The Adaptive Subject Pedagogy Model: Understanding Pre-Service Teachers' Pedagogical Reasoning in Design & Technology

David Morrison-Love, University of Glasgow
david.morrison-love@glasgow.ac.uk
Fiona Patrick, University of Glasgow
fiona.patrick@glasgow.ac.uk

ABSTRACT

Here, we share findings from the current phase of a practitioner enquiry project to explore ways of supporting undergraduate technology education ITE (Initial Teacher Education) students to inform their classroom practice with theory, research, and academic knowledge. The practitioner enquiry centres on our work in teacher education with students using a model created by Morrison-Love to scaffold the development of pedagogical reasoning: the Adaptive Subject Pedagogy Model (ASPM) (Morrison-Love & Patrick, 2022). In the first phases of our project, we explored students' challenges in relating theory to practice and developing pedagogical reasoning using focus groups with students and analysis of course assignments. Continued use of the model showed students improving in their connections across knowledges, but many still struggling with the development of coherent evidence informed pedagogical reasoning. Here, we present findings from our analysis of two in-depth interviews we undertook with students to understand more about how they were reasoning through engagement with the ASPM. During the interviews, student submissions were used as a mediating artefact to help scaffold questioning and discussion. The submissions each capture one full cycle of the ASPM for a topic chosen by that student. Use of student submissions in this way provided a tangible focus to help reveal more of the students underlying thinking. We describe the ASPM before reporting on the insights and reflections of two students who have used it to create evidence informed subject pedagogy. We briefly discuss what these findings suggest about thinking with the ASPM and what our evidence suggests more broadly for our own practice as teacher educators.

Key Words (Provide between 3 and 5 key words): Pedagogical reasoning, Initial teacher education, Adaptive Subject Pedagogy Model, Evidence-Informed Teaching

1. INTRODUCTION

The importance of theory- and research-informed teaching is well understood in the literature (Miles et al., 2016; Evans et al., 2017; Flores, 2018) but is something that many pre-service teachers struggle with during Initial Teacher Education (ITE) and as fully qualified teachers (Flessner, 2012; McGarr et al., 2017). Informing practice with research and theory is increasingly recognised to be a complex and demanding process. It requires that students understand and synthesise forms of knowledge which reside within different learning contexts, systems and structures. In Design & Technology, the demand of using different forms of knowledge to create towards effective classroom practice is two-fold for our ITE students: it is both a feature of technological capability and of pedagogy as the act and art of teaching. Despite our best efforts as Teacher Educators, supporting students to create evidence-informed subject pedagogy remains challenging.

This scholarship project centres on our work with students on a 5-year undergraduate integrated Master's teaching degree (the MDTechEd) in a Scottish teacher education institute where we use the Adaptive Subject Pedagogy Model (ASPM) to scaffold development of evidence-informed pedagogical reasoning (Morrison-Love & Patrick, 2019, 2021, 2022). The model, developed from the work of Shulman (2006, 1987), was a response to challenges students had in their preparation for teaching courses as part of the Design and Technology ITE programme. Students found it difficult to integrate evidence and knowledge from the different parts of their degree programme to inform planning for teaching. They also planned lessons using a behaviourist linear-rationalist approach which begins with learning outcomes before outlining content to be covered and activities to support coverage, ending with a lesson evaluation (John, 2006). As John highlights, this view of planning atomises teaching and learning into 'key elements, which are then sub-divided into tasks, further broken down into behaviours and then assessed by performance criteria' (2006, p.487). The potential richness of teaching and learning is reduced to a 'means-ends approach' (John, 2006, p.487): student teachers see lesson planning in technical terms rather than as something to support the development of pedagogical thinking (Rusznyack & Walton, 2011).

Another issue with our students' planning was the focus on generic rather than subject-specific pedagogies. There was little depth of thinking about the nature of what was to be learned and why, or connection to evidence about what subject-specific pedagogies might best encourage learning. Our concern was that, without this critical reflection, it would be challenging for students to develop the depth and sophistication of pedagogical expertise necessary for teaching Design & Technology.

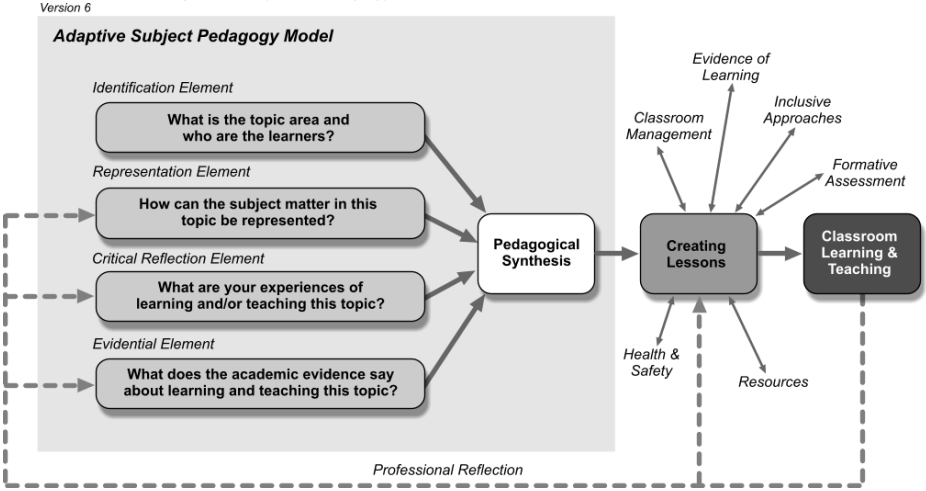
Our evidence so far has shown that the ASPM can help students to improve ideas for subject pedagogy, but some still struggle to connect with evidence and develop their pedagogical reasoning. This paper describes the findings from two interviews in which we asked students to reflect on their own reasoning in a cycle of the ASPM. The research question is: 'What do students' reflections on their use of the ASPM tell us about their pedagogical reasoning?' Our hope is that by understanding this we can develop our own practice as teacher educators to support students more effectively. The following section provides an explanation of the most recent version of the ASPM after which we provide an overview of the methodology.

2. THE ADAPTIVE SUBJECT PEDAGOGY MODEL

The ASPM (Figure 1) is a process-based model that was developed to support ITE students to create evidence-informed pedagogy by integrating research, educational theory and knowledge from across their degree programme. It builds from Shulman's (2006, 1987) ideas of pedagogical content knowledge, pedagogical reasoning and professional knowledge growth. The ASPM comprises four elements and begins with the curriculum. It is not a form of lesson planning and does not frame learning in terms of outcomes. Rather, it develops pedagogical reasoning and the creation of evidence-informed subject pedagogies: the forms of teacher expertise necessary for effective teaching and learning which are often assumed or omitted by rational-behaviourist approaches to planning.

In the more formative stages of using the ASPM, students typically move through each element successively but can use it more flexibly and iteratively as proficiency develops (see Figure 1).

Figure 1
Version 6 of the Adaptive Subject Pedagogy Model



In the identification element, students select a topic area of interest with reference to the curriculum and specify the age/stage of pupils they will work with. For our students, topics have included areas such as 3D modelling, visualisation, practical skills, graphic design, electronics and control systems. It should be noted that the ASPM is not designed to work at the level of individual lessons, and topics must span several lessons over an extended period. From here, students must think through and map out what is important or valuable to learn for their chosen topic and represent this without any reference to pupils or how they might teach it. This will include different concepts, ideas, skills and processes and allows the subject matter of learning to be developed (what we refer to as the subject episteme). Even in cases where knowledge is often thought of as objective, students will still have to interrogate, understand and make decisions

about how best to represent and explain it for their educational purposes (e.g. there are several 'correct' ways of defining and representing electrical current).

The identification and representation elements allow students to establish the 'what' of teaching and learning. The critical reflection and evidential elements begin to consider the 'how': the first by eliciting evidence from practice, and the second by eliciting evidence from research. Both forms of evidence seek insight into how the chosen topic could be taught, and some evidence that this approach is effective for learning. In the critical reflection element, students reflect deeply on their own experience as learners and/or teachers of their chosen topic and evaluate how particular approaches have supported understanding (or not). Did particular teaching approaches lead to misconceptions and why might this have happened? Were others particularly effective for developing topic skills or understanding? How do you know? In the evidential element, students identify and analyse published research for evidence of how they might teach their topic effectively. Students are encouraged to include specific reference to subject matter in their search terms to avoid genericism, consider the relevance and applicability of the papers, and avoid seeking evidence that simply backs up an existing idea about how they think something should be taught. It is made clear to students that, for the purposes of pedagogical reasoning, evidence from research is no more or less important than evidence from practice.

In the final stage of the ASPM, students synthesise what they have learned across the elements into a coherent pedagogical proposal for teaching their chosen topic. This is typically written out by students as a teaching approach and requires them to resolve any competing evidence from research and practice. Notably, this reflects something of who they are as developing teachers of Design & Technology.

3. METHODOLOGY

This work is underpinned by a constructivist ontology concerned with exploring the insights and learning of teaching students working to develop pedagogical reasoning through use of the Adaptive Subject Pedagogy Model (ASPM). We employed a purposeful approach to participant selection, inviting students from years 2, 3 and 4 of the MDTechEd programme to participate on a voluntary basis. There were 20 students in each year from a total cohort of 82. Because students were in a dependent relationship with us, they were invited to participate only after all programme assignments had been graded and returned towards the end of the academic year. Our intention was to select the first 2 students to respond from each cohort for the in-depth interview. However, it proved difficult to arrange interviews so two students were interviewed in the first round of data gathering, with a second round of invitations scheduled for the new academic session in September 2023.

Because of the need to focus on concrete, lived examples of working with the ASPM and the passage of time since students submitted their assignments, we used a stimulated-recall method to support students to verbalise their reasoning (Burden et al 2015; Lyle 2013). We developed artefact-mediated semi-structured interviews in which students' own assignment submissions using the ASPM were used to scaffold discussion with us, prompt recall and reduce abstraction by providing a concrete example to refer to. ASPM assignments were linked to specific areas of

the Scottish Design and Technology curriculum. We developed the interview protocols and prompts around the different elements of the ASPM and lesson creation process.

The interviews were carried out online using zoom following the recommendations of Gray et al (2020) and recorded with participant consent to support the analysis process. Participating students were sent a summary of the main interview questions and encouraged to reflect on these in advance of the interview. In this early stage of phase 4, one interview was carried out with a student in Year 3 of their programme (Student A, lasting 65 minutes), and one with a student in Year 4 of their programme (Student B, lasting 52 minutes). The recorded interviews were transcribed and analysed using an inductive approach to coding and theme creation (Clarke & Braun, 2017).

4. ETHICAL STATEMENT

Because this research involved summative assignments that we set and assessed, participants were in a dependant relationship. In conducting this research, it was therefore important to maintain our awareness of perceived and real power differentials. Students were made aware that participating or not would have no effect on any existing professional relationships with staff conducting the study, nor would it affect any future assessments. It was made clear that the research was not evaluative of their work, did not seek 'right' or 'wrong' responses, and that they were free to withdraw at any time without the need to provide a reason. This research was approved by the College of Social Sciences ethics committee at the University of Glasgow.

5. FINDINGS

The conversations gave rich insight into the thought processes of the students as they used the ASPM. Student A selected a cycle of the ASPM completed in degree year 2 focused on 'Energy & Efficiency'. Student B selected one focused on 'Cognitive Visualisation' (also completed in Year 2).

5.1. Theme 1: Shifting thinking about planning: from tasks to pedagogies

The conversations supported the idea of linear lesson planning leading to a more technical approach to planning for these students. Student A thought the generic plan was 'tick boxy' and overlong in contrast to the ASPM which enabled a degree of flexibility in approach to create units and then lessons. Student A's thinking shifted from filling in the generic plan with 'tasks' to do in sections of the lesson, to thinking 'how am I going to teach this?' Student B did not engage with the different elements of the ASPM in isolation as might have been the case with the elements of the generic lesson plan. Instead, Student B was aware of the interrelationships between the ASPM elements in their thinking.

For both students, completing a generic lesson plan was a requirement of placement – all ITE programmes in our TEI use a similar plan. However, both noted that the process of completing a cycle of the ASPM was more important to their thinking than writing the generic lesson plan

itself. Student A used the ASPM independent of the plan to create topics for use in schools as a student and intended to continue this as a qualified teacher. In developing topics, both students focused on areas of the curriculum they needed to understand more fully, or areas they were challenged by or had difficulty teaching. Student B saw it as a means of enhancing knowledge in relation to classroom difficulties and Student A wanted to continue to evolve the topics after teaching in order to refine them. In this way, both seemed to shift to the more developmental approach to planning that Rusznyack & Walton discuss as a move from creating lesson plans focused on 'descriptions of classroom procedures' to ones that build from 'consideration of how to enable learning' (2011, p.280).

5.2. Theme 2: It takes time: learning to like the ASPM

Time emerged as important in both a practical and a developmental sense. Firstly, in creating the topics, the ASPM frontloads the effort: both students said that lesson planning following the ASPM was far more focused and concise than it was if they had started with individual lesson plan proformas. Student A stated that lesson plans developed from an ASPM cycle could be 'one-pagers' because the underlying thinking had been done for the topic via the ASPM. Student A also spoke about it taking time to 'learn to like the ASPM': to develop knowledge and understanding of its purpose, the different elements, and how each person can use it to create their own pedagogical reasoning. Student A 'stopped resisting' the ASPM approach when its usefulness became clear and they stopped 'feeling daunted' by it. Student B also noted that 'the level of academia and the language sometimes… are quite daunting when you first get the [research] paper'. Thinking of the paper in parts helped: to think of the introduction, read the conclusion, and think about 'is this paper going to work for you' before moving on to read the whole article.

To begin with, Student A felt the class 'overthought' things when working with the ASPM. Student A initially felt lost in terms of where to start, even with the choice of topic: as this student developed practical understanding from placement choosing topics relevant to pupils, and being able to consider the ASPM more fully in terms of particular pupils. Student A said: 'I think that's maybe something that the ASPM's missing, is you know, how do you link that to *your* environment and *your* kids rather than just high level.' Student B thought that the better cycles of the ASPM were those in which the pedagogical approach at the end was not what you thought it would be at the start. Appreciating this evolves over time and seemed to rely on these students making the ASPM their own by developing a personal connection to it.

5.3. Theme 3: The challenges of connecting with evidence

Learning to connect with evidence was also an important but sometimes challenging aspect for the students. The importance of seeing evidence from reflection and practice as equally important to published research was mentioned by both. Student A mentioned how connecting with evidence felt a bit 'synthetic' to being with in year 1, and inauthentic. Student B noted challenges in engaging with published research papers in the early stages: 'initially it was really, really difficult… but the more I've done it, and the more I've seen the outcome, the more I've seen my own progression working with the ASPM'. Over time, Student B came to enjoy engaging with literature and then 'using that to enhance your practice'. Papers became valuable when this

student ‘connected’ with something in the research (a ‘lightbulb’ moment), often, because they spoke in some way to challenges with pupil learning that Student B observed in the classroom (e.g. difficulties pupils had in moving between 2D and 3D representations). Both students spoke about connecting with published research in a different way for the ASPM than was the case for other academic assignments. Rather than sourcing evidence to explain something, their purpose shifted to what that evidence could offer to make their pedagogical practice more effective.

Both students spoke of the significance of reflecting on practice, and both referred to reflecting on how they learned when reasoning about subject pedagogy. Student B drew not only on teaching and learning experiences in formal education, but on professional experiences working with apprentices. Student A noted the importance of repositioning perspectives from the self as teacher/learner to foregrounding the needs of pupils. To begin with, Student A wrote their ASPM cycle too much from the perspective of what they had preferred and found effective as a learner. As Student A developed understanding and practice during year 3, they realised they had to take a perspective that was more focused on their pupils as learners. This student mentioned that their practice had been transformed through the process of developing pedagogical reasoning, giving the example of pupil misconceptions. Student A shifted their thinking from why a pupil does not know something that has been taught, to asking why is the pupil not understanding and what might need to be done to support them to understand. In creating the final pedagogical proposal, Student B spoke about a process of shifting what had been learned from the elements of the ASPM into a form that would support classroom practice.

6. CONCLUSIONS & IMPLICATIONS

These conversations highlight the importance of students creating personal connections with the processes of the ASPM. These connections seemed to relate to the value students felt the ASPM could bring to them as developing teachers and to their pupils. Renegotiating how they think about their own learning experiences and what their pupils require is important and is a process that develops over time. The students we spoke with ultimately had made the ASPM their own, finding their own ways to connect with literature, reflect, and evolve pedagogical proposals. In the next phase of conversations will help us to understand whether the importance of personal connection is particular to Students A and B, or whether this is something common to other students on the programme.

As teacher educators, we now wonder whether there are threshold concepts that students need to understand in order to develop a depth of knowledge over time that will then enable them to make the ASPM their own. For the participants, understanding the role of evidence seemed to be important to this process, particularly coming to understand that evidence will not always be confirmatory of what we think might be the best pedagogic approach. It may lead us to adopt approaches to pedagogy that we did not anticipate based upon experience alone.

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