# Exploring the Use of Peer and Self-Assessment as a Pedagogical Tool in UK Secondary Design Education.

Andrew Halliwell, University of Cambridge
Correspondence: Ajth4@cam.ac.uk

## ABSTRACT

In this case study, a collaborative and social-constructivist approach to secondary Design and Technology teaching is explored. Self and peer-assessment interventions are employed as a pedagogical tool for increasing student attainment, knowledge gain and self-efficacy. Within schools, students learn by interacting with their peers; they help each other identify their strengths, address their weaknesses, and develop metacognitive skills. As a construct for aiding knowledge sharing, peer assessment can be significantly beneficial as it allows students to evaluate the work of their peers and provide constructive feedback within a supported environment. This research presents student perceptions on strategies designed to facilitate self-assessment, and peer-assessment as a pedagogical tool and investigates the order these strategies are employed within the classroom. Eighteen, year 11 design students aged 15-16 from across two classes took part in four 'peer-learning' sessions containing both self and peer-assessments. These sessions were spread across different stages of the student's design process: research, iteration, design development and testing and evaluation. The project began at the start of the 2022-23 academic year and concluded at the end of the second term. Each session approaches these assessment exercises with different methods and finishes with a questionnaire to enable comparison. The results gathered show an increase in student attainment, self-efficacy, and a greater understanding of the assessment criteria when students complete their design coursework. A sequence of activities for employing self and peer-assessment within design education is established and presented. This research aims to share evidence of self and peer-assessment as a pedagogical tool when students are completing their design coursework. In presenting the benefits and barriers of this method, teachers will be able to use and adapt it within their own classes.

*Key Words: Peer Assessment, Peer Learning, Pedagogy, Action Research, Secondary Design Education.*

## 1. INTRODUCTION

### *1.1. Context*

The research reported here is part of a pilot study for a larger educational doctorate project. The doctoral project explores the influence of collaborative learning curriculum on student creativity

and attainment with year 11 students. As a result, the study reports on the contextual application of SA and PA and only documents the views of the students within the study school, however, it aims to provide guidance for secondary design teachers to follow. As a teacher-researcher, my interest in this research topic stemmed from observing students produce coursework that missed the finer details in the mark scheme. I was frustrated that my feedback focused on simple mistakes and the standard of students' first submission was below expectation. To address these issues, I explored self-assessment (SA) and peer-assessment (PA) as a pedagogical tool for increasing student attainment, knowledge sharing and self-efficacy. Presented in this paper are the strategies I employed to scaffold student SA and PA activities as part of the pilot for the larger project.

### *1.2. Learning is social.*

Within secondary education, marking and providing feedback on several iterations of students work consumes considerable amounts of teachers time and has been documented as a significant contributor towards teacher stress and burnout (Brady & Wilson, 2021). Research by Harrison et al. (2015) demonstrates that traditional teacher assessment methods can hinder the development of independent learners. Instead, the authors advocate the use of SA and PA strategies to increase self-awareness and reflection amongst students, which they argue are essential components of self-efficacy. Furthermore, research that has involved students in their own learning highlights an improvement in their academic performance, ability to share knowledge and cognitive skills (Andrade, 2019; Davies, 2002). For Neo (2003), placing students within learning environments, where they learn from each other, provides opportunities for optimal intellectual and academic development. In this way, knowledge is the product of social negotiation and discussion with others. This is also further described by Pozzi et al. (2007) as 'the primary way to learn' as it promotes critical thinking and understanding. A learner-centred approach that focuses on the processes rather than the products of student learning is, therefore, proposed and explored (Lobato, 2003).

## 2. LITERATURE REVIEW

SA and PA activities have gained prominence in educational settings as effective strategies for involving students in their own learning and providing transparency to the assessment criteria (Panadero et al., 2013). SA involves learners making judgements about their own learning by describing their perceived progress or result with the purpose of generating feedback that promotes student learning (Andrade, 2019). Butler and Winne (1995) proposed that feedback is an 'inherent catalyst' of self-regulation; as students reflect on their progress, internal feedback is generated which describes the students' qualities of the outcomes and cognitive processes (p. 245). In this way, Brown and Harris (2013) define SA as a "descriptive and evaluative act carried out by the student concerning their work and academic abilities" (p. 368). When concerned with the reliability and validity of student SA Tejeiro et al. (2012) highlighted that student and teacher assessments are commonly not aligned when the student SA contributes towards their overall grade. This is, however, not representative of a learning activity that uses SA for feedback. Conversely, when SA is used for learning and feedback, studies have demonstrated that it shares comparable accuracy with external assessors (Andrade, 2019).

Unsurprisingly within classrooms, SA and PA are available in large quantities and can be accessed more directly than teacher feedback (Topping, 2017). Here, peer-assessment is viewed as a form of collaborative learning whereby students use criteria to evaluate the work of their peers and provide specific feedback and/or a grade (Alt & Raichel, 2018). For effective PA feedback to be given and for assessments to be reliable, Topping (2017) argues that training, checklists, examples and practice are required. Immediate practice of PA is essential; feedback and coaching from teachers should concentrate on students' thinking and justification by modelling sound reasoning, effective use of evidence and clear explanations (Brookhart, 2010). Students who doubt the efficacy of themselves or their peers when participating in PA may leave students feeling dissatisfied with the process (Alt & Raichel, 2020). This aligns with Van Zundert et al. (2010) who highlighted an increase in students domain-specific skills and attitudes towards PA when trained and experienced peer assessors provided feedback. To avoid the problem of inter social tensions, Davies (2002) calls for anonymity during PA to remove the bias from friendships, uniformity and race. Online PA is advocated by Lu and Law (2012) as a means of enabling students to mark, feedback and critique the work of peers anonymously. Working online allows teachers to oversee students' participation and progress in real time (Topping, 2018). If quality feedback is to be provided, students need to be able to comment freely on the work of others without the risk of reprisal (Bhalerao & Ward, 2001).

Davies (2002) notes that a crucial facet of PA is ensuring all students complete their marking thoroughly and offer constructive feedback to their peers. Similarly, it is important that students approach SA in a reflective and objective manner. For this to occur, Topping (2018) argues that students need to have a clear understanding of the assessment criteria that will be used to evaluate their work. This in turn will help students to become independent and reflective thinkers. Moreover, Topping proposes that students are more engaged and have greater clarity of the assessment criteria when they have helped to develop it, with many teachers supporting the use of assessment rubrics for scaffolding student interactions (p. 68).

In summary, whilst both SA and PA do not come without their difficulties, there are many educational benefits for students. This study explores strategies for implementing SA and PA within a secondary D&T classroom setting and the benefits for doing so.

## 3. METHODOLOGY

Within both SA and PA, learning is an active process of meaning-making where individuals create their own understanding by drawing on their own experiences (James, 2008). Constructivist learning environments align with SA and PA as they build on students' prior knowledge by encouraging enquiry, collaboration and focus on interactive learning (Kritikos et al., 2011). As a teacher-researcher exploring practice within my own classroom, I adopted a case study methodology with a social constructivist epistemology (Cohen et al., 2018). I am a design and technology teacher at the study school. The students involved in the study are from my classes, which I see three times a week. Due to my active involvement in the study, for clarity and consistency, I refer to myself as 'the teacher' when describing the study and its findings. The study adopted a quantitative approach towards research design with the purpose of answering the following research questions:

(i) What are students' perceptions on the value of strategies designed to facilitate SA and PA activities?

(ii) How do strategies designed to facilitate SA and PA activities influence student attainment and self-efficacy?

### *3.1. Participants, Research Context and Ethical Consideration*

The study was formed of 18 Design and Technology (D&T) students (seven girls and 11 boys) aged 15-16, from two classes. The research took place at one independent boarding school during the 2022-23 academic year. It's important to note that the study school facilitates its own courses equivalent to that of GCSE's. Consequently, the school is not bound by the national curriculum for the D&T GCSE (Department for Education, 2015).

As agreed by the school, the study was conducted within the normal lessons of the school's own course. Student participation was only voluntary in the data collection activities, where they were reminded of their right to withdraw at any time. The study conformed to the guidelines set out by the British Educational Research Association (BERA, 2018) and was ethically approved by the University of Cambridge.

### *3.2. The Study*

All students completed one design project across two terms as part of their D&T course. During this project, the participants completed four 'peer-learning' sessions, involving both SA and PA. These were spread out over the research, design, development, and testing and evaluating stages of the design process. At the start of each session, the teacher guided students through the assessment process by talking through examples of their own marking (teacher training) and provided additional marked examples for students to refer to as master reference sources (Topping, 2018). At the end of each session, each student had a SA, PA, and their teacher's assessment for the same piece of work. Providing teacher feedback aimed to re-affirm grade criteria and provide a direct comparison of student/teacher assessment standards. Any marking of student work conducted by me followed the assessment criteria established by the study school and was moderated by the head of the design department.

To mitigate any issues over students providing feedback for each other, all student work was anonymised and distributed randomly to students in the other class. Questionnaires were then completed by all students following each session to document their thought and learning progression. To explore SA and PA pedagogical strategies, the activities and format of each session changed. In session two and three students created their own mark scheme whereas session one and four used the schools' assessment criteria. Session two and four conducted assessment practice with students before they started the next section of the design process, however, session three completed it afterwards. The outline of each session can be seen in Table 1.

*Table 1:*
*Contents of the Peer-Learning Study Sessions*

| Peer Learning Session | Teacher Training | Mark Scheme Created | Assessor Practice Before | Assessor Practice Afterwards | SA | PA | Teacher Marking |
|---|---|---|---|---|---|---|---|
| 1. Research | ✓ | ✗ | ✗ | ✗ | ✓ | ✓ | ✓ |
| 2. Design | ✓ | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ |
| 3. Development | ✓ | ✓ | ✗ | ✓ | ✓ | ✓ | ✓ |
| 4. Testing and Evaluating | ✓ | ✗ | ✓ | ✗ | ✓ | ✓ | ✓ |

To gather the views of the students, questionnaires were employed as the data collection method with closed and 10-point rating scale questions (Coe et al., 2021). The rating scale questions aimed to document students' thought progression over time, for an example, see in Figure 1.

*Figure 1:*
*Questionnaire rating scale example.*


Within small class sizes the range of responses can be broad; the median has been employed as the measure for identifying the central tendency within the data due to its resilience from outliers within a distribution. This is achieved by identifying the dividing point in a response range so an equal number of scores are above and below that point (McCall, 1970). Aligning with a quantitative research design, this was conducted through a positivist view (Cohen et al., 2018). The findings present and compare the median scores of student responses from across the four questionnaires.

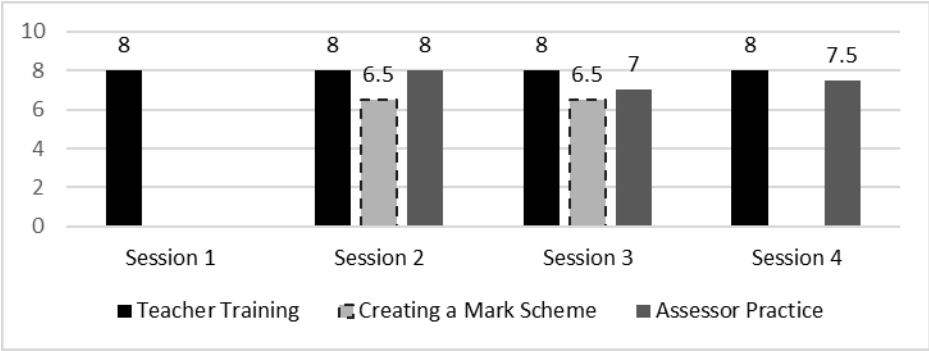
## 4. RESULTS AND DISCUSSION

In this section an overview of the results gathered from the four questionnaires in relation to the two research questions is given. A brief discussion regarding the implications of these results is also presented. In what follows, the medians (M1), (M2), (M3), (M4) relate to the range of results gathered from the questionnaires from sessions one, two, three and four respectively. This data has been calculated and presented in the appropriate figures below.

### *4.1. What are students' perceptions on the value of strategies designed to facilitate SA and PA activities?*

As highlighted in Table 1, each session incorporated different pedagogical strategies for facilitating and preparing students to conduct SA's and PA's. At the end of each session students were asked to identify how useful, they thought, each activity was to their learning. Three strategies were explored: teacher training (the teacher talking through and explaining their marking process with examples), creating a mark scheme (as a class producing a mark scheme based on the schools' assessment criteria) and assessor practice (completing practice PA's and comparing feedback and grades with the teacher's assessment for the same piece of work), see Figure 2.

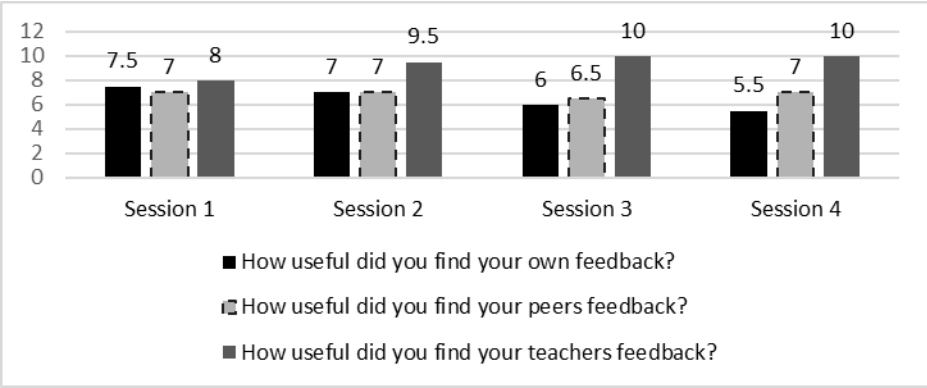
*Figure 2:*
*Usefulness of SA and PA strategies to Student Learning*




The results show strong and consistent favour towards teacher training with a median score across all four sessions returning an eight. Practicing assessment was equally valued highly by students, although, the lowest median (M3) of seven was produced when students practiced assessing work after they had completed the relevant page. Lastly, creating a mark scheme remained at six and a half which suggests that although some students found it to be beneficial it was not as useful as the other strategies.

Noted within the literature is the importance of students being able to both give and understand constructive feedback. When asked about how useful students found their own, peer's and my teacher feedback, they returned the following results: see Figure 3.

*Figure 3:*
*Student Views on Feedback*




As the sessions progressed the teacher feedback increased from M1 (8) to M4 (10). The usefulness of peer feedback remained within 0.5 of each median score. The usefulness of students' own feedback decreased with each session from M1 (7.5) to M4 (5.5). This may be the result of the repeated learning activities teaching students to identify and internalise the areas they need to improve without writing their feedback down. To further investigate the benefits and sequence of the pedagogical strategies, students were questioned on how valuable they thought each session was to their learning. At the end of the fourth session, students were then asked to identify which of the four had been the most valuable to their learning, see Figure 4.

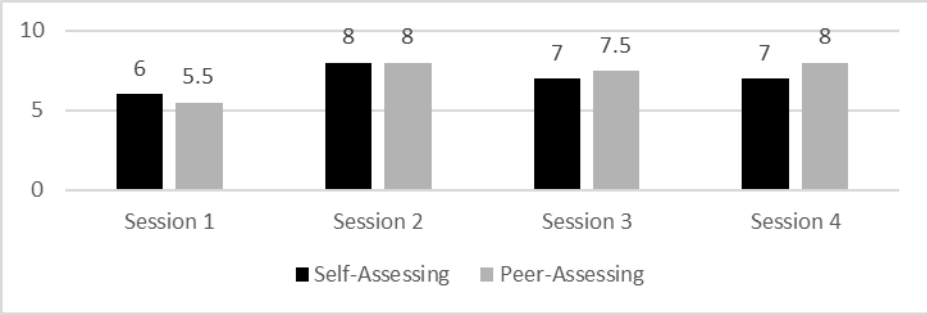
*Figure 4:*
*Session Value to Students Learning*


The results returned no favour towards any particular sequence of activities. 50% of the students' selected sessions that included creating a mark scheme to be the most valuable to their learning. It is important to note, however, that creating a mark scheme in addition to assessor practice running after students had completed the page (Session three) was scored equally with only completing assessor practice before students started their work (Session four).

### *4.2. How do strategies designed to facilitate SA and PA activities influence student attainment and self-efficacy?*

To investigate changes in self-efficacy, students were asked to identify how confident they felt, following each session, at self-assessing and peer-assessing coursework; the median scores are shown in Figure 5.

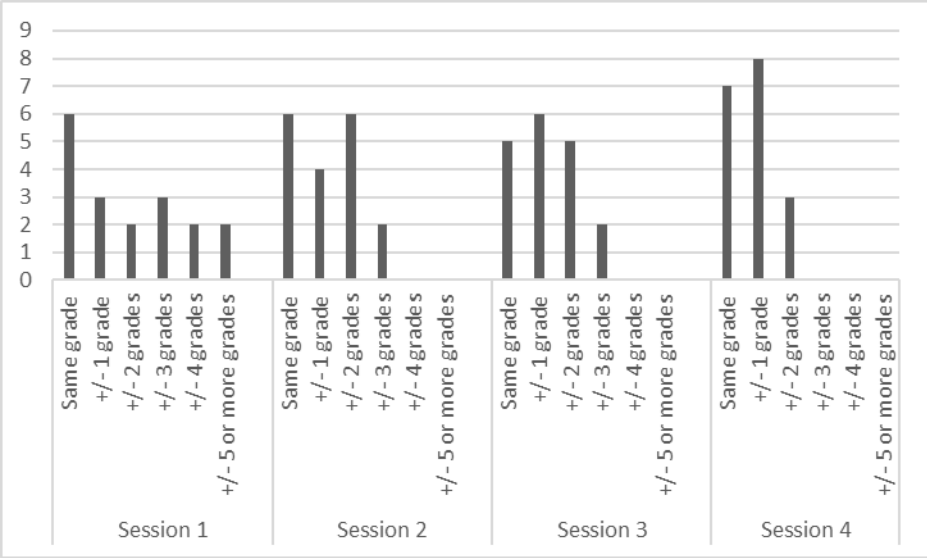
*Figure 5:*
*Students Confidence When Completing SA's and PA's.*




Presented within the results is an increase in student confidence when completing both SA's and PA's between sessions one and two. Whilst all sessions involved the teacher discussing their thought process when marking work, session two was the first to include assessor practice and mark scheme creation. Doing so saw an increase in student confidence for both SA and PA from M1 (6) to M2 (8) and M1 (5.5) to M2 (8) respectively. The findings also highlight that students have greater confidence when marking and providing feedback for their peers than their own work; this aligns with the findings from Figure 3.

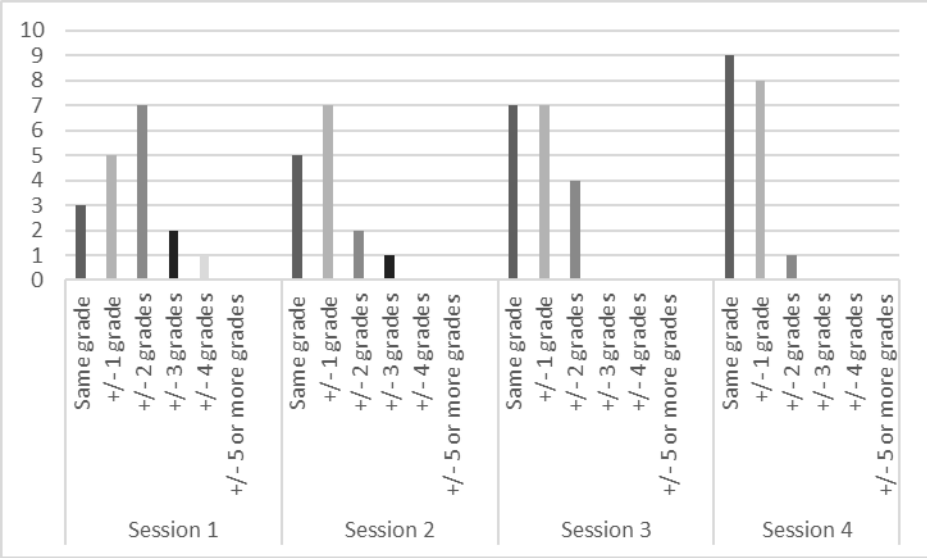
To explore the accuracy and reliability of student SA and PA, in each questionnaire students were asked to identify how close the grade they awarded themselves was in comparison to the one awarded by their peer. Highlighted from the results is that as the sessions progressed so did the accuracy of the self-assessed and peer-assessed grades. Whilst nine of the 18 students were within one grade of their peer's grade in the first session, by the fourth session this had grown to 15. At the other end of the scale, a significant change can be seen from those students who were three or more grades away from their peer. In session one this included seven students, at the end of session two this had dropped to two and by session four did not include any. The results from each session are displayed in Figure 6.

*Figure 6:*
*SA and PA Grade Comparison*




A similar trend can be seen when comparing SA grades with the grade awarded by the teacher; see Figure 7.

*Figure 7:*
*SA and Teacher Assessed Grade Comparison*



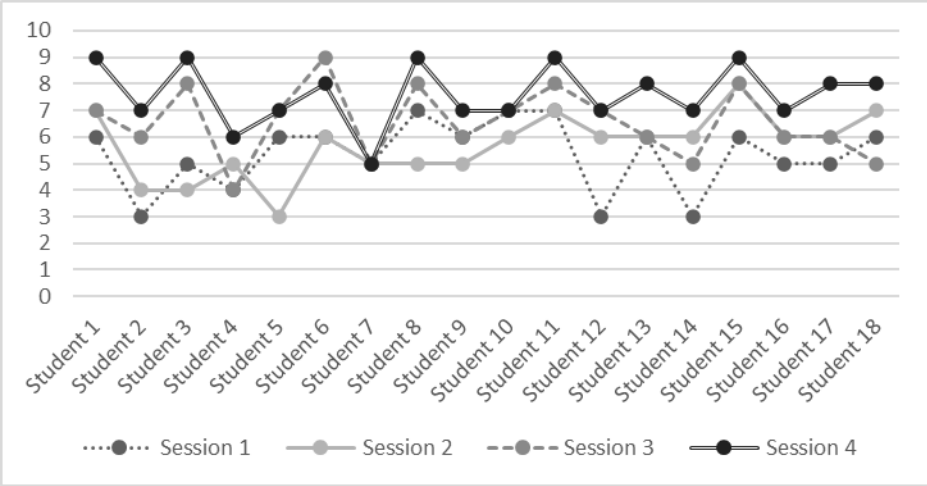

As the sessions progress there is a clear improvement in the accuracy of student awarded grades with the teachers. From session one to four this went from eight students being within two or more grades to 17. Like the results in Figure 6, there was a notable change between session one and two where the number of students who were two or more grades out decreased from 10 to three.

To further investigate the changes in student attainment, the grades awarded for each student across the four sessions was documented and are presented in Figure 8 and Table 2. Whilst these grades were initially awarded by me using the school's marking criteria, they were also moderated by the head of the design department.

*Table 2: Moderated Teacher Awarded Grades*

| Grades awarded from | Individual students | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| **Session 1** | 6 | 3 | 5 | 4 | 6 | 6 | 5 | 7 | 6 | 7 | 7 | 3 | 6 | 3 | 6 | 5 | 5 | 6 |
| **Session 2** | 7 | 4 | 4 | 5 | 3 | 6 | 5 | 5 | 5 | 6 | 7 | 6 | 6 | 6 | 8 | 6 | 6 | 7 |
| **Session 3** | 7 | 6 | 8 | 4 | 7 | 9 | 5 | 8 | 6 | 7 | 8 | 7 | 6 | 5 | 8 | 6 | 6 | 5 |
| **Session 4** | 9 | 7 | 9 | 6 | 7 | 8 | 5 | 9 | 7 | 7 | 9 | 7 | 8 | 7 | 9 | 7 | 8 | 8 |

*Figure 8:*
*Moderated Teacher Awarded Grades – Visual Representation*




The median results for each session show an increase in student attainment with the most notable being between session three and four: M1 (6), M2 (6), M3 (6.5), M4 (7.5). These results suggest that although individual activities may be valued by the students, it is the repetition of SA, PA and their associated activities that has produced an increase in student attainment.

## 5. CONCLUSION

Whilst there are benefits to creating a mark scheme with assessor training and practice, it is apparent that the frequency of these activities, is important. Aligning with Topping (2018) I agree that students require training over a number of sessions for SA and PA to be both effective and worthwhile. From this study, I propose to other practitioners that are considering incorporating peer learning into their classrooms the following: First, a student created mark scheme should be completed at the start of the lesson sequence and continually referred to instead of being remade for each session. Second, assessor practice should be conducted both before and after students complete their work and alongside the teacher talking through examples of their marking. Finally, teachers must provide their own marks and feedback for students to compare against. It is this structure that I will employ within my larger doctoral study.

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