed skills. Through the weekly evaluation of the personalised independent skill targets set by the students, the degree at which independent skills were developed was observed to vary among individual students. For example, while some students mastered and developed only one skill when their personal targets were reviewed in a particular week, others developed more than one. This was dependent on factors such as the type of AFL technique implemented and the kind of activities associated with it. This was evident in the postquestionnaire when the question 'Which independent skills have you developed most in this study?' was asked. Of the 29 students who responded, 11 believed that they developed at least two skills while the remaining 18 indicated that they developed only one. One student, however, did not respond.



However, of the skills that the study sought to help the students develop, teamwork was identified as the most developed skill, with 21 responses. This is consistent with the findings of Marshall (2012). Surprisingly, none of the respondents indicated teamwork as their least developed skill. The importance of developing this skill through AFL strategies has been highlighted by several researchers as mentioned in the literature review. By ‘activating students as instructional resources for one another’ through group work and peer assessment (Wiliam, 2011; Barkat, 2014), it was observed that students who never or rarely felt confident when working in pairs or in groups became more involved in the group activities and shared ideas, with some getting into the habit of giving advice to others on how they could improve. For example, one student, Yasmine, who rarely shared ideas in small-group or whole-class

discussions, justified why working in such a collaborative environment helped boost her confidence in mathematics. In the post questionnaire, she stated:

[i]t gave me confidence to share ideas in class as I was afraid of having the wrong answer.

For other students, their autonomy in class was developed, as their responses revealed a radical shift in their dependency culture ideology:

We did not need the teacher as much as we could work with each other. (Nadia)

This suggests that when using students as instructional resource for one another, students' teamwork skills can be developed if pairs or groups are well-structured and activities are purposefully planned (Lee, 2006). Students, thus, become self-regulatory learners (Zimmerman, 2002); the teacher is then seen as a learning facilitator (Wang, 2016).

However, apart from the teamwork skills developed, change was evident in the students' ability to actively take part in class discussion. Effective participation was identified as the second most developed independent skill. This was reported by 11 respondents, more than thrice as many students who identified self-management as their most developed skill. However, there was no substantial difference between the number of respondents who identified effective participation (n = 11) as their most developed skill and those who identified creative thinking (n = 10).

4.4 Least developed skills

Although the study saw a general change in the development of the students' independent skills, not all skills were developed at the same rate. For example, for some skills such as teamwork, the study noted a considerably higher rate of development compared to other skills like self-management whose rate of development was relatively slower.



On skills that were least developed, as evident in Figure 6, 13 students indicated self-management skills whereas 9 in each case identified creative thinking and effective participation, respectively. It was really surprising, however, to find that the skill which forms the core of the self-regulation framework was identified as the leading challenge for many students.

If students struggled with the ability to organise their time and reflect on their work to know what skills they need develop or improve, then the sample used in this study confirmed the problem Wiliam and Leahy (2015) believe most students encounter: 'learning how to learn' (p. 169). This raises concern about how teachers can constantly and effectively engage students to take ownership of their learning, most especially during the implementation of AFL strategies. 'Such change of ideology', as pointed out by Marshall (2012, p. 50), requires time and resources where in most cases classroom contracts need to be reconstructed with students (Heritage, 2010) and where they will be guided to create their own agreements or targets personalised to their learning.

4.5 The impact of AFL techniques

The study also sought to explore the specific AFL techniques that students identified as helpful in developing the skills outlined in the study. To bring this to life, in the postquestionnaire the question 'Which AFL techniques have helped to develop/improve on your independent skills?' was asked.

Q What specific AFL techniques have helped to develop students' independent skills?

Select where appropriate (% of respondents)

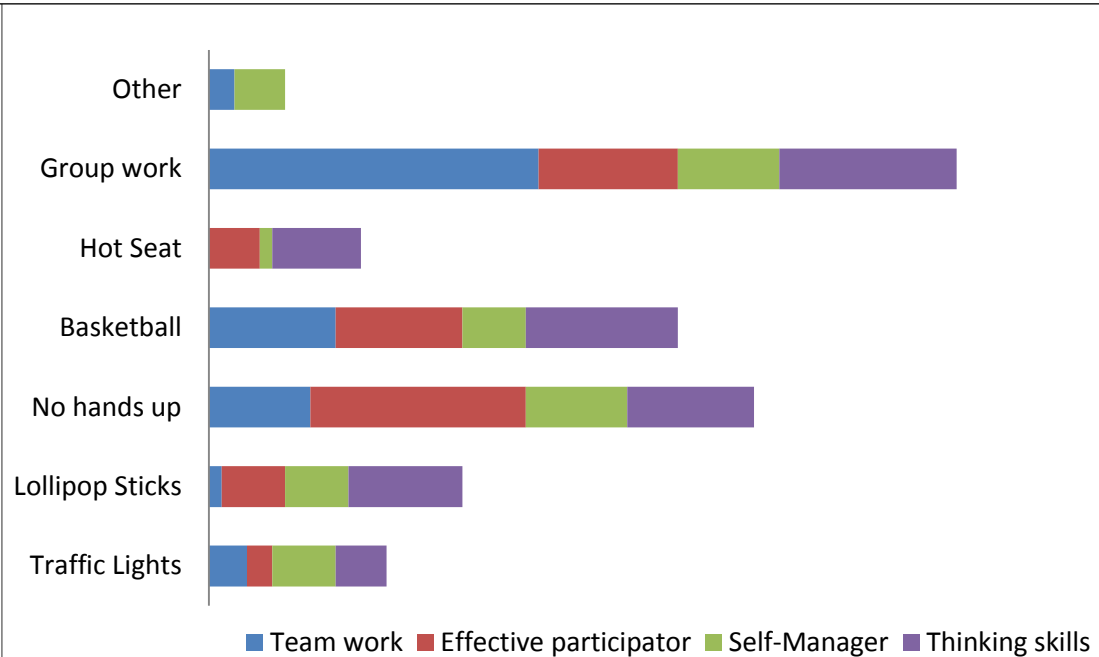


Figure 7: The Impact of AFL techniques on independent skills

As evident in Figure 7, of the 30 students who took part in the study, 26 believed that group work enabled them to develop their **teamwork** skills. This was seen to be proportionally higher than the 17 students who identified 'No hands up' as the best technique that developed or improved their **participation skills**. In terms of **thinking skills**, a higher proportion of the respondents (n = 14) indicated group work while 10 also identified 'Basketball discussion'. 'No hands up', on the other hand, appeared in 10 of the responses. Other techniques such as 'Lollipop sticks' and 'Hot seat' were also identified as significant AFL techniques in enhancing the development of their thinking skills. With respect to **self-management skills**, the responses appeared to be almost normally distributed with the same mode, median and mean value of approximately 15 students across all AFL techniques, with the exception of 1 student who indicated 'Hot seat'.

Therefore, while certain specific techniques dominated in the development of certain skills, the development of self-management required the combination of all the techniques. Perhaps this seems to illustrate why self-management was identified to be the least developed skill in the previous discussion. This suggests that in using the AFL strategies to develop independent skills, paying attention to the techniques implemented is vital since not every technique is useful in developing every skill.

Nonetheless, it is also not impossible for several independent skills to be developed through one specific technique. For example, in the open-question responses, one student, Judy, arguably believed that group work helped her improve on all four independent skills that the study targeted. Such belief, however, was noted to have been borne out of the interest that some students had for a specific AFL technique. Another student, Hafsa, was also noted to have developed an unusual interest for the 'No hands up' technique and accordingly identified it as the main technique that helped her develop or improve on all four skills.

4.6 Does the AFL technique matter?

In an additional questionnaire administered to elicit student perception about the implemented AFL strategies, the technique was also found to be not only a contributing factor to developing teamwork skills and involvement but also a "strategic catalyst" that helped boost the confidence of students in mathematics.

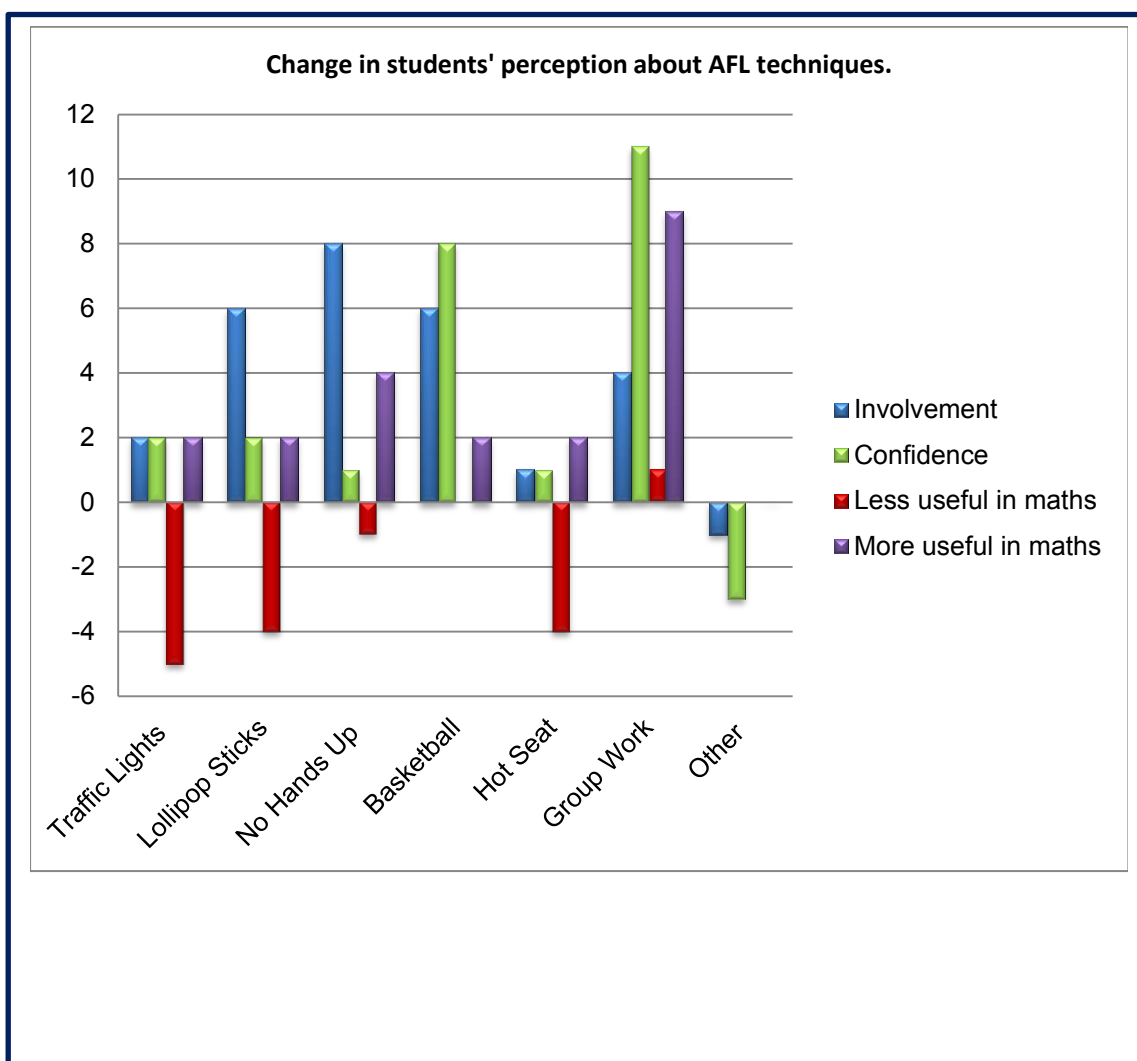


Figure 8: The increase or decrease in the number of students who changed their perceptions about the AFL techniques. The upwards bars indicate the numerical increase while the downwards bars show how much the number of responses in the pre questionnaire dropped after the study (for each attribute).

As shown in Figure 8, the students' passion for group work was an outstanding feature of the study as it was identified as a contributing factor to their involvement as well as a 'strategic catalyst' in boosting student confidence in mathematics. The study saw that the success of the group work is not determined by the size of the group but its structure (as asserted by Lee (2006). This implies that when a group is well-structured and carefully planned peer evaluation measures are put in place to ensure individual accountability, individual students exert more effort in accomplishing set tasks (John and Johnson, 1994). The execution of this technique is

more evident in the figure above where 4 more students believed that it helped improve their involvement in mathematics lessons. Similarly, a significant number of students (9 more) believed that the technique boosted their confidence in mathematics lessons. More strikingly, 9 more students also identified group work as useful, and they unequivocally reiterated that it must be used more often in lessons.

Different students shared different experiences about the technique:

Group work has helped me boost my confidence in maths because it let me talk to others. (Nadia)

Group work makes me feel confident when I'm working with peers. The others make sure I contribute. (Hannah)

I was able to solve questions with my friends. (Zoe)

It is also evident in the figure above that even though group work played an important role in getting the students to be involved in lessons, 'No hands up' was identified as the strongest technique that stirred them to get involved in lessons. This was consistent with the results presented in Figure 7 where 'No hands up' was also identified as vital in enhancing and developing students' participation skills in mathematics. Some justifications were offered in the open responses, which accordingly provided insight into how students felt about 'No hands up' and how it enhanced their involvement. One student, for example, expressed how the technique got her to pay attention and be prepared to answer questions in lessons:

[Y]ou don't know if you're gonna be picked. When you're chosen you have to talk. (Uluka)

The extended response by another student provided further evidence that not only did the technique cause the students to involve themselves 'behaviourally', but it also triggered their 'cognitive' investment (Fredricks et al., 2004):

Because you have to be working the maths out in case you get chosen or need to help someone else. (Stephanie)

Similar justifications were also offered for other randomised techniques such as 'Lollipop sticks' and 'Basketball discussions'.

However, one interesting observation that surfaced in the study was that how some students felt about 'No hands up' stood in opposition to the teacher's point of view of the technique. As I circulated around the classroom to take note of any comment by the participants regarding their perception about the AFL techniques, it emerged that students who did not want to put their hands up to share ideas during discussions did so to protect their self-esteem. In other words, while some students had a positive attitude towards 'No hands up', others saw the idea as a threat to their self-esteem. From the beginning of the study, one student, Delvor, who worked conscientiously in class and took pride in her work, appeared to feel uncomfortable when 'No hands up' was strictly implemented. When asked why she did not embrace the technique, she explained that:

It shows other people what I can't do and that can, sometimes, be embarrassing.

This and similar comments provided an insight into the extent to which students' area of development could be affected by their perception of certain techniques that teachers use in the students' learning process. Mostly, when such perceptions are negative, the development of the prerequisite skill needed to enhance progress would likely be hindered. For that matter, in observing behaviour during the implementation of the techniques, particular attention was paid

to the responses that needed further consideration in both the interventions and the follow-up interview process (Mack et al., 2005).

It was interesting, however, to note (after the study) how some of these students adopted an entirely new stance towards the 'No hands up' technique. In an interview, Delvor, for example, expressed how 'No hands up' helped boost her confidence in lessons:

It gave me confidence to share ideas in class as I was afraid of having the wrong answer.

Notably, the majority of the students who did not raise their hands in lessons would have continued to 'remain invisible' if participation in research lessons was to be optional. Even though the study found lack of confidence and the fear of getting a wrong answer as key factors hindering some students from participating in class discussions, some of the other reasons found go beyond the scope of this research. It could be that some students prefer not to be noticed in class or that they may be very reserved. One such student reinforced the latter case when she pointed out during the interview that:

I'm not a person who puts my hand up a lot. (Mackenzie)

For other students, it all boils down to the notion of what they personally perceive as their 'likes' and 'dislikes'. The response from a different student elaborated on this assertion:

I generally don't like putting my hand up. (Fiona)

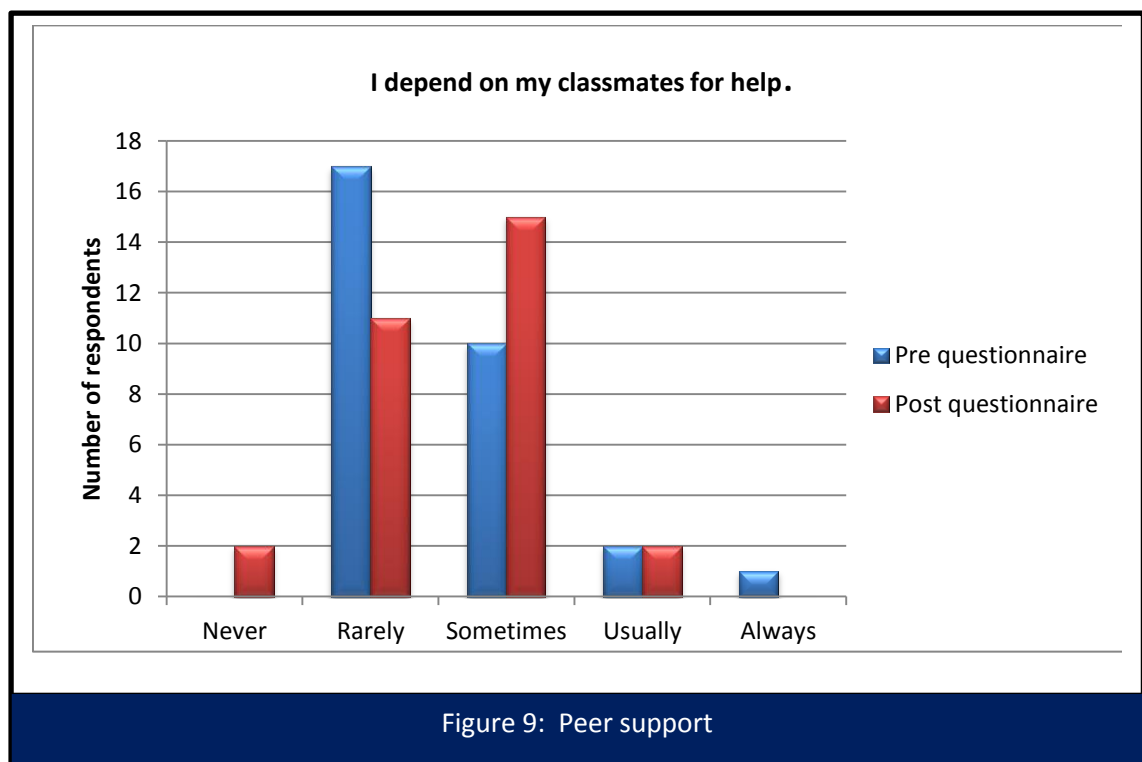
However, whatever the students' feelings or perceptions about the 'No hands up' technique could be, the evidence presented in the figure above shows that if participation in class through hand-raising was made optional, many students in this study would have forgone the opportunity of developing their participation and confidence skills (William, 2011).

4. 7 The impact of AFL strategies on engagement

The last thing that the study sought to explore was the extent to which AFL strategies can affect the engagement of the students in maths lessons.

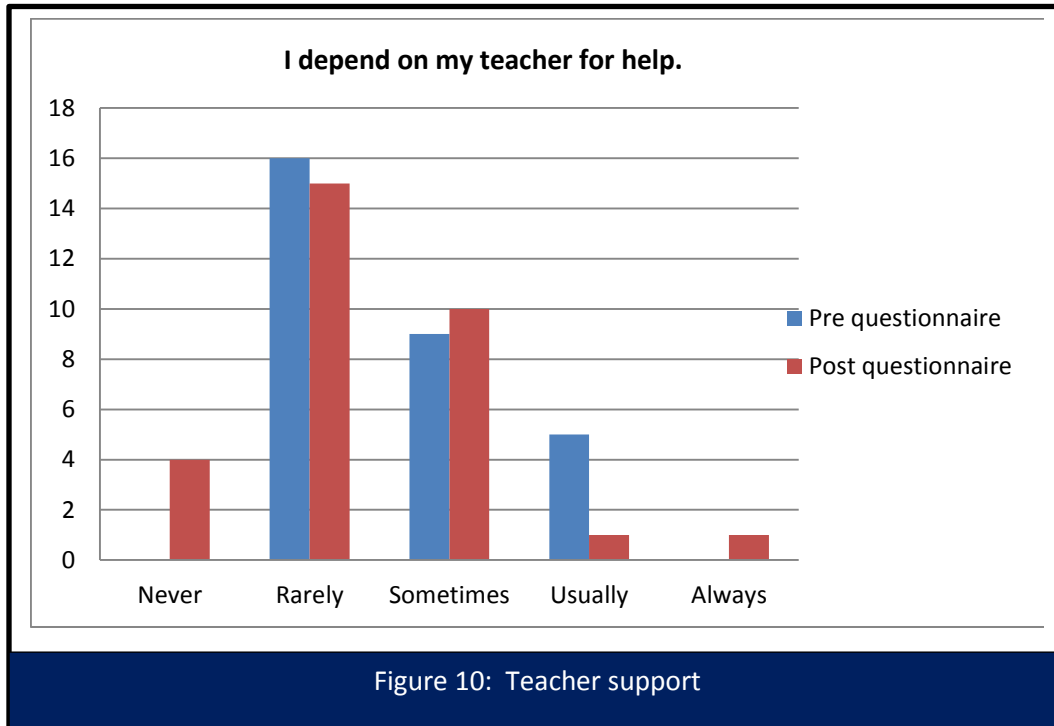
The study saw an improvement, through observation, in the effort that the students put in completing the class activities, how they related with one another and the zeal to ask for help where necessary. Appendix 4 further shows that the cognitive engagement of the students was also affected. For example, in responding to the statement ‘I think about different ways to solve mathematics problems’, the number of students who indicated ‘Sometimes’ was reduced from 11 to 3, and those who answered ‘Always’ increased from 1 to 8 when the pre and post questionnaires were compared.

Another significant improvement highlighted in the study was the change in the degree at which they supported themselves.



As the study evolved, some of the students began to work individually. As shown in Figure 9, 7% of the students never asked for help from peers. Notably, there was numerical swing between the number of students who 'rarely' depended on peers for help and those who 'sometimes' did. The decrease in the number of students who said they 'rarely' depended on peers for help from 57% to 37% and the corresponding increase in those who indicated 'sometimes' from 33% to 50% showed a noticeable improvement in their attitude towards peer support. In this case, they acknowledged the need to seek help from peers while seeing the teacher as a last resort. This contributes to the whole school's overarching vision of developing competencies in students alongside their academic knowledge through the 'Help I'm Stuck' learning arrow (see section 1.3).

Interestingly, while students recognised the role of peer support in the learning process, the evidence provided above showed that none of them was noted to be always dependent on peers. This could mean that the students explored all the ways that they could tackle any activity implemented in the study before talking it through with their peers. In effect, the degree of the "dependency culture" was reduced. This was revealed in the post questionnaire where the number of students who never depended on the teacher was four times as many as those who always did. The study also saw another development, as evident in Figure 10, where the number of respondents who indicated that they never or rarely depended on the teacher for help rose from 53% to 63%.



The overall effect of the AFL strategies on students' engagement was further explored in a separate questionnaire. All students completed the questionnaire. However, two did not respond to this statement.

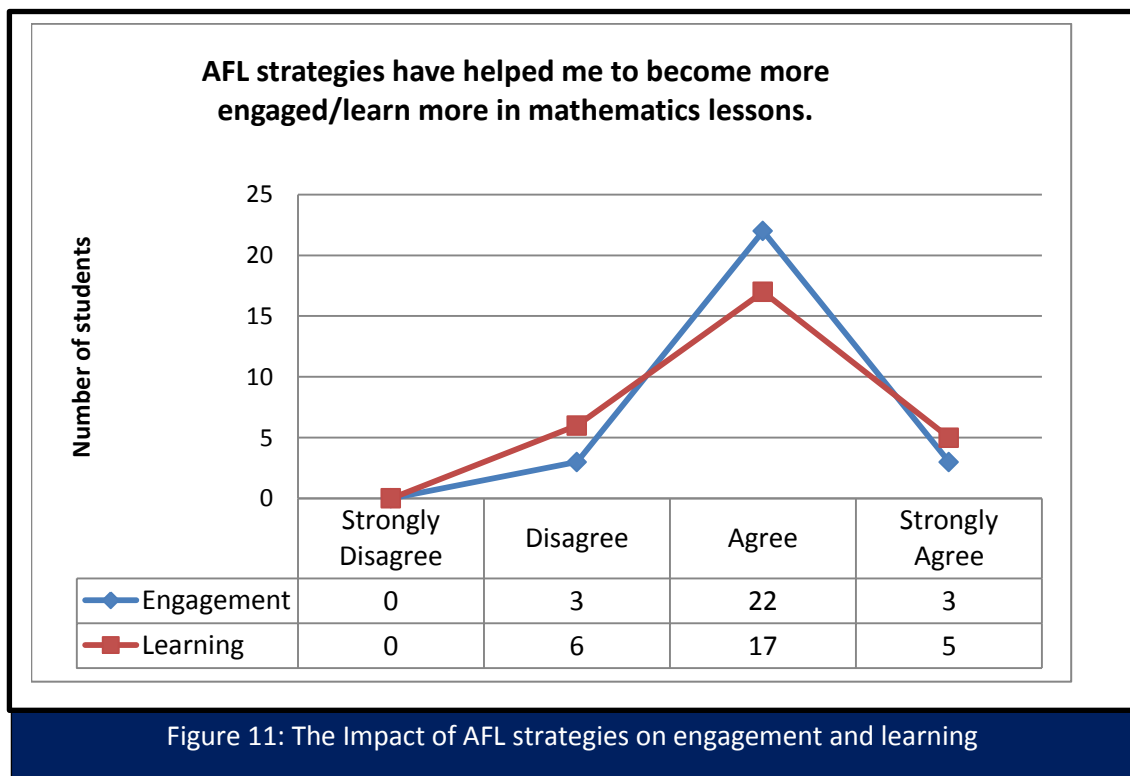


Figure 11 shows that of the 28 students who responded, 25 (89%) agreed or strongly agreed that AFL strategies have helped them become more engaged in maths lessons, with 3 (11%) disagreeing. Even though the study did not initially set out to measure the impact of the AFL strategies on the students' learning, it may be a contributing factor, as 79% of the students agreed or strongly agreed that the strategies did affect their learning.

The success in the students' zeal to engage in the study can be attributed to several factors. Firstly, the research activities were purposely 'designed to connect the student experiences to the real world' (Scott, 2015, p. 10). This in turn changed their focus, which consequently triggered their psychological investment in the activities and their willingness to complete the tasks successfully (Skilling and Stylianides, 2015).

1.

4m
1m
1m
1.8m
4m
Pond, radius 1m
Flower bed
Vegetable patch

- Area of the pond:
 $1m^2 \times 3.14 = 3.14m^2$
- Area of the Flower bed:
 $1m \times 1.8m \div 2 = 0.9m^2$
- Area of the vegetable patch:
 $1m \times 4m = 4m^2$
- Area of the whole garden:
 $4m \times 4m = 16m^2$
- $3.14m^2 + 0.9m^2 + 4m^2 = 8.04$
 $16 - 8.04 = 7.96$
Rounded up = 8
- She needs 8 pieces of turf
- Cost of turf:
 $4.60 \times 8 = £36.80$
- Price: £36.80

I rounded up as at stores you generally can not get the exact amount of turf.

well done

Sample of Student Work

Secondly, engagement was also driven by formative feedback and responses where the students were either asked to make critical reflections on how they could improve further (William, 2011) or justify the approach they used in tackling a problem.

Finally, this can also be attributed to the well-structured and purposely planned group work. In contrast to the traditional teaching strategy where students were normally asked to work in groups to work these tasks were planned and designed by

students. Students also delivered lessons to the rest of the class. The peer evaluation measures (see Appendix 6) put in place to gauge the individual student's contribution to the group were noted to contribute to the effect of AFL strategies on engagement.

One important thing observed in this kind of collaborative activity was that as the study evolved, the students were not only willing to put in necessary effort to seek understanding and share ideas in small groups, but they also adopted strategies to engage themselves in their learning process (see Appendix 4). This was seen as a strong attribute in the development of cognitive engagement (Fredricks and McColskey, 2012), a kind of mastery learning which Taylor and Wolters (2012) believe is triggered by goal orientation.

4. 7. 1 The disparities between engaged and disengaged students

Truly, while the majority of the students' involvement and participation in class discussion improved, the study also found distinct disparities among individual students. This was found after reviewing and evaluating the impact of the AFL strategies on five students who were "disengaged" in lessons and five who were "highly engaged" before the study. This classification and selection were made through observation and were also based on their effort and willingness in contributing to class discussions before the commencement of this study. The analysis and comparison of both the pre and post questionnaire data revealed that even though AFL strategies helped improve the general engagement of the students, the impact was observed to be proportionally higher among students who were not initially involved in lessons compared to their counterparts who used to actively participate in lessons. One of the factors that brought this change in the former was the use of randomised techniques such as 'No hands up' and 'Basketball discussions'. This was revealed during the interview when one of such students called the 'No hands up' technique the 'No way to escape' technique. Like many other

students, she justified that the technique helped enhance her effort and participation in lessons because:

[y]ou had to be involved whether you liked to or not. (Judy)

Two other students, on the other hand, cited group work as an intrinsic factor that contributed to the improvement in their involvement and participation in lessons. Justifications were provided as follows:

During the research we were put into groups and that helped me to speak to other people. (Mackenzie)

It got you to talking to other people so you relied more on them than just yourself.

I was doing stuff but it wasn't as effective doing stuff on your own. (Aida)

These responses appeared to be consistent with a study conducted by Nelson (2012), who found that engaging students in such learning experiences enables them to construct new meanings to their learning, which consequently enables them to 'think critically and create something that is greater than what each student could have created on their own' (Lee, 2006, p. 71).

However, for the students whose level of engagement was noted to have dropped during the study, as in the latter case, the cause of such disparity can be ascribed to several factors. One of the notable factors that accounted for this change was identified to be the restriction placed on their readiness to put their hands up to answer questions in class. The structured implementation of randomised techniques in selecting students to questions, thus, became the source of their frustration in lessons, as it deprived them of the opportunity to 'dislocate their shoulders in their eagerness to show the teacher that they have an answer to the question that the teacher has just asked' (William, 2011, p. 81). As a result, they began to react negatively to the changes in the lessons, and they began to display minor behaviour issues. One such student

attributed the drop in her engagement level and the change in her attitude to the boredom due to number of activities implemented in the lessons. This was revealed in the interview:

I started asking irrelevant questions because I started getting bored in class because we weren't doing as many activities . . . (Harley)

The above disparities in student engagement suggest that in implementing AFL strategies, teachers must differentiate both the AFL techniques and the tasks to meet the learning need of every student.

4.8 Summary of findings

4.8.1 To what extent can AFL strategies help develop students' independent skills in maths?

Comparison of the pre and post questionnaires of the study revealed that AFL strategies have potential in developing students' independent skills (Meyer et al.; 2008). In the development of teamwork skills, for example, the poststudy questionnaire revealed a 20% decrease in the number of students who never or rarely felt confident when working in a group compared with the prequestionnaire data. This means that AFL strategies have helped boost the confidence level (Paris and Paris, 2001) of the majority of the students which consequently enhanced their ability to develop, communicate and share ideas in a collaborative environment (Sebba et al., 2007). On the development of the students' participation skills, on the other hand, it emerged that although the AFL strategies contributed towards the participation of the students, only 40% usually or always participated actively in the discussion. Nevertheless, this was noted to be

slightly higher compared to the students (27%) who initially took part in class discussions as recorded in the baseline data.

The study also identified teamwork as the most developed skill. This is consistent with the findings of Marshall (2012). The main factors contributing to the success of group work were the structure of the group (in this case, a friendship group) as suggested by Lee (2006); the opportunity offered to the various groups to plan, design and teach their lessons to the rest of the class and the group work peer evaluation measures instituted in checking the individual student's contribution to their group work (William and Leahy, 2015). Notably, the majority of the students enjoyed this learning strategy – something that I have also introduced in other lessons and adopted by other colleagues in my department.

However, while students' participation and creative thinking skills were fairly developed as revealed through the questionnaires, self-management skills, on the other hand, were not developed. This was also revealed in the post study questionnaire where 43% of the students identified it as the least developed skill.

4.8.2 What specific AFL techniques can develop students' independent skills in mathematics?

It was interesting to note that the development of the majority of the skills delineated in the study was spread among the individual AFL techniques. A close analysis of the post study questionnaire showed that while 87% of the respondents believed that group work enabled them to develop their **teamwork** skills, 57% identified 'No hands up' as the best technique in the development of **participation skills**. Different students, on the other hand, attributed the development of **thinking skills** to a number of different techniques. For example, while 46% identified group work, 40% also indicated 'Basketball discussion', with 33% revealing 'No hands

up’ as a contributing factor to the development of their thinking skills during the study. ‘Hot seat’ and ‘Lollipop sticks’ also emerged as contributing factors but not as much as the other.

The study found the development of self-management skills to be problematic (Marhall, 2014) since the responses from the post study questionnaire appeared to be evenly distributed across the AFL techniques employed in the study (approximately 17%). This means that while certain AFL techniques such as ‘No hands up’ dominated in the development of certain skills (e.g., effective participation), developing such as self-management required the combination of many techniques. This could also mean the AFL techniques I used were not effective in developing these skills or that something else was needed.

There was a noticeable variation, however, in the students’ perceptions about the use of ‘Traffic lights’. While some students saw it as a technique that enabled them to access help from the teacher, the majority identified it as less useful in maths. The main reason, I noticed in the post questionnaire, was the lack of its potential to effectively involve them in lessons or help them manage their learning. I would, therefore, suggest that in using AFL strategies to develop independent skills, teachers must pay particular attention to the techniques implemented since not every technique is useful in developing skills.

4.8.3 To what extent can AFL strategies affect students’ engagement in mathematics?

The data collated from the questionnaires, interviews and observations revealed that AFL strategies have substantial impact on increasing students’ engagement (Cook-Sather, 2010) in mathematics. This was more evident in the post study questionnaire where 89% agreed that AFL

strategies have helped them become more engaged in maths. Students became more confident in a collaborative working environment, effectively developing, communicating and sharing ideas. Activating students as instructional resources for one another (Wiliam, 2011; Wiliam and Leahy, 2015), for example, not only motivated them to support each other but also provided them with the opportunity to critically assess each other's work, give constructive peer feedback as well as suggest ways to improve (Lakin, 2013). Thus, AFL strategies have enabled the students to develop a kind of mastery type of learning which built up their capacity to regulate their own learning (Edwards, 2014). As a result, the students viewed learning as an activity that they do for themselves instead of something dependent on the teacher (Zimmerman, 2002, p. 65). Consequently, this reduced the degree of the "dependency culture". Interestingly, the students developed the skill of either working on their own or seeking support from peers when they were stuck in class while relying less on the teacher (Barkat, 2014). However, this impact was not experienced by all students. This can also be attributed to the fact that engagement is dynamic and that it changes over time (Davis et al. 2012; Rimm-Kaufman et al., 2014).

Nevertheless, the study found, through observation, that peer feedback through effective collaborative learning enhanced the engagement of the students and shifted power from the teacher to individual students – something that was also found by Meyer et al. (2008).

Chapter 5: Conclusion

5.1 Recommendation

A significant number of studies have shown that AFL strategies affect students' independent learning (Wiliam and Leahy, 2015). Yet literature revealed a number of concerns in the approach and the strategies teachers use to elicit evidence of learning in mathematics lessons, as they do not provide students the opportunity to apply skills acquired in the classroom into other real-life situations (Hodgen and Wiliam; 2006; OFSTED, 2011; 2013; Wiliam, 2011). It was therefore important to me to find ways to help address this issue in my studies. I therefore explored how I can use AFL strategies and techniques to enable my students to develop their independent skills to regulate their own learning in mathematics and to equip them with lifelong skills to prepare them for the next stage of their education. I argue that AFL strategies not only have the potential to develop students' independent skills but also can enhance their engagement in mathematics lessons if carefully implemented.

The evidence from the studies including the interviews and observations suggest that the students enjoyed the studies, particularly the collaborative work. The reconstruction of the classroom contracts and the establishment of new practices showed that 'power does not solely reside with teachers, but it also shared with students' (Heritage, 2010, p. 100). This was reflected in the classroom environment, which increased emotional engagement (Davis et al., 2012). In addition, their ability to set personalised targets, think critically, reflect and evaluate their own learning improved; enabling to become self-regulatory learners (Creighton et al., 2015, Lakin, 2013; Zimmerman, 2002).

However, even though well-structured and purposefully planned AFL techniques and tasks contributed to this, the teacher's support was also needed in the intermediate stages of the implementation process to make the objectives achievable. Therefore, in implementing AFL strategies to foster skills development, I would recommend that teachers should provide the opportunity and approaches where students will be guided to take ownership of their own learning. Also, in using AFL strategies to develop independent skills, it is very important to pay particular attention to the techniques implemented since not every technique is useful in developing every skill.

5.2 Reflection and Evaluation

Throughout the study, I have critically reflected on the tasks as well as the AFL techniques I employed. I have also reflected on my professional practice in general. The disparities evident in the progress of 'engaged students' and 'disengaged students' left me with a crucial practical implication as classroom practitioner. As the students who became more engaged attributed their involvement and participation in the study to randomised AFL techniques and those who became disengaged attributed this to the boredom due to the slower pace in the research activities, this has provided me with greater insight to adopt differentiated AFL techniques in both my classroom practice and also to explore ways of engaging all students in mathematics lessons.

Nevertheless, some of my colleagues, including Lizzie, a PGCE student, have benefited from the study since they have used the research activities in their normal lessons. The presentation of the research findings to my department was also beneficial, as it contributed to the department's improvement plan. I am yet to present the findings to the whole school at the

appropriate CPD programme. However, what excites me at the moment, and something that I am earnestly looking forward to is the school's plan to use my research group for the production of EFA videos about the use of success criteria in lessons. The confirmation email from the assistant head teacher in charge of AFL summed it all:

This is to confirm that we will arrange for the new technician to video record about 5 students in your Year 8 research group (Year 9 in September) talking about the use of success criteria when learning. This video will be used in the next whole school EFA session in the new school year.

Thus, my research not only contributed to the wider school aim of sharing good practices rooted from an inquiry-based practice, but it also progressively contributes to one of the improvement priorities of the school – the EFA project.

In summary, my students have found my research very useful, as it not only helped them develop relevant lifelong skills but also significantly affected their engagement in mathematics lessons though the impact was not felt by all. I accept that not all the independent skills delineated in the study were developed by the students, but I also think the length of the study may be a contributing factor. Also, other limitations such as absenteeism may have prevented some students from experiencing the full impact of the study. For example, at the start of the study, one was absent for two weeks; in the middle of the study, another was also absent for two weeks. These two students told me at the end of the study that the strategies did not have an effect on them. In future studies, I would have to examine whether a longer period could make a difference in the development of independent skills.

Nevertheless, the research has also helped me adopt new and innovative teaching strategies. This has also reflected on the enhancement of my students' learning. The collaborative element

of the research helped me work effectively not only with colleagues in my department but also those from other departments. This is very important not only for the development of my professional practice but also for the deepening of my relationship with colleagues. I adopted and adapted new ideas from colleagues, and that contributed immensely to the development of my IT and presentation skills. In general, this is the most engaging and fulfilling teaching experience that I have ever had, and it satisfies my desire.

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Appendix 1: Pre and Post Questionnaires

Please read each statement carefully and circle a number to show your response. Please make sure that your responses are as honest as possible.

Students' Engagement in mathematics Lessons

Statement	Never	Rarely	Sometimes	Usually	Always
1. I work hard in Maths lessons at all times.	1	2	3	4	5
2. I talk about Maths to other students in class.	1	2	3	4	5
3. I think about different ways to solve Maths problems.	1	2	3	4	5
4. I work independently without asking for help.	1	2	3	4	5
5. Students in my class help each other.	1	2	3	4	5
6. I share ideas during whole class discussions.	1	2	3	4	5
7. I share ideas in small group discussions.	1	2	3	4	5
8. I depend on my classmates for help.	1	2	3	4	5
9. I depend on my teacher for help.	1	2	3	4	5
10. I enjoy learning Maths.	1	2	3	4	5
11. I feel bored in Maths lessons.	1	2	3	4	5
12. I learn a lot when I work in a group with my classmates.	1	2	3	4	5
13. I enjoy working on my own.	1	2	3	4	5
14. I find it difficult to ask questions when I get stuck in lessons.	1	2	3	4	5
15. I help other students when they don't know what to do in class.	1	2	3	4	5

Independent skills statement	Never	Rarely	Sometimes	Usually	Always
Team-Working					
1. I feel more confident working in a group with other classmates.	1	2	3	4	5
2. I am able to take a leadership role when working with my classmates.	1	2	3	4	5
3. I share ideas when working in a group.	1	2	3	4	5
4. I encourage other members to share their ideas and opinions when working in a group.	1	2	3	4	5
5. I give advice to other members on how to improve.	1	2	3	4	5
Effective Participant					
6. I take part in class discussions.	1	2	3	4	5
7. I can explain the methods I use to solve problems.	1	2	3	4	5
8. I think of ways to help my group to solve problems.	1	2	3	4	5
9. I support my group to solve problems or achieve goals.	1	2	3	4	5
Self-Management Skills					
10. I set out my work neatly.	1	2	3	4	5
11. I organise my time and complete all classwork or homework on time.	1	2	3	4	5
12. I remain focused in class and complete my work, even if there are distractions.	1	2	3	4	5
13. I reflect on my work to know what skills I must develop.	1	2	3	4	5
Thinking Skills					
14. I ask relevant questions in class.	1	2	3	4	5
15. I criticise and provide evidence to support my ideas and opinion.	1	2	3	4	5
16. I can link original and new ideas to complete a task.	1	2	3	4	5
17. I can decide on which information is useful when completing tasks.	1	2	3	4	5
18. I change my ideas to adapt to new situations.	1	2	3	4	5

AFL strategies and techniques questionnaire

This questionnaire asks for your thoughts about the AFL techniques used in this study. Please read each statement carefully and tick where appropriate. Please make sure that your responses are true reflections of your own personal experiences.

1. Which independent skills have you developed the most in this study?

- ☐ Team worker
- ☐ Effective participator
- ☐ Self - manager
- ☐ Independent thinker

2. Which independent skills have you developed the least in this study?

- ☐ Team worker
- ☐ Effective participator
- ☐ Self - manager
- ☐ Independent thinker

3. Which AFL techniques have helped to improve on your team-working skills?

- ☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work
- ☐ Other (specify)

4. Which AFL techniques have helped you to become an effective participant?

- ☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work
- ☐ Other (specify)

5. Which AFL techniques have helped to improve on your self-management skills?

- ☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work
- ☐ Other (specify)

6. Which AFL techniques have helped to improve on your thinking skills?

- ☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work
- ☐ Other (specify)

7. Which AFL techniques have helped to improve on your involvement in mathematics?

☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work

☐ Other (specify)

Please give reason(s)

8. Which techniques have helped to boost your confidence in mathematics?

☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work

☐ Other (specify)

Please give reason(s)

9. Which AFL techniques do you find less useful in mathematics lessons?

☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work

☐ Other (specify)

Please give reason(s)

10. Which AFL techniques would you like to be used most often in mathematics lessons?

☐ Traffic light ☐ Lollipop Sticks ☐ No hands up ☐ Softball ☐ Hot seat ☐ Group work

☐ Other (specify)

Please give reason(s)

11. AFL strategies have helped me to become more engaged in mathematics lessons

☐ Strongly Disagree ☐ Disagree ☐ Agree ☐ Strongly Agree

12. AFL strategies have helped me to learn more in mathematics lessons.

☐ Strongly Disagree ☐ Disagree ☐ Agree ☐ Strongly Agree

I give permission to use the information I have provided in your university essay and for it to be shared with colleagues in this school. Please tick this box to indicate your consent ☐.

All information provided in this study will be anonymous.

Appendix 2: List of predetermined interview questions

1. Could you describe the independent skills that you have developed or improved during this study?
2. Which AFL techniques do you think have helped you to develop those skills?
3. Are there any independent skills you would like to develop further?
4. How have the AFL strategies affected your engagement in mathematics lessons?
5. If this study was conducted again, what would you do differently to develop other skills?
6. What were your favourite tasks or activities in this study?
7. How did these activities or tasks help you to improve your skills?
8. In one sentence only, describe your experience in this study.

Interview schedule and transcript

Interview number	students	Date	Time
1	Delia Mariam	15/06/17	13:20 – 13:30
2	Judy Harley Fiona Delvor Biyu	20/06/17	13: 40 – 13:50
3	Aida	27/06/17	13: 35 – 13:45
4	Mackenzie	28/06/17	13: 20 – 13:30
Pseudonyms have been utilised.			

Question 1: Can you describe the independent skills that you have developed or improved in this study?

Interview number	Student	Response	Key independent skill developed
1	Delia	I've have been able to work on my own more often than before.	Self-management
	Mariam	I think I have developed to give advice to other members because I was the group leader when we were doing the presentation so [emmm] I gave advice to the other members on how to improve to make our presentation better.	Team work/ participation
2	Judy	I've been able to participate more in group discussions.	Participation
	Harley	I think self-management skills because I now have a neater handwriting and better classwork presentation.	Self-management
	Fionna	Team work skill because we haven't done a lot of this before in maths and it is something that is good to develop.	Team work
	Delvor	My participation skill has improved.	Participation
	Biyu	Well, I think participation skill.	Participation
3	Aida	Team work skills because it's made me to be less dependent. <u>Interviewer: Before the study, you were not involved in class discussions, why?</u> I guess I'm afraid that I will get it wrong and also afraid of asking for help. <u>Interviewer: why are you afraid of asking for help?</u> I just don't like asking for help, I guess. I find it embarrassing.	Team work/ participation
4	Mackenzie	Team working skills because during the research we were put into groups and that helped me to speak to other people.	Team work

Question 2: Which AFL techniques do you think have helped you developed those skills?

Interview number	Student	Response	Key independent skill developed
1	Delia	Basketball discussion because it makes you more engaged and attentive in the lessons.	Thinking skills
	Mariam	Yeah, because it made me participate more, I normally don't put my hand up because I can't be bothered but if you catch the ball, you have answer it so, <i>(you don't have a choice - Delia interrupted)</i> , yeah. <u>Interviewer: Why are you not bothered to put your hand up?</u> Because, [ermm, she paused], I don't know	Participation
2	Judy	No hands up because you had to be involved whether you liked to or not. Also, you never know when you gonna get picked; it forces you to pay attention.	Thinking skills Participation
	Harley	'No hands up' as well because it's fun just picking people and you get to know everyone in the class because you have to pick someone new each time. It helps you to know their names.	Participation
	Fionna	I like group work because it allows you to work together in a group and share ideas	Team work
	Delvor	'No hands up' because obviously you are picking other people in the class and it's quite funny when they aren't paying attention.	Participation
	Biyu	'Softball' because it's fun	
3	Aida	Group work because it got you to talking to other people so you relied more on them than just yourself. ... I was doing stuff but it wasn't as effective doing stuff on your own.	Team work Self-management
4	Mackenzie	No hands up because I usually get randomly chosen. I don't usually put my hand up. <u>Interviewer: Why don't you put your hand up?</u> Because I'm scared, in case, I get the answer wrong.	Participation

Question 3: How have AFL strategies affected your engagement in mathematics lessons?

Interview number	Student	Response	Key point
1	Delia	They haven't affected me much <u>Interviewer: Why?</u> Well, Ermm, it only affected me in the group work but to be honest, on learning, I kind of think I have just been paying a bit more attention in maths but I still haven't learnt how to enjoy maths and not get bored; It hasn't helped me with that at all.	Her engagement was not affected
	Mariam	Yeah, I think it's affected my engagement because I participate more. Lot of techniques make you like answering questions and stuff.	More engaged
	Judy		
	Harley	<u>Interviewer: You improved on setting out your work neatly</u>	

2		<u>but your engagement, in general, did not improve. Can you explain why?</u> I started asking irrelevant questions because I started getting bored in class because we weren't do as many activities.	Disengaged
	Fionna		
	Delvor		
	Biyu	<u>Interviewer: Looking at your target sheet, I can see that your engagement did not improve. Can you explain why?</u> Ermm, because sometimes the group work got a tiny bit off track.	Disengaged
3	Aida	It got me more comfortable to speak out and I've been asking my classmates for help more often.	Gained confidence
4	Mackenzie	It made me participate more, like getting me involved.	Engaged

Question 4: In one sentence only, describe your experience in this study.

Interview number	Student	Response	Key point
1	Delia	Delia: It's completely different strategy than what we normally do in lessons. <u>Interviewer: Give an example.</u> We used more strategies to help us learn. We did more group work and more AFL techniques like 'softball' etc.	Different approach to teaching and learning.
	Mariam	I think it was good; it's different from normal lessons as we did group work like Delia said. I think it also helps you to get to know and work with the other people in the class.	Team work and knowing others.
2	Judy	Not only I liked because it was different from normal lessons but then you also got to focus on what you wanted to achieve instead of going to into a maths lesson and do work in there. Ermm , yeah, I liked it!!!	Self – regulatory learner
	Harley	It was interesting.	Enjoyment
	Fionna	I will also say it was different too because we usually don't learn in interactive ways like that.	Interactive
	Delvor	It was different because it's kind of like you have to reflect on everything that you do.	Reflection
	Biyu	I think it was like new, and, I don't know – yeah, just new <u>Interviewer: Just new, how?</u> Well, because we don't really try any of that; we never learned in that sort of way.	New ways of learning.
3	Aida	It's good and it helps you to work in group more. I'm glad that I've been able to improve on my team work and participation skills.	Developed new skills
4	Mackenzie	It was great!!! My favourite part was, probably, creating the lessons. Everyone in our group got involved and it helped me with my team work skills.	Involvement

Appendix 3: Personalised targets

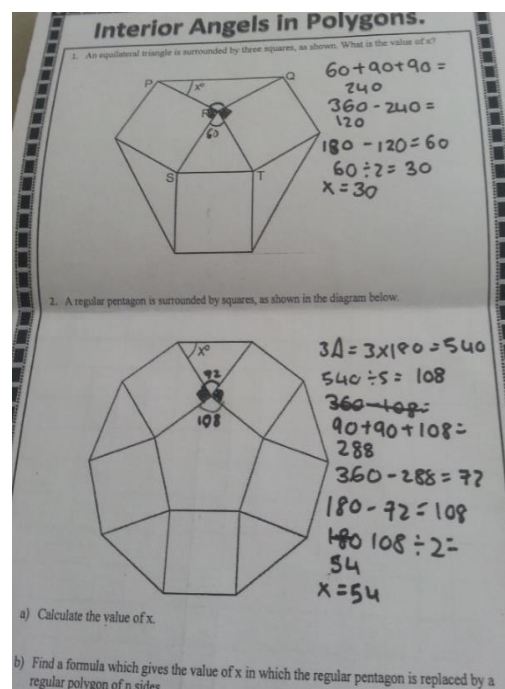
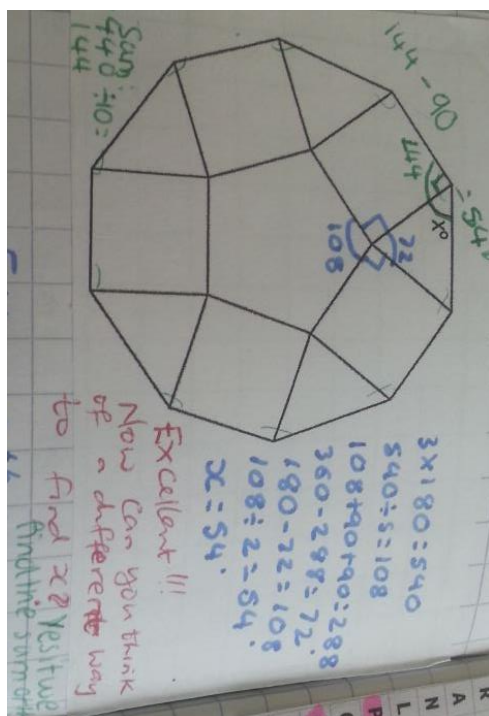
The targets individual students anticipated to achieve by the end of the study. These were set after completion of the pre questionnaire.

The Skills I need to develop in Maths Lessons					
Name: XXXXXXXXXX	Date: WB- 08/05 Topic: Interior angles in polygons				
Statement					
Engagement in Maths lessons					
1. To enjoy learning Maths.			9/5 ✓	17/5 ✓	
2. To think about different ways to solve Maths problems.				9/5 ✓	10/5 ✓
3. Ask questions when I get stuck in lessons.					9/5 ✓
Team-Working					
1. Give advice to other members on how to improve.			10/5 ✓	17/5 ✓	
2. To be able to take a leadership role when working with my classmates.				17/5 ✓	23/5 ✓
3. Feel more confident working in a group with other classmates.					9/5 ✓
Effective Participant					
1. Take part in class discussions.	17/5 ✓			23/5 ✓	
2. Think of ways to help my group to solve problems.					10/5 ✓
3.					
Self-Management Skills					
1. Remain focused in class and complete my work, even if there are distractions.					9/5 ✓
2. Reflect on my work to know what skills I must develop.	17/5 ✓				
1. Link original and new ideas to complete a task.			10/5 ✓	17/5 ✓	
2. Change my ideas to adapt to new situations			10/5 ✓	17/5 ✓	

Appendix 4: Two stars and a wish

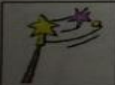
The outline of the lesson plan for the first four research tasks.	
AFL Strategy used: Engineering effective discussions through implementing tasks to promote effective participation. AFL techniques used during questioning and answering time: 'No hands up', 'Basketball discussion', 'and Hot seat'. Skills Objectives (PLTS) against which progress will be measured in this lesson: Team work Effective participation Creative thinking	Assessment as Learning will take place in the following way(s): Questions and answers during worked examples. Assessing students' understanding to address misconception. Self and Peer assessment through students' discussions. Informal assessment through the use of 'traffic lights' to check progress and understanding. Students will be expected to collaborate and/ or make choices : When completing main class activities. During whole class discussions and/or checking progress.
Lessons 1: Sequences	
Learning Goal. Describe relationship between terms in sequences. Specific success criteria against which progress will be measured in this lesson: Able to recognise a linear sequence and describe the pattern. Able to use the nth term rule to find terms in a sequence. Able to use algebraic rule to describe the pattern in a sequence.	Look at this sequence: 3, 7, 11, 15, __, __, Which is the best rule to describe this sequence? Give reasons for your answer. (A) $n + 4$ (B) $3 + n$ (c) $4n - 1$ (D) $4n + 3$ Other questions for individual and peer discussion: * Ben says that 2017 is a term in this sequence. Is he correct? You must show all your working. * Can all the rules above work for the sequence? Justify your answer with convincing reasons (Adapted from Wiliam, 2011, p.93)
Lesson 2: Jenna's Square Pattern	
This lesson develops on the previous one to incorporate functional skills problems. Extension: What if Jenna started her pattern 1 with one square, pattern 2 with four squares and pattern 3 with nine squares (a) Will that change the results in your table? b) Use a convincing algebraic rule to describe the pattern in the sequence. The "what if" was incorporated to engage the students to think critically and explore different ways of approaching mathematical tasks.	
Lesson 3: Interior angles	
Learning goal: Understand interior angles and determine sum of interior angles in regular polygons. Success criteria Know the sum of interior angles of triangle and quadrilaterals. Work out sum of the interior angles of irregular polygons. Find a formula for the sum of interior angles of polygons. Use a formula to find the sum of interior angles of	In this lesson, students worked in pairs to explore the relationship between the number of sides of a regular polygon and the number of triangles that can be formed in that polygon. Questions for exploration and discussion: Find a formula to explain how you would calculate the sum of interior angles from any n sided shape. What if the shapes were irregular polygons, would

polygons.	you get the same results as the regular polygons investigated above? Justify your answer.
Lesson 4: The Garden	
Functional task that required the students to use their knowledge on finding the area of rectangles, squares, triangles and circles to solve real life mathematics problem. (see the sample of students work)	After a student has used a specific method to arrive at the solution, an extension question was asked: What other method can you use to arrive at the same answer?
The outline of the students'	
Group: 1 & 2 Task: Revision lesson on Parts of circle, Area and Circumference of a circle Success criteria: Know the definition and names of the part of a circle. Able to establish the relationship between the circumference and diameter of a circle (π). Calculate the circumference of a circle. To be able to calculate the area of a circle. Use and apply knowledge of number and circles to solve multi-step problems in real-life contexts.	
Group: 3 & 4 Task: Revision on Solving Equations Success criteria Solve equations with brackets. Solve equations where the answers are fractions or negative numbers. Solve equations where the variable appears on both sides.	
Group: 5 & 6 Task: Revision lesson on fractions Success criteria: Add and subtract fractions. Add and subtract mixed numbers. Divide a fraction or a mixed number by an integer.	



Appendix 5: Two stars and a wish

The 'two stars and a wish' used by the rest of the class to give formative feedback to the various groups during the delivery of the lessons they created.

Name <u>[redacted]</u>	Date <u>07/06/17</u>	Group number <u>3</u>
	I like the way They incorporated many AFL skills in their lesson and it was very interactive	
	The best part of your work is The use of known ones that the learning was fun and included everyone	
	To improve further, you need to Speak one at a time as it was hard to understand	

Name <u>[redacted]</u>	Date <u>18/05/17</u>	Group number <u>1</u>
	I like the way You let us think independently, before explaining the method, which allowed me to practice changing my ideas to adapt to new situations	
	The best part of your work is The challenging question at the end: It really made me think and understand the method more	
	To improve further, you need to give us more chance to share ideas with our partner & the class	

Appendix 6: Students' self-evaluation form

Group work self-evaluation form used in the study to examine the individual students' contribution to their group tasks.

Name [redacted] Date 24/05/17 Group number 3

Lesson topic: equations

Describe what you contributed to your group task.

I answered the questions on the worksheet so we would have the answers to mark others on. I also ^{helped find} ~~found~~ a video that was educational and fun to help explain the method. Lastly, I found pictures to engage the class and keep them interested.

If you were going to do this task again, what you would do differently to make it even better?

I would improve the complexity of the work so it would suit all levels and capabilities.

What could your team do to improve their work next time?

To improve our work we would get more questions and to go deeper into the work exploring different areas.

Appendix 7: CUREC letter to head teacher

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Director Professor Jo-Anne Baird

Dear xxx,

I am writing to enquire about conducting research in school this academic year. As you know, I am studying for the Master's in Learning and Teaching at Oxford University, supervised by Dr Jenni Ingram. In my final research project, I am investigating into "Developing students' independent skills through the use of Assessment for Learning (AFL) strategies: How does this affect engagement?"

I will explore on Embedded Formative Assessment strategies that can help the students to develop their independent skills (such as managing their own work and dealing with getting stuck in mathematics lessons); and also examine how these strategies can affect their engagement in lessons. The research will take place with my Year 8Y/Ma1 class. I am developing ways of encouraging student engagement through the use of AFL strategies incorporated with variety of cognitive demanding tasks, in my lessons.

My research focus is on AFL strategies, and how I can use them to develop students' independent skills. Paul and colleagues in my department have agreed to collaborate with me on this. By participating in the research, the school would be contributing to a project that will enable students to develop real world skills needed to make them function successfully in the 21st century.

I hope to conduct this research between January 2017 until the middle of September 2017. Students will participate in some class tasks, questionnaires, as well as the interviews concerning this study. I would take notes and photocopy some students' written work.

Oxford University has strict ethical procedures on conducting ethical research, consistent with current British Educational Research Association guidelines. As practitioner research however, the University recognises that schools have the highest ethical standards in any event. Therefore only your formal consent as headteacher is necessary, and not that of individual parents or staff. However, throughout the research, students and other teachers will be able to refuse to participate in any research activities at any time.

All participants, including students, teacher and the school, would be made anonymous in all research reports. The data collected would be kept strictly confidential, available only to my supervisor and me, and only used for academic purposes. It will be kept for as long as it has academic value.

If you feel you would like to take part in the study, or need more information about what is involved, please contact me or my supervisor. Further, if you have any questions about this ethics process at any time, please contact the chair of the department's research ethics committee, though: research.office@education.ox.ac.uk

I look forward to hearing from you.

Yours sincerely,

“Developing students’ independent skills through the use of Assessment for Learning (AFL) strategies: How does this affect engagement?”

University of Oxford, Department of Education

- ☐ We do not wish to participate in this project.
- ☐ We would like to find out more about this project.
- ☐ We would like to take part in this project.

Head teacher's signature

Please return this form to me.

Thank you for your help.

Appendix 8: AFL Techniques Glossary

AFL technique	Meaning
Traffic light	Green, yellow and red cards used by students to assess themselves against the learning intentions. Green = Achieved the learning intention Yellow = Nearly there Red = Did not achieved it Similar approach was used as a visual means in assessing the level of understanding.
Lollipop sticks	Students' names are written on lollipop stick and teacher picks a stick at random and asks that student to respond to a questions.
No hands up	Teacher asks a question and then select student at random to respond. In some cases, the teacher can ask the student who responded to a question to select another student when the next question is asked. Students can be encouraged to put their hands up to ask question.
Basketball discussion	Bouncing questions around the classroom to elicit understanding and address misconception. A softball is passed to a student to respond to a question, the ball is then passed on to another student to add another main idea or decide whether previous response was wrong or correct. This discussion continues until the teacher finally decides that the main point has been made.
Hot seat	Choosing a student at random and putting him or her on a seat to respond to questions. Follow up are asked to probe the student's thinking skills.
Group work	Students work in small groups to discuss questions, create tasks or share ideas.
Homework help board	After the home work had been set, students identify questions that they struggle with. They then bring it to class, put them on the board and solve for one another.
Two stars and a wish	Use for peer assessment. Students are asked to write: • two things that are good about their peer's work – Two stars • one suggestion of how their peers could improve on their work – a wish.

Appendix 9: AFL Techniques Cartoons

I developed “AFL in Action” cartoon during the research project to depict the concept of randomised AFL techniques and the students’ reaction towards such techniques. This is displayed in my classroom.



This cartoon was drawn by one student in my research class upon seeing the “AFL in Action cartoon..

