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Assessment methods in Science in a Higher education institution described and compared with assessment methods in Science in a Secondary education institution.

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بسم الله الرحمن الرحيم

IN THE NAME OF ALLAH, THE BENEFICIENT, THE MOST MERCIFUL

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Abstract

Assessment has been emphasised as one of most important components of teaching and learning (Boud, 2010). However, the assessment methods across higher education and secondary education are markedly different and there is little investigation into the impact of this (Boud, 2010). In this study, assessment methods will be described and compared from two sectors: higher education and secondary education in order to investigate the similarities and differences from a teachers' point of view. This study is qualitative using an interpretative phenomenological approach to describe the phenomenon of assessment across the two sectors. The data collection method used was semi-structured interviews in which each participant was also asked to bring an assessment artefact with them for analysis. Also, documentary analysis was used to support interview findings from each context in order to describe and compare the similarities and differences between the assessment methods used across the two sectors. The data analysis procedure was interpretative phenomenological analysis to suit the design of the study.

Results show that at higher education the assessment methods used by lecturers have an emphasis on 'process' and 'skills' development and deep approaches to learning, whereas, in secondary education there is an emphasis on 'knowledge' and exam practise which can be repetitive and akin to students regurgitating mark scheme answers which is less cognitively challenging and leads to surface approaches to learning. Five themes emerged from the interview and documentary data which are: to assess knowledge and understanding, in order to assess throughout the learning, using a variety of assessment methods, teachers views on the learning process and to challenge students. Changes were suggested that can help revamp the current assessment methods in secondary education and higher education. Recommendations have been proposed in this research to help bridge this gap between the assessment methods used across the two sectors in order to help secondary education students successfully transition into higher education.

Key words: Assessment, higher education, secondary education, interpretative phenomenology, teachers' perspective.

Chapter 1

Introduction

1.1 Background

This study was carried out in the UK using one Higher Education Institution which will be referred to as HE1 and one Secondary Education Institution which will be referred to as SE1, both of which are in the West Midlands, UK. The SE1 is a Secondary Grammar School, which is a selective school rated as 'Outstanding' by Ofsted, the UK Education Governing Body (Ofsted, 2010) with approximately 700 students enrolled in the 2017-18 academic year. The HE1 is a popular choice for students due to its proximity to SE1 and because it is one of the founding members of the Russell group of British Research Universities and the International Network of Research Universities; offering a variety of courses in Science. HE1 is ranked 15th out of 121 UK University according to the Times Higher Education University Rankings (2017) and has approximately, 34,075 students on roll in the academic year of 2017-18 in all its degree programmes. The UK government is keen to attract students and give them wider access into University regardless of economic or social background and has policies in place appear to support this (HEFCE & OFFA, 2014). Given its reputation, SE1 encourages students to transition to HE1 and it is a feeder school to this University employing extra-curricular visits including providing student opportunities to attend weekly open lectures at the University and visits by guest speakers and career advisors at the school to promote the University.

In addition, SE1 encourages students to pursue Higher Education and holds UCAS (Universities and Colleges Admissions Services) events, student and parent information evenings in order to promote transitions into HE. In addition, all students are registered onto UCAS even if they are opting for a gap year or another course of action in order to provide practical training on how to apply to universities, including how to write a personal statement. SE1 has a tutorial programme for Year 13 students which runs for one term in order to help students develop these skills and help with these processes during form time each morning at the school. However, despite this

the OECD (2010) reports that almost half the students do not succeed in their first year and often withdraw from higher education altogether. Although the drop out rate varies from country to country including the UK, which has a drop out rate of 6.3% (REF) which is relatively low to other OECD countries, this still amounts to a large number of students. One of the reasons for this is the differences in teaching methods, including the assessment methods in schools and HE (Vanthournout, Gijbels, Coertjens, Donche & Van Petegem, 2012). This study looks at the assessment methods at SE1 and HE1 and describes and compares them in order to understand the differences from a teachers' perspective and to recommend changes to the assessment methods at SE 1 in order to help students with the transition into HEI. Currently transition into HE including HE1 is approximately 60% according to SE1 records of alumni students, but this figure does not include whether students have succeeded in their HE subjects. SE1's Sixth Form agenda is to increase this figure and encourage students to transition to HE. This study constitutes practitioner research as the results will be used by the researcher to improve the assessment methods and practices at SE1 which is the current workplace of the researcher in the hope that one aspect of the transition into HE namely, the assessment methods will better prepare students for HE. Recommendations will be proposed to SE1 from the findings in order to bridge the differences between the two sectors in order to better prepare SE students into HE.

1.2 Need for the research

I believe this research is necessary as it aims to develop assessments practices at SE1 and help students transition into HE. SE1 is a high achieving Grammar School with outstanding results from the students, but despite attaining high grades at A Level, students still face challenges going into and succeeding at HE. This study will focus on one aspect of this challenge from the researchers own observations and speaking to alumni students visiting the school during the annual award ceremony which takes place in December every year. Students often describe that the assessment methods were one aspect that they struggled with not least because of the methods used which were unfamiliar but also because there was a lack of guidance and support available when they were struggling. This was described as frustrating and students felt they were not prepared for these challenges by SE1. Such feedback from the students

inspired me to pursue this further as a doctoral practitioner research project so that I could directly impact my workplace in order to provide solutions and recommendations to the current assessment methods at SE1. In addition, my interests in the assessment side of teaching and learning at SE1 gave me the opportunity to pursue an aspect of my teaching and learning that I am passionate about but would also help improve assessment practises at my workplace. Focusing on something that I am passionate about in my research made the journey all the more satisfying and rewarding.

In addition, the current assessment methods in SE1 are focused on exam practise as UK GCSE and A Level qualifications have 100% examination weightings (Ofqual, 2017). As a result, SE1's assessment methods are skewed towards developing exam technique and exam practice which has limitations as other assessment methods are not explored and students do not develop other assessment skills. This research therefore, will address this and bridge the gap between the assessment methods at SE1 and HE1.

Assessment has been identified as one of the integral components of teaching and learning (Boud, 2007; Wiliam & Thompson, 2008). However, Boud (2007) suggested that assessment practices in secondary education are markedly different to those of higher education. Although there is a plethora of research looking at assessment methods separately at SE and HE (Boud, 2007, 2009; Brookhart, 2003; Boston, 2002; Chun, 2002) there is little research within the literature comparing assessment methods across the two sectors and looking at the impact of this on the students' preparedness for higher education from a teachers' perspective. This research aims to address this gap within the literature.

The researcher has observed from her own practice that alumni students from high school find the transition to higher education hard. Assessment practices have been identified as one of these difficulties (Boud, 2007). This research seeks to address this gap by investigating the assessment practices in two institutions namely, one secondary high school, and describing and comparing the assessment practices with that of one higher education institution; in order to bridge the gap between the practices between the two sectors.

The aim of this research is to describe and compare the assessment practices at secondary education with that of higher education in order to make the findings

available to teachers in both sectors so they can facilitate the transition for students. There is a lack of research in the literature comparing assessment methods across SE and HE sectors and this study will aim to fill this gap. Also, the study will aim to inform high school teachers how to better prepare students for higher education and inform lecturers of the current assessment practices at high school.

1.3 Purpose of the study and research questions

The purpose of this study is to improve the assessment methods at SE1 in order to help students with HE transitions. This will be done by describing and comparing the assessments methods at SE1 and HE1 and then improving the assessment curriculum by providing greater assessment experiences from the findings and recommending these to SE1. The purpose is not to make the assessment curriculums identical but rather to help inform teachers at SE1 and HE1 of what is happening across sectors and improve the current assessment practices at SE1 in order to help student become more familiar with HE methods with the hope of improving the transitions from SE1 to HE. Making the results available for both teachers at SE1 and HE1 will allow teachers and institutions to make improvements to their assessment curriculums based on the findings of this study by addressing any gaps or issues raised from the findings of this research. The context of this study is the UK and the purpose is to develop a greater insight into the assessment methods across the sectors from a phenomenological basis (King & Horrocks, 2010). Therefore, I will be positioning this research as an interpretivist/constructivist paradigm (Mackenzie & Knipe, 2006) because I will be constructing meaning from teacher/ lecturer interviews. This type of study fills the gap in the literature as it looks across sectors at SE and HE in a UK context which is unique and bridges the gap within the assessments methods used across the two sectors.

The purpose of the qualitative approach in the data collection methods is to allow for deeper analysis and allow me to gain a deeper understanding of the justifications of why certain assessment methods are used from a teachers' perspective. In addition, it will provide ''rich data about real life people and situations and being more able to make sense of behaviour and to understand behaviour within its wider context'' (Vaus, 2002, p.5). In order to achieve the research aims I will use a qualitative methodology

using interview and documentary analysis from each educational context and compare and describe the similarities and differences between the assessment methods used. In addition, during the interview stage of the research each interviewee will be asked to bring in one assessment artefact in order to provide material evidence of assessment methods that they use in their practice. Both secondary high school teachers and lecturers at the university will be asked to bring in one artefact to the interview. An artefact is defined as any material evidence of assessments including, rubrics, exam questions, mark schemes, etc. which the interviewee uses as part of their assessment routines within their own practice. This will provide further opportunities for analysis of assessment methods at higher education and secondary education respectively, in order to inform high school teachers and lecturers about the different methods used and bridge the gap between the practices between the two sectors. The findings from the teachers from both sectors will be used to develop and improve the assessment methods and the findings will be made available to both sectors in order for them both to see the practices from the opposite sector in the hope that the research will inform improvements in the assessment practices across sectors.

This study will contribute to further understanding the similarities and differences of assessment methods used across the two sectors SE and HE and help to develop strategies at SE1 to facilitate transitions across HE by bridging the gap in the assessment methods thus contributing to practitioner research. Currently the transitions to HE are not entirely successful and focusing on the assessment methods and bridging this gap between the two sectors may help to improve this. Studies in the literature focus extensively on addressing assessment methods separately (Briggs, Clark, & Hall, 2012; Hultberg, Plos, Hendry & Kjellgren, 2008; Hope, 2017; Gale & Parker, 2012). However, few make comparisons between the sectors (Jeffery, 2012; Wilson, Child & Suto, 2016; Suto 2012). This study will provide a unique outlook when addressing the problem of SE and HE student transitions and assessment methods as it will explore both sectors using one HE and one SE context for the study; thus providing fresh knowledge in this area by addressing this gap in the literature. The study constitutes practitioner research into higher education since it is an inquiry into a practical knowledge gap between the assessment practices between two educational sectors.

Having outlined the purpose of this study and its potential to address a gap in the literature the following research questions arise:

1. How do science teachers and science lecturers describe the purposes of assessment with regards to their teaching, and their student's learning?
2. How do science teachers and science lecturers describe their use of formative and summative assessment?
3. What methods of assessment are used by science teachers and science lecturers, and what justification do they give for using these methods?
4. What are the similarities and differences between teachers' views from both sectors?

   How do science teachers and science lecturers perceive the assessment methods and artefacts they use in their practice?

1.4 Personal motivation for the study

This study aims to satisfy my deep interest in assessment and why teachers use some assessment methods above others. Does a bias in using certain methods or favouring one type of method influence learning? What views do teachers hold on assessment and how does this influence their choice? These are some questions which ignited my curiosity when pursuing my research thesis. In addition, being part of the assessment focus group at SE1 and being tasked with reviewing the current assessment policies gave me the perfect opportunity to pursue this as a practitioner research and contribute to the development of the assessment practices at SE1. The opportunity to provide value to my workplace was exciting hence why I pursued this as my research project.

Contributing to helping develop assessment methods that will bridge the gap between SE and HE and which have the potential to help with student transitions is a good overall outcome of my study which I will be very satisfied with achieving. The study also has the potential to increase the current HE entries at SE1. This is currently one of the priorities of SE1 which aligns to the national policies in the UK to increase the intake and widen the participation of students into HE (OECD, 2010). Therefore, this

research not only excites my personal interests but has the potential to improve assessment practices at SE1 my work place and will allow me share my findings with my colleagues and whole school to improve assessment practices. It also has wider potential implications for assessment and policy across the UK in terms of driving a review of current practices in order to align practices and help lower attrition rates at HE (Walter, & Watson, 2014). Whilst the findings of this study only relate directly to the two institutions used in this study, SE1 and HE1, the information gained may well resonate in the sectors more widely, and promote a broader review.

1.5 Theoretical lens

A review of the current literature indicates the importance of assessment and how it is integral to the teaching and learning process of students (Boud & Falchikov, 2007). The literature has provided myriad points of illumination including the purpose of assessments, methods of assessment and decisions made using assessment (Clare, 2000; Linn & Baker, 2001; Brookhart, 2003). The methods used across SE and HE in the different contexts of this study will be discussed. The aspects of assessment will be viewed through the theoretical lens of students' approaches to learning and assessment methods which will confine the study more precisely. This will mean looking at the types of methods teachers use in their classroom teaching across each of the sectors, SE and HE and the approaches to students' learning (Marton and Saljo, 1984) from a teachers' perspective. An assessment method has been defined as any routine or task which is used to make a judgement about a student's learning (Brown, 2004). The methods of assessment used across SE and HE will be described and compared in order to deduce the methods used to help develop assessment practises at SE1 which will facilitate the transition of students into HE.

1.6 Thesis outline

This thesis has the following structure: Chapter 2 is a literature review on assessment methods within HE and SE contexts and provides the theoretical foundations of this study. It provides the definition of assessment methods used in this thesis and historical background of assessments. This is followed by a description and

comparison of the assessment methods used at higher education and secondary education using the theoretical lens of student learning. The chapter outlines how student learning is impacted by the assessment methods used and how students approach their learning including surface approach and deep approaches to learning depending on the assessment method used. Finally, the chapter details the formative and summative debate in higher education and secondary education and how methods can be used to encourage learning within the same process with the interest of the student in mind. Innovative assessment trends within HE and SE will be discussed and how assessment should be used to emphasise skills and student learning.

This will be followed by Chapter 3 which details the research design and interpretative phenomenology methodology used in this study. It begins with a brief discussion on interpretative phenomenology and I outline and explain what my research questions are and justify why this study is a qualitative interpretative phenomenological study. The chapter also outlines my primary research methods used to gather data which are documentary evidence and interviews and artefacts which each participant bought to the interview with them. I also summarise how the gathered data was analysed for each research method. Finally, I end the chapter with a discussion on the ethical and access issues that concern this study.

Chapter 4 presents the findings of this study from the documentary analysis and interviews as well as the artefact analysis which the participants were told to bring with them for the interview. The chapter will outline the five major themes of this study, whilst Chapter 5 discusses and makes sense of the themes discovered in this study. Finally, Chapter 6 presents the conclusion of this study and ties the whole thesis together by reflecting on the implications of this practitioner research to my workplace context. It summaries the proposed assessment strategies that will help improve the current assessment methods in SE1 in order to help students transition from secondary education to higher education.

Chapter 2

Literature review

2.1. Introduction

This chapter will describe the theoretical foundation of this research and its place within the broader conceptual framework of this study. The concept of assessment will be discussed and the theoretical lens which will be used in this study will focus on assessment and learning, looking at summative and formative assessment (Black, Harrison, Lee, Marshall, & Wiliam, 2003; Black and Williams, 1998) and how these can influence the approaches to learning (Entwistle, 2000). Boud (2007) argues that assessment should impact and inform student learning and therefore, the lens which will be used in this study will focus on assessment methods and learning as they are linked. Students' learning and how it is influenced by assessment methods will be reviewed. The majority of the literature deals with the problem of assessment methods in higher education and secondary education separately, I have synthesised the current trends within the two sectors and have organised them separately below in this chapter. The scope of the review includes current research on assessment in higher education and secondary education within the UK context. Following on from this I will discuss the formative and summative assessment dichotomy which is prevalent in the literature. This will be followed by a review of the literature on learning and approaches to learning including surface and deep approaches to learning and how they can be influenced by different assessment methods, (Ramsden, 1987; Anderson, 2010; Lindblom-Ylanne et al., 2018).

2.2 Definition of assessment methods

One challenge encountered during the literature review is that the definition of assessment across the literature is different and this has added to the complexity of the problem as terms are used interchangeably and they need to be clarified beforehand. Brown (2004) defines assessment as 'any act of interpreting information about student performance, collected through any of a multitude of a means or

practices' (p. 304). This is the definition which I have adopted in this thesis as it is broad and encompasses all forms of assessment. In addition, this definition allows me to focus down my review to keep it relevant to the problem I am investigating, namely assessment methods. However, it must be noted that "there is no generally agreed definition of assessment' (Evans, 2013 p.71). But, using the above definition to confine the parameters of my search in the literature review, will help me focus my research study. According to Gronlund (2006) teachers use different assessment methods in order to collect information about performance and achievement of students. Carless (2015) and Norton, Norton, & Shannon (2013) support this notion as they argue that assessment has two main purposes one of which is for the purpose of student learning and the other to evaluate and clarify students' achievement. It is this that will form the focus of this study, namely assessment methods and student learning as each is used to inform the other (Carless, 2015).

Moreover, Mundrake (2000) points out that 'assessment, testing, and evaluation are terms used to describe the outcomes of the educational process' (p. 45). But, Mundrake (2000) observes that 'assessment is the term currently used to describe all aspects of evaluation and testing' (p. 45). But what distinguishes one form from another? According to Bachman (2004) 'assessment' has a variety of meanings. This is because the term is used widely in many different ways in the educational literature and there seems to be no consensus on ''what it precisely means'' (Bachman, 2004, p. 6). For the purpose of this thesis to reiterate the definition above by Brown (2004) assessment methods for this study are routines used in the classroom to measure students' achievements including tests, quizzes, essays, oral exams and practical work to name a few. But the difficulties in the literature identify what, how and why assessment takes place and its purpose. Increasingly assessment is driven by other issues rather than improving learning and pupil performance which will be discussed in this literature review. In the section below, I will discuss the historical background of assessments and then the current literature on higher education assessment methods and secondary education assessment methods through the lens of improving learning (Boud, 2007).

2.3 Background of assessment in Higher Education

Traditionally, higher education was only available to students from privileged social backgrounds (Hosskins, 1999), but in higher education includes a diverse population of students from different ethnicities, social class, age groups and a female population of 62% (The Universities and College Admissions Service, 2018). In addition, students are now required to pay their own tuition fees which means they may be more inclined to question information regarding the type of learning that is promoted by the higher education institution before choosing where to study (The Universities and College Admissions Service, 2018). At the start of the 19th century the student ranking systems were gradually replaced by marking systems which meant more and more competitive assessments and objective testing was placed in curriculums including in top UK universities like Oxford and Cambridge (Willbrink, 1997). This meant that assessment became a very serious matter for students as their future career depended on the assessment marks and degree classifications. This shifted student focus to the assessments as what counted most was what they would be assessed on (Willbrink, 1997).

Universities are becoming more proficient at using sophisticated assessments to ensure that students are ready for industry and the global economy (Jenkins and Johnson, 2016). Jenkins and Johnson (2016) in their study of American Colleges and Universities (ACC&U) and assessment methods found there was an 11% decrease in the number of institutions using exams as a form of assessment between 2008 to 2015. Similarly, in the UK the Higher Education Academy (HEA) has called for universities to decrease the number of exams as a form of final assessments within courses. Graduates from universities in the UK face a competitive challenge when they enter the job market as employers differentiate potential recruits based on degree classifications often preferring first class degrees (McMurray et. al, 2016). Students are well aware of this and are keen to perform well on assessments as these are regarded as key performance indicators that will influence their chances of getting good employment after they graduate (Higher Education Academy, 2016). Therefore, universities and students are measured against assessments which is a key performance indicator in determining the classification of their degree overall (Higher Education Academy, 2016).

2.4 Higher education and assessment methods

Within the literature empirical work has shown the importance of assessment and assessment methods and its impact on student learning (Marton & Säljö, 1997; Watering et al., 2008; Struyven, Dochy, & Janssens, 2005; Laird & Garver, 2010); Fernandes, Flores & Lima, 2012; Webber, 2012). In higher education (HE) across the UK and Europe, the implementation of the Bologna process, which is an intergovernmental higher education reform process that includes 48 countries brought about changes in the teaching and learning strategies as well as in the assessment methods (Flores & Veiga Simão, 2007). The purpose of which was to enhance the quality of higher education systems across Europe, including the UK, although it had a greater impact across Europe than the UK. A paradigm shift was influenced, one which emphasised the key role of students as active learners creating a pedagogical reorganisation focusing on flexible curriculum designs and new assessment methods which emphasised more formative assessment methods rather than examinations and summative assessment methods which were once predominant in higher education (Flores & Veiga Simão, 2007; Simão, Santos, & Costa, 2003). In addition to this process, industry has also influenced the higher education assessment methods that are used today (Regnier, 2012). Employer and industry expectations for higher education mean that where universities initially examined students' knowledge of a subject through exams, today we see a multitude of different assessment methods used (Gibbs, 2010; Regnier, 2012). These include 'Dragon's Den' type presentations, reports and reflective portfolios all of which help prepare students for employment and are influenced by industry feedback on HE courses (Fook and Sidhu, 2016). The assessment methods used at HE and student learning will be discussed further in this section.

In higher education, within the literature it is argued that the assessment methods adopted by the university lecturers have an important role in the quality of learning (Atkins, 2004; Fernandes, Flores, & Lima, 2012; Flores et al., 2015; Hue, Leung, & Kennedy, 2014; MacLellan, 2004; Pereira, Flores, & Niklasson, 2015). However, several factors are influential on the most frequently used assessment methods at HE, particularly on student learning, for example, it is argued that summative assessment

including examinations may be seen as an incentive for study and improved performance (Biggs, 2003; Boud & Falchikov, 2007; Watering, Gijbels, & Dochy, 2008). Also, within the literature the ways in which students look at learning are influenced by the ways in which they perceive assessment tasks (Drew, 2001). Moreover, another theme which is present in the literature is that teaching tasks must be aligned with the assessment methods, taking learning goals into account in order for teaching to be more effective indicating that assessment and teaching and learning go hand in hand (Biggs, 2003). There are also differences on how assessment methods are perceived between teachers and students, for example, while teachers see the objectives of the curriculum as important in the teaching and learning process, students look mainly at the way in which assessment is carried out (Biggs, 2003; Ramsden, 2004). Therefore, Meyers and Nulty (2009) argue that assessment cannot be seen as the end of the process as students pay attention to it at first and then make decisions about the activities in which they are to be involved in or not involved in. The use of assessment methods and their alignment to the teaching and learning goals and communicating these to the student is thus of high importance (Meyers & Nulty, 2009).

The most frequent methods of assessment used traditionally in higher education according to the literature are exams or written tests, while they are effective in some contexts and for given purposes, they are not suitable for all assessment purposes as they encourage reproduction and memorisation (Biggs, 2003; Pereira & Flores, 2012). In fact, the existing literature shows that written tests promote low levels of comprehension (Dochy, Segers, Gijbels, & Struyven, 2007), as well as reproduction of information under pressure and surface approaches to learning (Brown, 2004). However, after the Bologna process other assessments methods take preference including ‘alternative’ assessment methods or student-centred methods such as portfolios, projects, self- and peer assessment, simulations, collaborative assessment, among others (Struyven et al., 2005; Flores et al., 2015; Pereira et al., 2015) which promote collaborative learning, and together with self and peer assessment seem to be more effective regarding deep approaches to learning and the development of new skills. Research also indicates that these assessment methods enable more effective learning (Struyven, Dochy, & Janssens, 2005; Tang, Lai, Arthur, & Leung, 1999). They foster the development of autonomy, a sense of responsibility, and reflection (Sambell

& McDowell, 1998) and also influence the ways in which students see their own learning in a more positive way (Sluijsmans, Dochy, & Moerkerke, 1998). These methods also provide students with feedback about their performance (Brown, 2004) and prepare them to the workplace situations after the higher education (Biggs, 2003).

On the other hand, other studies suggest that the student-centred methods like self and peer assessment and collaboration, do not always change the perceptions of students nor lead to deep approaches to learning (Segers et al., 2008). This means that the different approaches to learning may be influenced by the assessment methods used (Struyven et al., 2005; Fletcher et al., 2012) but also the contexts in which they are used. Biggs (2003) argues that the problem of students having surface approaches to learning has to do with assessment tasks that relate to teachers' practices and alignment with the aims of teaching and its environment. Similarly, Boyd and Bloxham (2014) argue that appropriate assessment can encourage deep approaches to learning and lecturers need to consider the link between assessment method and the approach to learning during the assessment design. Therefore, the author argues that the conception of assessment and the practices used by university lecturers needs to be investigated also. I argue that this further supports research into assessment methods used between the two sectors and the impact this has on students learning and their transition into higher education from secondary education.

Craddock and Mathias (2009) argue that the use of different assessment methods is an indication of good practice as it helps to respond to students' different learning preferences. Some authors have also discussed the potential of assessment methods such as portfolios, projects, collaborative assessment and simulations (Struyven, Dochy, & Janssens, 2005; Tang et al., 1999; Almond, 2009) for the development of student autonomy, sense of responsibility and reflection (Sambell & McDowell, 1998). Webber (2012), for instance, argues that student-centred assessment activities such as oral presentations by students, group and team projects and service-learning assignments foster feedback, collaboration with peers and imply an increase in student–faculty dialogue and interaction.

In addition, in HE earlier empirical work shows that the use of student-centred methods provides a more effective and motivating learning environment (Tang et al., 1999) than

traditional assessment methods like exams and essays. Sambell and McDowell (1998) also emphasise that student-centred methods are designed to develop autonomy, responsibility and reflection, which is in line with the aims of the Bologna process. They argue that these methods promote autonomous learning, which fosters students' sense of responsibility, enabling them to understand their own learning (Sluijsmans, Dochy, & Moerkerke, 1999). As pointed out by Tang et al. (1999) and Segers, Gijbels, and Thurlings (2008), using a portfolio to support student assessment, rather than other methods such as multiple-choice tests, has a greater positive impact on learning.

Another theme within the HE literature is formative assessment methods and feedback which imply students' involvement and collaboration between the student and faculty. Feedback is thus understood as a key element of the student learning process and student self-regulation (Carless 2006; Carless et al. 2011; Nicol & Macfarlane, 2006). In a study by Poulos and Mahony (2008) which intended to obtain a deeper understanding of the meaning and importance of feedback for students, three main dimensions of feedback were identified: the perception of the feedback, the impact of feedback and the credibility of feedback. The results suggested the need to promote consistent and transparent assessment practices, and clear criteria benchmark. Sendziuk (2010) states that teacher feedback on student performance should be timely so that it can be useful not only for the present assignment but also for future situations. In addition, students must be aware of the criteria accordingly, and thus feedback needs to be presented in a way that allows them to recognise or judge their level of performance against these criteria. It should also indicate clearly how to improve students' learning and to encourage them to reflect on the feedback that has been provided after an assessment. Thus, it is important to put into practice assessment methods that require the continuous active involvement of the students.

In a study by Segers and Dochy (2001) it was found that student-centred assessment methods enhance the reflection of the competencies required in real-life practice. Moreover, they conclude that while these methods are promising with regard to validity and generalisation, teachers have to improve their educational practice, specifically in the alignment of the main goals of the educational programme (Segers & Dochy, 2001). In this respect, Ramsden (2004) argues that teachers should consider two

essential aspects when it comes to choosing assessment methods: (1) the methods alone are not what determine learning and (2) rarely is there a method that satisfies all the educational goals. Despite the existence of studies in this field, further research is needed in order to better understand the practices and purposes of assessment in higher education. The literature in HE also points to the gaps in research into the preferences of HE students in relation to the assessment methods used and their results (Watering et al., 2008), the comparison of assessment practices in different disciplines, institutions and countries (Gilles, Detroz & Blais 2010) and the need for further evidence on the effectiveness of the 'alternative' methods of assessment including portfolios, presentations and projects (Segers, Gijbels & Thurlings 2008). . Following on from this theme Zabalza (2007) argues for a 'new culture at university' that implies the consideration of a set of competencies for faculty including the methodological dimension, the evaluative dimension and the supportive dimension. Of key importance are follow-up assessment methods of students' learning (Zabalza, 2007) which implies that the role, means and timing of assessment methods and practises need to be understood with a transparent framework for both teachers and students. This means that HE institutions need to consider the characteristics of HE students such as autonomy, active involvement, and responsibility for their learning. Price et al. (2012) described these characteristics as 'assessment literacy', arguing that students need to be assessment literate and to understand the assessment criteria and standards in order to direct their learning. This clearly indicates that assessment methods impact students' learning and the implications of this need to be researched further, including transition between educational sectors and comparisons between different sectors which will be done in this study.

2.5 Secondary education and assessment methods

In contrast, in secondary education, in the UK, the government regulating body, the Office of Qualifications and Examinations Regulation (Ofqual, 2017) issued the new GCSE grading systems as 9-1, which has put greater emphasis on summative assessment and examinations. Science courses, for example from 2017 onwards have no coursework element and are assessed 100% through examinations (Ofqual, 2017). There were political drivers for these changes including Parliament, whereby

the Conservative government argued that such changes would reduce teacher assessed work including coursework in favour of 100% external summative assessments to increase reliability of results and reduce the 'grade inflation' (p. 12) and address the issue that the GCSE exams were getting easier, (Torrance, 2018). However, many authors do not agree that this approach would improve assessment and challenged the assumptions that it increases validity and reliability of results and therefore it was a government opinion and not an educational opinion driving these changes (Torrance, 2018). Torrance (2018) for example, argues that there are sound educational reasons for including coursework and practical assessments in secondary education qualifications as they test a range of different educational goals which may not be directly assessed through exams. Within the literature, prior to this change there has been an emphasis on formative assessment methods (Atkins, 2004; Popham, 2008) which was challenged as a result of these curriculum changes. Thus, the opposite trend in assessment methods seem to have arisen in higher education and secondary education; where in higher education there is a focus on formative assessment methods, including projects and coursework (Webber, 2012; Lima, 2006) as a result of the Bologna process, whereas, at secondary education, the emphasis is on summative assessment methods and examinations.

Within the secondary education literature, it is argued that the main purpose of conducting classroom assessment is to obtain information about student's progress in learning and the achievement attained (Airasian, 2001; Linn & Gronlund, 2000; McMillan, 2003; Popham, 2008). This is similar to higher education. However, to gather this information teachers use a variety of assessment methods including written tests, performance assessment, observation and portfolio assessment (Airasian, 2001; Popham, 2008). Current research suggests a greater emphasis on formative assessments methods including: questioning, observation, discussion, self and peer assessment and group work (Popham, 2008; Wiliam 2003). However, there is limited research documenting the types of assessment methods used and why they are used, at secondary education and higher education and describing and comparing the differences. Therefore, this research will contribute new knowledge in this field and bridge the gap in order to inform the practitioners across the two sectors of each other's practices. This has implications to help students make a more successful transition from secondary education to higher education.

There is a theme running through the secondary education literature on formative and summative assessment methods, how they are distinguished and their effectiveness and uses (Harlen & Deakin Crick, 2002). The difference between formative and summative assessment lies in the way in which evidence is interpreted and used and not in the nature or mode of collection of that data (Wiliam, 2003). Vaden-Goad (2009) conducted an experimental study in which he compared formative and summative assessments. He found that the amount of information and motivation levels increased by changing the function of assessment from summative to formative. The literature seems to champion formative assessment methods over summative assessment, including end of year testing and examinations (Stiggins, 2001; Wiliam 2003; Babaii & Damankesh, 2015; Vaden-Goad, 2009). But, as discussed above, the new 9-1 GCSE's lean towards more summative assessment methods compared to other assessment methods. The impact of this on teacher practice needs to be further researched.

The most commonly used assessment methods in secondary education in the UK prior to the introduction of summative exams as the sole means of summative assessment were: teacher observation, self-observation, demonstration, peer observation and group tasks, according to Sutton (2000; Wiliam, 2011). However, this conclusion is drawn only from one study and it cannot be generalised to the whole secondary sector. In addition, this was before the return to exam only assessments which we find today. Of the commonly used assessment methods before these changes, within the literature there are many authors who advocate peer assessment because it is claimed that it develops thinking skills (Herrera et al., 2007; Stiggins & Chappuis 2005). According to Herrera et al. (2007) during peer-assessment, students compare other students' work to the accepted criteria which,

''Enables them to discern outstanding elements of both their own and their classmate's performances and products'' (p. 34).

In a study by Kwok (2008) investigating peer assessment he found that students viewed the experience of peer assessment as enhancing their confidence and providing them with opportunities to make judgements about their peers. However, the study was based on nineteen students only and therefore, cannot be generalised to other contexts. However, Boud (2000) and others agree that peer assessment can be

a tool to encourage students to think critically (Stiggins, Arter, Chappuis, & Chappuis, 2004). In a study by Gibson and Shaw (2011) they saw that the most prevalent assessment methods used in secondary education for summative assessment included exams, tests, presentations and projects. However, they argue that the timing of these assessment methods makes it difficult to improve student learning as they are done at the end of a course or programme of study. In contrast, Carless et al., (2010) argued that summative assessment can be formative if feedback is given in order to improve students' learning in the future. In higher education, Hernández (2012) and Taras (2009) concluded that the predominant assessment methods used by lecturers in their study was assignments which can have a summative as well as a formative component in order to further student learning. In the proceeding section of the literature review I will look at how assessment methods can impact student learning as ultimately the reason to assess student should be to identify gaps and improve their learning (Boud, 2003).

2.6 Learning and assessment

Generally, there is distinction between surface, deep and strategic approaches to learning. The literature suggests that students today develop a learning strategy where they only learn to pass assessments, this is also called a surface-approach to learning (Anderson, 2010; Lindblom-Ylanne, 2018). Students manage their time strategically and focus their learning on passing assessments (Peelo et al., 2002; Light et al., 2009; Chiesi et al., 2016). Course content that is not assessed is neglected which means students gain only superficial knowledge of the course content (Anderson, 2010). Ramsden (1987) described this type of strategic learning as an 'approach to learning' (Ramsden cited in Allen. 1997, p. 75). This will be discussed further below.

2.6.1 Approaches to learning and assessment

Ramsden (1987) coined the term 'approaches to learning' which is defined as, 'a relation between the learner and the learning task – the description of an intention and an action' (Ramsden, 1987 cited in Allen. 1997, p. 75). It is a student's response to

learning and what this will entail. This response is influenced by the teaching environment including the assessment. Students may respond by atomising the learning and focusing on the separate parts, or they may respond holistically and focus on making the connections between the tasks (Marton, 1988). Students who respond to learning by focusing on achieving the minimum required to pass modules and avoid failure, are referred to as surface-atomistic approach or as in the wider literature 'surface-approach' (Entwistle, 1997; Higher Education Academy, 2016). Students who focus on higher level activities and consider the connections between the parts, tend to adopt a deep-holistic approach also called a 'deep-approach' in the literature (Burton et al, 2009; Tsingo et. al, 2015). In addition, the phrase 'approaches to learning' according to Biggs (1987) can also refer to student's predisposition to adopt a particular strategy to their learning. Therefore, it can be seen that there are two factors in student learning, the first being motivation and why they are learning and the second being strategy, how they will learn (Yau-Kay, 2003).

Entwistle (1997) also identified a third approach to learning called the 'achieving approach' (p. 213) or the 'strategic approach' in the wider literature. This approach is when students put 'effort into organised studying' (Entwistle & Peterson, 2004, p. 415) in order to achieve the highest grade possible. This approach fulfils the assessment requirements but also enhances the self-esteem of students through competition with peers in their achievements (Burton et al., 2009). Biggs (1987) argues that this approach is based on ego and competition and not necessarily to fulfil learning goals. The achieving students will organise their work and time and select strategies which will be the most effective in achieving high marks on assessments (Hakkinen et. al., 2017). But, Biggs (1987) differentiates the achieving approach with the surface approach arguing that the surface approach is to do the bare minimum to meet the minimal requirements and the student only learns the essential content by rote in order to pass and get by. Thus, the student does not work too hard and has surface motivation to meet the minimal requirements. Surface learners can produce high scores in assessments, but it has been emphasised by Tsingo et, al., (2017) that the factual recall after a test is very limited. Students often forget the content within a week. In contrast, students who use the deep approach can get a same mark on a test a week later and even recall the concepts a year later (Tsingo et, al., 2017). An achieving student might appear like a deep learner but in actual fact the students has

concentrated on acquiring a fraction of the knowledge which will be assessed whilst neglecting the rest of the theory. In a study by Lyke, Kalaher and Young (2016) when the students were presented with more traditional assessment methods like essays the students choose deep strategies as the assessment required them to understand what they were learning. The evidence suggests that when students are presented with sophisticated information from different strands of information, deep approaches tolearning automatically occurs. Similarly, in Guven's (2008) study, students use comprehension monitoring strategies to eliminate distractions and anxieties to achieve learning goals. These coping strategies are effective at reducing the fear of failure and usually take the form of concept maps, charts and learning plans.

There is a close relationship between what approach a student takes to learning and the learning itself, whether the subject is science or geography or whether the outcome is defined as a grade or qualitatively (Ramsden, 1992). It is observed that the quality of learning depends on the approach and different approaches result in different outcomes. Deep approaches result in high levels of understanding. In contrast, surface approaches lead to low levels of understanding and a lack of reflection and criticality of the content (Ramsden, 1992). Because of the strong connection between the approach to learning and the outcome of learning the quality of a students' learning can be predicted by analysing their notion and conception of learning (Gibbs, 1995). However, although approaches to learning theories are useful, they do not consider the students' perceptions of the connections between the assessment, the learning and the student.

2.6.2 The Learning Context

In the current literature the learning context is relevant as there is evidence that students adopt different approaches to learning which are influenced by the environment and context (Chiesi et al., 2016). There have been a number of studies published in the last decade about surface and deep approaches to learning and the teaching and educational context. For example, Newstead (1999, 2000, 2002) and Hoskins (1999). Newstead (2000, 2002) observed that surface approaches to learning were predominant in HE where there were lectures, excessive workload and repetitive

assessment methods. In a later study by Newstead (2002) he claimed that students are motivated only to get good marks and not to primarily learn on the courses. He concluded that HE assessment practices were flawed and drastic changes need to be made in order to move from surfaces approaches to deep approaches to learning.

In addition, in a qualitative study by Hoskins (1999) at HE using focus groups she observed students' approaches to essay writing and found that students are highly motivated to learn in the beginning but deterred by the assessment methods. This is because of the inconsistent marking and feedback which deflates students and leads them to adopt surface approaches to essay writing. Ramsden (1992) in his research concluded that inappropriate assessment methods lead to surface approaches to learning in HE and SE. Gijbels and Dochey (2006) in their study looked at a science course, criminology at HE and noted that students shifted from one approach to the other depending on the assessment method used. The study looked at 108 students in the first year of study at the start of the first semester in a criminology course and their approaches to learning. They found that students still preferred 'higher order thinking' assessments even though they adopted surface approaches to learning. They were then given four ungraded formative assessments and graded summative assessments and asked to identify their preferences. Having experienced the higher order thinking formative assessments earlier, the students preferred these less. On the contrary there was an increase in surface approaches to learning from the original deep approaches to learning. In another study by Hall et al. (2004) he tested the hypothesis of changing teaching and assessment methods to encourage deep approaches to learning with students in an accounting course. Two sample groups were used in this study in the first year of their degree course. The first focus group was given accounting problems which they tried to solve and then the answers were discussed in seminars with the teacher. On the other hand, the second focus group were given accounting problems and split into smaller groups to discuss and work out the solutions in their groups. The study concluded that the students working in smaller groups developed deeper approaches to learning compared to the first group who discussed answers in a seminar.

But, Donnison and Penn-Edwards (2012) argue that first year students face other challenges in their transition to HE from SE and it is unreasonable to expect them to

adopt deep approaches to learning consistently in the first-year of study. In their study they aimed to improve the academic results of undergraduate students across courses at HE and developed an engagement model in which they argue that first year students are in a cycle of activity and assessment, and it is important they are persistent in their studies in the first year. The engagement model helps them to learn how to learn and favours surface approaches to learning in order to understand the foundations of the course in the first year and develop more deep approaches to learning approaches as they move through their transition into HE. Donnison and Penn-Edwards (2012) argue that assessment practices in the first year can be used as an effective pedagogic activity to develop post-transitional deep learning approaches in students.

In summary, it can be seen within the literature that the assessment method and learning contexts affect the students' approaches to learning. In this study two different contexts will be used namely, HE and SE and the assessment methods used by teachers and how they perceive these impact their students' learning will be explored.

2.6.3 Student-centred learning in higher education and secondary education

Higher education has in the past always emphasised teacher-centred learning according to the literature traditional assessments methods like lectures and exams predominate as teachers control the transmission of knowledge (Torenbeek, Jansen, Hoffman, 2011). In teacher- centred teaching and learning what is intended to be learned is disseminated by the teacher (Trigwell, 2012). In most higher education institutions, the teachers deliver lectures often using Microsoft PowerPoint to a large body of students who take notes in a teacher- centred learning approach (Liu, Oiao and Liu, 2006; Chen and Brown, 2016). On the other hand, student-centred teaching and learning refers to learning which is self-directed by the student where the student has an active involvement in the learning process (Maher, 2004). Rust et. al., (2003) goes further and describes a student-centred learning approach as student taking responsibility for their own learning goals and assessing their own learning experience. Student-centred learning is not new and is rooted in constructivism specifically in the humanistic learning theory which includes self-direction and self-actualisation by the student in an individualised learning approach (Boone et. al.,

2002). According to Fowler (2008) the student-centred approach is concordant with experiential learning principals proposed by Kolb (1984) and the purpose of student-centred learning is closely related to Bloom's (1956) higher-order thinking skills. Currently, higher education institutions are increasingly accept the values of student-centred approaches as Watson et. al., (2008) argue that there is an increase in student-centred approaches in order to encourage deeper learning approaches. Whereas, in secondary education institutions student-centred learning approaches were adopted in classrooms much earlier than HEI as the value of self-direction and self-determination was seen to impact student learning and motivation positively (Cannon and Newble 2000; Savery and Duffy 2001).

Torenbreek et al., (2011) argue that in the past the teacher-centred approaches which were traditional in HE led to surface-learning. Whereas, student-centred approaches develop cognitive skills as students take an active role in their learning and interact with each other. It has been observed that teacher-centred approaches lead to duplication and regurgitation of information and do not develop problem-solving skills or critical thinking skills (Prince, 2004; Pleschova and McAlpine, 2016). In a study by Lucardi and Bursari (2017) the authors investigated a student-centred learning approach, namely a flipped- classroom, and knowledge retention. In a flipped classroom the students adopt the role of the teacher and teach each other. The students were split into a control group and a flipped-learning group and completed a survey after the completion of one module to measure their knowledge. The results showed that for the students who adopted the more student-centred approach, the flipped classroom showed more knowledge which the authors attributed to the learning approach adopted. Lucardi and Bursari's (2017) study further supports the literature on the positive impact of student student-centred learning approaches(Fowler, 2008).

Both secondary education and higher education literature champion student-centred approaches although SE was quicker to adopt these approaches in their pedagogy than HE (Boekaerts 2002; Boekaerts & Corno, 2005; Backman et. al.,2011; De Kock, Sleegers & Voeten, 2004). But not all the literature is positive about student-centred learning. In a study by Chen and Brown (2016) in China a teacher-centred approach and student-centred approach to learning was investigated. Many Western authors have been critical of higher education in China because of the emphasis on rote

learning and predominant examination assessments (De Haan, 2008). The Chinese government acknowledging this trend have worked to change it by adopting more student-centred teaching and assessment methods (Tatsuoka and Corter, 2016). When Chen and Brown (2016) compared the attainment taught in a teacher-centred environment with examinations compared with a student-centred environment they found that the students taught in a more traditional teacher-centred environment performed better and developed a deeper understanding of what they were taught by critical thinking and application. Chen and Brown (2016) explain their findings by arguing that rote learning is not reproducing work but is a 'consolidation of knowledge and deepening of understanding' (Chen and Brown, 2016, p. 360). On the other hand, Flemming-Castaldy (2015) explains the results by arguing that in order for student-centred approaches to be successful the students need to understand the approach and be on board with it. There needs to be small stepping stones from secondary education to higher education in the assessments in order for it to be successful (Edwards, 2016). Secondly, there has to be an understanding of the student body including the diversity and cultural background and approaches to teaching and assessment (Giwa, 2017). Students who are not familiar with this independent approach might experience greater anxiety and inadequacy and withdraw from the learning. Increasingly, Universities have started to provide the same education at host countries by having campuses internationally. This means taking the UK's academic faculty into a new environment in order to provide teaching and assessment strategies in the host country (HESA, 2017). Baja (2011) carried out a study involving 400 Indian students across two campuses in India who were accustomed to examination assessment methods which encourage surface learning including rote-learning. When the students were faced with student-centred approaches which encouraged deep-learning, the students who had previously performed well on assessments now faced challenges with the new learning approach and many were discouraged to the extent that they gave up (Scheyvens, 2008). This supports Flemming-Castaldy's (2015) argument that student-centred approaches can be only be successful if there is regular coaching and practice of the skills required from secondary education to higher education in order to be successful. In addition, the literature indicates that academic practitioners need to understand the cultural backgrounds and the previous learning and assessments in order for student-centred approaches to be successful (Crafts, 2017). The studies reviewed here link assessment to the approaches of learning and it is commonly believed in the literature

that formative assessment methods encourage deeper levels of learning which will be explored in the next section.

2.7 The formative and summative assessment debate in higher education and secondary education

Black and Wiliam (1998) carried out substantial work on the positive impacts of formative assessment on student learning in Secondary Education, which at the start of the century marked the 'assessment for learning' debate. Black et al. (2003) clarify that 'the phrase 'assessment for learning' has become a common substitute for 'formative assessment', yet there is possible ambiguity in this label' (p. 5).The authors argue that whilst assessment for learning can be used to gain information about student learning, if it is used by the teacher for purposes like curriculum and teaching improvements it will not be formative for the student, but may be formative for the teacher. Therefore, it is important that the learning of the students is at the forefront when using formative assessment. However, some authors are keen to move away from the formative assessment debate. For example, Stiggins and Chappuis (2006) argue that it is no longer about using formative assessment to create learning opportunities, but rather about frequent use of summative assessment to see what learning has taken place and therefore, propose a better way to use summative assessments rather than using it at the end of courses which is how it is commonly used. But, in the literature there is a tendency to create new categories as noted by Pollard (1992) and Eccelstone and Pryor (2003) which may cause confusion. For instance, the current literature as well as the Quality Assurance Agency (QAA) for Higher Education (2017) documents use the phrase 'assessment for learning' and 'formative assessment' interchangeablyIn order to clarify this the next section will look at the development of formative assessment.

2.7.1 Formative assessment

Bloom's (1976) mastery learning model (Figure 1) which encourages teachers to change student learning and behaviour through enrichment activities and feedback in order to achieve specific learning objectives was used by Black and Wiliam (2003) in their formative assessment model. They argue that formative assessment helps with the learning process as it is adaptable (Bloom, 1971 in Lau, 2013. P. 10). On the other

hand, summative assessment has been described by Bloom (1971 in Lau, 2013, p.10) as the process of judging and grading what the student has learned. Black et al (2003) explain that formative assessment is a tool for assessment for learning and is a process which gives rise to learning and can be used to modify teaching and learning. Formative assessment therefore, allows teachers to feedback to students what they have learned and how they can improve their learning.

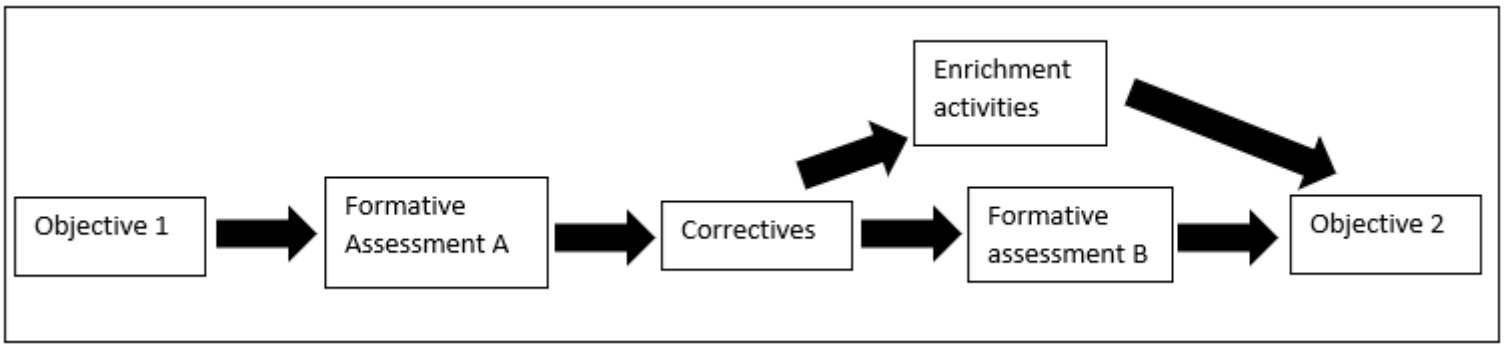


Figure 1: Bloom's (1976) Mastery learning model (from Guskey, 2005)

Three key aims of using formative assessment were justified by Ramaprasad's (1983) in the teaching and learning process which are:

- Finding where students are in their learning
- Finding out where they are going
- Finding what needs to be done to get them there

William and Thompson (2007) argue that it is the teacher who is responsible for creating these learning processes through a stimulating learning environment and the student who is responsible for learning through this provision. This means that both teacher and the student take the responsibility of learning in order to mitigate failure. Extending Ramaprasad's (1983) processes further they indicate that formative assessment consists of five key strategies which involves the teacher as well as the student and peers. These are:

1) Clarifying and sharing learning objectives

2) Enabling effective classroom discussion and other learning strategies to enable students' understanding

3) Providing feedback to further understanding and learning

4) Getting student to engage in discussion with their peers to learn
5) Getting students to be responsible for their own learning

Some authors postulate that effective pedagogy includes having formative assessment within the teaching and learning and provide a range of techniques on how this can be implemented (Black and Wiliam, 1998; Clark and McCallum, 2001; Webster, 2010). Many institutions in the UK and worldwide including higher education and secondary education have incorporated formative assessment into their teaching and learning since these studies.

In their extensive review of the literature, Black and Wiliam (1998) looked at 250 studies in different institutions and within the discipline of Science looking at the formative assessment processes and evaluating them. One of the priorities of their review was to identify studies that provided quantitative evidence that formative assessment led to improvements in student learning. The evidence to support this in their review is compelling and done in comprehensive detail. However, Sebatane (1998) argues that summative assessments impacting on teacher and students' behaviour, were not taken into consideration in Black and Wiliam's (1998) study. Whilst, Sebatane (1998) commends Black and Wiliam's (1998) comprehensive review of the literature, but they argue that, 'it does not seem entirely satisfactory to have excluded summative assessments and contextual factors when dealing with assessment methods. It is this subject, namely summative assessment that will be dealt with in the next section.

2.7.2 Summative assessment

In order for formative assessment to work teachers need to create opportunities for students, peers and teachers to share thoughts and ideas (Lopez-Pastor and Sicillia-Comacho, 2017). This may be challenging for teachers to include in their teaching. Heritage, Vendlinski and Herman (2009) describe some of these challenges in their study including the high workload involved in coordinating student-centred activities to encourage student thinking. In addition, they mention student resistance and lack of motivation in putting in work which is not going to be assessed. At higher education, institutions seeing the value of formative assessment were keen to adopt these as part

of their assessment methods, but in the last few years there seems to be a slight uprising and movement away from these methods (Lopez-Pastor and Sicillia-Comacho, 2017). In response to student's feedback and performance, some institutions have begun to remove the ungraded parts of formative assessment in their assessments (Zwelijogile-Gaylard, 2015). Gibbs (2010) reports that students are not putting in the effort into assessment that are not graded. In addition, teachers feel they do not have the time to give extra feedback and adequately plan formative assessments due to the pressures of higher education teacher being 'research active' and because of the overall focus on final assessments and results. Yorke (2007) noted other reasons for teachers not implementing formative assessment methods which included teachers viewing summative assessment as more reliable and fairer than formative methods.

The purpose of summative assessment is to measure the student against specified learning goals and is usually quantitatively graded. Summative assessments are carried out at intervals within a course or module in secondary education and higher education (Harlen and James, 1997). Tara (2009) emphasises that formative and summative assessment are part of the same process and there is a flawed focus on the functions of each assessment which can lead to duplication of processes and an increase in workload for both teacher and student which is unnecessary (Taras, 2007, p. 364). For example, when teachers and students see formative assessment as an extra function rather than part of the same function, they may perceive this as an additional workload and fail to engage in the process; which means they miss out on the opportunity for feedback to improve their work. Rather than focusing on definitions the purpose should be on creating assessments methods to encourage student learning. This will be dealt with in the next section

2.7.3 Formative and summative dichotomy or harmony?

Why then are we focusing on the dichotomy of formative and summative assessments when the focus should be on student learning? Are they not both part of the learning process? Biggs (1998) was very critical of Black and Wiliam's (1998) work for making formative and summative assessment mutually exclusive. Instead, Biggs (1998) argues that both are essential for student learning and that a sensible model of

assessment should include both formative and summative assessment methods. It is common for teachers to focus on learning aims and objective during their teaching so they know what should be learned by students. This helps teachers to identify the strengths and weaknesses of student understanding (NRC, 2011). On the other hand, students tend to use marked assessments to identify what they need to learn (Biggs, 1996). But, as discussed previously learning only for the assessment resultsis surface learning. Therefore, it is important to synthesise and use both formative and summative methods rather than giving them different definitions in order for students to gain the maximum benefit when it comes to their learning (Clinchot et al., 2017). Lau (2016) argues that students are more likely to be motivated and have high aspirations if the assessments within a module meet all the elements of the module. This means that if students are primarily motivated by summative assessments as indicated by the literature, if we ensure that formative assessments are aligned within the learning process this will give opportunities for feedback incrementally which will engage students with the learning at a deeper level. Barnett (2007) writing about HE in the UK agrees with this view and argues that it needs to be avoided the '*temptation to distinguish between summative assessments and formative assessment and place all weight on the latter'* (Barnett, 2007, p. 35). Barnet (2007) goes further and argues that if teachers provide an environment with engaging relationships with students, the students will learn that assessment is in their 'educational interest' and not just a means to pass a course or gain a certificate for an economic gain in the future. Formative and summative assessment should not therefore be separate but part of a whole learning environment which work in harmony (Baleni, 2015; Lau, 2016). Instead of focusing on the dichotomy and definitions what is more beneficial is to look at creating assessments that will encourage students to learn.

2.7.4 Assessments to encourage student learning

There has been a wealth of studies exploring student learning behaviour and how this has shaped modern curriculums and course designs including the assessment methods within these courses (Flores et al., 2015; Flores et al., 2016). In higher education there has been an increasing movement away from traditional types of assessments like essays and exams to new types of assessments which encourage student learning and student-centred approaches to learning (Iannone and Simpson,

2012). Secondary education was quicker to respond to research into engaging students to learn through student-centred approaches and new types of assessment (Black et al., 2003). The question of how to assess is not new (Cowen, 2010; Flores et al., 2015). Traditionally, assessment was based on the theory of individual difference, where human abilities and traits are measurable and comparable to others, as regarded by Taylor (1994). This view posits that there are limits to human intelligence and capacities and these are distributed across a population. Accepting this view means that a student's performance can be judged relative to their peers. Thus assessment is relative rather than absolute (Gipps, 1994). Accepting this view within assessments would mean that a student's performance would be measured against standardised criteria which would limit creativity and the scope for different views. Therefore, one is assessed according to what is the norm. Taylor (1994) argues that this type of objective assessment has led to most assessments at higher education being standardised exams and essays. However, currently academics have become more focused on human cognitive abilities rather than human intelligence within secondary and higher education institutions (Fores et al., 2015). Khan (2015) argues that instead of focusing on the limitations of student's intelligence the focus should be on the process of thinking and learning through interactive processes and contexts, including student-centred approaches, for example. Shepard (2000) draws parallels with cognitive theory with that of Vygotsky's (1978) social development theory arguing that interactive and social process included in the assessment process can help students to learn.

2.7.5 Innovative assessment practices

It is clear in the literature that teachers are keen to improve their teaching and assessment methods in order to improve student experience and develop student learning (Cowen, 2010; Lau, 2016). It is interesting to discover that Hoskin's (1999) looking at the origins of the essay as an assessment method in higher education in the UK, found that it was a method as old as higher education itself and went hand in hand with the exam paper for centuries. The purpose of the essay as an assessment method was to assess higher order thinking skills and the ability to apply different concepts in different contexts. It is difficult to argue against the use of essays as an assessment method except that it does not prepare one for employment and does not

always suit every student learning style (Baker, 2010). The Higher Education Academy (2010) published a range of innovative assessment methods from disciplines across science to the arts which aimed to enhance learning. These innovative assessment methods included: e-portfolios, online blogs to peer-assessed viva exams. Student can be expected to be assessed in a range of innovative ways including, group work assessments, essays have been changed to business reports, 'Dragon's Den' type pitches, 'House of Commons' type debates, simulation assessments and work-based projects (Higher Education Academy, 2018). Within the literature the reason for creating innovative assessments at secondary education and higher education are because of the advantages to student learning approaches, learning styles and collaboration between peers (Flores et al, 2015; Zlatkin-Troitschanskaia et al, 2016). It is common now for both secondary teachers and higher education teachers to have gone through a certified teacher training program in order to develop an awareness of the different theories and teaching and assessment practices in order to develop assessments which encourage student learning. This thesis looks at the assessment methods used by secondary education teacher and higher education teachers and how they use and justify these methods to help with their student learning.

2.7.6 Assessment and skills development

Assessment should not be about going through the motions in order to satisfy the course requirements or get to the next class in secondary or higher education. Rather it should train the mind to think and lead the student to acquire skills which are beneficial in the future and everyday life. Einstein (1921) asserted that, 'Education is not the learning of facts but the training of the mind to think' (Einstein, 1921). Frank (2002) argues that the quote can be traced back to Einstein arguing that a person can read facts from books, and if this was their only goal then indeed a formal education at secondary or higher level is not required. But Einstein added that the value of going to school is to train the mind how to think and for that a secondary education and a higher education is very valuable. The debate on the need for higher education after compulsory secondary education seems as relevant today as it was in the past. The skills gained on this educational journey get emphasised in academic circles across the sectors. These include the 'soft skills' or graduate skills, gained through the journey

of a degree course, for example. In 2015, The Higher Education Academy (2015) launched the 'Graduate Skills Framework' which was followed suit by the Quality Assurance Agency launching the initiative of 'Focusing on Graduate Skills' (QAA, 2018). Higher education institutions pride themselves on having students with graduate skills which sets them apart from other employees who do not have a higher education degree. The QAA (2018) listed some of the graduate skills in line with developing thinking skills as Einstein argued including, independent thinking skills, critical thinking skills, analytical skills and the ability to engage in investigations independently. As well as this the QAA (2018) listed the ability to problem solve, communicate effectively and be familiar with current and new technologies as all part of the 'graduate skills' set. Employers agree that when graduates start their professional careers, they hope they have acquired these skills through the degree programme. But they also stress that without the theoretical knowledge and understanding of the profession and field they enter; the graduate skills are of limited value. Therefore, in science and as well as the arts the soft skills and the knowledge gained in individual modules are needed for students to be successful in their chosen careers. Soft graduate skills are needed for industry and are needed for transitions from secondary to higher education and assessment should be encouraging the acquisition of these soft skills (Touloumakos, 2020).

2.8 Synthesis of literature review

The literature review presented in this chapter looked at the definition of assessment methods and an overview of the historical background of assessments. The literature was synthesised and assessment methods at higher education and secondary education were described and compared and presented within the theoretical lens of students learning and approaches to learning (Ramsden, 1992; Newstead, 2002). The literature review indicated the complexity of the problem of assessment and the many facets that assessment has been dealt with within the literature. In order to confine this study, the theoretical lens that will be used will focus on students' learning and approaches to learning. The purpose of this is to focus the study more precisely and ensure the results have a direct impact to the institutions used in this study namely, HE1 and SE1 in order to improve their assessment practices. The review demonstrated how higher education institutions have moved to more innovative

assessment methods which we see today but also how secondary education institutions have regressed back to examinations. The methods of assessments have diversified as indicated in today's higher institutions with an 11% decrease in institutions of HE using exams as a form of assessment between 2008- 2015, but the opposite trend in seen in SE with more exams used today compared with the diverse methods used in the past; this is partly due to political tensions in the UK (Torrance, 2018).

Gibbs (1995) identified that assessment methods can have a direct impact on student learning behaviours by adopting a ‘surface approach’ to learning, whereby the student focuses on learning the bare minimum to pass the assessment by rote learning. Or the student adopts a ‘deep approach’ to learning and seeks to understand the content and make sense of the learning. Biggs (1987) identified a third approach called a ‘strategic approach’ to learning where the student organises their time in order to achieve the highest grade possible. However, a strategic learner only attains a fraction of the theory that is being assessed and therefore, does not have a depth of understanding. A deep approach to learning leads to higher order thinking skills compared to surface and strategic learners. In addition, the approach adopted by the students to their learning are linked to context and environment which is relevant to this study as two different contexts will be used. Newstead (2002) also argues that the method of assessment directly impacts a students’ approach to learning.
As well as environment the teaching approach can also impact the learning of students. As seen in the literature a student-centred learning approach is closely linked to deep approaches to learning and higher order thinking skills. But for student-centred approaches to learning to be successful students must be introduced to student-centred strategies early on including at secondary education.

Finally, the literature review moved onto the formative and summative debate at higher education and secondary education. Formative assessment allows students to incrementally act on feedback and therefore change their behaviour and learning direction. Formative assessment lets the teacher know where the students are in their learning and what needs to be done to get them where they want to go. Formative assessment encourages deep approaches to learning as students work towards the learning outcomes and their learning goals. Teachers should use formative and summative assessments as part of the same process, rather than focusing on

definitions and distinctions when they are briefing students. Instead, teachers should create engaging assessments which are in the best interests of the student. Assessment should focus on student learning and in the modern curricula of today the focus on cognitive ability has driven this increasingly forward.

Having considered the journey of assessment methods at higher education and secondary education this study will look at describing and comparing assessments methods from two different contexts HE1 and SE1 from a teacher's perspective and look at how teachers use and justify these methods for their student learning using the lens of approaches to learning. The study aims to design assessment methods in the curriculum that encourage deep approaches to learning in order to maximise student learning as assessment should be a learning tool and not a hindrance to student learning.

Chapter 3

Methodology

3.1 Introduction

In this chapter I will outline the research aims and the rationale for using a qualitative methodology for this research. This chapter describes my positionality as a researcher and describes the rationale behind the approach. I will state my research questions and why they were posed. The chapter will proceed by explaining why this research was designed as a phenomenological study, the aims of the research and why this methodology is the most suitable for this research. I will then present the rationale of the specific methods used to gather data which are semi-structured interviews, artefacts and documentary analysis. Following from this I will summarise the data analysis procedure and what this involved. Finally, I will end the chapter with a discussion on the ethical issues in my study.

3.2 Research aim

The aim of this research is to discover how science teachers and lecturers describe their use of assessment methods and the justifications of using these methods. Two research sites representing two educational contexts will be used namely, one Higher education institution (HE1) and one Secondary school (SE1), both within the same geographical area of the UK. The assessment methods at each context will be described and compared in order to make the results available to both HE1 and SE1 in order to facilitate each institution to make an informed review of their current assessment methods in order to improve alignment and promote effective transition for students. Whilst the findings of this study only relate directly to these two institutions, the information gained may well resonate in the sectors more widely, and promote a broader review.

3.3 Research questions

The research questions were derived in keeping with the phenomenological principles of this research. The questions use open-ended verbs like ‘what’ and ‘how’ (Creswell, 2013) to reveal the teachers’ perspective related to the phenomenon of assessment methods which is the aim of the study. The specific nature of the questions relates to the literature reviewed in Chapter 2 on assessment methods (Boud, 2007) and student learning (Entwistle, 1997).

1. How do science teachers and science lecturers describe the purposes of assessment with regards to their teaching, and their student’s learning?

2. How do science teachers and science lecturers describe their use of formative and summative assessment?

3. What methods of assessment are used by science teachers and science lecturers, and what justification do they give for using these methods?

4. What are the similarities and differences between teachers’ views from both sectors?

5. How do science teachers and science lecturers perceive the assessment methods and artefacts they use in their practice?

The research questions lend themselves to a qualitative approach to data collection which were interviews which allowed me to understand the interpretation of the teachers’ ‘human experience’ (Cohen and Manion, 1994, p. 36) of assessment methods and the situation being studied (Creswell, 2013). This is important because the context of the study which is the UK, across two sectors, namely SE and HE are of interest in this research.

These five questions direct my study and they have been carefully thought about in order to elicit the choices and reasons behind the use of different assessments methods and also describing them and their use in teaching and learning. This data is

very valuable for my institution, SE1, as it will inform future practice and help create relevant assessment policies and curriculums with assessment methods that are better aligned to HE practices in order to facilitate secondary school students' transitions into HE education. In addition, this thesis will be made available to the HE1 institution which was used in this study to help inform their foundation courses and understand what experiences of assessment methods first year students have had so that they can better support them. I will actively seek out how assessment practices are similar/ different in order to inform secondary managers about the results and help improve the practices of SE1 so that transitions between the two sectors are less challenging. Therefore, the research questions above are intended for this purpose.
The first two questions of my research look at the theoretical nature of teaching and learning and teachers' use of formative and summative assessments (Boud, 2007) in order to understand if there are different trends and uses across the two contexts.
Question three and four specifically look at the similarities and differences of the assessment methods which is the crux of this research. Question four will explore the views of the participant in terms of assessment to uncover how their practice is affected by their own personal views. Finally, question 5 looks specifically at the artefacts which each participant brought to the interview with them. An artefact is defined as physical evidence of an assessment method that the participant uses in their practice which will enable me to further analyse how teachers perceive these and the similarities and differences between the two institutions as well as be a point of discussion in the interview.

3.4 Epistemology

When considering which methodology to use to answer research questions, researchers use parameters of ontology and epistemology to guide their process (Braun and Clarke, 2013). Ontology is the nature of reality whilst, epistemology is the study of the nature of knowledge and how knowledge is gained (Baumgarten, 2010). The epistemology of this study is interpretivist. Interpretivist is underpinned by constructivist ontology which is concerned with meaning, understanding and insight (Crotty, 1998). Being a researcher who is looking to inform practice and who is interested in better understanding the interpretations of human experience within context means I am more aligned with the social sciences than the natural sciences

epistemology. In the natural sciences, this is done through experimentation and quantitative results (Moses & Knutsen, 2007; Thomas, 2014). In contrast, in the social sciences epistemology, whilst there may be observable laws and truths in the natural world (Moses & Knutsen, 2007), when it comes to studying human experience and behaviour these are open to interpretation and it may not be possible to grasp the full truth of any concept given that they are constructed or interpreted by the experience of each individual (Guba & Lincoln, 2005). Therefore, this research is interpretivist as interpretative researchers 'attempt to understanding phenomena through accessing the meaning participants' assign to them' (Orlikowski and Baroudi, 1991, p. 5). In addition, the study will look at the 'lived experience' (Smith et al., 2015) of participants and therefore will be phenomenological. Within the phenomenological epistemology the study will be concerned with Heidegger's (1914) hermeneutics where the 'researchers are part of the research' (Smith and Osborn, 1999) and co-create new knowledge with the participants. Dallmayr 2009) defined hermeneutics as 'the practice or art of interpretation' (p. 23). Therefore, Smith (2004) argues that researcher must practice 'double hermeneutics' where 'the participant is trying to make sense of their personal and social world; the researcher is trying to make sense of the participant trying to make sense of their personal and social world' (p. 40). Interpretivist researchers use open-ended questions to encourage others to share their experiences as well as focusing on the 'specific contexts' (Creswell, 2014, p.8). Interpretive research needs to be designed through experience and interactions with individuals within their context for it to be meaningful (Creswell, 2013). With this in mind the aim of this study is to understand the phenomenon of assessment methods from a teacher's perspective and from teachers from two contexts, namely HE and SE and therefore the study will employ interpretative phenomenological analysis (IPA). IPA recognises analysis involves interpretation and is strongly connected with hermeneutics and idiography which is concerned with an in-depth examination of how individual persons in their unique contexts make sense of a phenomenon (Noon, 2018). Context is relevant to this study as participants individual experiences form two contexts will be investigated in this study.

The phenomenological basis will allow me to understand the assessment methods employed at HE and SE from a teachers' perspective and the justifications of using these methods as described by the teacher. The purpose of the assessment methods

as well as how the teacher interprets this in regards to student learning will be revealed from the interview responses in this qualitative study. This will also help to interpret how assessment methods and student learning are linked. In addition, the comparison and description of the assessment methods from both contexts will allow me to further my understanding of each context and understand how to improve the assessment methods at my context SE1 in order to bridge the gap of assessment experiences and therefore, allow for a more successful transition into HE for secondary education students.

The perspective of the teachers will also assist me in questioning my own views of the phenomenon of assessment methods. Van Manen (2016) claims that individuals are able to challenge their own assumptions when they recount their experiences. This phenomenological approach therefore, will allow me to draw deeper interpretation and meaning from the data collected and assist in minimising my own bias as a researcher by challenging my own assumptions of assessment.I believe that the phenomenological approach is most suitable to this study as the teachers are interacting in different contexts which are unique (Engin & McKeown, 2017). Therefore, this approach will reveal the teachers' views of the contexts as well as their interpretations of assessment methods and how this can help with their students' learning. Once the experiences have been interpreted by the participants, the aim of the research will be to make recommendations from the study in order to improve the assessment practices in both contexts. It is hoped that this will bridge the gap of assessment experiences for students in order to help with transitions across secondary education into higher education.

3.5 Rationale for a phenomenological study

In any research study the research methodology is important as this is the overall strategy that the researcher uses to complete a study which includes all aspects of a study including data collection procedures and method, and therefore it is important in determining whether the study addresses the research problem (Penlay, 2018). It is important to note that the research problem determines the type of design that is most appropriate for a study and not vice versa. The design should not be decided and then attempt to fit the research problem around the design (de Vaus, 2001). To emphasise

this Creswell (2014) stresses that research approaches are plans and procedures that determine the steps of the research from broad assumptions to data collection methods, analysis and interpretation. One type of qualitative research methodology known as phenomenology gathers information by describing a particular phenomenon in a detailed and focused way using interviews, open ended questions or focus groups (Tuohy, Cooney, Dowling, Murphy, Sixmith, 2013). Interviews can vary in their structure from being open ended questions to limited in structure and take the form of a conversational interview. But open-ended and semi-structured interviews are most appropriate for a phenomenological study as this will allow the researcher to get closer to the participant and understand the meaning and experiences of the participant and the phenomenon being investigated (Ben-Eliyahu, 2017). In this study I will be using an interpretive phenomenological research methodology because this methodology explores the lived experience of the individual and is most suited to answering my research questions. The purpose of interpretive phenomenological research is to 'describe, understand and interpret participants' experiences' (Tuohy, Cooney, Dowling, Murphy, Sixmith, 2013, p. 18). Its aim is to articulate the meaning of the experienced phenomenon by the individual rather than the researcher ascribing meaning to a phenomenon (Christensen, Welch & Barr, 2017). The goal of this phenomenological study is to examine and interpret the 'lived experience' of the participants relating to the phenomenon (assessment methods) and how this impacts their students' learning in their unique contexts. I will be describing and comparing assessment methods from the point of view of the lecturers and teachers. Christensen, Welch & Barr (2017) posit that, "phenomenological inquiry seeks to articulate the meaning of experienced phenomena'' (p. 67). As such it seeks to go beyond measuring things but goes into deeper exploration (Christensen, Welch & Barr, 2017). Moreover, the authors argue that,

> *''the phenomenological inquiry can be considered a source of evidence beyond existing understanding and as such provide deeper more meaningful productive insights" (Christensen, Welch & Barr, 2017, p. 113-114).*

There are two predominant schools in phenomenological research, namely interpretative phenomenology and descriptive phenomenology. According to Wojnar & Swanson (2007) descriptive phenomenology emphasises the universal essence, whereas, interpretative phenomenology emphasises a contextual understanding of a

particular context. This has helped me choose my own methodology because to answer my research questions context is important as is the interpretation of the experiences of the participants within context, therefore with this in mind an interpretative phenomenology is most appropriate for this study. This is because the lecturers/ teachers will be describing and interpreting a phenomenon in their unique contexts and so in order to understand the types of assessment methods used in their practice the context has importance as two different contexts namely HE and SE will be described and compared. In addition, my research aims are to describe and compare assessment methods in secondary education with higher education and therefore, it is important to illicit from the teacher/ lecturer what they are doing in this regard across the two contexts as the context forms part of my research questions.
Edward Husserl is acknowledged as the founder of phenomenology and it is referred to as the study of the 'lived-experience' and is a way of describing phenomenon as they appear to the person experiencing the phenomena (Dowling, 2007). The aim of descriptive phenomenology is to describe the phenomenon's general characteristics rather than the individual's experience in order to determine the meaning or essence of the phenomenon (Giorgi, 2008). The objective therefore, is to describe things as they appear (Moran, 2000). In contrast, the aim of interpretative phenomenology is to describe, understand and interpret the participants' experiences in which time and space or context are important (Tuohy, Cooney, Dowling, Murphy, Sixmith, 2013). The focus is to explore the 'lived experience' and a key part of interpretative phenomenology is to recognise that participants' realities are influenced by the world in which they live and experiences are linked by social, cultural and political contexts (Flood, 2010). In this study both the 'lived-experience' of the phenomenon, namely assessment methods are important as well as the contexts which are being investigated: HE and SE and therefore, an interpretative phenomenology is the best methodology for this research.

However, within any research methodology there are shortcomings. Descriptive phenomenology believes that removing any previous preconceptions and beliefs helps to conduct research. Whereas, interpretative phenomenology holds the view that participants co-create knowledge and interpretation of a phenomenon (Smith, 2015). But there is an assumption that descriptive phenomenological research is free from bias, whilst interpretative phenomenology assumes that co-created interpretations are

trustworthy (Matua, & Van Der Wal, 2015). In order to address this limitation and generate valid 'pre-reflective' data (Moran, 2000) in a descriptive phenomenological study, Husserl emphasised the need to set aside natural, everyday assumptions and preconceived ideas and describe the phenomenon in its purest form before being corrupted by attitudes, prejudices or any other influencing factors (Tuohy, Cooney, Dowling, Murphy, Sixmith, 2013). This is achieved by 'bracketing' which is a process whereby the researcher must be aware of their biases and set them aside as much as possible (Finley, 2008). This involves the researcher, 'engaging a certain sense of wonder and openness to the world while at the same time reflexively restraining pre-understandings' (Finlay 2008). To remove all bias may be impossible but is it important that the researcher acknowledge and manage these preconceptions and influencers in descriptive and also in interpretative phenomenology.

One practical way to achieve bracketing in descriptive phenomenology would be using a journal to record all preconceptions during the research in order to manage these influencers and reduce them in a research study. However, according to McConnel-Henry et al (2009) bracketing has no role in interpretative phenomenology because the researchers is part of the research, and their previous understanding and knowledge helps with the interpretation. But it is important to distinguish what bracketing is. If we understand bracketing from a pure Husserlian perspective where all conscious and unconscious thoughts, beliefs and influencers are set aside then this would be impossible to set this aside during interpretations and it would therefore, not fit interpretative phenomenology (Finley, 2008). But, in interpretative phenomenology rather than setting aside thoughts and influencers, Finley (2008) argues that the researcher needs to bring to the forefront any biases or influencers by acknowledging them; only then can we be open to other people's interpretations. In order to achieve this in this study I will acknowledge my own biases and understandings prior to conducting any interviews and gathering any data in order to 'bracket' my own influencers in this study. I will do this by reflecting on my own pre-understandings as part of the bracketing process. It is hoped that acknowledging my biases and understandings of assessment methods will minimise the effects of my own influencers on the findings of this study (Finely, 2008).

But bracketing has less of an emphasis in interpretative phenomenology than in descriptive phenomenology. As a core part of interpretative phenomenology is that the researcher is 'considered inseparable from assumptions and preconceptions about the phenomena under investigation' (McCaince and Mcilfatrick 2008) therefore, these must be acknowledged and integrated into the research findings. I will therefore, reflect and acknowledge my own assumptions and understandings during this study. As a researcher I cannot rid myself of what I know or think and according to Flood (2008) this can be valuable during the enquiry as knowledge can be ‘co-constitutional’ meaning it is a blend of the participants' and the researchers’ meaning. But it is important in any research that I as the researcher identify any pre-understandings so that readers can be aware of study’s context and any possible influencing factors. I will engage in continuous self-reflection and self-scrutiny' (Karlsson et al 2012) in order to ‘ensure that the interpretations being made were valid and grounded in reality’ (Karlsson et al 2012).

This study is an interpretative phenomenological study in which the participants experiences of assessments methods will be revealed. As the participants are interacting in different contexts, higher education and secondary education, the context is therefore, pertinent. Thus, a phenomenological approach will be used because the teacher, context and experiences of assessment methods are the basis of this study (Creswell, 2013). The advantage of this methodology is that it will shed light on the participants views and experiences of assessment methods within their unique contexts which is the aim of this study (Engin and McKeonwn, 2017).In conclusion, the goal of this study is to investigate the human experiences of the phenomenon of assessment methods in regards to context and so interpretative phenomenology is most suited as meaning will be co-created by the researcher and the participant (Wojnar & Swanson, 2007).

3.6 Participants

Two different contexts will be used in this study which will consist of one HE institution, which will be referred to as HE1 and one secondary institution which will be referred to as SE1. The secondary institution is also my work context and I am employed as a full-time Science teacher here. From each institution eight participants will be chosen

for the interview part of this study. The subject discipline of the participant will be science or a science related discipline. This is because it is a subject area which I am familiar with and therefore I am less likely to miss anything significant in the data if I was not familiar with the subject discipline. In addition, focusing on one discipline narrows the study down and ensures that assessment methods can be compared across the two contexts HE and SE as the disciplines will be the same. The total participants from both institutions HE1 and SE1, are sixteen participants, eight science teachers and lecturers from each of the contexts. The interviews will consist of looking at assessment methods from a teacher's perspective in terms of their everyday practise .to help with this an interview protocol was prepared to ask questions regarding assessment methods. However, participants were able to deviate from the interview protocol and discuss what they interpreted as being relevant in terms of their practice and assessment methods and their student learning.

Table 1 below, illustrates the participants used in this study. Each participant was from a Science subject from each of the institutions. Both male and female teachers were recruited for the study and the population of male and females was equal, although gender was not the focus of this study and therefore this was not included in table 1, below.

Secondary Institution: SE1			**Higher Institution: HE1**		
Participant	**Subject**	**Number of years teaching**	**Participant**	**Subject**	**Number of years teaching**
SEI - 1	Biology	5-10	HEI - 9	Biology	10-15
SEI - 2	Biology	10-15	HEI- 10	Chemistry	10-15
SEI - 3	Chemistry	10-15	HEI - 11	Chemistry	10-15
SEI- 4	Chemistry	10-15	HEI - 12	Chemistry	10-15
SEI- 5	Chemistry	5-10	HEI - 13	Physics	15-20
SEI- 6	Physics	20-25	HEI - 14	Physics	10-15
SEI- 7	Physics	10-15	HEI- 15	Physics	5-10
SEI - 8	Physics	5-10	HEI – P16	Physics	10-15

Table 1: Sample of participants used in this study.

The participants consisted of teachers and lecturers with science specialisms including Biology, Chemistry and Physics specialisms across SE1 and HE1. The experience of the participants varied from 5 years of teaching science to 25 years and this has been included in table 1 by the range of teaching years. I have avoided giving the specific number of years of teaching in order to protect the participants identities. The purpose of including the experience of the sample of participants is to indicate that the whole population are experienced teachers, 5 years being the least but still indicative of professional teaching and learning experience in a science discipline.

I obtained ethical approval from The University of Liverpool as part of this EdD thesis and I obtained signed approval from both SE1 and HE1 for this study before I approached any of the potential participants. After signed consent and ethical approval was obtained from SE1 by the principal of the school who also was one of the SE1 participants of this study (SE1-6), the teachers at SE1 were approached directly as they were my colleagues and in the Science department so I had direct access to them. After an informal discussion about the research and gauging their interests I sent a formal invitation to participate in the study with a participant information sheet and participant consent form attached to the email invitation (Appendix 2). Nine invitations were sent to science colleagues and eight were returned successfully and therefore recruited for the study. For the HE1 participant sample the school SE1 had links with the University, HE1 and I was on the STEM enrichment programme which was an initiative to attract SE1 science students into science courses at HE1 in the academic year of 2017-18. During this programme I was able to meet HE1 science teachers and therefore gauge their interests and recruit them into the research. After obtaining formal ethical approval from HE1 and the University of Liverpool, ten HE1 participants were invited formally to the study via a formal email with the participant information sheet and participant consent form attached and eight teachers successfully replied and were recruited from HE1.

3.7 Methods of data collection

In this qualitative study semi-structured interviews and artefacts were used as the data collection methods as these methods allowed for the inherent phenomenological

assumptions to be fulfilled. In addition, institutional documents were used to support the findings from the interviews and to add contextual detail to the findings to help with the interpretations. Richie (2003) and Snape and Spencer (2003) suggest that when investigating a phenomena methods of data collection need to be appropriate and 'sensitive to the social context in which the data are produced'. Hence, I used semi-structured interviews with teachers. The methods used are aligned to qualitative data collection methods (Cohen et al., 2011; Hammersley and Atkinson, 2007). Semi-structured interviews were used because they suited the phenomenological approach of this study as they 'allow researchers to develop in-depth accounts of experiences and perceptions with individuals' (Cousins, 2009, p. 71) within their contexts. In addition, I asked each interview participant to bring with them an artefact which is defined as any assessment material that they use in their everyday classroom routines. The purpose of the artefact was to collect material evidence of assessment methods which were used by the participant and analyse these as well as to provide a point of discussion during the interviews. The inclusion of the different data collection methods namely interviews and the artefacts and institutional documents was to increase the validity of the study as Duffy (2005) explains documentary analysis is used to check the validity of information gathered from interviews. In addition, the artefacts are a source of evidence that can also be used to check the reliability of the evidence gathered from the interviews. This is the rationale for using these methods and I will discuss the primary data collection methods below in detail.

3.8 Semi-Structured Interviews and artefacts

The primary data collection method used in this study was semi-structured interviews. This method was chosen in order to achieve the first aim of this study, namely to describe the assessment methods that were used by teachers and lecturers and why they were used across the two different sectors: higher and secondary education. This study is interpretivist in nature and semi-structured interviews will allow participants to describe their experiences and interact with the interviewer which will allow meaning to be constructed which is congruent to the constructivist approach to qualitative research (Braun & Clarke, 2006). The semi-structured interviews were the primary source of data collection which allowed exploration of the participants experiences and

to understand the phenomenon of assessment methods from their perspective and their unique contexts (Creswell, 2013).

The first step in preparing for the interviews was to devise an interview protocol as described by Silverman, (2010) as a framework for obtaining data. A set of questions were carefully crafted in order to answer the research questions of this study. Although there was an interview protocol (Silverman 2000) used in order to elicit greater detail the interviewer was able to ask further probing questions to gain more detail and an understanding of assessment methods and the rationale for using the different methods by the interviewee. Rubin and Rubin (2005) describe this as a conversational partnership that is dynamic and changes the interview process. But, as opposed to a conversation the semi-structured interviews were more thorough and the focus revolved around answering my research questions. The interview questions were designed to elicit what methods were used by the interviewee and why.

The first interview question which was linked to my first research was identifying the interviewees role within assessment in their context and their role. This was used to identify what autonomy they had over the choices of assessment methods that they used within their practice. The second interview question looked at the views of the interviewee in terms of what the purpose of assessment was in regards to their teaching and student learning. I used this research question to illicit the reasons why teachers/lecturers were using assessment in their teaching and learning and how it impacts learners. It also enabled me to identify any pedagogical views of the participant which might impact the choice of assessment methods that they used within their practice. In addition, special attention was paid to the participants justification and choice of assessment methods in particular to identify assessment methods which linked to ‘deep’ learning, ‘surface’ learning or ‘strategic’ learning in students. The third, forth and fifth interview questions concerned the types of assessment methods used and why they were used by the teachers and their views on how it helped with student learning which was the focus of my research. These questions linked with the third and fourth research questions respectively. I asked the participant about their use of formative and summative assessment methods for the sixth interview question and this was linked to my second research question. This was used to identify and compare the assessment methods used across the two sectors

which was directly related to my fourth and fifth research questions. I also prompted teachers to describe their use of formative and summative practices which again allowed me to explore this question in depth which generated rich comparative data to analyse the methods used across the different sectors. The eighth interview question was related to my fifth research question which was about the participants artefact and understanding its use and justification for bringing it as well as using it within their classroom practice. This allowed me to generate concrete data on assessment methods used across the two sectors which again allowed me to compare across the different sectors more effectively. In addition, it provided a point of discussion at the interview. The interview questions were coherent and followed on from each other in order to derive answers in a detailed way. The results from the interviews will be discussed in detail in chapter 5, the findings section which will follow this chapter. A few examples of the interview questions are provided below with the full interview protocol provided in Appendix 4.

1. Could you tell me a little about your role in assessment, please?
2. Could you tell me a little about how you would describe the purpose of assessment with regards to your students' learning?
3. In your view how do you think assessment can help with students' learning?
4. Can you tell me about the methods of assessments you use?
5. Can you tell me about why you use these methods of assessment in your teaching?
6. Can you tell me about how you would describe your use of formative and summative assessment?
7. Can you tell me what you know on how assessment is used in science at higher education/secondary education?
8. Can you tell me a little about the artefact you bought with you? Why did you choose to bring this artefact, please?

Wengraf (2001) argues that the interview method is specifically designed to further knowledge as it is conversational in format which is unique in that new knowledge can be constructed. I used semi-structured interviews as it is flexible and allowed both the interviewer and the interviewee to digress from the interview protocol when needed

and also because it allowed for extrapolation of the lived experience (Van Manen, 2016). The flexibility inherent in semi-structured interviews allowed the participants to express their views about assessment methods in their contexts. This encouraged spontaneous responses and new ideas can be contributed to the discussions (Merriam & Tisdell, 2016). The phenomenological approach revolves around looking and understanding a particular phenomenon, in this case it was assessment methods across the two contexts. However, whilst semi-structured interviews are flexible one drawback of the data collection method is that arranging the interviews and carrying them out can be very time consuming. In this study the participants were invited to take part in this study via email. As I work at SE1 I was able to approach the participants in the science department directly. Participants at HE1 were invited via email and I was able to recruit these as I had direct access to HE1 as a STEM ambassador for SE1 where I was involved in some training at HE1 as part of a STEM initiative at SE1. SE1 interviews took place in the schools meeting room which was booked as each interview was scheduled. HE1 interviews took place at the HE campus in the science specialist building which the participant worked at and the interview took place either in their office or a conference room which the participant selected. The meeting room and conference rooms were reserved for approximately one hour to ensure there was enough time for the interview so that the participant was not rushed in their responses and were able to talk about their views openly (Van Manen, 2016). Prior to the interviews the participants were sent the Participant information sheet as well as the consent forms (Appendix 3) to read prior to the interviews by email. SE1 interviews were scheduled in February 2018 whilst HE1 interviews were scheduled in July and August 2018 after the examination period at HE1.

In total sixteen participants were recruited from SE and HE for this phenomenological study and the average time for each interview was 55 mins. At each interview I took a copy of the participant consent form in case these were not signed and returned prior to the interview to ensure all consent forms were signed prior to the interview commencing. Creswell (2013) suggests this sample size is appropriate for a phenomenological study as primary data is collected with the appropriate breadth and depth using interviews. Participants were reminded that pseudonyms would be used and their identity would remain confidential and that a full transcript of the interview would be made available within a week of the interview for them to review before being

used in the study. In order to ensure that anonymity and confidentiality was maintained in my own contexts pseudonyms were used for each participant on any written notes and transcripts. Each interview was recorded using a personal Sony recording device and saved in separate folders using pseudonym which were then transcribed verbatim manually by the researcher which allowed me to have close exposure and an understanding of the interview data which helped with my analysis and findings. At the interview each of the sixteen participants bought with them an artefact which added further material evidence of the types of assessment methods that were used in SE and HE. The justification of using artefacts was to bring material evidence of an assessment method the participant used in practice. In an interpretative study by Reischauer (2015) the author used artefacts for 'organizational sense-making' (p. 286) in order to understand the meaning of innovation within an organisation. Similarly, in this study artefacts are used to understand participants' views of assessment methods. Artefacts are considered as 'historic remains of behaviour in an organization' (Reischauer, 2015, p. 290) and can allude the perspectives of assessment methods by the contexts which will be relevant in this study. Artefacts refer to 'physical manifestations' (Reischauer (2015, p. 290) for example, a test paper or homework assignment. Moreover, Edward and I'Anson (2020) in their study used artefacts to elicit participants' views 'about their learning process and to explore their experiences with aspects of the curriculum they struggled with, along with how assessment and feedback impacted their learning' (p. 49). In this study the artefacts were 'used in a flexible way' (p. 49) and to act as prompts for the discussion about the teachers' views about student learning including assessment and feedback. Similarly, in this study I will use artefacts to elicit teachers' views about assessment methods and their students' learning. The artefacts provided a point of discussion at the interview and the findings from the analysis of these will be discussed in chapter 4, the findings section using interpretative phenomenological analysis (Smith, 2015). A detailed description of the data analysis procedure which was used for the interview data and the artefacts will be provided below in this chapter.

3.9 Data Analysis Procedures

The data analysis procedure that was used in this study to analyse the interview and artefacts was a type of thematic analysis which consisted of, “identifying, analysing and reporting patterns (themes) within data” (Braun & Clarke, 2006, p. 79). However, Hycner (1999) argues that in phenomenology data analysis is not congruent per se as this means that data will be dissected into parts. Analysing phenomenological data means obtaining the meaning and ‘essence’ of the phenomenon being described by the participant. The process involves looking at the data as a whole to understand the meaning that the participants want to bring to the interview (Smith, 2015). This is known as ‘explication’ which means that the data is looked at as a whole in order to obtain meaning that the participants are trying to communicate in the interview. Overall, the aim of the researcher is to interpret the ‘personal and social world’ (Smith, 2015, p. 28) of the participants and the participant reflects on the phenomenon and their experiences. This data analysis procedure suits the study's qualitative design. Whilst analysing the data although in descriptive phenomenology bracketing is a necessity, as this study is an interpretative phenomenological study McConnel-Henry et al. (2009) argues that bracketing is not a requirement. Instead, Finley (2008) argues that in order to be open to other people’s interpretations of a phenomenon the researcher needs to bring any biases and influences to the foreground by acknowledging them and only then can they be open to other people’s interpretations. In order to mitigate any biases and influences in this study as described previously I acknowledged any biases and influences by reflecting on my own pre-understandings of the phenomenon. This this will minimised the effects of my own influences on the study McCaince and Mcilfatrick, (2008) argue that the researchers’ assumptions and preconceptions are ‘inseparable’ and therefore these must be acknowledged and integrated into the research findings which will be done in this study. I reflected on my own experiences in relation to assessment in order to redirect my focus on the participants (Creswell, 2013) this was to help me in “identifying unanticipated phenomena and influences” (Maxwell, 2005, p. 22) during the data analysis process.

Mercer (2007) argues that to achieve rigor the data collection method and data analysis are required to be congruent with phenomenological approaches. As a result

of this, the data analysis procedure that I used in this study was interpretative phenomenological analysis (IPA) because this suited the study design as the lived experiences from the teachers' perspective are revealed (Lester, 1999). Figure 2 indicates a summary of the IPA data analysis procedure used in this study which has four stages.

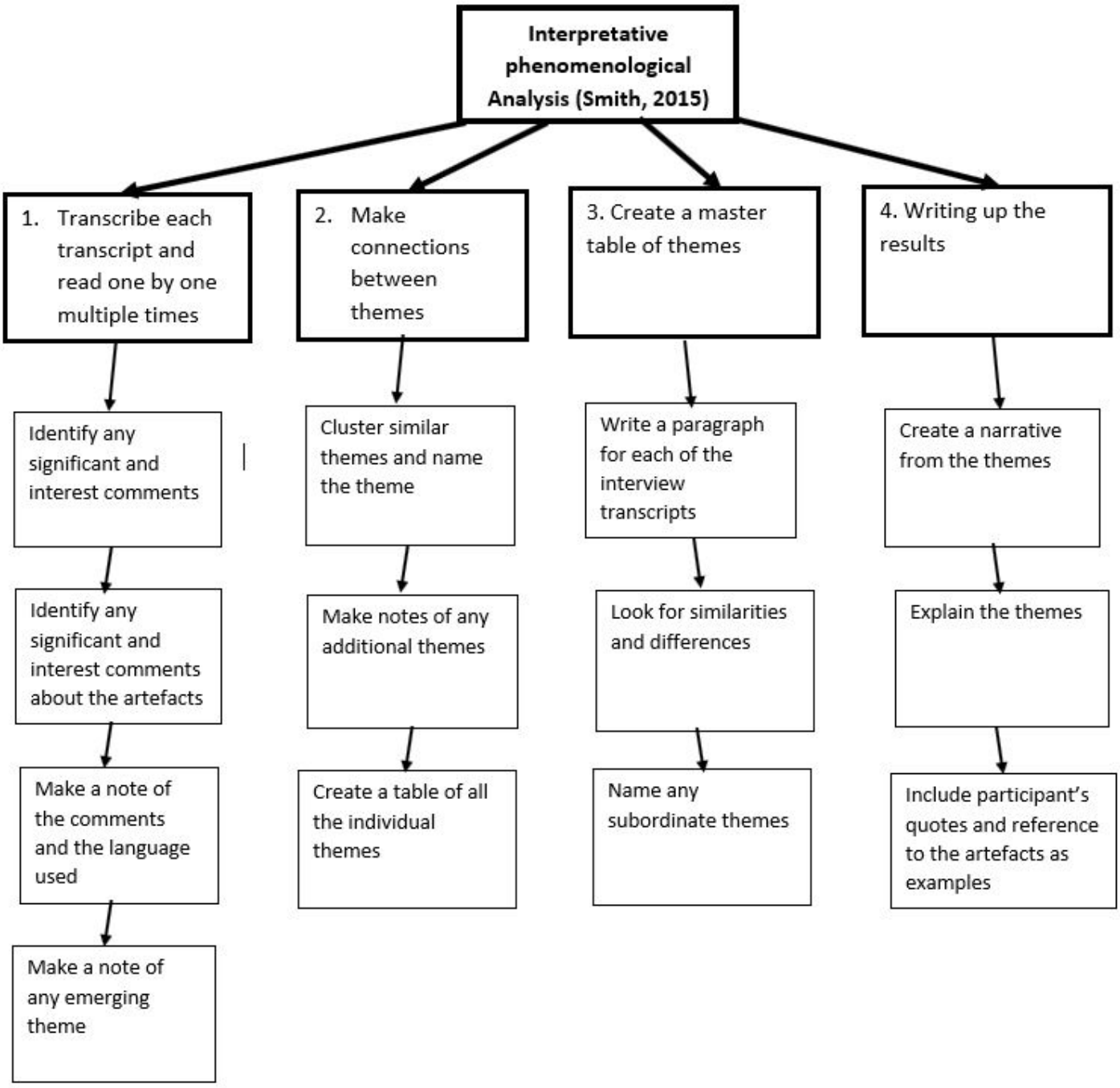


Figure 2: Summary of the data analysis procedure using Interpretative Phenomenological Analysis (IPA) adopted from Smith, (2015).

In IPA both the researcher and the participant are involved in the sense making of a particular phenomenon. The participant shares their experiences whilst the researcher is trying to understand what the participant understands (Smith, 2015). In this study the aim of the researcher is to understand assessment methods at each context in order to bridge the gap between the two sectors HE and SE by making the results available to HE1 and SE1 in order to help facilitate the transition of SE students to HE. IPA will facilitate an in-depth insight into the assessment methods across both contexts from a teachers' point of view. Using IPA will allow teachers to describe the purpose of assessment with regards to their teaching and student learning. Also, using IPA will mean that the methods of assessment used and whether they encourage 'surface' approaches to learning or 'deep' learning can be explored (Entwistle, 2000) as presented in the theoretical lens in Chapter 2. Further justification of using IPA for the data analysis procedure is that it is suitable to the theoretical nature of the research questions which explore the lived experiences from a teachers' perspective.

In IPA the first stage which can be seen in Figure 2 is to read the transcript one by one multiple times and note any 'significant statements' (Creswell, 2013, p. 193) and the language used so that emerging themes within the interviews could be identified. In addition, any significant and interesting statements about the artefacts were also identified from the interview data. This list of statements was reviewed repeatedly so that repeated statements were eliminated and recurring comments were not included. Once the significant statements had been noted they were clustered together into 'meaning units' (Creswell, 2013, p. 13) and connections were made between the emergent themes. Once I established a clustered list of themes for each transcript, a description of teachers' assessment methods and student learning was written.

The IPA data analysis then continued with writing a paragraph explaining the experiences of each participant and the assessment methods they used in their practice. When this process was complete for each of the interviews and a table of themes was produced for each transcript, I then searched the 'themes common to most or all of the interviews' (Hycner, 1999, p. 154). This process was iterative and allowed me to create a master table of themes and the final subthemes (Smith, 2015)

and from this I wrote a ‘narrative argument’ (p. 49) explaining each of the themes and used quotes from the participants to support my interpretations.

3.10 Analysis

The first stage of my IPA data analysis involved transcribing each of the interviews verbatim, this was done by myself. Each of the interviews were read multiple times in order to identify any significant and interesting comments in the interviews as well as identifying any significant and interesting comments about the artefacts within the interviews. Reading multiple times helped me ‘immerse myself’ in the data as Pietkiewicz and Smith, (2014, p. 12) describe in order to gain a new insight after each reading. At this stage notes were made about my initial observations and comments were made about anything significant including the language used and the context. My initial interpretative comments were made here and any emerging theme were noted. I transformed my detailed and comprehensive notes into emergent themes by formulating a concise phrase which encompassed the comments and was at a ‘slightly higher level of abstraction’ (Pietkiewicz and Smith, 2014, p. 12). Figure 3 below shows an example of emerging themes from an interview extract.

Original transcript	Emerging themes
Interviewer: Could you tell me a little about your role in assessment, please?	
I am a classroom teacher, so my role in assessment is to assess all my teaching groups to ensure that the students are making progress and to identify any gaps in their knowledge; and then to close those gaps as a result of my assessment. I do this on a day-to-day basis as part of my normal classroom routines. This can be done through question and answer sessions, or getting students to do questions in the class, where the students use the green pen strategy and self-assess or peer assess to identify any gaps in their knowledge. This is done as a formative assessment and then summative assessments are done at the end of every topic.	Student progress Identifying gaps in students' knowledge and closing them Formative assessment methods including Q&A sessions, self and peer assessment Schools' green pen strategy Summative assessment, end of topic test.
Interviewer: Can you tell me how you would describe the purpose of assessment with regards to your teaching?	
The purpose is to identify where the students are, what their strengths and weaknesses are and then to tailor my teaching according to those strengths and weaknesses. So, it also, acts as feedback for my teaching as well.	Identify strengths and weaknesses of student Adjusting teaching to students' needs Feedback to own teaching

Figure 3: Example of developing emergent themes from an interview transcript.

The next stage involved making connections between themes and grouping them together according to 'conceptual similarities' (Pietkiewicz and Smith, (2014, p. 12) and providing each cluster with a descriptive name. This meant in practice compiling themes for the whole transcript before looking for connections and clusters. Any additional themes were noted and also some themes were dropped at this stage as they did not fit well with the emerging clusters and because there was weak evidence across the interview transcript. A table of all the individual themes was created. Figure 4 illustrates an example of clustered themes from the same interview transcript in Figure 3. The third stage involved creating a master table of themes from all the interview transcripts and writing a paragraph for each of the transcripts. Similarities and differences between the interview transcripts were identified and any subordinate themes names. The final step was the write up which involved creating a narrative of the themes which involved taking each of the final themes and explaining them. Each theme was described and explained using quotes from the participants followed by

analytic comments. Pietkiewicz and Smith (2014) argue that using participant quotes has two functions the first being, ‘it enables the reader to assess the pertinence of the interpretations’ (p. 13) and secondly ‘it retains the voice of the participants’ personal experience’ (p. 13) within the researchers’ interpretative commentary and findings.

Teachers’ views on the purpose of assessment
To assess knowledge and understanding of students
To close the gaps in knowledge
To identify the strengths and weaknesses of the students’ understanding
To see if the students are making progress
To see what the students have learned
To assess practical skills
Teachers’ use of formative and summative assessment
Used continually as part of classroom routines to assess students’ understanding
To assess content learned during the topic
Formative methods like self and peer assessment to reduce teacher marking
Marking strategies including the use of green pen strategies to reduce teacher workload
Questioning as part of classroom routines
End of topic tests/ exams

Figure 4: An example of clustered themes

This analysis was done across all the interview transcripts and the artefacts which were analysed as part of the discussions within the interviews. The final themes that resulted from this data analysis procedure are presented in Chapter 4, the findings section.

3.11 Ethical considerations

As this study will involve qualitative data in the form of interview data there are a few ethical considerations which will bound the research. In order to protect the confidentiality of all participants all responses will be anonymised in order to protect their identities. In addition, the contexts used in this research will remain confidential and instead pseudonyms will be used to protect the SE and HE context used in this study which will further ensure participant identities remain confidential. All participants signed a written consent form in order to make them aware of how they will be involved in the research and how the information will be used and stored (Oliver,

2003). The data was stored in secure folders using pseudonyms to protect the confidentiality of the participants and contexts throughout the study. In addition, both organisations will have access to the findings and the thesis in order to encourage both to consider the findings and the recommendations of the study as this may have a positive impact to their future practise.

Another ethical consideration will be to remove any bias in the study as the researcher as I am employed at SE1. In order to remove any conflict all participants involved were selected randomly and had a science specialism relevant to the study. The SE school is fairly large and has a thriving science department where eight science teachers consented to taking part in the research. McNay (2007) argues that in qualitative studies confidentiality is important in order to protect the participants from any undesirable results being published. This was done in this study to safeguard the participants from any disciplinary action on the part of their respective organisations due to any unforeseen disclosures (McNay, 2007). To ensure that my participants had knowledge of my research and understood the aims and their right to privacy and their right to withdraw at any point in the research without any consequence, I sent a Participant Information Sheet (PIS, Appendix 2) to them via email in their invitation email. The PIS outlined the participants rights to confidentiality and privacy. Marmolejo (2006) claims that research work will impact the organisation in one form or another therefore it is crucial to protect respondents from any adverse effects by protecting their identities. Moreover, participants gave their full consent to be involved in this study using the participant consent form which was distributed to each participant at the interview. Also, I pursued each of the institutions separately and gained consent and ethical clearance by following their own respective policy and procedures in order to conduct my study in their institutions. I also obtained full ethical approval from the University of Liverpool prior to conducting any research. Finally, Cohen, Manion, and Morrison (2007) argue that it is not always possible to identify and alleviate all risks and ethical issues encountered during research. However, I have tried my utmost to be continually reflective as a practitioner and maintain an awareness of any potential risks and ethical issues arising (Parsell, Ambler, & Jacenyik-Trawoger, 2014; Wright, Suchet-Pearson & Lloyd, 2007). This research will result in a meaningful understanding of the current assessment methods described and compared in two different sectors in order to help inform curriculums and help with student transitions

from secondary education to higher education. This practitioner research has the potential to impact both sectors SE and HE with the potential to develop more effective assessment methods to help SE final year students and also first year HE students with their transitions into higher education.

3.12 Summary

In this chapter I have explained the methodology that I used and explained the purpose and design of my study as an interpretative phenomenological study. The rationale for choosing this approach and the suitability of using it for my research has been explained above. This also stems with my epistemological view of interpreting reality through the lived experiences of those involved with the phenomenon being researched. Assessment methods within SE and HE sectors is the phenomenon being studied in this research. Creswell (2013) emphasised that data collection methods need to match the design of the study. As this was a qualitative study, the data collection methods that were used were compatible with this design and included interviews and artefacts as well as documentary analysis.

Chapter 4

Findings

4.1 Introduction

This chapter details the findings of this study. This study used the interpretative phenomenological approach and the methods used support the nature of the study which was to describe and compare the assessment methods used at SE and HE from a teachers' perspective through their 'lifeworld, the world of everyday lived experience' (Van Manen, 2016, p. 313) in their classroom routines. The methods and approaches used in this study were congruent in assisting in answering the following research questions:

1. How do science teachers and science lecturers describe the purposes of assessment with regards to their teaching, and their student's learning?

2. How do science teachers and science lecturers describe their use of formative and summative assessment?

3. What methods of assessment are used by science teachers and science lecturers, and what justification do they give for using these methods?

4. What are the similarities and differences between teachers' views from both sectors?

5. How do science teachers and science lecturers perceive the assessment methods and artefacts they use in their practice?

The findings are organised into topics which each of the research questions explore. This is illustrated below in Figure 5 which indicates the research question, the equivalent topic that will be explored in the sections below. A mix of deductive and inductive approaches were used whereby the research questions guided the analysis

of the data to some extent. Figure 5 below illustrates the topics which each RQ explores and how this section will be organised.

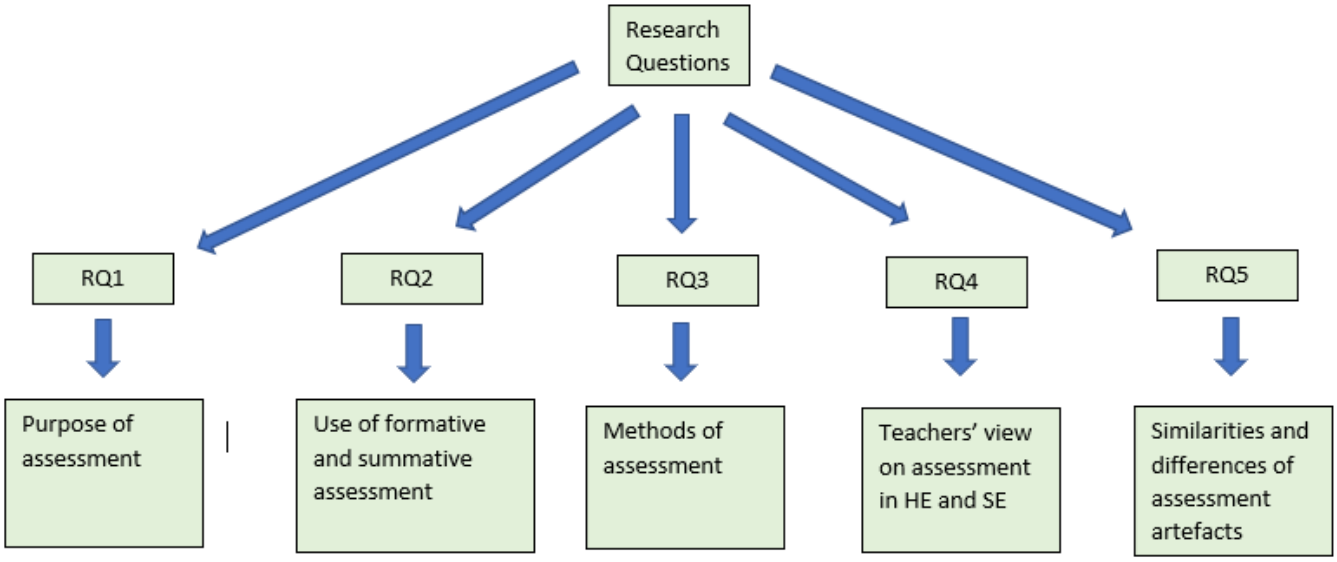


Figure 5 Research questions and topics which were explored.

The data analysis procedure which was explained in chapter 3 in the methodology section was IPA. The stages have been described in the above chapter. The first stage involved transcribing and reading the interview transcripts multiple times and identifying any interesting and significant comments and making a note of the comments. The extract below in Figure 6, illustrates my exploratory comments including the language and views of the teachers on assessment methods used in their practice, from a compilation of interview transcripts which helped me identify the emergent themes within my interview data. The corresponding participant transcript is identified as well as the emergent themes which were revealed from my data analysis. A full list of emergent themes, with corresponding transcripts and exploratory comments is illustrated in Appendix 1.

Emergent themes	Participant transcript	Exploratory comments
To assess knowledge and understanding	SEI1	Holds the view that without assessment will not be able to test students' knowledge and understand
	SEI4	Uses assessment for the purpose of assessing students' knowledge and understanding
	HEI14	At the end of a teaching unit need to assess the knowledge and understanding of students
To close the gap of knowledge	SEI7	Views assessment as enabling teachers to see where they are at and then where they need to go and how to close that gap in knowledge
	SEI1	Helps to close the gap in understanding
	HEI15	Uses to identify gaps in students' knowledge
To develop skills to acquire degree certificate	HEI16	Views the degree qualification as proof that students have gained the required skills needed to earn the degree certificate
	HEI15	Thinks that skills need to be developed as part of the physics degree
	HEI14	The degree certificate means that students have the necessary skills
To monitor and track students' progress	SEI7	Views assessment as a means to track and monitor students' progress throughout the course
	SEI3	To track the performance of students in the class
	SEI1	To ensure students making progress
	HEI10	To monitor the overall performance of students and compare with previous modules in order to get a normal bell curve distribution of student performances

Figure 6 Emergent themes from interview data with corresponding transcript number and researchers' exploratory comments.

Following the four stages of IPA data analysis the final list of themes and subthemes that emerged from my data are illustrated below in Figure 7. The themes below are a

result of meticulously analysing the HE and SE data which resulted in the themes illustrated in Figure 7 across HE1 and SE1.

Theme	Sub theme	Example participant quotes
To asses knowledge and understanding	To identify gaps in students' knowledge	'It should be a point to show off what they have learnt and then a place for them to identify where they need to close gaps in their knowledge' (SEI1, p. 1). 'If we can pinpoint their weaknesses then also we can hopefully provide intervention for them in order to tackle those weak areas, but that should then add to the learning. It should hopefully close the gaps in the understanding that the students may have' (SEI4, p. 4). 'It's also useful for the lecturer to identify gaps in the students' knowledge and also the students to realise how the journey has been in their learning' (HEI15, p. 2).
	To monitor and track students' progress	'One role is to identify where the students are in order to help them to progress' (SEI7, p. 1) 'In my current role assessment is used to as a tool to monitor student progress overall, school wide' (SEI5, p. 1)
	To help develop skills	'A lot of what we do is to try and develop skills in our assessment. For example, assessments around laboratories' (HEI14, p. 4). 'I use assessed practicals which the students do…so they acquire practical skills' (SEI7, p. 3).
	To maintain quality standards for employability	'We as an institution ourselves have a round QA, we set assessment then we validate assessment in some way and then we rank students on how we believe they have performed in the assessment and that has a value to prospective employers' (HEI9, p. 2). 'As an employer what's the point of university unless you are graduating people with qualifications that we can judge them by' (HEI14, p. 6).
In order to assess throughout the learning	Formative assessment is used continually	'Quite a lot of AFL (formative assessment) is built into the lesson' (SEI1, p.4). 'For my formative assessment that is anything that will affect my teaching or affect the path of the student… my formative assessment will go on throughout the lesson' (SEI3, p. 2)

	Assessing through question and answer sessions	'As a classroom teacher a lot of my assessment is carried out informally in terms of questioning during the lessons' (SEI3, p. 2). 'I find questioning probably the strongest tool, it's immediate and it can be developed and it can be targeted to students within lessons' (SEI1, p. 3). 'During the lectures I asked questions to get feedback on their understanding' (HEI13, p.4).
	Assessing through coursework and assignments	'The assessment is done by giving students two assignments which are released during the term and students are given 2 weeks to finish these' (HEI13, p. 14) 'They will have computer modelling assignments in physics which they will do throughout the year' (HEI14, p. 7). 'Coursework is teacher assessed…the coursework in physics is sent to the external moderator to be moderated' (SEI7, p. 8).
	Summative is used to assess content	'For lecture courses the assessment method is exams…which assess the content and I put forward the content of such exams' (HEI10, p. 5). 'Exams are there to test knowledge and to some extent the application of that knowledge. We use them in the first-year science courses…because it is a suitable way to assess the content that they learn' (HEI11, p. 9). 'If it is a summative assessment… we assess the content' (SEI2, p. 3).
	Assessing through exams and dissertations	'The ultimate end is for students to sit an external exam which will test the criteria of the national curriculum in the UK' (SEI8, p. 3)

		'There is a dissertation at the end depending on the year. So, for example final year students will write a dissertation. And this will be a big chunk of their marks' (HEI14, p.8).
Using a variety of assessment methods	Self and peer assessment	'Self-assessment gets used more frequently, and your self-assessment is purely formative…and quick quizzes where the students might self or peer assess' (SEI3, p. 5). 'All the students can peer assess each other's work using the mark scheme which I will put on the board… and within the exam pack there is mark scheme attached to this exam pack the students can use for self-assessment purposes' (SEI7, p. 5). 'I give the students a weekly homework assignment which is not compulsory but there are questions that they can find online and they are self-marked online' (HEI9, p. 4).
	Practical assessments	'Assessed practicals…ensuring that the students meet the criteria of the practical; and assessing whether or not you think they should pass that practical or not' (SEI3, p. 3). 'In the practical labs we are assessing their lab books which is part of their assessment, in the lab books we are looking at the ability of the students' understanding…and their ability to record accurate data and records' (HEI15, p.10).
	Presentations, posters and viva	'Presentations (are) primarily verbal assessment, but this may also include posters, which might be a mixture of visual and verbal presentation so that there are a variety of communication mechanisms which students are getting used to' (HEI9, p. 5). 'Another method of assessment I use are presentations, getting the students to explain or present a concept in their own words' (SEI8, p. 9).

Teachers views on the students' learning process	To provide exam practice	'Written practice questions or exam questions; I use these because some students are very good at verbalising answers but not very good at written questions... so, it allows them to practice that skill. It is training for the exam, training the students to perform on the day' (SEI2, p.4). 'This is an exam question for practice on one concept in physics which is worth nine marks and the students have to go away and do it and submit it within a week' (SEI7, p. 10).
	To provide and assess mathematical and practical skills	'The purpose of the tutorial sheet is partly to do with mathematical skills so it is asking them to apply some knowledge that they have learnt in their first couple of weeks in lectures in year one but it's also primarily about exposing them to questions of different forms so as I mentioned before it got questions in the form of words without equations and other questions which are in the form of equations and no words' (HEI11, p. 14). 'In this exam paper most of the questions are mathematically based. So, the 25-mark question Is looking to see if the student can manipulate mathematical data but also demonstrate the correct procedures which they must apply for the correct answer' (HEI17, p. 13). 'In labs (we assess their) working skills and their practical skills' (HEI16, p. 5). 'I assess practical skills which the students do. Some of them are compulsory, core practicals and each practical is followed by some follow up task' (SEI7, p. 8).

	To focus on the process of learning	'Lab reports are about what scientists do… they write published papers and the lab reports are basically trying to develop that process, how do you formally communicate those ideas within that environment and how to structure a piece of work correctly, i.e. with an introduction, method, results, discussion etc' (HEI14, p. 4) 'You're looking for the process so if the number at the end is not completely within the boundaries but their thought process is correct they can still get some marks' (HEI15, p. 10).
To challenge students	Developing critical thinking skills	'In some questions… it is a matter of calculating and a bit of critical thinking' (HEI16, p. 6). '(Problem sheets) are done on a weekly basis and it demonstrates problem solving skills and critical thinking which the students need to acquire as part of their degree programme. They are also specific to the course programme and incrementally the level of the problems increases and we want to see that the students engage with them so that we can see that they have understood the course material' (HEI14, p. 5).
	Using mark schemes	'The mark scheme is for a Key Stage 5, Biology test on biological molecules there is a mix of higher order questions, low order questions, as well as multiple choice questions' (SEI2, p. 8). 'This is a mark scheme for a Chemistry test on energetics on enthalpy which is an A-Level topic for my A-Level Chemistry, which I have just done today, and this is my mark scheme for it' (SEI4, p. 6).

Figure 7 Final list of themes and sub themes from the interviews and artefact data.

In this section each of the themes and sub themes will be explored in terms of the research question and the topic that was being investigated by each research question (see Figure 5). Documentary analysis evidence in the form of institutional documents will be referred to in order to add context to the findings and to support each theme across HE1 and SE1 contexts.

4.2 Purpose of assessment

Theme 1 To assess knowledge and understanding

4.2.1. To identify gaps in students' knowledge

The first theme that was discovered after analysing the data was knowledge and understanding. This theme became apparent as a result of the interview transcripts and documentary analysis which indicate a predominant view and justification for the use and purpose of assessment. Teachers from both sectors, Secondary and Higher Education emphasised that the primary purpose of assessments in their view was to assess the knowledge and understanding that the student learned during the course or module. This was a concurrent theme running through fourteen of the participants.

> *'It (assessment) should be a point to show off what they have learnt and then a place for them to identify where they need to close gaps in their knowledge'. SEI-1, (p.1).*

Also, assessment of knowledge can be seen from the response below by SEI-7, Secondary Education.

> *'I use assessment for consolidation of knowledge mainly, and tests which are recorded against the students target and analysed in terms of their performance'. SEI-7, (p.1).*

In the documentary evidence in SE1 within the Sixth Form A Level Handbook (2018) the breakdown of the assessment criteria in Biology A Level points to the examination assessment criteria of knowledge and understanding supporting theme 1 in the findings.

> *'New A Levels will be fully linear so assessment of a student's knowledge and understanding of the whole course takes place at the end of two years of study... At least 15% of the question paper assessment covers knowledge and understanding' (Sixth Form A Level Handbook, 2018, SE1, p. 32)'.*

Moreover, the data at HE re-iterates theme 1 and the sub-theme identifying gaps in knowledge for example. Participant HEI-15 states that,

> *'(assessment is used) to identify gaps in the students' knowledge and also for the students to realise how the journey has been in their learning'. HEI-15, (p.2).*

Understanding the content and key concepts was a theme running through both the SE and HE data

> '*problem sheets are designed to see if the students have understood the key concepts within the course. They also encourage students to engage with the course content and these are given on a weekly basis and they can show if the student has understood or not' HEI-14, (p. 9)*

The subtheme, 'identifying gaps' in knowledge was identified across the SE and HE data as this was a frequent justification for the purpose of assessment and a tool to adjust teaching accordingly in order to help students' progress in their learning. Heller, Steiner, Hockemeyer and Albert (2006) describe this as a 'personalised approach' to learning. In addition, in HE and SE there was also an emphasis on understanding and ensuring that students/ graduates are reaching a minimum threshold of understanding in order to successfully graduate or pass the course.

> *'So basically, it is a matter of ensuring that people know what they have been taught and they don't graduate if they don't! (HEI-16, p.1).*

4.2.2 To monitor and track students' progress

Another subtheme which was identified in the HE and SE interview transcripts was 'monitoring and tracking students' progress'. This subtheme was reoccurring in three of the eight participants in SE and in two participants in HE. For example,

> *'assessment is as a tool to monitor student progress overall, school wide and also to identify underachievers at three points which coincide with the reporting dates during that time so we use those really to identify where students are underachieving' (SEI-5, p.1).*

The subtheme was identified across the interview data from participants SEI-4, SEI-5 and SEI-6 in SE1 and in HEI-9 and HEI-12 in the HE1 teacher interviews. The students are monitored and tracked to ensure that they are progressing on the course. On occasions where the student is not progressing well and are failing the assessments, intervention is put in place to help the student with aspects of the content or course in order to address their knowledge and understanding to help raise their performance. Participant SEI-7 states that,

> *'Overall, the main roles (of assessment) are one: to identify where the students are in order to help them to progress, the second role is a managerial role in which I standardise the assessments across my department' (p. 1).*

Similarly, Participant SEI-4 asserts that the purpose of assessment is to,

> *'Provide feedback, identify areas of weakness, and show that to the students and show them how to improve, in order to make the relevant progress' (p. 1).*

In addition, in HE there was also an emphasis on understanding and ensuring that students/ graduates are reaching a minimum threshold of understanding in order to successfully graduate or pass the course.

> *' I It's like a minimum standard of knowledge that they must demonstrate before graduating...it is not just a matter of studying it is a matter of understanding it also'. HEI-16, (p.1).*

In SE1 within the Teaching and Learning Policy (2018) document it states that,

> *'Using the principles and processes of assessment, we aim to monitor progress and support learning' (p. 5).*

In addition, teachers are encouraged to,

> *'Assess progress and provide written and /or verbal feedback regularly that supports each student in making progress' (SE1, Teaching and Learning Policy, 2018, p. 3).*

Therefore, this subtheme is supported within the documents of SE1 and teachers are expected 'to adapt learning plans appropriately based on assessment of student progress' (SE1, Teaching and Learning Policy, 2018, p. 4).

In HE1 there was less emphasis of monitoring and tracking students' progress from the individual participants interviewed, however, the individual students' performance is tracked within modules to ensure they are progressing within each module in HE1 and also for maintaining standards within modules. According to HE1, in the Staff Handbook, 3.3.1: Assessment Procedures (2018),

> *'Statistical information is prepared for each module. In recent years, this has usually taken the form of a scatterplot for each module, plotting the marks obtained by each student who took that module against the student's average mark overall. The purpose of any analysis is to identify modules in which marks are noticeably out of line with overall average marks. The initial marks in the scatter plots should all be presented as non-adjusted marks. The analysis is considered at the Module Board meeting before the main Examination Board meetings'*

In addition, in HE1 the students' performance within modules is discussed by the Personal Academic Tutor and not the individual lecturers within the modules. The Code of Practice on Taught Module Assessment and Feedback (2018) document indicates,

> '*Registered Students should be given feedback on their academic performance in order to facilitate improvement and promote learning. Feedback from module tutors should focus on performance against module learning outcomes. It is a shared dialogue to support the continual learning process and Registered Students should discuss feedback themes with their Personal Academic Tutor. The link between the Personal Academic Tutor is therefore very important and*

all staff should ensure that there is effective communication' (The Code of Practice on Taught Module Assessment and Feedback, 2018, p. 4-5).

Therefore, support and improvement strategies are discussed with the Personal Academic Tutor. Students who fail a module are able to re-sit as indicated in The Code of Practice on Taught Module Assessment and Feedback (2018),

'Registered Students who fail a module shall have one opportunity to retrieve the failure, either by re-assessment or by repeating' (The Code of Practice on Taught Module Assessment and Feedback, 2018, p. 22).

Thus, the subtheme 'monitoring and tracking students' progress was found in the HE and SE data, but, the difference across the two contexts is that SE1 teachers are tasked with monitoring and tracking and facilitating improvements in performance. Whereas, at HE1 this is the responsibility of the Personal Academic Tutor, although the marking and feedback of the students' scripts is done by the HE lecturer. But, , monitoring and tracking student progress occurs across both sectors.

4.2.3 To help develop skills

The subtheme of 'developing skills' was identified across the data in HE and SE because of the emphasis on skills development. Skills development including mathematical skills, lab/ practical skills, thinking skills and computational modelling skills which was emphasised by five of the eight participants at HE and four participants in SE. For example, HEI-16, explains the purpose of assessment from a HE perspective, below.

'A lot of what we do is to try and develop skills in our assessment. For example, assessments around laboratories' (Participant HEI-14, p.4).

Although knowledge is also present in HE there is a greater emphasis on skills rather than just acquiring knowledge. HEI-12, states that,

'I... teach laboratory undergraduate courses and teach year four students who are engaged with their 4th year, end of science projects in the lab...there are skills that the University wishes the students to acquire, one of which is accurate documentation of their experiences within a lab in such a way that it can be useful data for future use (in their lab books)'. HEI-12, (p. 6).

This subtheme is also echoed in the SE interview data, as indicated by SEI-2 who describes numeracy skills being developed through graphing and analysis assessment questions,

> *'For example, the year 12's have just done a test and there was a graph that the students have to interpret and so what I got the students to do first was to read all the information and then we looked at the calibration curve on the graph of the different concentrations, related to the question' SEI-2, (p. 3).*

This skill development is also reflected in the Numeracy Policy (2018) which states that SE1,

> *'is committed to raising the standards of numeracy for all of its students in order to support them in developing their ability to use numeracy skills in all areas of the curriculum and also to confidently manage the demands of further education, employment and adult life' (p. 1).*

Similarly, at SE1 literacy skills are also developed which is reflected in the schools Literacy Policy (2018) which sets an expectation for all teachers to have high standards of literacy. Teachers should,

> '*Teach the skill of writing in order to develop the confidence and skills to communicate ideas and emotions effectively and write for a range of purposes and audiences' (SE1, Literacy Policy, 2018, p. 1).*

The policy 'describes our practice in the teaching of reading, writing, spelling, grammar and speaking and listening' (SE1, Literacy Policy, 2018, p. 1) which indicates that this skill is developed in SE1 including though the assessments.

*A*t both sectors developing skills was revealed to be a subtheme. Skills were assessed and developed during the course or degree programme. Participant SEI-2 describes how she develops thinking skills below,

> *'I tried to get my students to put things in their own words when it comes to board work or class work in order for the students to use their thinking skills and to get the students to think for themselves, to be a bit more independent and less reliant on my notes' (p. 5)*

In addition, within the documents in SE1 in the Information for Prospective Sixth Form Students, (2017) practical skills are developed through compulsory practical activities within the A Level Science courses, including Biology.

'The practical component is a teacher assessed component where candidates complete a minimum of 12 practical activities to demonstrate practical competence' (p. 31).

4.2.4 To maintain quality standards for employability

The subtheme maintaining quality standards for employability was one which was echoed across the HE participants as being the purpose of assessment. For example, participant HEI-9 states that,

'As an independent body you certify that this person can do this at this level that has a value to you as an employer because the employer does not have to test that individual.' (HEI-9, p. 5).

Achieving a degree level qualification means this is certified by the University as an assurance of the knowledge and understanding of the individual who has successfully gone through the University degree programme which is important for future employability of the students. Participant HEI-9 goes further and explains how HE1 has its own quality assurance and ranks students based on performance for prospective employers.

'So, within chemical engineering basically we have an additional layer as well so we as an institution ourselves have a round of QA, we set assessment then we validate assessment in some way and then we rank students on how we believe they have performed in that assessment and that has a value to prospective employers' (p. 10).

Employability is an important factor at HE and HEI-9 states that HE1 'runs at about 95% success at recruiting our undergraduates' (p. 5). Participant HE-14 argues that,

'*As an employer what's the point of university unless you are graduating people with qualifications that we can judge them by' (p. 4).*

The emphasis on employability is reaffirmed by HEI-9 who argues that,

'To some extent it is a business and some students get this, but some students might not appreciate this…this person got a 2:2, I wonder what somebody with a 2:1 or a first class degree is like... You want that kind of positivity, so that the students and the employers value a 2:2 as a commodity as they have got the

skills and been through the course so they have a level of competence to show for it' (p. 5).

Within HE1 there is also a Careers Network which consists of five college teams made up of 'Careers Consultants, Careers Advisers, Employability Advisers, and Internship Officers' to help graduates with employment. Within the prospectus at HE1 there is also a Personal Skills Award (PSA) which is an,

'employability programme for undergraduate students, supported by a range of graduate recruiters. The programme enables you to develop, recognise and articulate your skills in preparation for real-world recruitment processes' (HEI, Careers Network website, 2017).

Therefore, the subtheme of maintaining quality standards and employability was prevalent across the HE interviews but not SE interviews.

4.3 Use of summative and formative assessment

Theme 2: In order to assess throughout the learning

4.3.1 Formative assessment used continually as part of classroom routines

Formative assessment was described as being used throughout the learning to check student progress. Across the HE and SE data formative assessment is used more frequently this is seen in all eight of the SE1 participant interview data and in six of the HE1 interview data. Thus, this subtheme developed from the analysis of interview data as there is a propensity to use formative more often to check the students' progress throughout the learning process. Participant SEI-1 from SE states that, '*assessments (are used) to prove that students are progressing' (p. 2).* This is reaffirmed by SEI-1 again below,

'We have been driven into a culture of proving progress in every single lesson so within your lesson you have got to give the students new information they've got to have learnt something and then you'll have to prove that they have progressed in that lesson (SEI-1, p.3).

Formative assessments at SE are linked to progress and they are used to check specific points within the learning to see if learning has taken place and progress made. The use of formative assessment is explained by participant SEI-1 below,

> *'for my formative assessment that is anything that will affect my teaching or affect the path of the student. I probably use formative assessment more than I use summative assessment...anything that informs me about how the student is doing and anything that I need to change that will be from my formative assessment and that will go on throughout the lesson.' (SEI-1, p. 7).*

In SE1 within the Teaching and Learning Policy (2020) formative assessment and feedback from these assessments is linked to student progress which supports this sub theme. Summative assessments are also used to enhance student progress as indicated in the extract below from the policy.

> *'All types of feedback aim to enhance student progress. These are used in a variety of ways by teachers and can include day to day Assessment for Learning strategies, formative assessment or summative assessment. Students may be assessed and have feedback on in-class learning activities, exercise books, on-line or remote learning, homework tasks, tests or examinations' (Teaching and Learning Policy, 2020, p.2).*

In SE1, Participant SEI-8 states that,

> *'In terms of day-to-day teaching, assessment can be just a sequence of questions as part of formative assessment' (p.5)*

In addition, Participant SEI-5 argues that,

> *'Formative assessment for me is much more important. It's more day to day because formative assessment can take the form of a written comment or feedback or verbal feedback' (p. 7).*

Participant SEI-5 explains the use of formative assessment used on a day-to-day basis as part of her classroom routines. Again, this sub theme is reiterated by Participant SEI-2,

> *Formative assessment is done in every lesson. I use question and answer sessions quite frequently in my lessons. For example, direct questioning, indirect questioning, written questions' (p. 6)*

Formative assessment has been described as being used continuously in classrooms at SE and is emphasised more than summative assessments. On the other hand,

summative assessments are described as being used to 'assess content' which is also a subtheme across the interview and documentary analysis data in HE and SE.

Similarly, at HE1 lecturers described their use of formative assessment as part of their everyday teaching and learning routines. For example, Participant HEI-10 describes his use of formative assessment,

> *'Formative assessment includes questioning, presentations, and also my interaction with them as a supervisor in the lab course so they can ask me any questions if they wish and I can also demonstrate uses of technical apparatus...interaction with the demonstrators would be a good learning process because they are getting formative assessment and feedback' (p. 10).*

In HE1 the formative assessment is structured within tutorials and labs where students have access to the lecturer and demonstrators in order to ask any questions as part of their learning tasks. During lectures these opportunities are limited but students are still encouraged to ask questions and participate. Participant HEI-8 states that, *'during the lectures I ask questions to get feedback on their understanding' (p. 12)*. Participant HEI-8 goes on further to explain how she uses formative assessment within her lectures,

> *'During my lectures I ask the students questions to keep them engaged. Sometimes I also might give them a keypad and get them to interact and show me their responses to a particular question and then we might go through that as a discussion' (p. 12).*

Similarly, Participant HEI-9 discusses how formative assessment routines are used in tutorial sessions,

> '*For me I tend to have in most of the modules that I do a very decent mix between lecture and tutorials. So, I try to do Q&A in a tutorial setting where ideally, I have got students sat in groups of anything between 6 or 8 depending on their preference. Then I can wonder around and chat to little groups and see if everything OK?' (p. 10).*

Participant HEI-9 describes his use of formative assessment,

> *'Pretty much every single element would have a formative and summative assessment. For example, when they are doing computational modelling or*

software, they have the opportunity to ask questions. The first lab report that they write is formative, but subsequent lab reports are summative' (p. 5).

From the above description it can be seen that formative assessment is used across HE1 in order to prepare students for summative assessments. The practice and feedback gained from the formative assessments will allow students to get practice on the element and method of assessment in order to better prepare them for their summative assessments. Formative assessment is also used more regularly than summative across tutorial sessions and labs which is congruent with SE1 findings where formative assessment is used continuously in the classroom or in the case of HE1 tutorials. Hence, how the subtheme formative assessment used continuously developed from the HE and SE data. In addition, HE1 documents (HE1 Assessment Model, Pritchard, 2016) reflect the formative assessments and summative components present in each module. In a three-year degree course worth 180 credits each year, each module is worth 20 credits and there are three modules per semester as illustrated in Figure 8 below.

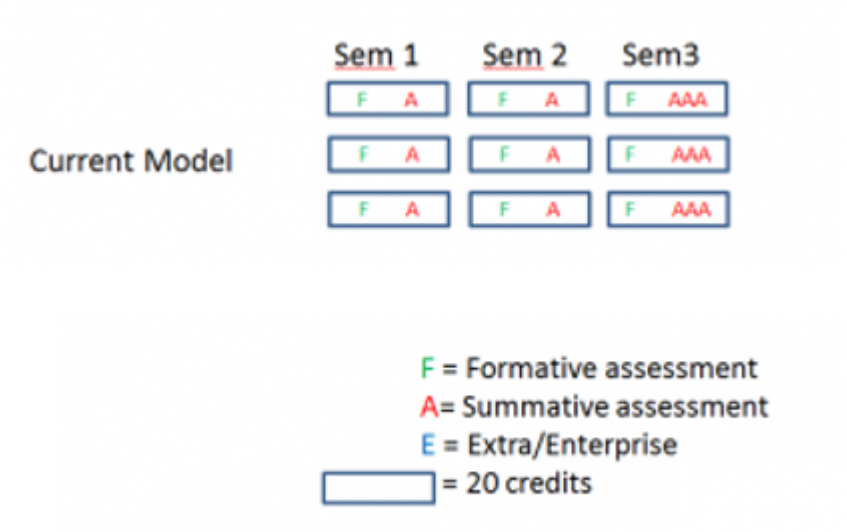


Figure 8 HE1 Assessment Model, Pritchard (2016)

In each module there is a formative and summative component indicating the distribution of these assessment methods in HE1 which led to this subtheme. It also supports the major theme as indicated in Figure 8 assessment is done throughout the learning process. In addition, the Code of Practice for Taught Programme and Module Assessment (HE1, 2018) indicates that,

'*The assessment of each module shall generate a single mark between 0 and 100... The pass mark for... modules is 40' (p.3).*

Formative and summative assessments at HE1 are given a numerical value which is translated to the equivalent classification of a degree, as illustrated in Figure 9, below which is taken from documentary evidence at HE1.

The following ranges of weighted mean marks shall be used in determining degree classifications:

70 or above	Class I
60-69	Class IIi
50-59	Class IIii
40-49	Class III

Figure 9, HEI Degree classification. HEI, Code of Practice for Taught Programme and Module Assessment (2018), p. 16-17.

Similarly, at SE1 the assessments are given a numerical percentage value which equate to a grade from A-E for A level or for GCSE these are translated into Levels from 1-9, 9 being the highest awarded level at GCSE.

4.3.2. Assessing through question and answer sessions

The second theme to emerge from the analysis of the interview data and documentary evidence was 'assessment throughout the learning' process because it was found that formative and summative assessments were used throughout the process of learning to check student progress and to assess the learning at short as well as long intervals in HE and SE. Both sectors used formative and summative assessments but there is a difference in the types of formative and summative assessments used. One way that assessment is carried out throughout the learning is through question and answers sessions which was identified as a subtheme across the data set because it was emphasised by the teachers in the interviews as a formative assessment. Both SE and HE teachers used questioning, but in HE question and answer sessions took

place during consultancy sessions where students pose questions and get answers to those questions by asking the lecturer or demonstrator during the consultancy sessions. Participant HEI-16 describes consultancy sessions as,

> *'Students can ask any questions to the lecturers (during) consultation sessions and tutorials, this is formative. They also get to ask questions to the demonstrators which is also formative'. (p. 5).*

This formative assessment during tutorials and consultancy sessions is further explained by HEI-9,

> *I try to do the Q & A in a more academic tutorial setting where ideally, I have got students sat in groups of anything between 6 or 8 if you like depending on their preference then I can wonder around and chat to little groups and see if everything is OK?' (p. 6).*

In contrast, in SE students are able to ask questions throughout the lessons for example, SEI-5 explains,

> *'we assess all the time as teachers, we assess by questioning as it is quick and easy to get a response' (p. 7).*

SEI-1 states that,

> *'As a classroom teacher a lot of my assessment is carried out informally in terms of questioning during the lessons, (p. 2).*

Question and answer opportunities are provided by both HE and SE as a way to assess students throughout the learning. This subtheme was found in both HE and SE data and was used formatively across both sectors, however, the format is different in HE and SE where scheduled consultancy sessions are used in HE in contrast to the everyday lesson where question and answers can take place in SE in the classroom on a routine basis in each lesson. Questioning was an assessment method which eight out eight of the SE teachers described as using. Participant SEI-1 states that,

> *'I find questioning probably the strongest tool, it's immediate and it can be developed, and it can be targeted to students' (p. 3)*.

Participant SEI-8 posits that,

> 'In terms of day-to-day teaching, assessment can be just a sequence of questions' (p. 1).

This assessment method is very common at SE and was emphasised as part of day-to-day routines in classroom teaching. The justifications of using questioning included 'instant feedback' (Participant SEI-2, p. 4) and 'targeting levels' of difficulty of the question to students to challenge them and 'assess their understanding' of the concepts being taught in class (Participant SEI-8, p. 7). The targeting questioning also meant that questioning was differentiated by the teachers in their classroom practice. Participant SEI-7 justifies using questioning below,

> *'Because it is a well-known fact as you articulate your understanding you understand it better, and that's what the effectiveness of questioning is and if you're only getting a one-word response you're clearly not getting an understanding of what the student knows' (p. 3).*

Moreover, Participant SEI-4 argues that,

> *'It allows me to identify my weak students, and then I can use targeted questioning within the lesson to develop their knowledge and understanding' (SEI-4, p. 9).*

Therefore, within the interview data it was found that SE teachers used questioning as it provided instant feedback, allowed teachers to target students based on their abilities and develop knowledge and understanding by using 'probing' questions (Participant SEI-3, p. 6).

4.3.2. Assessing through coursework and assignments

Another sub theme which emerged from the interview data was 'coursework and assignments'. This subtheme was more specific to HE1 as coursework is used as a form of assessment. However, in SE1 assignments are used and so this subtheme has been linked together. In SE1 assignments do not have a weighting to the final grade for the students but they make up homework assessments. Participant SEI-5 explains,

> *'I assess through homeworks so intermittently through each topic or we use homework as a review of work that has been covered and also from previous years.' (p. 5).*

This is supported by the Homework Policy (2018) in SE1 which guides teachers to the frequency and time of homeworks for Years 10-13. Students should be allocated,

'One homework per subject per week (40 minutes)' (Homework Policy, SE1, 2018, p. 2).

In contrast, in HE1 coursework carries a grade and is weighted towards their final degree. Although in HE1 coursework and assignments are done in an informal setting either during tutorials or at home they are assessed and each coursework can carry from 1% or 2% weighting towards their final mark. Participant HEI-11 explains that,

'Coursework is a catchword which covers everything from weekly problem sheets or looking at application of mathematics in context for example, in problem sheets. Coursework covers the spectrum from maybe a reflective essay talking about what they have learnt or a placement that they have undertook '. (p. 8).

Participant HEI-15 states that,

'At the University a fraction of the assessment is to work on coursework and the coursework is open book and they are allowed to do it at home' (p.18).

The Code of Practice on Assessment & Feedback (June, 2017) in HE1 outlines the weighting of coursework in modules and the degree of flexibility that module coordinators have in the types of coursework they issue in equivalent degree programmes including Science degrees, see Figure 10, below.

: **20 credit modules**: As you might expect, the assessment load should be equivalent to that of 2 x 10 credit modules; for example:

- coursework of 4-5,000 words (or numerical subject equivalent);
- ***or*** 2 x two hour examinations;
- ***or*** 2,000 words coursework ***plus*** a two hour exam
- ***or any combination*** that makes up the total assessment load. For example, an essay/lab report ***plus*** an exam; ***or*** an exam ***plus*** a poster; ***or*** a series of shorter assessments/tests. There are many potential combinations and the needs of a discipline will determine the combination selected. Variety is encouraged.

Figure 10, Document adapted from The Code of Practice on Assessment & Feedback (June, 2017, p. 1) in HE1

Participant HEI-13 explains the weighting of coursework or problem sheets which it is also known as,

> *'they also have problem sheets which do count towards their final mark in their degree but only around 1 or 2%' (p.12).*

Participant HEI-16 goes on to further to explain that,

> *'In some modules there is an element of coursework maybe a percentage of the marks for example, 20%-25% of the total marks (in the module). In other modules there is no coursework' (p. 6).*

In addition, participant HEI-13 describes the formative assignments which are given to the students and assessed in each module of a Chemistry degree at HE1,

> *'the assessment is done by two assignments which are released to the students during the term and students are given two weeks to finish these assignments and then they submit the assignment on a specific deadline' (p. 7).*

The 'coursework and assignment' subtheme was present in twelve of the interviews in HE1 and the documents at HE1 indicate that this is an important part of the weighted component of assessments and counts at least 20% in some modules across Biology, Chemistry and Physics degrees or they can be 25% in some modules across the science degree courses in HE1 (HE1 Module Outline, Chemistry 2017-18). Each type of coursework assesses a different component or skill within the module and therefore, HE lecturers gave different justifications for using a particular type of coursework. For example, weekly problem sheets were used to assess mathematical skills and problem-solving skills (Participant HEI-11, p. 19). The tutorial sheets were also used to assess problem solving skills and there was an emphasis on the process of coming to the solution and students' justifications rather than the correct answer. Participant HEI-11 explains that,

> *'Coursework might also be a piece of application of science it might be an examination element of the course which tests knowledge versus a coursework which tests the application of that knowledge to a certain problem…It might be a real-life context or application. So, then we are looking for the process rather than the outcome or the answer at the end' (p.16).*

Similarly, Participant HEI-14 posits that,

> *'You're looking for the process so if the number at the end is not completely within the boundaries but their thought process is correct, they can still get some marks' (p. 14).*

Participant HEI-11 goes further to explain that the purpose of the problem sheets.

> *'So, it was up to the students to tackle the problem and how they tackle the problem. It was as much about getting the students to think about the problem and develop a way of tackling the problem. To be honest I don't care what answer they came up with but I was looking for the process and how they tackle the problem' (p. 13).*

In addition, Participant HEI-14 justifies the use of writing assignments including essays and reflective journals in order 'to develop their writing skills' (p. 10) and communication skills. These coursework assignments help students think about the audience and develop more engaging communication skills which is a useful skill especially when it comes to report writing and their dissertation (Participant HEI-14, p. 9).

Another coursework assessment which was frequently mentioned within the HE interview data was computational assignments. Participant HEI-10 explains that,

> *'Another element is computational assessment…the students are assessed on C++ because they need to know how to code and write code (p. 13).*

The justification given for using computational assignments was in order for students to learn coding and a particular software which they needed for modelling experiments. Participant HEI-15 explains this further,

> *'Basically, the students have to learn to code and then they need to have a working output and how they produced the working output would be assessed on the basis of knowledge the students use precisely and what they gained and how competently they used it and what they gain from the project' (p. 20).*

HE lecturers justified using computational assignments as an assessment method to develop coding skills and for the students to learn different software to model experiments and draw conclusions from these (Participant HEI-15, p. 22).

In addition, assignments were also an assessment method used in SE1. Within the documents in SE1 specifically the 'Homework Policy' and 'Homework Schedule' weekly homework assignments are scheduled across subjects including science which are assessed formatively. SEI-7 explains that,

> *'After an assessment or test the student will identify a weak area and I will give them an improvement task to close the gap within their knowledge. They must do it as a homework. (p. 4).*

Homeworks are assessed formatively in SE and are scheduled weekly in order for the students to address any weak areas and practice a concept they learned within the lesson. SEI-8 explains,

> *'In my subject physics, for example, we use physics boosters for all Key Stage 4, Year 11 and to Year 12, which are weekly (homeworks)' (p. 4).*

Within the Physics Dept at SE1 teachers use 'booster' homeworks on a weekly basis which is reflected in the Physics Department Staff Handbook, which is done by all physics teachers at SE1 (Physics Department Staff Handbook, 2017-18, p. 4). This assessment initiative has been developed in the physics department and all physics teachers adhere to it in order to provide students 'exam practice questions' (SEI- 7, p. 5). However, across SE1 the Biology and Chemistry department adhere to the weekly homework timetable to give out homework which is reflected in the documentary evidence at SE1 (SE1 Homework Timetable, 2017-18).

4.3.4 Summative assessment to assess content

The next subtheme that emerged from the HE and SE data was summative assessments are used to assess content. Participant SEI-1 describes how summative assessment can be used to assess content and see if the learning can move on or if it needs to be redressed.

> *'If it is a summative assessment where we are in a position, where we can move on in the content or where we are in a position where we need to readdress what's happening and also pick out individuals who haven't quite got it and who might need further support' (SEI-1, p. 11)*

Predominantly it was found that summative assessments were used at the end of topics or modules. For examples, Participant SEI-8, states that, *'the summative assessments are predominantly (the) end of topic tests' (p. 7).* The summative

assessments seem to be used to assess the content for formative purposes so that any misconceptions can be redressed in the class at SE1. This is echoed by Participant SEI-7 who explains that, *'summative assessment are tests and unit tests which are at the end of every topic' (p. 4).* Also, by Participant SEI-1,

> *'Summative assessment may be at the end of a topic or obviously their end of year exams. It is going to give me the whole picture of how they've done over a longer period of time' (Participant SEI-1, p 8).*

Similarly, in HE this is also the case where at the end of a module students are assessed by a summative exam. Participant HEI-12, HE states that,

> *'With the summative assessment there are exams which a large cohort of students take' (p. 12).*

For both sectors SE and HE summative are used at the end of a course or module to assess the content at the end of the educational programme.

4.3.5 Assessing through exams and dissertation

The final subtheme that emerged from theme 2 Assessment throughout the learning was 'exams and dissertation'. In HE1 exams and dissertation are used for summative assessment for examples, participant HEI-12 explains that,

> *'With the summative assessment there are exams which a large cohort of students take... there is mark criteria for the exams which the students take after the lecture courses' (p. 9)*

Participant HEI-15 goes further and states that,

> *'For lecture courses the assessment method is exams. So basically, exams are the most straightforward way to test the knowledge of the students and to some extent their ability to apply such knowledge' (p. 5).*

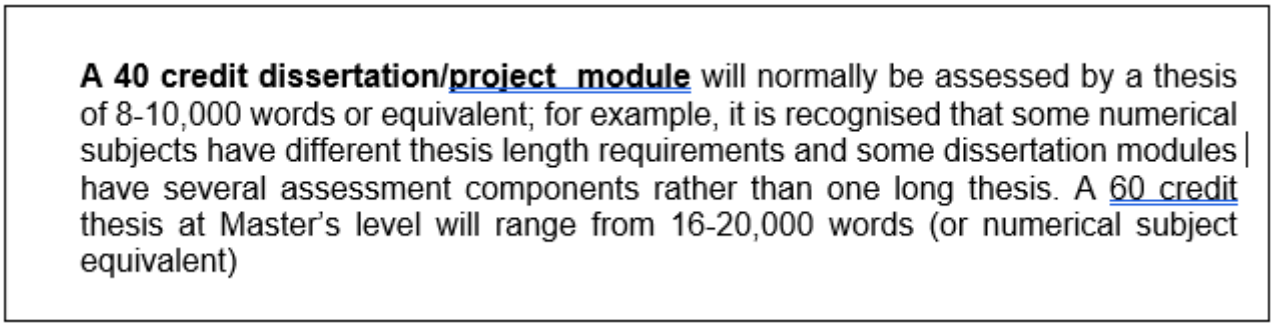
Summative assessments are used to assess the learning at the end of a module in HE. These assessments are done at the end of a module or at the end of the year and have a weighting in terms of marks to the overall degree. In addition, the other method that lecturers described which they used as part of their summative assessment was dissertation. This assessment method was mentioned as the main summative method from all of the HE participants. Participant HEI-14 describes that,

> *'There is a dissertation at the end depending on the year so for example, final year students will write a dissertation and this will be a big chunk of their marks in our case 5/12th of their final mark' (p. 4).*

Participant HEI-15 goes further and explains that,

> *'There is a dissertation in (the) fourth year or third year. This is around fifty to sixty pages. First of all, the ability to communicate and to write scientific information which is a very useful skill for the future for their work and also if they want to go into research in the future. So, it teaches them research writing which is a skill' (p. 6)*

This is supported by the documentary evidence at HE1 where The Code of Practice on Assessment & Feedback (June, 2017, p. 1) indicates that the dissertation is worth 40 credits and requires 8-10,000 words or equivalent and corresponds to two modules in the degree programme which is a higher weighting than any other summative assessment at HE.



A 40 credit dissertation/project module will normally be assessed by a thesis of 8-10,000 words or equivalent; for example, it is recognised that some numerical subjects have different thesis length requirements and some dissertation modules have several assessment components rather than one long thesis. A 60 credit thesis at Master's level will range from 16-20,000 words (or numerical subject equivalent)

Figure 11, Extract from The Code of Practice on Assessment & Feedback (June, 2017, p. 1) in HE1

It is clear that the dissertation has the highest weighting in their degree programme and this was the predominant summative method which lecturers described as using. Dissertation is a unique method used in HE and was described as an important method to teach research and scientific writing skills (Participant HEI-15, p. 6).

However, although dissertations are unique to HE, both HE1 and SE1 use exams as summative assessment and this was mentioned by all sixteen of the participants, thus this subtheme developed from the HE and SE data analysis. HEI-12 explains that,

> *'The lecture courses are examined with written exams at the end...I think that written exams are a traditional method at the University of assessment which are still very effective in stretching the students' knowledge of a subject and the understanding' (p. 10).*

Summative assessment is used to assess the student's subject knowledge of the content and understanding which links to the subtheme above 'summative assessment assess content' and explains the purpose of summative assessment in HE from the lecturers point of view. This is echoed by Participant HEI-14 who states that,

> *'For lecture courses the assessment method are exams. Basically, exams are the most straightforward way to test the knowledge of the students and to some extent the ability to apply such knowledge' (p. 9).*

Similarly, in SE1 exams are used to assess students as a summative assessment. Whereas, exams are at the end of modules or the end of the year in HE1, in SE1 the exams are at the end of A Level and GCSE courses which is at the end of the two years and five years of the course, respectively. These are assessed externally but teachers assess students using exams at the end of each unit of work and create mock exams for the students to experience the exams under controlled conditions. This is indicated by SEI-2 below,

> *'I think summative assessments (exams) are good because it is good to get the students revising it's good practice for their real exam and it's good to experience the exam format and setting so that they are prepared' (p. 4).*

Participant SEI-3 explains that the exam assessment objectives include assessing students' knowledge and understanding which is a similar view to HE1 lecturers.

> *'The assessment objectives of (A Level exams include) assessment A01 which is 'knowledge and recall' A02 is 'understanding and applying' and then AO3 is 'application of scientific skills and evaluation' (p. 5).*

This is supported by the documentary extract below in Figure 12 from the EdExcel Exam Board in SE. Within the framework the exam board has adhered to the exam requirements of Ofqual as stated on p 19,

'Ofqual requires us to have a specific percentage of each assessment objectives' in the exam. (Pearson Edexcel, Understanding Our Exams, 9-1 Science, 2016, p. 19).

	Objective	Weighting
AO1	Demonstrate knowledge and understanding of: • scientific ideas • scientific techniques and procedures	40%
AO2	Apply knowledge and understanding of: • scientific ideas • scientific enquiry, techniques and procedures	40%
AO3	Analyse information and ideas to: • interpret and evaluate • make judgements and draw conclusions • develop and improve experimental procedures	20%

Figure 12, SE Exam Assessment Objectives, Pearson Edexcel Science 9-1, (2016), p. 19.

In addition, exams were described as an important part of the degree programme with end of year exams each year which students take to go to the next year (Participant HEI-14, p. 20). This is a summative assessment method which was mentioned by all eight of the HE participants and has a big weighting for each year.

Participant HEI-14 explains that,

> *'The weighting of the final exam typically is high but it depends on the year. In the final year the third and fourth years are typically high. Early years first and second years it's around 80% the weighting of the final exam at the end of the year' (p. 30).*

Participant HEI-15 explains the justification of using exams is to assess the 'knowledge' of the students and their ability to apply knowledge.

> *'Exams are the most straightforward way to test the knowledge of the students (Participant HEI-15, p. 19).*

On the other hand, Participant HEI-9 argues that exams are a 'traditional' (Participant HEI-9, p. 15) method of assessment and are expected at University and looking from a consumerization perspective the 'customers of our product expect exams' (Participant I, p.15). By customers the participant is referring to employers who hire graduate employees. Another common justification for the use of exams by the HE participants was that they are timed and in controlled conditions,

> *'Exams are timed and in a controlled environment, and I haven't come across anything that is independent of an exam or equivalent that does that. (Participant HEI-9, p. 15).*

The justifications of using exams as an assessment method by HE teachers was commonly to assess knowledge and also to ensure conditions were timed and controlled to ensure that the students' worked independently without any input from other students or teachers. Therefore, the subtheme 'exams and dissertation' was directly linked to the second RQ in this study and resulted from SE and HE interview data and supporting documentary analysis and indicates that these assessments methods are used across both sectors for summative assessments.

4.4 Methods of assessment

Theme 3: Using a variety of assessment methods

This section of the findings relates to the third RQ in this study which looked at the methods of assessment used by teachers across HE1 and SE1 and their justification of using these methods. Theme 3 'variety of methods' arose as a result of interview data and supporting documents at HE and SE which indicate that teachers use a variety of methods of assessments and the justification of using these methods will be explored below. The assessment methods used across the sectors is illustrated in Figure 13 below. Some of these assessment methods have been explored above and will not be repeated here, but the sub theme which developed from the interview data and documentary data will be presented below.

Theme 3 Variety of methods	
HE assessment methods	**SE assessment methods**
Exams	*Exams, Exam questions and mark schemes*
Questioning	*Questioning*
Self and peer assessment	*Self and peer assessment*
Coursework/ assignments	*Practical assessments*
Computational modelling/programming assignments	*Homework*
Presentations/ posters	
Dissertation	
Viva	
Reports/ lab reports including lab book/ log book	

Figure 13: Methods of assessment used in HE and SE

4.4.1 Self and peer assessment

The self and peer assessment sub theme emerged as this was a popular assessment method described by the teachers at both HE1 and SE1 in the interview data. For example, Participant SEI-1 explains that,

> *'Self-assessment is used routinely using the green pen on quizzes or tests, etc. I use peer assessment, for example, if the students are doing the presentation and I asked them to peer assess each other, with some guidance for peer assessment' (p.17).*

In SE1 in the assessment policies it was found that feedback by teachers and students was done using the 'green pen strategy' (Teacher Assessment and Feedback Policy, 2018). The rationale for using the 'green pen strategy' at SE1 is so that feedback can be distinguished and students can engage with it more readily. Students are encouraged to respond to the green pen comments in turn using a green pen so that

the teacher can see that feedback has been acted upon and engaged with. The SE1 Teacher Assessment and Feedback Policy, (2018) states,

> *'Students should engage with their own assessment through reflection and improvement, 'green pen' time, self and peer assessment. To do this and to allow them to be active in and engage with their progress feedback should be personal to the needs of the student. It could be written by them as part of this time. It should be used by the student and teacher for future learning' (SE1, Teacher Assessment and Feedback Policy, 2018, p. 1).*

In addition, the policy states that students should,

> *'Use their green pen to identify what they have done well and ways they can improve as well as to make improvements to their work' (SE1, Teacher Assessment and Feedback Policy, 2018, p. 2).*

Participant SEI-3 above is using this strategy for self and peer assessments where students mark their own work or mark each other's. Participant SEI-8 explains,

> *'I use peer assessment by getting other students to assess whether the students' responses are correct…another method that I use is using flash cards and getting the students to write a question and then peer assess the responses to the questions from other members of the class...Therefore, the students take on an examiner mindset and ask each other questions' (p. 4*).

Moreover, participant SEI-4 justifies using peer assessment as it develops thinking skills,

> *'I use peer assessment because it is useful for the students to see what answers the other student has written down. They can then use that and develop their own thinking, so the students can add to their answers' (p. 7).*

SE1 teachers justified using self-assessment as it was a way of letting students see and correct their own mistakes and practice using mark schemes and rubric. Also, self and peer assessment were used frequently as it reduced the teacher workload in terms of marking (Participant SEI-1, p. 9). Peer assessment was also used as a means to share ideas and see someone else's perspective on a question or task. Participant SEI-2 explains that,

> *'I use peer assessment because sometimes sharing ideas with other people, for example, when you swap papers or exercise books and you look at*

someone else's answers it might give the student a clue or a different way of thinking that perhaps they have not come across before' (p. 6).

Participant SEI-7 justifies using peer assessment for exam questions so students can see how they are progressing when it comes to exam technique,

'Within my lessons I use peer assessment as it is useful for students because I do this on a day-to-day basis so they know how they are doing when it comes to exam questions' (p.7).

Similarly, in HE1 self and peer assessment methods were also used by the lecturers, but, self-assessment was not used as much as SE1 as only two participants at HE1 described using this method in their practice in comparison to all eight participants at SE1. HEI-I states that,

'I give the students a weekly homework which is not compulsory but these are questions that they can find online and they are self-marked online' (p. 6)

On the other hand, peer-assessment strategies were described by the majority of HE1 lecturers as being used in their practice. For example, HEI-9 describes posters being peer assessed by other students,

'Often you might get them to do peer assessment where students are given a set of criteria that the students who are producing a poster are assessed against these criteria' (p. 10).

Also, Participant HEI-11 describes peer assessment during a presentation,

'They (the students) did a group presentation and then I also allow the students to do a peer assessment, so I was able to differentiate who contributed what and ensure that each group member participated' (p. 11).

In HE1 peer and self-assessment is dependent on the module and the assessment within each module which is directed by the module/ programme leader and reviewed by the Quality Assurance Committee (QAC) at HE1. In the Assessment Procedures Handbook (2017) in HE1 it states that,

'The committee monitors assessment in the School on a global basis. In particular, it ensures that different assessments are of a comparable standard, and propagates good practice in examination papers and continuous assessment' (Assessment Procedures, 2017).

The continuous assessment (CA) refers to formative assessment described in theme 2 which includes self and peer assessment methods. Self and peer assessment may be included in some modules and not others, hence why it was mentioned by a small number of HE1 participants.

4.4.2 Practical assessments

The next sub theme for theme 3, 'variety of methods' which emerged from the HE and SE interview data and documents was 'practical assessments'. This subtheme was frequently mentioned as an important part of any Science courses at HE1 and SE1. In HE1 practical labs and lab reports form part of the assessment methods and in SE1 there are compulsory practical assessments as part of the A level and GCSE Science courses that are assessed, hence why this sub theme was prevalent in the interview data. For example, participant SEI-7 asserts that,

> *'I use assessed practicals which the students do. Some of them are compulsory Core practicals and each practical is followed by some follow up task' (p. 14).*

Participant SEI-3 goes further and explains that,

> *'There are lots of practical assessments with the CORE practicals for example, in GCSE and PAGS that are assessed within the A-Level biology course...I will be assessing their kinaesthetic skills', (p. 4).*

Participant SEI-4 justifies using practicals as they help with understanding of theoretical concepts learned, *'practicals are extremely useful and very often aid their understanding' (p. 7).* In addition, Participant SEI-4 argues that practicals ensure students acquire practical skills,

> *'I am pleased that these core practicals have been introduced into the course because it makes sure that when we have students in Year 12, we know that the students will have that minimum level of practical skills' (p. 8).*

The acquisition of acquiring practical skills is also the justification given from Participants SEI-1, SEI-3 and SEI-5. But the main justification for using practical assessments for SE teachers is that they are a compulsory component of the course and need to be assessed as a requirement from the exam board. The other reason why SE1 teachers use practical assessments include to help with understanding and to improve kinaesthetic and practical skills. In the OCR exam board Practical Handbook (2018) for A Level Biology it states that,

> *'The 'practical' component is a direct assessment of practical skills displayed by learners as they are performing practical work. This is assessed by the teacher across the whole of the course' (OCR A Level Practical Handbook, 2018, p. 7).*

In addition, in SE1 within the A Level Biology Specification (2016) the assessment objectives clearly indicate that there is a practical component that is assessed within the course, see Figure 14, below. The same can be found in the Chemistry and Physics OCR (Oxford, Cambridge and RSA) specifications (2016).

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling qualitative data • when handling quantitative data.
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: • make judgements and reach conclusions • develop and refine practical design and procedures.

Figure 14, OCR A Level Biology Specification, 2016, p. 53.

The assessment objectives also support the above sub theme 'exams and dissertation' as it is evident that the A Level exams are 100% summative which are assessed after the two-year course. In addition, one of the assessment objectives is 'knowledge and understanding' which links to theme 1 above.

Similarly, at HE practical assessments and practical reports were used as assessment method and were justified as being an important skill for students to acquire as part of the degree programme (Participant HEI-9, p. 10). HE participants stressed the importance of practical skills and report writing skills which were usually in conjunction with practicals and are sometimes referred to as lab reports. Practical assessments were emphasised as an important requirement of Science degree courses and a lab

report would follow from practical modules. This sub theme resulted because seven participants mentioned this as an assessment method in HE1. HE participants emphasised that it was a course requirement to acquire and develop practical skills including the use of technical apparatus but more important the justification of practical assessments was to develop accuracy and precision in measurements and create experiments where the parameters are defined by the students depending on what they are trying to investigate. Participant HEI-13 explains her justification of using practical assessments,

> *'Because at the end of the day in real life laboratories what matters is how accurate and how precise you can be in the lab that is what matters because you have to make sure that your experiments are running' (p. 13).*

As part of practical work students are requested to submit their lab books or log books which is a record of all their primary data and experiments. Practical assessments are concluded with a submission of a report which is an account of their practical work and what they found. Participant HE-15 explains the justification for submitting lab work/ log book as part of the practical assessment,

> *'In the practical labs we are assessing their lab books which is part of their assessment, in the lab books we are looking at the ability of the student and their understanding…and their ability to record accurate data and keep accurate records' (p. 12).*

Similarly, at SE practicals were described as an important assessment method to acquire skills, however, the nature of practical work at HE is considerably different and not as 'prescriptive' (participant HEI-15, p. 12), instead it involves a considerable amount of planning and trial and error and the student is responsible for the set up and choosing variables and calculations. Participant HEI-15 explains that this is a difficult skill and SE students in the first-year in HE struggle with this transition,

> *'What I have noticed from ...secondary school (students is that) for practicals they seem to have a different attitude than what the university would like them to have. They always ask what to do next and it's quite prescriptive and they do learn and develop this but at the beginning it can be a bit frustrating because we ask them to think and they do not necessarily understand it takes a bit of time to for them to transition to the type of thinking*

> *that we expect during practicals. With less emphasis on prescriptive practicals work' (p. 14).*

Participant HEI-15 continues with,

> *'The other thing that I find is one of the hardest things that they seem to face is to write a report about their practical. They're not used to presenting in a logical way to explain what they have done in a way that will be understandable for their peers to repeat (p. 15).*

Therefore, practical work is not just about acquiring primary data at HE but also to document the findings in a structured scientific report, structured like a scientific journal article. The log books/ lab books are also submitted as proof that the students have acquired the primary data and to substantiate the report findings in order to check their validity. Participant HEI-12 justifies using practical assessments in order for students to develop lab techniques and use specialists' scientific apparatus which they might choose to use later in their final year dissertation.

> *'The goal of the laboratory classes of the first and the second year is to give students a grounding in practical physics (science) techniques…The goal is to acquire practical skills' (p. 22).*

In addition, Participant HEI-16 explains that for practical assessments and reports the 'students process all their data by themselves' (p. 17) and this is used in their reports. Participant HEI-11 justifies keeping accurate lab books/ log books in order to make use of their primary data in the lab reports but also this is an important research skill which the students are acquiring and practicing.

> *'In general (practicals) are more skills based and with it is the idea of developing skills and outcomes or tests and their uses, so the focus on their books and lab work is on skills. So, from a University perspective it can be very valuable intellectual work, it could be the basis of a PhD' (p. 13).*

In summary, practical assessments at HE consist of not only acquiring data and submitting a lab book/ log book but also writing a scientific report of their findings which is an assessed component of the practical work. HE teachers justified using practical assessments to acquire practical skills, keep accurate records of primary data and write a scientific report of their findings structured like a scientific journal. The justification of submitting a report is to report their findings from the practical labs and

assess their accuracy in their practical work and writing skills (Participant HEI-15, p. 18).

4.4.3 Presentations, posters and viva

The third sub theme that was identified from the HE and SE interview data was presentations, posters and vivas; the emphasis being oral skills which was mentioned by six of the HE participants, compared to one SE1 participant (SEI-3) who mentioned presentations as an assessment method used in her classroom routines but this was coupled with peer assessment. SEI-3 states that,

> *'I use peer assessment, for example, if the students are doing the presentation and I asked them to peer assess each other, with some guidance for peer assessment' (p. 1).*

On the other hand, HE participants justified using presentations and posters in order to develop verbal/oral presentation skills and also because posters are a useful format to present data in a concise and engaging way especially for conferences. Students opting to pursue academic careers and also go into industry once they graduate develop these skills during their degree courses. Participant HEI-9 explains that,

> *'We would add a round of presentations which is primarily verbal assessment, but this may also include posters...We use this assessment method because we feel there is a need for that form of transferable skill ultimately whilst talking to industry, they need employees who are comfortable either writing reports or standing up and giving presentations to people' (p. 7).*

In addition, participant HEI-12 justifies using presentation and posters as methods of assessment,

> *'Because it is a very essential skill that students learn to present and convey technical information in a concise and accurate way to a number of different audiences because it is the skill that they can use in their future, for example, when they are presenting in a conference or making a proposal in industry. Therefore, it is a transferable skill which I think is important to assess' (p. 8).*

These were the main justifications made by HE lecturers, there was an emphasis in developing verbal/oral and communication skills and thinking carefully about the

audience the students are addressing. The posters and the presentations were assessed using a rubric by HE lecturers and within the University degree there was more than one opportunity for the students to do a poster or presentation in order to develop this skill. An example of a rubric was brought to the interview as an artefact by participant HEI-12 which will be discussed in theme 5, below.

Another method of assessment which was specific to HE1 that was mentioned by all the participants was a viva voca. This is associated with a dissertation and is an oral exam so has been linked to this theme. Participant HEI-9 explains that a viva is,

> *'A type of exam... In a viva you've produced a piece of work and within 10/15mins I can tell whether you have produced it or not, or at least you have read it enough to understand it. But mainly we are using it as an acid test to say you've handed in this piece of work; do I think you are capable of producing it?' (p. 34).*

Again, viva was mentioned by all the participants interviewed in HE which emphasises its significance in degree programs. Both the dissertation and viva are unique to HE and the justification for using vivas as an assessment method was that it ensures that the work was produced by the students and also that they can defend their research if examiners were to ask them questions about it. Participant HEI-13 argues that students find it challenging as they cannot predict the questions beforehand,

> *'I think the unpredictability of an oral examination is probably the biggest challenge for students' (p. 13).*

The justifications of using vivas include that they are a University requirement and are a traditional assessment method (Participant HEI-9, p. 16). Participant HEI-10 argues that having a viva orally is important because, *'you can clearly see a student's understanding' (p. 27).* Similarly, Participant HEI-15 justifies using vivas because,

> *'This basically aims to assess their understanding to a deeper level because basically in a viva you can test the students with probing questions and so you can really go to quite some depth...We tend to ask the same type of questions as a whole for all vivas but every project is different so you cannot just ask the same identical questions' (p. 20).*

Overall, vivas are justified as being used to assess the depth of understanding and authenticate the work produced by the student. They are used in conjunction with the dissertation and allow the examiners to approach the students research from a critical point of view. Both types of assessment methods are summative and carry a substantial weighting in the final year of a Bachelor's degree or Master's Degree (Msc) in HE1. A Bachelor's Degree is a three years program consisting of 360 credits, whereas, a MSc requires one additional year with an additional 180 credits. This is reflected in the documentary evidence indicating that vivas are associated and weighted with the dissertation component of the HE degrees and are compulsory.

> *'An oral examination (viva voca) is compulsory for all doctoral degrees' (HE1, Guidance Notes for Research Degree Thesis, 2016, p. 5).*

The dissertation has a weighting of 40 credits for Bachelor's degrees or 60 credits for MSc degrees (The Code of Practice of the Taught Programme and Module Assessment and Feedback, 2018-19, p. 2). Within the document Guidance Notes for Research Degree Thesis, (2016, p.5) in HE1 the purpose of the viva voca is:

- provides the candidate with an opportunity to defend their thesis
- examines the general field within which the subject of the thesis lies
- clarifies points of ambiguity
- satisfies the examiners that the thesis is the candidate's own work
- assists the examiners in their decision as to whether or not the candidate has met the requirements for the degree.

This is congruent with some of the justifications which the HE1 participants provided in the interview data above.

4.5 Teachers' views on assessment in HE and SE

Theme 4: Teachers' views on the learning process

The fourth RQ was 'what are the similarities and differences between teacher's views from both sectors' and hence this section is organised into the topic of 'teachers' views on assessment in HE and SE'. This section will cover theme 4 'teachers' views on the student learning process' which emerged from the interview data and documentary

evidence whilst looking at the fourth RQ. The section is organised into the three sub themes that evolved from theme 4. From the data there were similarities and differences in the learning process in HE and SE which will be discussed below. The learning process is a term the interviewees used and concerns the assessment methods used and the training or process of learning that results from these assessments.

4.5.1 To provide exam practice

The first similarity that emerged between teachers' views from both sectors is that summative exams are considered as the end goal of the program. In HE the highest weighting at each year on the degree program is the end of year exams which determines whether a student can progress onto the next year of study. Similarly, the GCSE and A Level exams at the end of SE ultimately determine the success of the student whether they pass or fail. Therefore, there is an emphasis in SE particularly on practicing exam questions in order to prepare for this (Participant SEI-1, p. 2). Participant SEI-1 describes the importance of exam questions as being the 'end goal' as this will be the format of the assessment at the end of their educational programme, therefore, it is justified as a frequent assessment method used by SE teachers.

> *'At Key Stage 5 (A Level) we have exam questions every lesson. I use them because it is the end goal at the end of the day as much as I do not like to say that we are an exam factory' (p. 13).*

In addition, at HE formative tests are carried out in order to prepare students for their final exams at the end of the year. Participant HEI-9 explains that,

> *'The only assessment is the end of year examination so the first time if you like you actually have a proper summative go at something it is the final thing. So typically, what I would do is this coming year I would give this year's students last year's test as their formative test to have a go at' (p. 18).*

Therefore, ultimately both HE and SE sectors place emphasis on summative assessments. At SE1, 100% of the assessment which has a weighting is summative which is the final exam and so therefore, there is a lot of emphasis by SE teachers to

train them for this 'end goal' in order to succeed in the exam. One component which is assessed in exams is knowledge and understanding and this has been discussed as a separate theme above. Another similarity across both SE and HE sectors that is assessment must be in place in order to assess knowledge and understanding. Teachers from both sectors agreed that without using assessment methods this would not be effectively assessed. Participant HEI-9 from HE argued that the easiest way to do this was some form of exam. This view was echoed by fourteen of the participants at SE and HE. Participant HEI-10 believed that it is important to get the 'fundamental principles (p. 10) right in order to tackle the more challenging aspects of the HE science degree without which students will struggle.

> *'In my opinion it is better to start with the theory so that they have the foundation principles before they start with the practical work, etc... because time is limited' (p. 10).*

Similarly, Participant HEI-9 argues that,

> *'Fundamental principles can be conceptual and 8 out of 10 students struggle with it' (p. 15).*

In SE teachers argued that the purpose of exams is to assess knowledge and understanding, (Participant SEI-2, p. 25). Participant SEI-4 argues assessment,

> *'Allows us to, for example, identify our students by seeing their performance within an assessment, it allows me to identify my weak students, and then I can use targeted questioning within the lesson to develop their knowledge and understanding' (p. 18).*

Similarly, Participant SEI-3 argues that,

> *'My main use for assessment methods is to see where the students are, where did they think they are, assessing knowledge (p. 14).*

4.5.2 To provide and assess practical and mathematical skills

Another subtheme in terms of similarities between SE and HE sectors and teachers' views are that both sectors placed an emphasis of learning practical and mathematical skills. In addition, both sectors had listed practical assessments as an assessment method in theme 3 which has been explained in the above section. Teachers from

both sectors agreed that practical skills need to be learned and acquired on the course. SE teachers described 'core practicals' (Participant SEI-3, p. 18) which are integrated into the GCSE and A Level courses and these must be assessed. Participant SEI-7 states that,

> *'I use assessed practicals which the students do. Some of them are compulsory, core practicals and each practical is followed by some follow up task' (p. 11).*

All sixteen SE and HE participants viewed practical assessments as an important skill to assess. Similarly, Participant SEI-12 asserts that practicals are important,

> *'Because there are skills that the University wishes the students to acquire (including) accurate documentation of their experiences within a lab in such a way that it can be useful data for future use' (p. 17).*

Another view which was similar across SE and HE sectors is the acquisition of mathematical skills. Again, all sixteen participants across both sectors viewed this as an important part of science courses in SE and HE. Participant HEI-16 from HE asserts that,

> *'Math's is very important...we are looking to see if the student can manipulate mathematical data but also demonstrate the correct procedures which they must apply for the correct answer' (p. 18).*

This is echoed by SE teachers, Participant SEI-2 explains that,

> *'I practice, practice, practise (mathematical skills). The students must have a calculator every lesson because there will be a maths question every lesson' (p. 10).*

Although practical assessments are important both in SE and HE the nature of the practicals and the teachers views in SE and HE are markedly different. HE teachers described SE practicals as 'prescriptive' (Participant HEI-11, p.12) and found that students of the first year of their degree programme struggled with practical labs as methods for practicals were not given. Instead in HE students work independently and plan and design their own practicals including the variables and parameters which they will be testing. In contrast, SE teachers' agreed that practical skills are important but the focus of the practical assessments was more about following a 'prescribed' procedure and collecting data and drawing a conclusion. SE teachers usually knew

the conclusion, whereas, at HE the lecturers were not always aware of the conclusion as new research was being carried out. Participant HEI-15 argues that first year students struggle with practical labs coming from SE because,

> *'Within the practicals they have quite well-known outcomes or outputs which are prescribed and the students' expectation that they arrived at this data everything works which is completely incorrect because it's not the nature of science it is the opposite of the nature of science. So, the other thing is that does not help the natural approach to science that the students have in higher education' (p. 5).*

In addition, Participant HEI-15 goes further and states that,

> *'For practicals they seem to have a different attitude than what we at the university would expect. So, they always ask what to do next and it's quite prescriptive and they do learn and develop this but at the beginning it can be a bit frustrating because we ask them to think and they do not necessarily understand it takes a bit of time for them to transition to the type of thinking that we expect during practicals' (p. 7).*

Therefore, HE teachers' view the practicals in secondary prescriptive and not independent. At University the students take time to develop the inquiry skills required to do well in practicals and learn also that it can be trial and error when it comes to practical work (Participant HEI-11, p. 15).

4.5.3 To focus on the process of learning

The final subtheme links directly to theme 4 'learning process' overall. In HE assessment methods described by teachers' focused on the process and challenging the students. This included problem sheets and assignments which were skills based including mathematical problems where the final answer was not emphasised but rather the students process of solving the problem. In addition, mark schemes were not published for problem sheets or assignments in HE but were at SE because the idea was to shift the focus from the right answer to creatively working out the solution (Participant HEI-13, p. 4). Moreover, in HE problem sheets had more than one solution and allowed students to derive their own solutions as long as they justified it within the process of working out their answer. Analysis, evaluation and critical thinking skills

which are cognitively more challenging according to Bloom's taxonomy (1967) were common skills assessed for HE assessments. In contrast, in SE knowledge and application skills were common cognitive skills assessed in the assessment methods used. Participant HEI-9 explains that,

> *'(Students) come to the academic tutorials side where they would have a problem sheet and find that they are not really getting it...And it is trying to get you used to understanding a problem, being able to take that problem and create a mathematical statement that you can then solve' (p. 28).*

Participant HEI-9 goes further and states that in the problem sheets,

> 'We are looking at the critical analysis skills so that is another thing that I think students struggle to get used to' (p. 24).

Similarly, Participant HEI-11 asserts that for problem sheets,

> *'We are looking for the process rather than the outcome or the answer at the end...So we need to move away from prescriptive and mathematical questioning for example where students plug into a formula and get one answer only, they need to be exposed to a bit more interpretation in math and science' (Participant HEI-11, p. 20).*

Another difference was the lack of mark schemes in HE but not at SE, this is to discourage memorising mark scheme answers in HE and to work out solutions independently as stated by Participant HEI-9,

> *'So, you would get this view which is echoed by how the students are like; you need to tell me what questions I will be asked and what the specific mark scheme answer is to that question because that is what I have to regurgitate' (p. 27).*

Therefore, there is a greater emphasis on process at HE compared to SE which can be seen from the teachers' views across each of the sectors and the types of assessment methods they are using. One Higher Education lecturer pointed out that failure is an important part of learning and students should have opportunities to fail at Secondary Education so that they can learn from their mistakes.

> *'If I had to say one thing which I feel is missing from Secondary Education is that the students are not allowed to fail…Facing failure for the students in a safe environment is healthy and mentally it gives them resilience' (HEI-13, p.16).*

4.6 Similarities and differences between assessment artefacts

Theme 5: To challenge students

The final theme that emerged from the interview and documents was 'challenge' which is specifically looking at the artefacts which the SE teachers and HE teacher chose to bring. This is related to my fifth RQ 'How do science teachers and science lecturers perceive the assessment methods and artefacts they use in their practice?'. Figure 15 below, illustrates the artefact that each participant in SE and HE brought with them to the interview and the type of artefact including a description of the purpose of artefact as described and perceived by the participant in the interview. It is clear that the biggest difference between the HE and the SE artefacts was how cognitively challenging the assessment artefact was, hence, the final theme of this study, theme 5 'challenge'. The subthemes which emerged from the analysis of the interview data and the artefacts will be discussed below.

Particip-ant	SE/ HE	Artefact	Artefact description	Formative/ summative	Exploratory comments
SEI-1	SE	AFL tool	The artefact three different AFL strategies to use as part of formative assessment.	Formative	Refers to teachers 'tool kit' and views formative assessment more important than summative.
SEI-2	SE	Exam Mark Scheme	Mark schemes for training purposes, so that the students get familiar with the terminology and the key words which they must use in their exam. OCR mark scheme with concise answers and guidance notes on how to apply the mark scheme and what is credited and what is not credited in an exam.	Formative	View exam training as essential to develop student technique. Emphasis on examiner notes and key words stressed in mark scheme.
SEI-3	SE	Exam questions	Exam question pack which the students use to practice exam technique and answer a series of exam questions on a topic. One exam pack for each topic is given to students for practice.	Formative	Views exam practice as 'important training' for students in order to be successful in their exams.
SEI-4	SE	Exam Questions	For example, two or three could be multiple choice questions and then the others would be short structured questions. The booster would consist of 5 exam questions only, on a variety of different topics which are unrelated and on a part of the physics course	Formative	Refers to 'booster' exam questions which are viewed as important to develop student exam technique.

			whether that is GCSE physics or A-level physics.		
SEI-5	SE	Placemat / mind map	Revision tool to aid with learning the content form a module/ topic	Formative	Refers to 'visual' aid to help the more visual learner. Describes herself as a visual learner.
SEI-6	SE	Exam mark scheme	Exam mark scheme with calculations and workings out and examiner notes and guidance	Summative	Holds the view that it is important to refer to the examiner notes and guidance when marking exam questions.
SEI-7	SE	Booster - exam pack	Weekly exam questions given to students for practice and to improve their exam technique	Formative	Sees exam questions as important to practice exam technique for students.
SEI-8	SE	Mock exam marking folder with mark schemes	Marking folder with mark scheme	Summative	Finds it important to have a consistent marking strategy across the department when marking summative exams.
HEI-9	HE	Summative test	Summative test with a mix of mathematical questions and short answer problems	Summative	Emphasises that students need to have numeracy skills as well as theoretical knowledge to answer exam questions.
HEI-10	HE	Report writing rubric	Structure of writing a report, rubric breaks down what needs to be included in the report.	Summative	Views academic writing as an important skill that students need to develop at HE.
HEI-11	HE	Tutorial sheets/ coursework	Tutorial sheet with a mix of mathematical problems, short questions and interpretation questions to	Formative	Holds the view that students need to be challenged with different problems and contextual applications to

			apply knowledge in different ways.		effectively assess their understanding of key concepts.
HEI-12	HE	Presentation marking rubric	Presentation rubric which assesses criteria for effective presentations	Formative	Sees communication skills essential for post-HE industry.
HEI-13	HE	Weekly online problem-solving resources	Practice problem resolve used for weekly online problems which the students complete on their own - formative as not compulsory to complete.	Formative	Believes students need to use all opportunities including online resources to improve their understanding of the course material.
HEI-14	HE	Problem sheet	Problem sheets to engage students with the content	Formative	Thinks students' needs to develop their critical thinking and problem-solving skills.
HEI-15	HE	Exam paper	Test of knowledge and understanding	Summative	Refers to mix of contextual questions as well as mathematical questions in the exam paper to challenge students.
HEI-16	HE	Rubric for viva exam	Rubric which is used to assess the viva to ensure consistent practice across the department	Summative	Views viva as a traditional form of assessment and effective to assess depth of understanding in research undertaken by the student.

Figure 15: SE and HE artefacts with exploratory comments

4.6.1 Developing critical thinking skills

Analysing the artefacts in table 6, there are clear differences between the SE teacher artefacts and HE teacher artefacts. The first apparent difference is that SE teacher leaned towards exam questions or mark schemes. Six of the eight SE teachers bought in either exam questions or mark schemes, these types of assessments are assessing

knowledge and dictate that students write down the answer and it is marked according to the stringent requirements of a mark scheme. SE teachers leaned towards these assessment artefacts because it is the 'end-goal' of the course and the students therefore need to 'practice' (Participant SEI-7, p.17). These types of artefacts assess 'knowledge and understanding' (Participant SEI-3, p. 14) which has been discussed in theme 1 and are not as cognitively challenging according to Bloom's taxonomy (1967) of thinking skills as they represent the less challenging thinking skills.

On the other hand, HE teachers bought in a greater variety of assessment artefacts including a report writing rubric, a presentation rubric and a viva rubric. These assessment artefacts are more challenging because there is not a mark scheme answer, instead the emphasis is more on the development of critical thinking skills and problem-solving skills rather than knowledge and there is more than one correct answer or way to do the assessment task. Participant HEI-10 brought in a report writing rubric and explains,

> *'it's the structure that they must include in the report including an instruction they must be able to structure it as they are told. For example, they need to state the problem in the introduction, how they address the problem what were the main points that they solved and then also an explanation of what they used in terms of C++ and the methodologies that they used in the problem solving and then also what conclusions they drew from the experiments' (p. 13).*

Problem solving is a key feature that is assessed in this assessment artefact. How the students tackled the computational problem as well as structuring their findings into a scientific report. Features that are assessed in the artefact are 'organisation', 'literature review', 'critical thinking', 'method', 'analysis and discussion' and 'referencing' (HEI-10 report writing artefact document). This indicates that critical thinking skills are assessed and need to be developed in HE1 in order for them to succeed in this assessment. Similarly, Participant HEI-12 bought to the interview a presentation marking rubric and explains the purpose as,

> *'This presentation rubric will have a number of components that we are assessing for example, appropriate content, legibility, is the information accurate, are the visuals and graphs/charts clear? Have the (PPT) slides conveyed the information that the students are talking about? Is a content and the information that they are presenting correct scientifically and factually? And*

> *is it an accurate description of the work that they have done by themselves?' (p. 12).*

The presentation rubric assesses accuracy of scientific information as well as presentation of graphs/ charts and legibility of text (HEI-12 presentation rubric artefact). These skills need to be practiced in order to develop them and can be challenging for students. The quality of the presentation is dependent on the student and so the student has autonomy on how they tackle this assessment. In addition, lecturers will assess the accuracy of the information presented which means students must have an understanding of the scientific concepts. Participant HEI-12 describes that the lecturer as well as students will have a chance to ask questions as the audience which again adds challenge to this assessment method.

In addition, Participant's HEI-16 choice of artefact is a marking rubric for a viva voca. This oral assessment is unique to HE and is challenging as Participant HEI-14 describes,

> *'I think the unpredictability of an oral examination is probably the biggest challenge for students' (p. 10).*

The viva voca is compulsory for all doctoral degree and provides an opportunity for students,

> *'to defend (their) thesis and it assists the examiners in deciding whether or not (the student) has met the requirements for the degree' (HE1, Intranet, Viva Examination, 2020).*

The viva rubric includes assessment of preparedness, clarity of communication, content and comprehension (HEI-16 viva rubric artefact). This assessment method does not have a mark scheme answer and is open to the student's interpretation and the autonomy is on the student to demonstrate to the examiner their knowledge of their thesis and prepare a defence against the examiner's questions and critiques. Again, this links to the subtheme of critical thinking as students prepare a literature review in their thesis which they may be examined on in the viva and therefore, they need to demonstrate their critical thinking skills and their ability to listen and answer questions effectively in their viva exam.

Moreover, another key feature seen across HE1 and SE1 teachers' artefacts was their emphasis on mathematical and literacy skills within the assessment artefact. For

example, Participant's HEI-9 artefact consisted of a summative test with mathematical problems and short answer questions. The artefact focused on solving numerical problems and the emphasis was on how the students derived their solution not necessarily their final answer. Similarly, Participant's HEI-11 artefact consisted of a tutorial sheet with a mixture of mathematical problems and interpretation questions. Participant HEI-11 explains that,

> *'This artefact is an early tutorial sheet from a mathematics part of the science course in engineering science and mathematics. The purpose of the tutorial is partly to do with mathematical skills so it is asking them to apply some knowledge that they have learnt in their first couple of weeks or lectures in year one but it's also primarily about exposing them to questions of different forms' (p. 16).*

The artefact comprises of mathematical contextual problems and also interpretation questions which require students to apply their knowledge and think through the solutions which is challenging. Similarly, in SE teachers were also concerned with mathematical skills and applying these skills to questions. For example, Participant SEI-4 describes his artefact,

> *'This is a mark scheme for a chemistry test on energetics on enthalpy which is an A-Level topic...and this is my mark scheme for it. There are a number of questions which require numeracy skills; therefore, I can identify whether my students can do the energetics calculations correctly. If there are any weaknesses I know where I need to work on' (p. 10).*

In addition to mathematical skills in SE1 one participant SEI-2 describe how literacy and key words are emphasised in her mark scheme artefact which the students are trained on in order to develop their exam technique.

> *'I have brought a year 12, mark scheme. The mark scheme is for a key stage 5, a biology test on biological molecules there is a mix of higher order questions, low order questions, as well as multiple choice...I mention the extra guidance notes, what is allowed, what is not allowed. So that the students get the buzzwords, the key words' (p. 9).*

SEI-2 also describes the 'high-order' and 'lower-order' questions assessed supporting theme 5 challenge. However, although there are application questions which are

challenging there is only one correct answer so critical thinking is not necessarily reflected in this SE artefact.

4.6.2 Using mark schemes

Another subtheme which emerged from the artefacts was 'mark schemes' and exam questions. This particular subtheme emerged as a result of six teachers from SE1 choosing exam papers or mark schemes for their choice of artefact. SE1 teachers emphasised looking at mark scheme answers to improve exam terminology and students making their own mark schemes and exam questions for further practice. For example, Participant SEI-1 describes,

> *'The students produce their own mark scheme this is really good for us at the moment because I do this quite a lot because there is new stuff on the specification that has not been assessed before so if I cannot find an exam question on the new specification they do this and make their own exam question with the mark scheme answer', (Participant SEI-1, p. 13).*

SE teachers also emphasised looking at mark schemes to help improve the accuracy of student responses to exam questions. Participant SEI-2, asserts that,

> *'Sometimes the examiners will only credit the first answer on the line and no credit if you put two answers on a line, things like that. It's getting them around the rubric of the exam and how to get more accurate answers and better marks' (p. 14).*

The justification of using mark scheme included improving the accuracy of student responses, improving exam technique and also training them for their final exam. Participant SEI-2 explains that,

> *'It's something that I use in my practice often with the year 12 students (A Level Students) and it's a good indicator of how they are trained for exam purposes. It is relevant to key stage 5, as a 100% of the A-level is weighted on an external exam'. (Participant SEI-2, SE, p. 14).*

Participant SEI-3 describes her artefact below,

> '*The artefact that I have bought with me is a series of exam questions...this particular example is very heavy in terms of the number of*

> *assessed homeworks there are... They are marked by me and then given a total score, agreed by me. Then they are generally given feedback on what they need to improve on, and they may carry out corrections for example they may use a green pen' (p. 12).*

Similarly, Participant SEI-7 describes her artefacts which consists of exam questions,

> *'Physics boosters are an exam question paper that are prepared by the members of the physics department. I used to prepare the A-level Physics boosters and so you have questions from past paper exams, multiple choice questions. They are all exam-based questions directly taken from the Physics specification, so it enables the students to practice their exam skills. It is a revision tool and also development of exam technique' (p. 14)*

Thus, the majority of SE1 teachers chose to bring exam papers or mark schemes as an artefact. Exam practice has already been covered in theme 4, but a clear trend that must be reported in the findings of the artefacts is that at SE1 teachers leaned towards exam questions and mark schemes as their artefact and a common justification for this artefact was to develop exam technique in preparation of final exams. In comparison to HE1 teachers mark schemes are not as challenging as there is a defined correct answer and so students have less opportunity to be creative and original compared to the open-ended assessment artefacts from HE1 teachers, for example, presentation rubric.

In contrast to SE, HE lecturers did not encourage the use of mark schemes even after an assessment or exam but rather wanted to emphasise the process of getting the right answer and not 'rote-learning' answers. Participant HEI-9 states that,

> *'The thing that has concerned me most coming out of the language talking to people coming out of A Level assessment is the obsession with mark schemes answers and rote learning if you are asked a question' (p. 13).*

At the HE1 giving students a mark scheme is not common practice in order to discourage them from memorising answers and regurgitating them in assessments. This was one major difference in the artefacts across the SE and HE sectors which resulted in this subtheme. This indicates a sense of what Marton and Saljo (1976, p.

4) termed ‘surface learning’ as opposed to ‘deep learning’ taking place at SE than in HE because of the emphasis on mark scheme answers.

4.4 Summary of the findings

This chapter discussed the themes that emerged from applying interpretative phenomenological analysis to the data collected. This data analysis procedure is congruent with the epistemological underpinnings of this study, which aims to describe and compare the assessment methods across HE and SE sectors in order to improve the transition for SE students to HE. Figure 16, below illustrates the main findings of this study in relation to the research questions. In research question 1, the purpose of assessment was to develop knowledge and understanding as was evident for the interview data. This research question also linked to theme 2, as in order to develop knowledge and understanding assessment is used throughout the learning process. This theme in turn related to research question 2 as formative and summative assessments are scheduled throughout the module in order to assess the knowledge and understanding developed by the students. Regarding research question 3, the findings suggest that teachers across sectors HE and SE employ a variety of assessment methods during the course of their teaching within a module or course to develop skills including practical and oral skills. The justifications of using a variety of methods were varied and teachers used different methods for different purposes. For example, presentation assessments to develop communication skills. Theme 3 also linked with the research question 2, as some of the assessment methods used had either a formative or summative purpose. The fourth research question concerned the similarities and differences of teachers views across the sectors and it was found the learning process across the sectors was markedly different. In SE there is a predominant focus on exam questions and mark schemes which was also evident in the SE artefacts which were brought to the interview. The learning process which SE teachers were predominantly concerned with was therefore practicing exam questions and developing exam technique. In contrast, HE teachers were more concerned with the thought process students took to reach solutions or solve problems, hence a greater focus on critical thinking skills and problem solving which linked to the fifth theme, challenge. HE teachers brought in artefacts that were cognitively more challenging assessment tasks compared to SE teachers where the focus was on mark

scheme and exam questions as this was the 'end goal' of the course. Theme 5 also linked with research question 3 as material evidence was seen of the types of assessment methods used by the teachers in HE and SE.

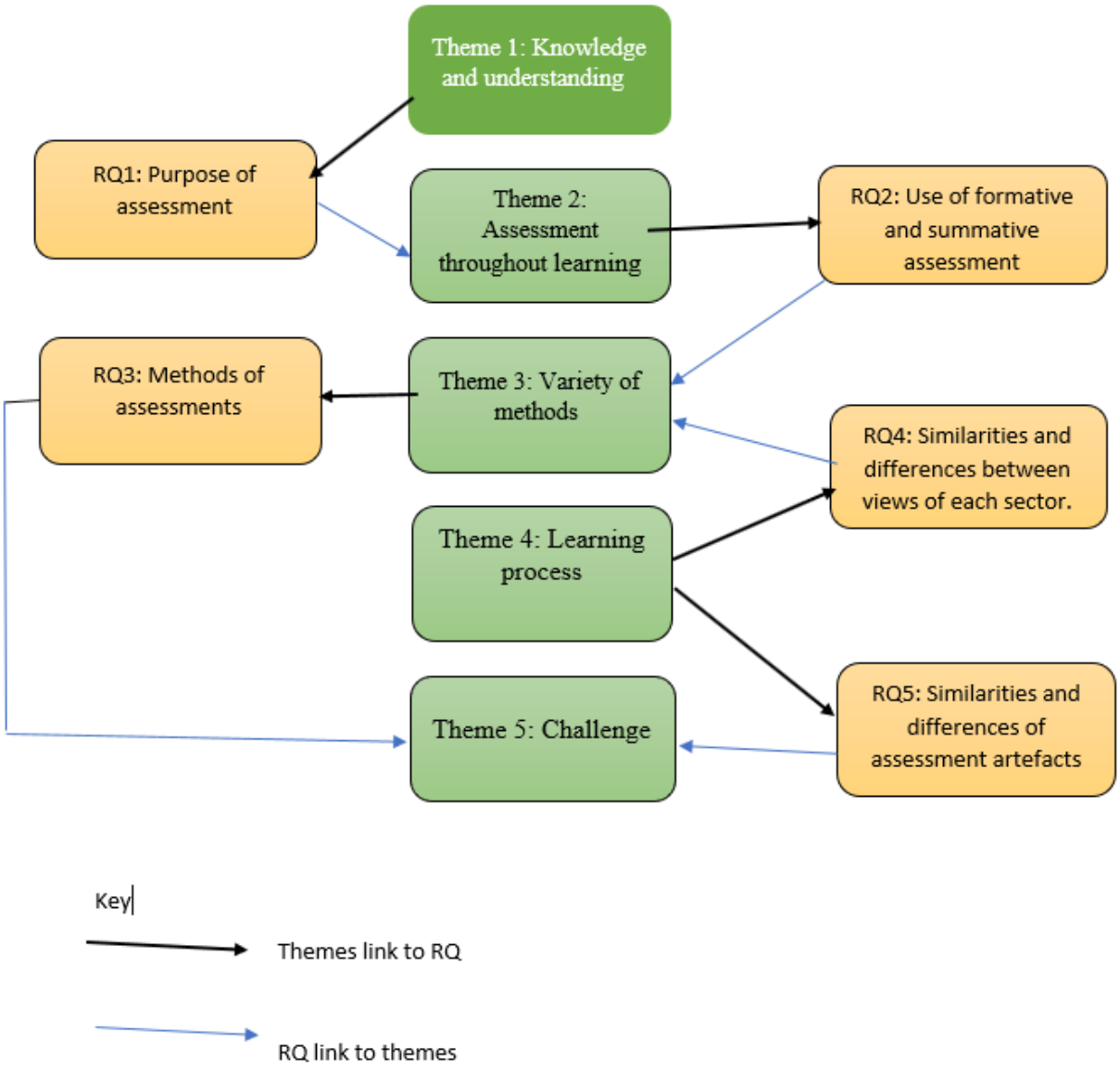


Figure 16 The five themes and their links to the five RQ's of this study.

The next chapter will interpret the findings in relation to the literature discussed in Chapter 2 and will highlight areas where adjustments can be made to the current assessment methods at SE1 in order to support the transition of student to HE1. In addition, improvements and an awareness of assessment methods in SE1 will be

made available to HE1 teachers so that HE1 can develop their first-year programmes which support a more successful transition for students from SE to HE.

Chapter 5

Discussion

5.1 Introduction

The findings of this interpretative phenomenological study indicate the diversity of assessment methods employed by teachers across SE and HE sectors and the range of justifications for using these methods including; preparation for final exams, developing skills and ensuring knowledge and understanding are assessed. The findings show some markedly different assessment methods and justifications used in SE and HE that can be seen by the five themes which emerged from the data. Wilson, Child and Suto (2016) argue that students struggle to transition from SE and HE because students are unfamiliar with the assessment methods in HE. SE teachers need to diversify their assessments methods to help with this transition as assessment methods are part of the problem (Jansen and Meer, 2012; Suto, 2012). In order to ensure SE1 the SE context which was used in this study facilitates the transition of students from SE to HE reviewing the current assessment methods and the assessment policy to include a greater exposure to HE methods may help to address the challenges that SE students face with their transition to HE. Greater use of a variety of assessment methods, for example, posters/presentations, planning practical investigations and projects in science will help develop independent learning skills to prepare for HE transitions (Wingate, 2007) and ensure students have extended assessment opportunities in order to develop and practice skills which is in line with the literature discussed in chapter 2, the literature review (Cowen 2010, Lau, 2016). Suto (2012) argues that it is the style of assessment at HE which SE students find challenging and therefore by looking at assessment methods and addressing this in this study it will help with the student transitions. However, Teig, Scherer and Nilsen (2019) argue that SE teachers have limited time due to the high content of GCSE and A-Level courses and to use extended periods of time on problem-based learning or projects may not be feasible (Black & Wiliam, 1998). However, developing skills according to Torenbeek et al. (2010) will help for a more successful transition from SE to HE and it will help students in their future academic career.

This discussion chapter will assist in helping SE teachers identify assessment methods which they can use to create greater exposure to HE methods and also focus on developing skills which will assist them in a successful transition to HE. The findings concur with assessment methods and approaches seen in the literature review with a large variety of methods used by both SE and HE teachers but their justification for using these methods was not always the same (Cowen 2010, Flores et al, 2015). SE and HE teachers described different purposes of using the methods they chose. Similarly, Newton (2007) argues that the purpose of assessment is multi-faceted and therefore, the teachers' views are valid and this is cognisant with the literature (Bauer, 2016).

The chapter will continue by discussing the findings through each of the emergent themes and subthemes in relation to the current literature and discuss how each of the themes can be used to derive successful assessment practices at SE1 and HE1 in order to help students with transitions to HE successfully and to increase their confidence with assessments methods by focusing on skills and ‘deep approaches’ to learning. It is hoped that the findings of this research will be made available in order to embed some of these assessment methods with the SE science assessment and learning policy at SE1. In addition, the study will inform HE1 teachers of SE student experiences so that they can be aware of SE practices in order to help develop a possible foundation course to help ensure a smoother transition into HE.

5.2 Discussion of emergent themes

Theme 1: To assess knowledge and understanding

The first theme to emerge from the IPA relates to the first RQ namely the purpose of assessment. The primary purpose identified by teachers across HE1 and SE1 was ‘to assess knowledge and understanding’. This can be seen from Figure 8 with the participants’ quotes clearly evident in supporting this view. However, assessing knowledge is not the only purpose of assessment and this view was asserted by

participants SEI2, HEI11, HEI12, HEI13 and HEI16 and others who viewed the purpose of assessment as monitoring progress, identifying gaps in knowledge and to maintain quality standards. This multifaceted view is reiterated in the literature by Newton's (2007) research at HE and Ofqual (the Office of Examinations and Qualifications) who argues that assessment has many purposes including to make a decision regarding students' learning, make a judgement about their work or impact and motivate students to engage with the content. Table 2 below from Newton (2007; 2010) concurs with some of the views of the SE and HE teachers, for example, 'student monitoring', 'formative' and 'placement'.

Table 1: Purposes of Assessment, Initial List (Newton, 2007; 2010)

Level	Categories	Description
Decision	Social Evaluation	Judge the social or personal value of students' achievements
	Formative	Identify proximal learning needs, guiding subsequent teaching
	Student monitoring	Decide whether students are making sufficient progress in attainment in relation to expectations or targets
	Transfer	Identify educational needs of students who transfer to new schools
	Guidance	Identify the most suitable courses, or vocations for students to pursue, given their aptitudes
	Institution monitoring	Decide whether institutional performance – relating to individual teachers, classes or schools – is rising or falling in relation to expectations or targets
	Resource allocation	Identify institutional needs and allocate resources
	Program Evaluation	Evaluate the success of educational programs or initiatives, nationally or locally
	Placement	Locate students with respect to their position in a learning sequence
Judgment		Derive a standards-referenced judgment, expressed as a grade
Impact		Ensure that students remain motivated, and that all students learn a common core

Table 2 Newton's (2007) multifaceted purpose of assessment.

However, some of the views were not evident including 'transfer' and 'guidance' from Newton's (2007) model. The views that were evident for the purpose of assessment compared to Newton's model (2007) will be explored in the subthemes from theme 1, below.

Subtheme 1 – To identify gaps in students' knowledge

From the teachers' perspective it emerged that one of the purposes of assessment was to identify gaps in students' knowledge and assessment helps to do this. Teachers then use the 'gaps' identified to feedback and adjust their teaching or target weak areas and reinforce these in lessons (SEI1, SEI3, SEI4, HEI15). Heller, Steiner, Hockemeyer and Albert (2006) describe this as a 'personalised approach' to learning, the aim of which is to 'tailor teaching to individual needs, interests, and aptitude to ensure that every learner achieves and reaches the highest standards possible' (p. 75). Both SE and HE teachers and lecturers described identifying gaps as a purpose of using assessment in their practice. This is concordant with Newton's (2007) model as one of the purposes of assessment is 'formative' in order to 'identify proximal learning needs, guiding subsequent teaching' (p. 163). Teachers viewed it as an opportunity to indicate to students their 'gaps' so that students can address these, which means that identifying gaps is related to feedback according to teachers' views. Similarly, in the literature Tan (2013) argues that once gaps in knowledge are identified students need 'to receive and act on feedback' (p. 3) in order to address the 'gaps' (p. 1). This is supported by Black and Wiliam (1998) who go further and add that closing the gap in knowledge and feedback are all part of the same formative assessment processes. Therefore, identifying gaps and feedback are part of the assessment for learning cycle which is congruent with the literature (Wiliam, 2010; Orsmond, et al., 2011; Tan, 2011; Black, et al., 2003). Tan (2013) links all three strands: identifying gaps, feedback and formative assessment in his 'triangulated model of assessment for learning' (p. 2) which can be seen in Figure 17 below.

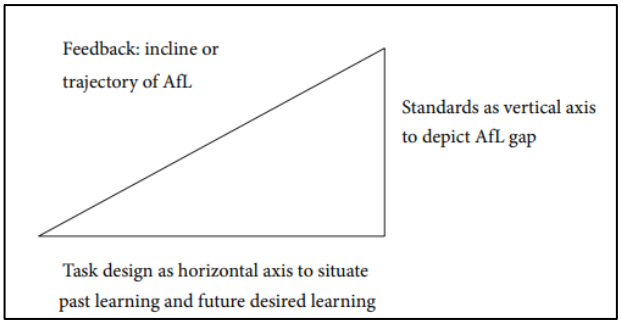


Figure 17, Triangulated model of assessment for learning by Tan (2013)

Tan's (2013) model links three reoccurring emphasises in the literature identifying gaps, feedback and AfL in his model and argues that the three are linked and necessary for student to improve their learning. The HE and SE teachers linked identifying gaps and feedback as one of the purposes of assessment. However, it was not the only purpose according to the findings and other subthemes were identified which will be discussed below.

Subtheme 2 – To monitor and track students' progress

The findings suggest that another purpose of assessment according to teachers in HE and SE was to monitor and track students' progress. Assessment is used to track student progress and if a student is not performing adequately or failing, intervention is put in place (SEI7, SEI4, HEI16). This is in line with the literature, for example, according to Stecker, Lembke, and Foegen (2008) assessment is used to monitor students' strengths and weaknesses in areas of the curriculum in order to track their progress over time. They claim that 'teachers' use progress-monitoring data to target students who are not performing satisfactorily' (p. 48) in order to provide intervention. However, according to the findings although SE1 teachers were tasked to do these intervention strategies themselves (SEI3, SEI4, SEI7), in HE1 intervention was put in place by the Personal Academic Tutor. But in both cases, monitoring was used to track the progress in learning. Stecker, Lembke, and Foegen (2008) claim that in addition to tracking progress it is important to 'use the data to make changes in instruction (this) is one of the most important functions of progress monitoring' (p. 52). SE teachers described these changes to include going over concepts (SEI1, SEI3) and HE teachers described creating a personalised learning program with the Personal Academic Tutor to help students reach their target (HE16, HEI12). From a HE perspective, Romero-Zaldivar, et al., (2011) emphasise that monitoring and tracking students' progress is an important factor that contributes 'towards the effectiveness of a learning experience' (p. 1058). Similarly, HE and SE teachers emphasised progress monitoring as an important purpose of assessment to help students improve their learning in order to 'help them progress' (SEI7, p. 1). Teachers in SE described interventions to improve progress in assessments to include giving additional homework's (SEI3), online Active learn tasks (SEI2) and self- assessment (SEI4). In

contrast, HE1 teachers were not responsible for the intervention but liaised with the Personal Academic Tutor (PAT) to notify them of a student's poor performance so that the PAT could put together a personalised learning programme which included additional reading materials from the library, time management and organisational strategies including timetabling to help students organise themselves and peer mentoring with other students to support them in their learning (HEI12, HEI14). These strategies were put in place to help raise progress of students.

Subtheme 3 – To help develop skills

Teachers described skills development as a purpose of using assessments. These skills included mathematical skills, lab/practical skills, thinking skills and computational modelling skills (SEI2, SEI5, SEI7, HEI12, HEI14, HEI16). SE teachers described the use of Core Practical's and Practical Assessment Groups (PAGS) in GCSE and A Level sciences respectively as practical assessments that give students the opportunity to develop their practical skills (SEI4, SEI7). Practical skills were a key skill in science courses that was emphasised by both SE and HE teachers. Participant HEI14 reinforces this in his statement that 'a lot of what we do is to try and develop skills in our assessment. For example, assessments around laboratories' (HEI14, p. 4). The practical skills developed included handling lab apparatus, conducting experiments, keeping accurate records in lab books and writing up lab reports in HE1. Similarly, SE teachers described skills such as evaluation of practicals, following procedures to collect data and writing a conclusion; all skills acquired through practical assessments (SEI1, SEI4, SEI7). But in HE there is a greater degree of independence and autonomy during practical classes and this is evident by the frustrations expressed by some lecturers during the interviews, for example the way first year students handle practicals. One HE115 lecturer explains that,

> '*for practicals they seem to have a different attitude then what the university would like them to have. They always ask what to do next and it's quite prescriptive' (p. 14).*

Wilson and Child (2016) argue that during transitions from SE to HE lecturers report that students experience difficulties with the degree of autonomy and lack specific academic skills (Green, 2005; Smith and Hopkins, 2005; Torenbeek et al., 2010). One

academic skill which was identified as a challenge for HE1 lecturers was independent learning skills (HEI15). Similarly, within the literature this has also been identified as a challenge for SE student during HE transitions (Ellis, 2008; Lister, 2009; Winterson and Russ, 2009). Ellis (2008) suggests there is a tension between the lecturers providing sufficient guidance at University and encouraging students to be independent learners; this can be seen in the frustrations expressed by participant HEI15. Jeffery (2012) argues that although SE teachers may aim to develop independent learning skills in their students this is challenging because of the pressure of the school accountability measures. This pressure is reflected by SE participants who stressed the heavy content at GCSE and A Level means time is limited and teachers cannot be flexible in their teaching of the content as they risk not completing the course (SEI2 and SEI3).

Another skill which was emphasised by HE and SE teachers was mathematical skills. SE teachers described using exam questions with mathematic problems in order to practice and develop this skill as numeracy skills are tested in the external exams (OCR Biology Handbook, 2017). Similarly, HE lecturers described using mathematical problems in assignments as it was an 'essential skill' (HEI12, p. 12) at University level. In addition, computational modelling skills were sometimes coupled with practical and mathematical skills in HE1, for example, HEI12 states that in a physics degree,

> *'the students are also assessed via computer programming and computational modelling…it forms an element of their practical skills. In addition, the students are assessed on programming skills… Computer programming is essential in a physics degree' (p. 13).*

These skills are developed through assessments labs or research work which the students will conduct as part of the final year research project (HEI12). Finally, lecturers also mentioned thinking skills being developed through lab assessment. For example, HEI15 states that,

> *'To enhance the thinking process this way of assessment (labs) where I sit and we argue about the way of doing things it helps them to enhance their thinking skills and to think deeply about their justifications in their lab work' (p. 5).*

Lecturers mentioned asking questions about students' lab work in order for students to justify their choices. HEI15 claims that this improves students' thinking processes and enhances their experimental choices when they do their lab work. Similarly, within

the literature Tari and Rosana (2019) argue that practical skills can help develop critical thinking skills as students design investigations through contextual learning.

However, in the literature there is a debate whether SE practical assessments develop practical skills at all. Wellington (1999) argue that,

> *'The skills and processes of investigations are not taught, but experienced, and the conduct of investigations is about summative marks for GCSEs rather than formative assessment to become a competent scientist. In that both pupils and teachers see them as more about getting marks than learning some science, the assessment tail is definitely wagging the science dog' (p. 17).*

This sentiment is echoed by Bennett and Kennedy (2001) who argue that SE practical work is inadequate and only examines a 'very limited range of abilities' (p. 108). Although HE lecturers picked up on the frustrations of practical labs for first year undergraduate students, SE teachers did not identify this limitation in assessing practical skills through summative assessments at GCSE and A Level.

Subtheme 4 – To maintain quality standards for employability

Lecturers described assessment as having a role to maintain the quality standards for employability. This resonated with HE lecturers rather than SE, however quality assurance purposes were also present in SE. Teachers in SE1 use standardised assessment and standardised marking procedures to maintain quality assurance standards and ensure procedures are consistent across the whole science department. For example, SEI8 describes using a standardised marking procedure for the physics department to,

> *'allow the whole department to consistently apply the mark scheme criteria to each question, therefore, there is minimum variance across teachers' (p. 10).*

In addition, SE teachers thought it was important to standardise summative tests for QA purposes so that class performances can be compared accurately. Similarly, in HE1 assessments undergo QA, HEI9 states that 'we set assessment then we validate' (p. 2) the assessment as part of maintaining quality standards. But there was a greater emphasis on employability and the importance of the degree qualification being recognised by prospective employers as an assurance that the students have the knowledge and understanding and acquired the necessary skills for employment in

their related field of study. In addition, HE lecturers have more autonomy over the curriculum and assessment to ensure skills are developed, whereas, SE teachers do not have this autonomy (Priestley, Edwards, Priestley & Miller, 2012). This is concordant with the literature as Gabor, Blaga and Matis (2019) argue that employability for graduates is a hot topic internationally and within the literature. Woya (2019) links quality assurance with employability and argues that, 'Higher education adds value by developing job related skills and competencies' (p. 1) for employment and this is an aspect of QA in HE. Within the literature assessments that develop real-world skills for employability are known as 'authentic assessments' (Wiggins, 1997). Wiggins (1993) explains that in authentic assessment,

> *'The tasks are either replicas of or analogous to the kinds of problems faced by adult citizens and consumers or professionals in the field' (Wiggins, 1993, p. 229).*

Hodgeman (2014) claims that authentic assessments, for example, student portfolios encourage self-evaluation, reflection and critical thinking; soft skills that students can transfer to industry. HE lecturers described the use of such authentic assessments including portfolios, research posters used for conferences and proposals for projects (HEI12, HEI14, HE16). The justification of using such methods of assessment was to prepare students for employability which is congruent with the literature (HEI12, HEI14).

Theme 2: In order to assess throughout the learning

Teachers in both HE and SE described their use of formative and summative assessment throughout the learning process in order to assess student learning, hence the emergence of theme 2. This theme relates to the findings from the second RQ. The literature is at times dominated by a debate on formative and summative assessment as was indicated in chapter 2 the literature review. Formative and summative assessment play an important role in student learning according to the literature (Black et al., 2003) and this is concordant with the findings of this study. The findings revealed an array of formative and summative methods were used by teachers to engage student learning which will be discussed below.

Subtheme 5 - Formative assessment used continually as part of classroom routines

Teachers in both HE and SE stressed their frequent use of formative assessment as part of their everyday classroom routines (SEI1, SEI3, HEI9) in order to check student progress. This relates back to subtheme 2 where monitoring and tracking progress was an important purpose of assessment. Teachers use formative methods to do this which is congruent with Tan's (2013, p. 2) Triangulated model of assessment for learning in Figure 12, above. Monitoring and tracking, formative assessment and feedback are all linked as part of the same student learning cycle to help student progress in their learning. This theme is consistent with the literature (Wiliam, 2010; Orsmond, et al., 2011; Tan, 2011) and has been discussed in subtheme 2, above. William and Thompson (2007) argue that the teacher is responsible for creating these student learning cycles through their use of appropriate assessment methods. The formative as well as summative assessment methods used by teachers at HE and SE will be discussed in the subthemes below. However, there is greater agency in the summative methods used by HE lecturers than SE teachers as a result of the high stakes assessments at SE (Priestley, Edwards, Priestley & Miller, 2012).

Subtheme 6 – Assessing through question and answer sessions

Question and answer sessions in the classroom or during consultancy sessions in the case of HE was a popular choice of method used as part of formative assessment routines by teachers from both sectors. SE teachers used questioning throughout their everyday classroom routines, SEI5 states that 'we assess all the time as teachers, we assess by questioning as it is quick and easy to get a response' (p. 7). On the other hand, HE lecturers used questioning during specific consultancy or tutorial sessions where students had the opportunity to engage with the lecturer on an informal level (HEI9, HEI16), which was not as flexible as SE teachers. However, both teachers stressed the importance of this method as a means to assess students' 'knowledge and understanding' (SEI4, p. 9). Similarly, in the literature Arslan (2006) argues that questioning 'is the strongest tool at a teachers' disposal as it teaches students how to think' (p. 81). The justifications for using questioning for HE and SE teachers was similar namely to assess understanding and also that it provided 'instant feedback'

(SEI2, p. 4). 'Probing questions' (SEI3, p. 6) was also a justification in order to improve thinking skills and depth of understanding of concepts which is consistent with the literature. Nappi (2018) argues that questioning can be used to teach and also assess understanding. However, she argues that 60-80% of questions used by teachers require students to recall information only (Tienken, Goldberg, & DiRocco, 2010; Saeed et al., 2012) and instead teachers need to plan high-level interactions in order to encourage high order thinking (Bloom et al., 1956) and develop critical thinking skills. Although knowledge and understanding is at the bottom of Bloom's et al,. (1956) taxonomy, there is evidence that both SE and HE teachers use high order questions to stimulate learners. SEI3 states that,

> *'For some GCSE students you may well start off with level 5 questions and the progress to level 6 and 7, and so they are progressively going through Bloom's (1956) Taxonomy' (p. 4).*

Similarly, in HE during consultancy sessions lecturers have the opportunity to ask critical questions about student's' projects and research developing critical thinking skills.

> *'We discuss sometimes the weaknesses of the project but we do it in a very critical and constructive way but it does not reflect badly on the student' (HEI15, p. 7).*

This is concordant with the literature as Tienken et al., (2010) suggests that teachers need to use high order questions in order to develop cognitive thinking skills including critical thinking; HE and SE teachers used these strategies in order to develop students' thinking skills.

Subtheme 7 – Assessing through coursework and assignments

Another formative assessment method used by HE and SE teachers was coursework and assignments. SE teachers used homework assignments in their practice regularly according to the homework policy at SE1 in order to support learning at home and consolidate concepts covered in class. SEI3 describes using additional practice exam questions for further practice at home and this was a strategy used by other SE teachers also (SEI7, SEI1, SEI8). This homework was not weighted towards their final attainment. In contrast, HE lecturers used assignments including problem sheets, computational assignments and essays as part of formative assessment within

modules which were weighted 1%-2% (HEI11) towards their final end of year mark. There was a greater variety of formative assessments described by HE lecturers than SE teachers and the justifications of using these types of assessment by HE lecturers included to develop mathematical skills, problem solving skills and to develop writing and communication skills. The emphasis here being on skills development which was covered above in the subtheme 3. Similarly, within chapter 2 the literature review, soft skills including problem solving, communication and independent thinking skills were identified by the QAA (2018) as necessary for graduates for future employment. According to HEI11 coursework is a 'catchword' (p. 8) and covers everything from problem sheets to work-based reflection essays to tutorial assignments and in the literature the use of 'innovative assessments' has advantages to students' learning approaches and learning styles (Flores et al, 2015; Zlatkin-Troitschanskaia et al, 2016). Marton and Saljo (1976a, 1976b) coined the terms 'surface' and 'deep' approaches to learning when they were researching students and how they approached a reading assessment. The authors described students who learned a series of disjointed facts as having used a surface approach to learning, whilst student who made interpretations about the text as having used a deep approach to learning. The model was later developed by Biggs (1991) and also Entwistle (1997) who reconstructed the model and added a third approach known as the 'achieving approach' (p. 213) or the 'strategic approach' to learning (Entwistle & Peterson, 2004). From the formative assessment methods chosen by HE teachers it can be inferred that they promote a greater degree of deep approaches to learning as they are open to student interpretations and problem solving. Formative assessments like essays and problem sheets were used by HE lecturers in order to encourage students 'to tackle the problem' (HEI16, p. 11) by getting students to think about the 'process' (HEI16, p. 11) whereby there was more than one solution to the problem. This means that there was a degree of creativity involved in problem-solving and this would require students to be more aligned to the deep approach to learning in order to come up with their interpretations (Biggs, 1997).

In contrast the homework assignments which were given by SE teachers consisted of a 'rich diet' (SEI2, p. 4) of exam questions which would entail students regurgitating facts from textbooks which is more aligned to a surface approach to learning (Biggs, 1997). However, a critical analysis of Bigg's (1997) surface and deep approach to

learning model by Howie and Bagnall (2012) indicates that the model is 'over-simplified' (p. 10) where a 'surface approach' is assumed to be bad and a 'deep approach' to learning is assumed to be good. In addition, the authors claim the model is 'under-developed' (p. 11) conceptually and students do not take one or the other approach all the time but a nuanced approach is used depending on the learning. Therefore, it can be seen that the choice of assessment methods used by teachers in HE and SE can influence the approach to student learning.

Subtheme 8 – Summative is used to assess content

It is evident from the findings that summative assessments are used to assess content. This is indicated by both HE and SE teachers. SEI2 states that summative assessment is used to 'assess the content' (p. 3) that students have learned at the end of topics or modules and this view is also echoed by others (SEI3, SEI7, HEI10, HEI11). Teachers found it important to measure students' performance against learning objectives within modules or topics and then assess this through summative assessment as it was reliable measure of whether the students understood the content of modules (HEI16). This view is support by Yorke (2007) in chapter 2 the literature review who noted that teachers preferred using summative assessments as they were a fairer representation of a student performance. HE and SE teachers also noted the importance of monitoring and tracking summative assessments to indicate students' progress which has been explored in subtheme 2, above. Within the literature, Black and Wiliam (1998) champion the formative and summative assessment discourse, however, Biggs (1999) is very critical of the dichotomy created and argues instead that both are essential for student learning. Similarly, HE and SE teacher did not use formative or summative assessment exclusively, instead these were used as part of the same learning cycle to help with the student learning overall (SEI3, HEI16). The methods of summative assessment which were used across SE and HE will be explored in the subtheme below.

Subtheme 9 - Assessing through exams and dissertations

According to the findings SE teachers predominantly use exams and tests for summative assessment because 'the ultimate end is for students to sit an external

exam' (SEI8, p. 3). As UK GCSE and A Levels are assessed 100% as summative assessments (Ofqual) there was a strong emphasis on exams from SE teachers. However, although these methods can be used to indicate students' knowledge they do raise some issues (Scouller and Prosser 1994) and encourage surface rather than deep approaches to learning as students are encouraged to memorise and 'regurgitate' (HEI14, p. 5) facts (Ramsden 1988; Struyven, Dochy, and Janssens 2005; Tang 1992). This trend is reaffirmed as HE lecturers indicated that first-year students had a tendency towards 'rote learning' (HEI9, p. 5) and found assignments challenging as they struggled with application questions and problem solving (HEI9, HEI16). However, using exams as summative methods was not exclusive to SE, HE lecturers used exams for their end of year assessments which carried a substantial weighting and were 'the most straightforward way to test the knowledge of the students and to some extent their ability to apply such knowledge' (HEI15, p. 5). HE lecturers used exams because they were 'traditional' (HEI9, p. 15) and also indicated that students were motivated to learn because of the exams. This is concordant with the literature as Gibbs (2010) indicates that exams act as a motivating factor for students to learn and students tend not to put any effort into assessments that are not graded.

HE lecturers also used dissertations as a summative assessment and this was unique to HE. The dissertations were emphasised as an assessment for 'final year students…and this will be a big chunk of their marks' (HEI14, p. 4). Documentary evidence at HE1 indicated the 40-credit weighting of the dissertation and this was a 'research' assessment (HEI15, p.6) designed to assess students' original work and their ability to communicate their research problem and write scientifically (HEI14, HEI14). Within the literature dissertations are a traditional form of assessment in HE (Brown, Bull & Pendlebury, 2013) and the primary purpose is to conduct an original investigation and make a contribution to one's field (Evans et al., 2018). Students develop not only writing and communication skills, but analysis and critical thinking skills as well as how to structure a scientific piece of work (Boote and Beile, 2005). HEI14 explains that dissertations involve 'synthesising information' (p. 5) which is a high order skill according to Bloom's (1956) taxonomy of learning. Students have to explore a problem 'deeply' (HEI15, p. 6) and therefore this encourages a 'deep' approach to learning (Entwistle, 2007) which is unique to HE.

Theme 3: Using a variety of assessment methods

Teachers in HE and SE described using a variety of methods (see Figure 13) including self and peer-assessment, practical assessments, presentations, posters and vivas and gave different justifications for these including developing communication and oral skills, reducing teacher workload and developing kinaesthetic skills. These will be discussed further in the subthemes below. In addition, the literature also supports the notion that a variety of assessment methods should be used by teachers in order to challenge students and keep them motivated (Durisova, et. al, 2015). Boud (2005) argues that teachers should avoid using exclusively conventional assessment methods or only one type of assessment method in order for students to be successful in their future careers and gain a wider skill set (Dochy, Segers, and Sluijsmans 1999). As mentioned earlier the assessment method can influence students' learning approach and lead to deep or surface learning (Marton and Saljo 1997; Segers, Gijbels, and Thurlings 2008). It is therefore important that teachers from both sectors use a variety of assessment methods in order to provide opportunities for deep approaches to learning.

In a study by Wilson, Child and Suto (2017) comparing English assessment methods in SE with HE it was found that in HE there was a greater diversity and variety of assessments which is concordant with the findings of this study. Wilson, Child and Suto (2017) found that SE A Level assessment comprised predominantly of examinations, compared with HE where there was coursework, extended writing and textual analysis assessments. Similarly, teachers in SE in this study emphasised examinations compared to other assessment methods and this is also evident in the artefacts which they brought with them to the interview which will be explored in theme 5 challenge, below. Wilson, Child and Suto (2017) claim that the lower diversity of assessments at SE were a result of the 'school accountability measures to ensure that their students achieve the best grades possible' (p. 202). This is concordant with the findings of this study as SE teachers reported accountability of high stakes assessments meant that exam practice dominated teaching rather than other assessment methods (SEI3). HE lecturers also noted these pressures,

> *'At Secondary Schools at the moment it seems like assessment has taken over the learning and there is a lot of pressure on Senior members of staff… to over assess and to focus on exam results' (HEI13, p. 18).*

Wilson, Child and Suto (2017) conclude their study by indicating that there is a 'mismatch' (p. 204) between assessment methods SE and HE which poses challenges for students transitioning to HE. First-year undergraduate courses at HE need to consider this and ensure there is enough scaffolding and guidance available to students in order to help them with transitions (Bassett et al., 2009; Green, 2006; Smith and Hopkins, 2005). In this study the variety of assessment methods at SE and HE from the findings will be discussed in the subthemes, below.

Subtheme 10 - Self and peer assessment

As part of formative routines which was explored in theme 2, HE and SE teachers reported that they used self and peer assessment in their teaching and learning routines. SE teachers in particular described how self-assessment of exam questions was done frequently to reduce teacher marking (SEI2). In addition, in SE1 all marking and teacher feedback was done using a 'green pen strategy' in accordance with the School's, Teacher Assessment and Feedback Policy, (2018). This was in order to distinguish feedback comments from teachers and peers during peer-assessment. Students were encouraged to engage with the comments by adding their own comments or completing the set task by the teacher in order to progress in their learning. This formative assessment and feedback cycle links to the subtheme 2 as it is part of the same cycle of learning depicted in Tan's (2013) Triangulated model of assessment for learning described earlier. Similarly, HE lecturers described the use of self-assessment when engaging with online learning resources and additional practices questions and resources in order to promote independent learning skills (HEI9). This is in accordance with the literature as Panadero, Jonsson and Strijbos (2016) argue that self and peer assessment promote self-regulated learning (SRL) which is when students actively engage with assessment and take responsibility for their own learning. The authors argue that self and peer assessment involve student within the assessment process which improves learning and increases motivation. However, the authors warn that if self and peer assessment task are poorly designed

they ‘could become an activity in itself that consumes valuable classroom time without necessarily contributing effectively to student learning’ (p. 323). Panadero, Jonsson and Strijbos (2016) suggest teachers work together in professional learning communities to share pedagogical resources in order to effectively design self and peer assessment activities within their classrooms.

Although teachers from both sectors used self and peer assessment as part of the formative routines one teacher in SE (SEI6) remarked that he always double checks the marks after self-assessment tasks as students tend to be generous and over-estimate their performance. Similarly, Jonsson et al. (2015) and Panadero and Brown (2015) concluded that some teachers prefer not to use these types of assessment and leave students out of assessments for these same reasons. However, Panadero, Jonsson and Strijbos (2016) argue the benefits of self-directed learning as a result of implementing these strategies is more than the drawbacks and instructs teachers to share rubrics, mark schemes and criteria and scaffold how to apply these in order for students to get better at using self and peer assessment strategies in the classroom; HE and SE teachers could do this in order to overcome any drawbacks of these strategies.

Subtheme 11 – Practical assessments

Practical skills were identified as an important skill to acquire in subtheme 3 and these skills were assessed during practical assessments in HE and SE. Some of the frustration which HE lecturers identified during practical’s in HE was also discussed in the subtheme 3 and will not be repeated here. These frustrations and lack of adequate practical training impacts transitions into HE (Wilson, Child and Suto, 2017) as first-year students struggle to grasp with the independence of practical assessments as they are used to following a ‘prescriptive’ procedure (HEI15, p. 14). HEI10 explains the purpose of practical assessments is for students to, ‘explore the nature of science by experimenting via trial and error’ (p. 4). This justification is given by HE lecturers (HEI9, HEI11, HEI5) but the set-up of Core Practical’s and PAGS at GCSE and A Level at SE is not congruent with this type of nature of science enquiry (Hanuscin, 2013; Lederman, 2007; Hetherington & Wegerif, 2018) as practicals are procedural and a methodology is already predetermined. Bennett and Kennedy (2001) in the

literature argues that 'practical work' rather than 'skills' is a more suitable label for practicals in SE as the nature of science is missing. In the UK the National Curriculum in Science does aim to 'develop understanding of the nature, processes and methods of science' (Department for Education, 2013) for students but the overwhelming literature suggests that this is not being taught effectively at schools (Lederman & Lederman, 2014; Lederman & Lederman, 2019). This affects students transitions to HE as HE lecturers' expectations are on problem solving and scientific inquiry within practical assessments,

> 'the aim is to give the students experience on creating their own experiments on their own and to solve problem' (HEI10, p. 5).

SE teachers justified the use of practical assessment as it was a compulsory part of GCSE and A Level science courses and gives students experience in handling scientific apparatus and procedures (SEI2, SEI6, SEI7). HE lecturers on the other hand stated the aims were to develop problem solving and inquiry skills as well as organise and keep accurate records of primary data in lab books (HEI12; HEI10; HIE9). Lab books provided important training for students in 'recording accurate data' (HEI15, p. 12) and had potential use for future post graduate research (HEI10, HEI15). Practical labs were also associated with a lab report where students were expected to 'write-up' (HEI15, 12) the problem they investigated in the structure of a scientific article (HEI10, HEI12, HEI15) and therefore their writing and communication skills were also assessed. Overall, the nature of practical assessment in SE and HE are different as this is a contributing factor to some of the challenges SE students face during the transition to HE (Child, Wilson and Suto, 2017; Jansen & Meer, 2012; Jeffrey, 2012).

Subtheme 12 – Presentations, posters and vivas

An important 'transferable skill' (HEI9, p. 7) for students to learn are communication and oral skills according to HE lecturers, thus was the justification of using presentations and posters within modules (HEI8; HEI9; HEI14; HE16). In HE students were required to do presentations including group presentations where they were assessed on their ability to communicate to an audience and present scientific information in a concise and accurate way (HEI8). This skill is important as, employers,

> *'need employees who are comfortable either writing reports or standing up and giving presentations to people' (HEI9, p.7).* For example*, 'when they are presenting in a conference or making a proposal in industry' (HEI12, p. 8).*

In addition, students were required to produce posters which were usually A0 in size and sometimes in conjunction with presentations. The purpose of which was to experience conference style posters and assess skills of conveying complex information from a research project in a condensed and palpable way to an audience (HEI9; HEI15). Teamwork and project management skills were also assessed as HE lecturers explain that in industry projects will be conducted in teams and the ability to work in a team effectively is a skill employers covet (HEI9). In contrast, SE teachers did not indicate the use of presentations and posters frequently as only one participant mentioned this assessment methods which was used in conjunction with peer assessment,

> *'I use peer assessment, for example, if the students are doing the presentation and I asked them to peer assess each other, with some guidance for peer assessment' (SEI3, p. 1).*

Perhaps this was due to time constraints and the pressure of high stakes assessments as in the literature these methods of assessments were used routinely in SE (Boekaerts 2002; Boekaerts & Corno, 2005; Backman et. al., 2011; De Kock, Sleegers & Voeten, 2004).

Within the literature presentations and poster assessment methods are part of a student-centred' pedagogy which promote active-learning where students take responsibility and direct their own learning (Maher, 2004; Rust et. al.,2003). These assessment methods are encouraged as students set their own learning goals and learn to be independent (Boone et. al., 2002). In student-centred learning, the student has an active involvement in the learning process (Maher, 2004), as opposed to teacher-centred learning methods, for example, lectures where students take on a more passive role, whereby the teacher tells the student what to learn (Trigwell, 2012). In SE student-centred approaches were adopted much earlier than HE according to the literature (Cannon and Newble 2000; Savery and Duffy 2001) but in this study there were more types of student-centred methods adopted by HE lecturers evident from Figure 13, but the total number of participants from SE was only eight and this is not representative of all the SE population or generalizable to other SE institutions.

According to the literature student-centred methods also promote a 'deep approach' to student learning, as opposed to lectures which encourage a 'surface approach' to learning (Torenbreek et al., (2011). This is because students have to engage with their own learning and solve problems which encourages 'deep' approaches to learning (Prince, 2013; Pleschova and McAlpine, 2016). However, as pointed out earlier the model assumes that students use one approach or the other, but a critical review of Bigg's (1998) model has shown students tend to use a mixture of approaches including the 'strategic approach' (Entwistle, 1997) depending on the assessment method (Howie and Bagnall, 2012).

HE lecturers also mentioned viva voca as an important method of assessment and as being traditional to HE similar to dissertations (HEI9). Lecturers reported that the viva is an 'acid test' (HEI9, p. 34) to assess the originality of a dissertation and to explore students' in-depth understanding of the problem they investigated (HEI9; HEI10). Lecturers indicated that the

> '*unpredictability of an oral examination is probably the biggest challenge for students' (HEI13, p. 13).*

Apart of assessing oral skills students' rebuttal and defence against their thesis is also examined. In the literature the viva as an assessment method has been defined as,

> *'assessment in which a student's response to the assessment task is verbal' (Joughin, 1998, p. 367).*

According to Sayce (2007) vivas not only develop students' communication skills but facilitate deep approaches to learning and prepare graduates for their careers. This is supported by Borin et al., (2008) who argue that vivas examine high order thinking skills, promote an active learning pedagogy and allows student to demonstrate their application of theory and mastery of what they have learned. Pearce and Lee (2009) argue that in a viva students demonstrate deep approaches to learning as they analyse, synthesise and evaluate information and also demonstrate problem-solving skills which are all high order cognitive skills. Therefore, the viva is not only traditional but a rigorous method of assessment according to the literature.

Theme 4: Teachers' views on the learning process

Theme 4 emerged when it became apparent that there were similarities and differences between teachers' views in HE and SE especially regarding the learning process. The learning process is a term the interviewees used and concerns the assessment methods used and the training or process of learning that results from these assessment methods. Theme 4 relates to the findings from RQ4 and it is split into three subthemes below which explore teacher views.

Subtheme 13 – To provide exam practice

A similarity between HE and SE teachers' views is regarding exam practice and the importance of providing learning opportunities for practising exam questions for summative assessments as these are the 'end goal' (SEI1, p. 13). This was emphasised by SE teachers in particular as students are judged in their final summative exam which has a 100% weighting towards their final grade. This links with the subthemes 8 and 9 and the issues raised with these methods have been discussed above. Similarly, HE lecturers reported that final exams had the highest weighting each year and therefore exam questions were provided formatively to practice and develop exam techniques (HEI9, HEI10). SE teachers reported frequent use of exam questions in lessons as well as homework including 'boosters' (SEI7). For example, SEI1 states that,

> *'at Key Stage 5 (A Level) we have exam questions every lesson. I use them because it is the end goal at the end of the day as much as I do not like to say that we are an exam factory' (p. 13).*

However, this focus on exams according to Boud and Brew (2013) creates a 'commodities to be consumed' approach to education which is driven by results and can lead to a surface approach to learning (Marton and Saljo 1997; Segers, Gijbels, and Thurlings 2008). The commodities view is evident in SEI1's use of the words 'exam factory' suggesting that the focus is on developing exam technique rather than on student learning. Within the literature Jeffery (2012) argues that due to the pedagogical differences between A Level and University, students experience a 'shock to the system' (p. 4) when they transition to HE. Jeffery (2012) argues that this is

because of the methods of assessment where there is a strong emphasis on exams at A Level and 'surface' approaches to learning and because students do not experience a wide range of assessments and skills due the time constraints and the high content in A Levels. In SE there is a culture to get 'good grades' (SEI1, p.13) and maintain a good position in league tables which may be contributing to this problem (Jeffery, 2012). SE teachers focus on exam practice, rather than other assessment methods is a contributory factor to challenges faced during HE transitions. Jeffery (2012) recommends rather than focusing on subject knowledge through exams more student-centred methods like presentations and group exercises to encourage independent learning and critical thinking.

Subtheme 14 – To provide and assess practical and mathematical skills

Both HE and SE teachers asserted that providing and assessing practical and mathematical skills as part of the learning was important in Science. Developing skills has already been discussed in subtheme 3 and practical skills have also been discussed in subtheme 11 above and will not be repeated here. Teachers from both sectors emphasised that the practical component in science is just as important as the theoretical. SEI4 claims that practicals in science 'aid their (student) understanding' (p. 4) which is concordant with the literature (Abrahams, Reiss and Sharpe, 2013).

In addition to practicals both HE and SE teachers stressed the importance of mathematical skills in science courses. Mathematical problem solving and manipulation of data is a pre-requisite for success on science courses at HE and SE (HEI9, HEI10, SEI3). HEI-16 states that,

> *'Math's is very important...we are looking to see if the student can manipulate mathematical data' (p. 18).*

A similar sentiment is echoed by SEI-2 who states that, *'I practice, practice, practise (mathematical skills)' (p. 10).* However, despite this emphasis HE lecturers complained that first-year undergraduates have weak mathematical skills and often struggle with mathematical problem solving in the first year. HEI9 claims that,

> *'students have weak mathematical skills, they understand the problem but they do not understand how to tackle the problem…this is a lack of skills' (p. 13).*

Similarly, in the literature Parsons & Bynner, (2005) argue that in the UK students with poor mathematical skills face challenges in HE including student retention. In addition, in a study by McNaught and Hoyne (2011) the authors found that school leavers have become calculator dependent and lack mental maths skills and the ability to reason and analyse without the use of a calculator. Brady (2016) suggest that poor mathematical skills in SE will affect HE transitions as the majority of HE courses require mathematical proficiency to some degree. This suggests that SE institutions need to bridge this gap and ensure students engage with mathematical problem solving (Brady, 2016).

Subtheme 15 – To focus on the process of learning

A key difference between HE and SE teachers' views was the focus on the process of learning rather than the outcomes by HE lecturers. HE lecturers stressed that rather than the end solution the students' journey and thought process was more important when it came to assessments. HEI-11 explains that for problem sheets, 'we are looking for the process rather than the outcome or the answer at the end' (p. 20). This is echoed by HEI-15 who states that,

> '*You're looking for the process so if the number at the end is not completely within the boundaries but their thought process is correct they can still get some marks' (HEI15, p. 10).*

This is an important distinction, as SE teachers focused on mark scheme answers and correct use of terminology, in contrast, HE lecturers encouraged creativity and there was a flexibility in how students derive solutions. Moreover, HE lecturers did not share mark schemes or solutions to problems after exams or assignments were complete, but rather encouraged students to justify their own solutions from the data and problems presented. HE lecturers expressed how first year students found the lack of mark schemes challenging and took time to adjust to this way of working. HEI-9 recounts interactions with first year student as,

> *'tell me what questions I will be asked and what the specific mark scheme answer is to that question because that is what I have to regurgitate' (p. 27).*

This is reflective of passive learning as opposed to active learning and 'regurgitates' suggests a 'surface' approach to learning (Marton and Saljo, 1976; Biggs, 1987). In addition, the literature suggests that focussing on the thinking process has a positive

impact on student learning and develops student's problem-solving skills and cognitive skills including analysis and evaluation (Brookhart, 2008; Halverson & Clase, 2014). Therefore, SE teachers would benefit by shifting the focus away from the outcome but to the process of learning instead.

Theme 5: To challenge students

The final theme emerged as a result of the choices of artefacts brought to the interview by HE and SE teachers and their pedagogical implications. This theme relates to the fifth RQ, how science teachers and science lecturers perceive the assessment methods and artefacts they use in their practice. Table 6 in the findings sections illustrates the range of artefacts brought in by the teachers and the main differences between the HE and SE artefacts will be explored in the subthemes organised below. The HE and SE artefacts choices varied in challenge, hence the emergence of theme 5.

Subtheme 16 – Developing critical thinking skills

HE lecturers described a greater range of artefacts that were brought to the interview compared to SE teachers, who predominantly brought in either exam questions or mark schemes. HE lecturers' artefacts ranged from problem sheets, presentation rubrics, viva rubrics and report writing rubrics which are pedagogically more challenging that SE artefacts. SE teachers described the purposes of exam questions and mark schemes artefacts as assessing 'knowledge and understanding' (SEI-3, p. 14) which are low order thinking skills in Bloom's et al., (1956) taxonomy, compared to the high order problem solving tasks brought in by HE lecturers (HEI11, HEI13, HEI14). HE lecturers described their artefacts as 'challenging' (HEI9, p. 11) and entailed a range of skills being demonstrated by the student included communication and oral skills, writing skills, mathematical problem solving and presentation skills. The diversity and the pedagogical nature of the artefact meant that student-centred approaches were encouraged rather than teacher-centred (Trigwell, 2012) in HE. HE lecturers emphasised developing critical thinking skills in their artefacts,

> *In some questions… it is a matter of calculating and a bit of critical thinking' (HEI11, p. 6).*

In addition, HEI14 describes problem sheets,

> *'(Problem sheets) are done on a weekly basis and it demonstrates problem solving skills and critical thinking which the students need to acquire as part of their degree programme' (HEI14, 5).*

Half the HE lecturers explicitly mentioned developing critical thinking skills in relation to their artefact choices (HEI10, HEI11, HEI14, HEI16) indicating that at HE criticality is a key skill which is practiced and assessed. This is supported by the literature as Watson et. al., (2008) argues there is an increasing trend recently towards student-centred approaches to learning including presentations and open-ended writing assessments which encourage deeper learning approaches. It is argued that the value of these types of self-directed assessments increase student motivation and impact learning positively as they encourage self-determination and independent learning (Cannon and Newble 2000; Savery and Duffy 2001; Priestley, Edwards, Priestley & Miller, 2012).

In contrast, the opposite trend is seen by SE teachers where the majority emphasised exam questions and mark schemes as being important 'techniques' (SEI7, p. 14) and 'training' (SEI4, p.7) which the student needed to acquire in order to succeed in their final exam. It is clear that the pressures of high stakes examinations are confining the diversity of assessment methods SE teachers select which according to the literature is creating is skills 'gap' (Jeffery, 2012, p.8) because in SE the 'teaching being assessment-driven rather than learning-driven' (Jeffery, 2012, p. 8). Jeffery (2012) argues that the methods and types of assessment 'play a role in approaches to teaching' (p. 8) and the confining of SE methods impact HE transitions adversely. In order to 'bridge the gap' (p. 8) Jeffery (2012) suggests that

> *'a targeted 'scaffolding' of students' existing skills can be encouraged and enhanced within their first year of study' which was implemented by one HE university in the UK.*

In addition, increasing critical thinking skills, independent learning and adopted more student-centred approaches are also recommended to help with University transitions (Jeffery, 2012).

Subtheme 17 – Using mark schemes

Whilst HE artefacts leaned towards student-centred approaches and focused on developing critical thinking skills and challenging learners, SE artefacts were exam questions or mark schemes. SE teachers emphasised using mark schemes in order to model answers and follow 'examiner guidance' (SEI3, p. 6) to improve the accuracy of answers and use the correct 'terminology' (SEI2, p. 14). The findings suggest that the predominant skills which are assessed in such assessments are 'knowledge and understanding' and 'application of knowledge' according to the Assessment Objectives of the exam board in SE1 (Figure 12, OCR A Level Biology Specification, 2016, p. 53). This links to theme 1 'to assess knowledge and understanding' which was discussed above. According to Bloom's et al., (1956) taxonomy these are low order thinking skills as opposed to critical thinking which is high order skills which was discussed in the subtheme 16, above. It is therefore, ironic that the summative exam having the highest weighting is limited to less challenging cognitive skills compared to HE assessments as indicated by the artefacts. The limited scope and confinement to mark scheme boundaries means that students have less flexibility and interpretation is discouraged instead students are encouraged to 'regurgitate' (HEI9, p. 27) facts. This has been noticed by HE lecturers; HEI9 states that first year students have an 'obsession' (p. 13) with mark schemes and 'rote learning' answers (HEI9, p. 13) which as discussed above is akin to a 'surface' approach to learning (Donnison and Penn-Edwards (2012). In contrast, HE lecturers did not use or publish mark schemes but rather wanted to emphasise the process of getting the right answer which links to the subtheme 15, above. Wilson, Child and Suto (2017) argues that the uniformity and lack of diversity in assessment methods is in part due to,

> *'structural differences between A level and university: at A level, there is the need to design assessments which can be marked reliably and administered efficiently on a large scale. University assessments, in contrast, are typically designed for a much smaller cohort' (p. 205).*

Wilson, Child and Suto (2017) argue that it is the pressures from 'school accountability measures to ensure that their students achieve the best grades possible' (p. 202) which is impacting assessment methods and types in SE which has implications to HE transitions as students are not equipped with the necessary skills and a 'scaffolding' (p. 201) approach will be needed to support A Level students with transitions to HE.

5.3 Summary

The discussion of the findings of this study indicates the diversity of assessment methods used across SE and HE sectors and a range of justifications for using these methods. There was a greater diversity of assessment methods used by HE lecturers than SE teachers which has implications to SE student transitions to HE. By employing a greater diversity of methods at SE1 which are similar to HE1 it will bridge the gap in experiences for students and fare better for their transition to HE (Baker, & Sirling, 2016). In addition, by employing student-centred approaches to assessment methods at SE1 this will help to develop skills necessary for SE students including independent learning, critical thinking and problem solving which will make transition smoother and lower attrition rates according to the literature (Jackson, 2003; Leese, 2010; Scott, Hughes, Evans, Burke, Walter, & Watson, 2014).

Five themes emerged from the interview and documentary data and these linked together as assessment and student learning are a part of the same cycle and thus there was an overlap across the themes. The focus in SE with exam questions and mark schemes by SE teachers is posing challenges to transition including students' approach to learning. HE lecturers are frustrated with the mark scheme culture and argue that Undergraduates need to move past 'regurgitating' facts and learn to problem solve and interpret mathematical problems independently. The 'obsession' with mark scheme answers implies a 'surface' approach to learning (Marton and Saljo, 1987) which is problematic at HE. Rather, SE teachers should use a variety of assessment methods including poster, presentations and report writing in order to encourage a more 'deep' approach to student learning. Expanding the assessment methods at SE1 to include exposure to methods used at HE will help bridge the skills gap and help with a smoother transition to HE. The discussion has provided insights of the types of assessment methods SE1 can employ to help with student transitions. In the final chapter which follows limitations of this study and recommendations for the future will be presented.

Chapter 6

Conclusion

In this interpretative phenomenological study, the assessments methods at an SE institution were described and compared to assessment methods at a HE institution and teachers' views and justifications were compared across sectors in order to make recommendations to help the transition of students from SE to HE. The study focused on the assessment methods across the sectors and bridging the gap between the methods used in order to facilitate this transition. Trede and Smith (2014) assert that, 'assessment practices are neither an isolated nor a homogeneous activity' (p.156). The previous chapters highlighted these differences and similarities and the methods that could be adopted by SE teachers in SE1 to help with students transition into HE. The study indicates how exam training and practice although the 'end-goal' of SE and HE programs, developing skills within the assessment methods used including critical thinking skills, independent learning skills and practical skills are important for future success academically and in the world of work (Pang, Wong, Leung, & Coombes, 2019; Hayter & Parker, 2019). It is important to include a variety of assessment methods to ensure students are challenged and develop 'deep' approaches to learning (Lyke, Kalaher & Young, 2016; Biggs, 1998) and that student-centred approaches are provided for this purpose (Durisova, et. al, 2015; Priestley, Edwards, Priestley & Miller, 2012) in SE in order to bridge the gap across the sectors and facilitate a smoother transition for SE students.

In this final chapter, a summary of the main findings of this study will be presented in response to the research questions. This will be followed by the limitations of this study should you wish to replicate the study under different conditions. This will be followed by the implications of this study and my recommendations for future research.

6.1 Findings from the research questions

The findings confirm with Wilson, Child and Suto's (2017) research that there are different assessment methods employed by SE and HE teachers and that there is a

greater diversity of assessment methods employed by HE teachers which has an implication on the transitions of SE students to HE. It was found that some assessment methods encourage 'surface' rather than 'deep' learning approaches (Ramsden 1988; Struyven, Dochy, and Janssens 2005; Tang 1992). In addition, there were different purposes for using assessment methods (Newton, 2007) and employing a variety of methods ensures that scientific skills are developed in students (Durisova, et. al, 2015). The study suggests is it essential to develop student-centred approaches to assessments at SE in order to facilitate a successful transition to HE. Assessment methods employed at HE encourage more independence and are student-centred rather than teacher-centred assessments (Fernandes, Flores, and Lima, 2012). The current assessment methods at HE1 and SE1 need to be described and compared before bridging the assessment gap across the sectors.

Therefore, the research questions posed in this study were:

1. How do science teachers and science lecturers describe the purposes of assessment with regards to their teaching, and their student's learning?

2. How do science teachers and science lecturers describe their use of formative and summative assessment?

3. What methods of assessment are used by science teachers and science lecturers, and what justification do they give for using these methods?

4. What are the similarities and differences between teachers' views from both sectors?

5. How do science teachers and science lecturers perceive the assessment methods and artefacts they use in their practice

The first research question aimed at finding out why SE and HE teachers employed assessment and how this impacted student learning. In short, teachers used assessment primarily to assess 'knowledge and understanding' which the students had learned but, also to monitor and track progress, develop skills and for QA and

employability purposes**.** Hence, theme 1 emerged which was 'knowledge and understanding' as the primary purpose of assessment which is congruent with the literature. But assessment has multifaceted purposes and can also be used to make a decision about a student's learning, judge or motivate students to learn (Newton, 2007). This is all part of the same formative learning cycle according to Tan (2013) and the different strands and subthemes relate to each other in order to help learning progress. Providing greater opportunities for independent work would also ensure SE students develop skills which would benefit their future transition to HE.

In terms of the second research question the formative and summative debate is extensive in the literature (Black & Wiliam, 1998; 2003; Harlen, 2005). The purpose of this RQ was to find how SE and HE teachers describe their uses of formative and summative assessments. The findings resonate with the literature related to formative and summative assessments as SE and HE teachers used these methods in order 'to assess throughout the learning' which is congruent with the literature (Black et al, 2004; Gleaves, Walker, and Grey 2007; Huxham, Campbell, and Westwood 2012; Tian 2007). Both these methods coexist in the SE and HE curriculum but formative assessment is used 'continuously' throughout the process of student learning, whereas summative assessments have a greater weighting and impact in terms of acquiring qualifications in both SE and HE. The study recommends greater project work and/or coursework for SE1, the SE institution in this study in order to allow students to develop problem solving skills (Sambell and McDowell 1997; Segers, Gijbels, and Thurlings 2008) and deep approaches to learning (Biggs, 1998) rather than the current 'surface' approaches and excessive focus on exam technique and practice which currently are the dominating methods in SE1.

Research question three was important in order to discover what assessment methods were being used and why across the two sectors to see the differences in order to bridge this gap across the sectors by improving the current assessment methods at SE1. The findings resonate with the literature in that it was found that a 'variety of methods' were used which can be seen in the findings section (Figure 13). The literature affirms that using a diversity of assessment methods develops a student-centred approach to learning and develops skills for students' future careers (Maher, 2004; Wen and Tsai 2006). In SE1 in order to encourage student-centred methods

strategies such as presentations/ posters and practical report writing should be used so that students have autonomy and a sense of responsibility over their learning rather than an over-reliance on the teacher (Durisova, et. al, 2015).

The fourth research question was looking at teacher views across SE and HE and how these compared. This research question was important in understanding some of the assessment choices and rationale for using those choices. It was very revealing to find that the views across the sectors were different; SE teachers were focused on the exam practice which is the 'end-goal', whereas, HE teachers were more interested in the 'process' behind the assessment rather than the final outcome. This is in contrast to the view of SE teachers who as a result of the high-stakes assessment at GCSE and A Level (Ofqual, 2015) which are 100% weighted by exams, tended to focus on mark scheme answers and exam practice. The literature reflects these tendencies at SE and the pressure and accountability placed on SE teachers to ensure their students succeed in their exams (Wilson, Child and Suto, 2017; Abrahams et al., 2013; Wilson et al., 2016). In order to shift to the 'process' of learning at SE1 the findings suggest implementing a greater diversity of assessment methods in order to develop high order thinking skills (Bloom et al., 1956) and shift the focus to 'process'. This will help bridge the gap between the SE and HE assessment methods in order to facilitate the transition to HE (Jeffery, 2013).

The final research question looked at how teachers perceived the assessment methods and artefacts they use in their practice and the similarities and differences between the assessment artefacts across SE and HE sectors. Whilst there was a range of assessment artefacts brought by HE teachers, SE teachers tended to have a more limited approach and focused on 'using mark schemes' and exam questions which encouraged surface-learning approaches according to the literature (Struyven, Dochy, and Janssens, 2005). In contrast, HE lecturers had a diversity of assessment artefacts which were challenging including presentation rubrics, problem sheets and a viva rubric which encouraged the development of critical thinking skills. HE artefacts were student-centred and more likely to encourage 'deep' approaches to learning (Hogan, 2000; Zwick, 2012). Recommendations were made to SE1 to use a greater diversity of assessments which were more student-centred and challenging in order to encourage critical thinking skills and problem solving.

6.2 Implications

This study has been useful in providing insights into assessments methods across SE and HE sectors and providing recommendations to improve the current assessments methods in SE1 in order to help students bridge the gap in their assessment methods. This will in turn help SE transitions into HE. It is clear that different methods of assessments are used at SE and HE for different purposes (Newton, 2007) and employing a variety of assessments methods will ensure that students are developing the skills required for successful transitions to HE. The views from teachers at SE and HE indicate that they are not aware of what is going on in the other sector and the impact this has on transitions. In order to bridge this lack of awareness SE1 could liaise with HE1 and invite university speakers in order to prepare students for the assessment methods at HE and raise awareness to SE teachers (Jeffery, 2013). In addition, in order to support SE students, HE1 could develop an effective foundation course for study in the first year to support SE students with their transitions. The findings suggest that the assessment methods used by teachers can greatly impact how students approach their learning (Struyven, Dochy, and Janssens, 2005). Therefore, in SE1 developing students-centred learning approaches early on can help students succeed at HE (Doyle and Zakrajsek, 2018).

The findings imply that SE1, the SE institution used in this study would benefit to broaden the spectrum of assessments methods and not excessively focus on mark schemes and exam practice as a result of the high-stakes, GCSE and A Level exams. Instead using presentations/ posters, projects and problem-solving to broaden independent learning skills and problem-solving skills would bridge the gap between the diversity of assessment methods used across the sector and help with SE transitions into HE (Wilson, Chils and Suto, 2017; Durisova, et. al, 2015).

In addition, there are wider implications in terms of policy and practise in SE which need to be addressed perhaps even by the UK Government. The findings suggest that the high stakes assessments at GCSE and A Level are confining students' approaches to learning and these need to be broadened within the examining bodies including Ofqual and the QAA. Embedding more formative assessment methods including coursework, practical assessments and/ or portfolios as a weighted component of the

GCSE and A Level examinations will help alleviate the pressures on teachers to 'teach to the exam' and excess reliance on mark schemes which is a dominating culture at SE. Moreover, this will help bridge the students' skills gap between SE and HE by ensuring greater assessment experiences are developed at SE. Practices at SE could be improved by changes in policy by improving the variety of assessment methods which SE students are exposed to. This in turn would benefit SE transitions into HE and make them smoother as a result of employing a variety of assessment methods which would help develop deep approaches to student learning; as they are challenged with different assessment methods.

6.3 Limitations

This study was carried out in one SE institution out of the 292 in the whole of the UK and one HE institution out of 12 in the West Midlands, UK indicating the small population size. The assessment methods across the West Midlands and are not homogenous and the context of this study needs to be considered as it may not be generalisable to other institutions in the UK. The recommendations need to be carefully considered in the context of the two institutions used in this study, namely, SE1 and HE1. In addition, a total of sixteen participants were used in this study, eight from SE and eight participants from HE and as a result of the small population size the views of the teachers are not representative of the whole population in the UK, but are specific to the context in this study. It is also a small representation of the population of teachers and lecturers at SE1 and HE1 and therefore, this needs to be considered when making any recommendations.

This study used an interpretative phenomenological methodology where the main limitation lies in the fact that it is impossible as a researcher to prevent any biased interpretations as a researcher and a teacher at SE1. The SE participants were my colleagues which imposes a limitation as teachers may have wanted to impress me with their pedagogical knowledge. In addition, my position as a teacher and researcher may have influenced the power dynamic and the information the participants subsequently divulged. This could have affected how teachers responded to interview questions which may affect the validity of my interview data as teachers could have exaggerated their classroom practice (Van de Vijver & He, 2014). Whilst the findings

only relate to the two institutions in this study, the information gained may well resonate in the sectors more widely, and promote a broader review. The findings will be made available to SE1 and HE1 in order to encourage both institutions to look into the current assessment methods and provide an awareness of the assessments methods across two sectors.

6.4 Contributions to knowledge

In the introduction of this thesis the theoretic lens and the research questions were discussed. The literature review demonstrated how assessment methods have influenced students' approaches to learning and how formative and summative assessments contribute to the students' learning cycle. Current research shows that context and environment impact students' approaches to learning, demonstrating that student-centred teaching encourages deep approaches to student learning as opposed to surface approaches to learning. The literature also shows how assessment methods that are more student-centred encourage deep approaches to learning.

This study is unique in its methods of data collection as participants were asked to bring an assessment artefact with them to the interviews, which formed the primary data collection method of this research. The artefacts formed a point of discussion and revealed insights into teachers' lived experience of the phenomenon being investigated in this study. This unique point enabled me to delve into the teachers perspectives on assessment methods and student learning and describe and compare the similarities and difference between teacher responses across HE and SE sectors.

The key findings of this study are that the assessment methods across HE and SE are different and there is a greater variety of methods in HE which SE students are not exposed to. The greater diversity and differences have implications to SE student transitions and may be a contributory factor in the challenges SE students face when transitioning to HE. In addition, it was found that HE assessment methods were more student-centred than SE and encouraged deep approaches to learning than SE. There is a propensity towards exam questions and mark schemes in SE which is more likely to encourage regurgitation and surface approaches to learning. Exposing SE students to a greater diversity of HE methods would help with this problem. Assessment

methods at HE were cognitively more challenging than SE, encouraging problem solving and critical thinking; skills which are lacking in SE assessment methods. Bridging the gap between the diversity of assessment methods employed across the sectors will facilitate a smoother transition to HE for SE students.

Five themes emerged which overlapped considerably as indicated by the conceptual diagram, Figure 12 in the results section. The links between the RQ's and the themes not only demonstrate the overlap in teachers' views but also the overlap between assessment methods, student learning and pedagogy. It is interesting to note that HE and SE teachers were not aware of the practices across each other's sector and this important finding has implications in teachers' liaising across the sectors and sharing practices and methods to close this gap in order to develop more effective first year foundation courses in HE, for example.

6.6 Recommendations for future research

This study looked at assessment methods from the perspective of the teachers' view, however, teachers may have their own assumptions about assessment methods which may be inaccurate. A recommendation for future research would be to look at how students perceive assessments methods and how this affects their learning and their transition. Students are directly affected by the assessment practices at SE and HE and researching this area further with those who are actually involved in the process of learning would give beneficial insights on the effectiveness of some of the assessment methods above compared to others. This would involve conducting more interviews but this time using a sample of students in SE or HE and more qualitative phenomenological research. This research could be used in order to further the recommendations for change in the assessment methods used in SEI and HEI to make them more effective in terms of teaching and learning which could impact students' learning and preparedness for their future careers (Hayter & Parker, 2019).

Given that this study advocates a greater focus on 'processes' and developing skills, rather than 'knowledge' when it comes to assessment methods it would be interesting to capitalise on how to develop these skills in students and understand their experiences of the learning and assessment methods (Brinke, Sluijsmans, and

Jochems 2010; Turner et al. 2013). Current research focuses on an educator's perspective or from a teachers' point of view (Atkins 1995; Fernandes, Flores, and Lima 2012; Flores et al. 2014) so looking at this problem from another angle would be relevant to designing effective assessment methods that impact student learning. This gap would help establish effective assessment pedagogies at SE and HE which would also prepare students for the world of work as argued by Moore and Morton (2017).

Additional areas of study would be looking at teacher training programmes and developing assessment literacy (Norton, Norton, & Shannon, 2013; Price, Rust, Donovan, and Handley 2012) in teachers and also students at SE and HE. Price, Rust, Donovan, and Handley (2012) argue that there are considerable concerns of how aspects of how assessments are currently organised and implemented. This problem is further magnified with the low assessment literacy rates of teachers and also students (Norton, Norton, & Shannon, 2013). Bevitt (2015) in a recent paper summarises the problem well with a number of assessment changes that need to be researched in order to: enhance the students experience, enhance technological development and to respond to the diverse student populations. More research in this area would improve teachers' effective use of assessment methods and their understanding about the learning that is developed from using the different methods which would impact their classroom teaching and learning.

6.7 Summary

The study's main aim was to find out the similarities and differences between assessment methods at SE1 and HE1 from a teachers' perspective and how this relates to their students' learning. The purpose of this was to raise awareness and possibly develop the assessment methods at SE1 in order to help students transition from SE to HE successfully. The research helped to suggest methods which can be used within the assessment practices of SE1 in order to support deep approaches to learning and the development of skills (Ramsden 1988; Struyven, Dochy, and Janssens 2005; Tang 1992). In the literature it is well known that assessment methods impact the students' learning process (Kuisma 2007) and their performance in relation to the assessment method used (Betts et al. 2009). Assessment and learning are connected and assessment can have a significant effect on student learning (Gibbs

1999; Scouller 1998; Light and Cox 2003; Scouller 1998). In the literature assessment methods impact the quality of learning (Atkins 1995; Fernandes, Flores, and Lima 2012; Flores et al. 2014) and influence students' approaches to learning (Brown and Knight 1994; Drew 2001; Struyven, Dochy, and Janssens 2005; Tang 1992). It was found that in SE1 there was greater emphasis on 'rote-learning' and 'knowledge' whereas, at HE 'process' and skills were the justifications of the assessment methods used. In order to develop the assessment methods in SE1 recommendations include increasing the diversity of assessment methods and using more student-centred methods to promote high order cognitive skills, foster independent learning and develop critical thinking and problem-solving skills (Segers, Gijbels, and Thurlings 2008; Marton and Saljo 1997; Struyven, Dochy, and Janssens 2005). Employing a variety of assessments methods is also recommended in order to bridge the gap of assessment experiences across the sectors to help with SE transitions into HE (Wilson, Child and Suto, 2017; Hayter & Parker, 2019). In addition, the results will be made available to HE1 in order to possibly develop a foundation course which could help bridge the gap between the methods across the sectors. It is my hope that the study can be used as practitioner research in order to revamp the current assessment methods at SE1 in order to improve the overall student learning experiences.

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Appendices

Appendix 1

Emergent themes	Respective transcripts	Exploratory comments
To assess the knowledge and understanding of students	SEI1	Holds the view that without assessment will not be able to test students' knowledge and understand
	SEI4	Uses assessment for the purpose of assessing students' knowledge and understanding
	HEI14	At the end of a teaching unit need to assess the knowledge and understanding of students
To close the gap of knowledge	SEI7	Views assessment as enabling teachers to see where they are at and then where they need to go and how to close that gap in knowledge
	SEI1	Helps to close the gap in understanding
	HEI15	Uses to identify gaps in students' knowledge
To develop skills to acquire degree certificate	HEI16	Views the degree qualification as proof that students have gained the required skills needed to earn the degree certificate
	HEI15	Thinks that skills need to be developed as part of the physics degree
	HEI14	The degree certificate means that students have the necessary skills
To monitor and tracking students' progress	SEI7	Views assessment as a means to track and monitor students' progress throughout the course
	SEI3	To track the performance of students in the class
	SEI1	To ensure students making progress
	HEI10	To monitor the overall performance of students and compare with previous modules in order to get a normal bell curve distribution of student performances
Focusing on the process of learning	HEI14	Holds the view that it is not about the end result of the assessment or the final answer but rather the process that is being assessed at HE1
	HEI15	Teacher wants to see the process of student thinking when solving problems and not just final answer as credit is given to the process of arriving at the answer

Dissertation	HEI13	Describes the dissertation as having a lot of credits and demonstrating research skills for students
	HEI15	Views dissertation as an in-depth study of a problem can be up to 50 to 60 pages.
	HEI9	Thinks that this is an independent research tasks that the students must complete on their own
Viva	HEI9	This is an assessment of students' oral and communication skills
	HEI15	Views it as challenging as student find it hard to think on their feet
	HEI6	Holds the view that as a lecturer you can easily tell within 5 minutes if the work was produced by the student or not. A good measure of authenticity
Using exam papers and mark schemes	SEI2	Thinks it's important that students have a 'rich diet' of exam questions and exam papers for exam practice. Refers to final exam being the 'end goal' for A level as it is 100% assessed summative with an exam.
	SEI7	Feels it is important that students look at the mark schemes when completing practice exam questions so that they can see the examiner notes and use the correct terminology. She emphasises key words and picks out examiner comments which she feels are important for the student to adhere to.
	SEI4	View practice exam papers as helping to practice and develop accurate answers to questions. It develops students' exam technique.
To develop mathematical and practical skills	HEI9	Views mathematical skills as an integral part of the physics degree course and students need to be confident with numbers and solving mathematical problems.
	SEI4	Views practical's as important as it helps with students' understanding of concepts
	SEI3	There is a compulsory part of the course which is practical and students must be able to answer examination questions based on practicals done in the class.
	HEI9	Views the degree course as being practical as well as theoretical knowledge as concepts will be applied to industry and students need to know how to tackle them.
To assess using coursework and assignments	HEI10	Views coursework as practice as students get to practice problem solving with different contextual problems which they could be faced with as a chemist.
	HEI10	Holds the view that assignments test whether the students understood what was imparted to them during the lectures.
	HEI9	Gives assignment to the students which are assessed to test their understanding and application of knowledge.

Formative assessment used continuously as part of classroom routines	SEI1	Uses formative as part of everyday classroom routines in the form of questioning.
	SEI3	Feels that formative assessment more important as you get that instant feedback on how the students are doing.
	SEI7	Refers to teachers' 'toolkit' of strategies which she uses in her daily classroom practice to assess the students including: questioning, self and peer assessment, round robin, card sorts.
	HEI9	States that there is always some form of formative assessment for example, questioning during lectures to make it more interactive.
Summative assessment assesses content	SEI2	Views summative assessment as there to assess knowledge of the content of the material covered
	HEI10	Justifies using summative assessment as being important to test students about their understanding of the content learned
	SEI6	States that ultimately the students will be assessed summative by their end of year examination.
	HEI11	Holds the view that students must be tested by an exam to see how much they know.
Presentations/ posters	HEI10	Views presentation skills important as they will be needed when students graduate for using when they are trying to win projects via proposals in industry in Chemical engineering.
	HEI11	Feels that presentations are important to develop student's oral and communication skills.
	HEI13	Views posters as a way of testing if students can present scientific data in a concise and coherent manner for an audience to understand. Feels that this will be relevant when they are presenting at a conference, for example.
	HEI16	Sees group presentations as an opportunity for students to work in a team and present their work. The question and answer session at the end of presentations is just as important as presenting as it will demonstrate students listening skills and whether they can think on their feet.
	HEI12	Indicates the presentation rubric artefact as assessing not only students' correct scientific understanding but also the eligibility of slides, for example, the font, the background colour of slides, the clarity and structure of the presentation is assessed also.
Using questioning	SEI1	Uses questioning everyday as part of classroom routines.
	HEI11	

	SEI5	Views consultancy sessions as an important opportunity for students to ask the lecturer questions about their projects. Asks questions to see how much the students have understood the concept in lessons.
Using lab reports/ lab books	HEI12	Views lab reports as an important aspect of practical work as students need to report how they went about solving a problem and why they did what they did, include their use of equipment, method, analysis and any computational software they may have used.
	HEI11	Emphasises the lab books as just as important as the report. Student's hand in their lab books with the report so that lecturers can see they raw data and ensure that students are keeping accurate as well as legible and organised notes.
Self and peer assessment	SEI3	Feels that it is important to reduce teacher workload in marking by using self and peer assessment.
	HEI7	Views self-assessment as quick opportunity for feedback for the students. It helps them see their mistakes so that they can avoid them next time.
	HEI9	Thinks that peer assessment is a good way for students to learn from each other and see how another student has answered a question. Perhaps they have a new perspective.
	SEI1	Views peer assessment as a great opportunity for a 'flipped' classroom experience so students can teach and assess each other.
To develop critical thinking and problem-solving skills	HEI15	Thinks how the students tackled the problem just as important as the solution. She is interested in see the students critical thinking skills and how they arrived at their solutions.
	HEI14	Refers to the problem sheet artefact as a means for students to practice problem solving. Explains that the problem sheets are assignments and have questions which are problems, some mathematical problems which the students must solve.
To maintain quality standards	HEI9	Views the assessments as a bench mark for quality and it helps compare other students' performances across a modules/ course.
	HEI14	Views performances on a module as an important indicator to the success of the teaching and delivery of the module. If marks are poor what can the lecturers do to improve the module and delivery next time?
Assessment for employment preparation	HEI13	Thinks that the degree is earned and being successful in the assessments prepares the students for the types of problems when they are employed.
	HEI12	The degree is earned so that students can be employed in industry.
	HEI9	

		Explains that the knowledge and skills acquired will be put to use when students get employed in industry.

Appendix 2

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Interviews for Research

Participant Information Sheet

1. **Title of Study**

Assessment methods in higher education described and compared with assessment methods in secondary education.

2. **Version Number and Date**

This is the second version of the Participant Information Sheet by Adeeba Mahmood created on September 17th 2017 in Walsall, UK.

3. **Invitation to Participate in this Study**

You are being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask me if you would like more information or if there is anything that you do not understand. Please also feel free to discuss this with your friends, relatives, or colleagues if you wish. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to.

Thank you for reading this.

4. **What is the purpose of the study?**

The purpose of this research is to describe and contrast the assessment practices at secondary education with that of higher education in order to make the findings available to teachers in both sectors so they can facilitate the transition for students across the sectors. This is a qualitative study in which I will use documentary analysis of one secondary institution, namely, Queen Mary's High School and one higher education institution, namely, the University of Birmingham.

In addition, I will use interviews of 8 -10 teachers of A Level science teachers from a secondary institution and interviews of 8-10 teachers/lecturers of science from a higher education institution to describe and contrast the assessment practices between the two institutions. Finally, I will ask each interviewee to bring one assessment artefact in order to provide material evidence of assessment methods that they use in their practice. It is hoped that the research will bridge the gap and provide teachers/ lecturers within the different sectors an awareness of the practices across the sectors.

5. **Why have I been chosen to take part?**

You have been selected to participate within this research as you are teacher/lecturer from a science discipline working at a secondary education institution, Queen Mary's High School, or from a higher education institution, the University of Birmingham.

6. **Do I have to take part?**

You are not required to participate in this study.

If you do volunteer to participate you may withdraw at any time.

7. What will happen if I take part?

Participants of this study will be invited to a private and confidential interview which will be recorded using an audio device. The interview will involve the participant being asked to discuss their assessment method practices within their every day teaching. No personal items will be discussed or any sensitive topics.

We anticipate interview participation to last approximately one hour.

8. Expenses and / or payments

There are no expenses or payments associated with participating in this study.

9. Are there any risks in taking part?

There should be no physical risks associated with participation in this study. The interviews will not involve disclosure of any personal information or any sensitive topics. However, should you experience any discomfort or risk please free to contact your GP to refer you free to an NHS councillor. Alternatively, please refer to the National Counselling Society who can be contacted directly on 01903 200666. A list of services available are indicated on their website at, https://www.nationalcounsellingsociety.org, as well as their address and other contact details which you can refer to.

This study is completely separate from the professional role of the principal researcher, Adeeba Mahmood, as a Teacher of Biology at Queen Mary's High School. Accordingly whether you do, or do not, have any professional connection to the researcher these study procedures will be kept separate from the day to day duties of my professional role. Therefore, the research will not impact the researcher's day to day professional role at Queen Mary's High School. The purpose of the research is for the degree of Doctor of Education, at the University of Liverpool. This is separate from the above professional role of the researcher.

10. Are there any benefits in taking part?

We hope that participants will feel a sense of benefit knowing that they are helping to describe their assessment methods to help identify any differences across the secondary and higher education sectors in order to help with student transitions.

11. What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let me know by contacting Adeeba Mahmood on 07471347190 or my email, adeebamahmood@hotmail.co.uk and I will try to help. If you remain unhappy or have a complaint which you feel you cannot come to me with then you should contact the Research Governance Officer at ethics@liv.ac.uk. When contacting the Research Governance Officer, please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make.

12. Will my participation be kept confidential?

All names of participants and employers will be kept confidential.

All audio recordings and transcripts will be kept secured for at least five years on computer files that are password protected by the researcher. Should any documents be printed they will be stored within a locked filing cabinet under the control and access only by the researcher.

13. What will happen to the results of the study?

This study will form the basis of a Doctor of Education thesis paper which will be submitted to the University of Liverpool in the United Kingdom, which will keep the study and make is available as per university guidelines.

Your participation will not be identifiable within the study.

14. What will happen if I want to stop taking part?

All participants can withdraw at anytime, without explanation. Results up to the period of withdrawal may be used in the EdD thesis, if you are happy for this to be done. Otherwise you may request that they are destroyed and no further use is made of them.

Because results will be anonymised your personal results may only be withdrawn prior to anonymisation.

15. Who can I contact if I have further questions?

If you have any further questions please feel free to contact the principal investigator, Adeeba Mahmood on 07471347190

Appendix 3

Committee on Research Ethics

PARTICIPANT CONSENT FORM

Title of Research :
Assessment methods in higher education described and compared with assessment methods in secondary education.

Project: EdD
Researcher(s): Adeeba Mahmood

Please initial box

1. I confirm that I have read and have understood the information sheet [dated 15th August 2014] for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without my rights being affected. In addition, should I not wish to answer any particular question or questions, I am free to decline. ☐
3. I understand that, under the Data Protection Act, I can at any time ask for access to the information I provide and I can also request the destruction of that information if I wish. ☐
4. I agree to take part in the above study. ☐

Participant Name	Date	Signature
Name of Person taking consent	Date	Signature
Researcher	Date	Signature

Researcher:
Name Morag Gray
Work Address **Laureate Online Education B.V.,the e-learning partner of The University of Liverpool**

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Version 2.1
June 2013

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Optional Statements

- The information you have submitted will be published as a report; please indicate whether you would like to receive a copy. ☐

- I understand that confidentiality and anonymity will be maintained and it will not be possible to identify me in any publications **[or explain the possible anonymity options that you are offering participants and provide appropriate tick box options accordingly].** ☐

- I agree for the data collected from me to be used in future research and understand that any such use of identifiable data would be reviewed and approved by a research ethics committee. ☐

- I understand and agree that my participation will be audio recorded /video recorded **(please delete as appropriate)** and I am aware of and consent to your use of these recordings for the following purposes **(which must be specified)** ☐

- I understand that I must not take part if… **[list exclusion criteria, for example pregnancy]** ☐

- I agree for the data collected from me to be used in relevant future research. ☐

- I would like my name used and I understand and agree that what I have said or written as part of this study will be used in reports, publications and other research outputs so that anything I have contributed to this project can be recognised. ☐

- I understand that my responses will be kept strictly confidential **[only if true]**. I give permission for members of the research team to have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. ☐

- I understand and agree that once I submit my data it will become anonymised and I will therefore no longer be able to withdraw my data. ☐

FOR MARIARC PROJECTS ONLY:

- I agree that my GP may be contacted if any unexpected results are found in relation to my health. ☐

Appendix 4

Interview Protocol

During this interview, I will seek to understand how assessment methods are used within the secondary education sector and within the higher education sector in order to discover how assessment practices are similar/different across the sector and what implication this has.

All information you provide in this interview will be anonymised for use within this research. You have the right to decline to answer any questions, end this interview at any stage, or withdraw completely from this research at any time.

Goal /Objective	Primary question	Optional expansion questions
Interview clarification.	Have you read the Participant Information Sheet, that was released to you at least 48 hours ago, in full?	Do you have any questions about the information within the Participant Information Sheet? Do you understand the purpose of this research? Are there any words or phrases within the Participant Information Sheet that you would like clarifying?
Introduction and setting the context of the interview.	Could you tell me a little about your role in assessment, please?	Can you tell me please why you use assessment in your teaching and learning?
To understand the teacher's conceptualisation about the purpose of assessment	Can you tell me how you would describe the purpose of assessment with regards to your teaching? Could you tell me a little about how you would describe the purpose of assessment with regards to your students' learning? Could you tell me about your views on the purpose of assessment? Is there anything else you would like to say about the purpose of assessment?	Could you tell me a little bit about how important assessment is to you? Is there more than one purpose to assessment with regards to your teaching? And please can you tell me a little about this? Could you tell me what assessments means to you?
To understand teachers' implementation and intention of using assessment in their teaching and learning.	In your view how do you think assessment can help with students' learning?	Is assessment helpful with student learning in your view? Could you tell me a little bit more about this? Can students' learn without having assessments methods within teaching and learning in your view?
To understand what assessments methods are being used within the teachers' practice and a description of these methods.	Can you tell me about the methods of assessments you use?	Could you describe some of your assessment methods? Could you tell me a little bit about why you use these methods? How often do you use these methods?
To understand the teachers' purpose of using the described	Can you tell me about why you use these methods of assessment in your teaching?	Could you tell me if you use some of these assessment methods more than others?

assessment methods.		Could you tell me about them? Can you tell me why you use them more/less frequently? Can you tell me you me about what influences your choice of assessment methods in your practice, please?
To understand how assessment methods are used in the teachers' current practice.	Could you tell me something about the methods of assessment you currently use in your practice? Is there anything additional you would like to say about the methods of assessment you use?	Could you tell me a little bit about why you use these methods?
To get a description of what formative and summative assessment methods are being used by the teacher.	Can you tell me about how you would describe your use of formative and summative assessment?	Can you tell me why do you use formative and summative methods of assessment in your teaching? Could you tell me why you have picked these strategies in your teaching? Could you tell me about how you know these methods are effective?
To understand to what extent assessment practices are known across different educational sectors by the teacher and if they think it is relevant to know.	Can you tell me what you know on how assessment is used in science at higher education/secondary education?	In your opinion do you think it is relevant to know what methods of assessment are used in the higher education sector/ secondary education sector?
To get a description of the artefact which the teacher bought with them to the interview.	Can you tell me a little about the artefact you bought with you?	Could you describe the artefact and it's use in assessment?
To understand the reason why the teacher chose the artefact and it's use within their practice; and whether it is formative or summative or another method of assessment.	Why did you choose to bring this artefact, please?	Can you tell me about how you use this artefact in your teaching and learning? Could you tell me about how this artefact helps with student learning? Please can you tell me about how often you use this artefact in your teaching?

Thank you very much for joining me here today. I will now transcribe and anonymise the information you have provided for use within my research.