PGCAP ADEV710 - Final Submission

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This written submission consists of eight reflective patches, as well as a wraparound reflection around these patches. The first three patches correspond to Tasks 1a, 1b and 2, which have already been assessed.

Patch 1 - Learning Theories and Diverse Learners

Being recently employed as a Lecturer at the University of Liverpool, it was my first time teaching at this level during the fall of the 2019/2020 academic year, and I was assigned a rather fundamental postgraduate module in Computer Science. Looking back at my teaching experience with the module, the most problematic part was with regard to the "students' eyes" [Brookfield, 1998, Lens 2]. Before the students submitted their first assignment, I was unaware of the difficulties they were facing. My expectations were mistakenly based on my experience from other universities (with more homogeneous student bodies), and did not take into account the diversity of students as learners [Carroll and Ryan, 2007; De Wit, 2011]. For example, I noticed that several of the international students were reluctant to ask questions in class, but they were keen to ae-mail me afterwards. From discussions I had with colleagues [Brookfield, 1998, Lens 4]), I was made aware that this might be a cultural issue; at the same time, my impression was also that they did not feel comfortable conversing in English in front of their peers.

After completing the Day 2 workshop, I realised that the theory that most closely explains the teaching of my module [Brookfield, 1998, Lens 3]) is Behaviorism; students are solely assessed by two coursework assignments and a final exam, and any evidence that they have learned is from their marks. Being aware of the documented drawbacks of this approach, at least when used in isolation [Merriam and Bierema, 2013], I can now identify them in my teaching. For example, most students did not engage in problem-solving for the tutorial exercises, since these were not graded. I did share my experiences with multiple colleagues [Brookfield, 1998, Lens 4] and received valuable feedback. I also consulted with the head of the PGT programmes at the Computer Science department, to ensure that my planned changes are in line with the expectations and the vision of the university.

Based on my reflection, the next step is to implement those changes. My primary goal is to become more aware of the different learners' backgrounds [UKPSF, 2011, V1, V2]. First, I will adopt an active learning approach and facilitate group work and exercise-solving sessions during the tutorials [UKPSF, 2011, A1, A4, V2]. To address students' reluctance to speak in front of their peers, I will set up an online forum where the students can engage in discussion and provide comments on the teaching delivery and the material. Such a format is in line with the "Digital Fluency" part of C2021, with [UKPSF, 2011, K4, K5], and was extremely valuable to me as a student [Brookfield, 1998, Lens 1]. I will also offer feedback on unmarked assignments, which will allow students to engage more in "learning-via-doing" from an early stage, and me to monitor their progress [UKPSF, 2011, A3, K5]. I will also elicit their regular feedback, by means of anonymous questionnaires (similar to Brookfield [1998]'s CIQs) [UKPSF, 2011, K5]. On a more general level, I will introduce Cognitivism to my teaching model, as I firmly believe that the learning of the module's concepts requires a connection to already present cognitive structures (as highlighted in [Ausubel, 1967]). The challenge here is to comprehend the different such structures of students (given their diverse backgrounds), and adjust the activities to their individual needs [UKPSF, 2011, K1, V1, V2]. Learning about Ausubel's [Ausubel, 1967] *advance organisers*, I think that a similar

approach could work in mapping the students' backgrounds to the expectations of the module from the very beginning.

Patch 2 - Learning Environments as an Aid

After coordinating a module for the first time last year, I was faced with several challenges which I had to address for the second iteration of the module this year. As I highlighted in Task 1a, some of these were related to student engagement and adhering to the diverse student backgrounds and abilities [UKPSF, 2011, V1, V2]. However, given that as it turned out, the module had to be delivered entirely online, I had to completely revamp my plan on how to address those challenges. To this end, I explored how to effectively use the different learning environments (related to Day 5 of the workshops and to [UKPSF, 2011, A4, K4]) in order to provide a multifaceted learning experience that would accommodate the needs of individual learners.

The core material of the module (i.e., the lectures) are provided asynchronously, as recorded videos that the students can watch in their own time and at their own pace. These videos are relatively short and have subtitles, and the students can freely go back and forth through the videos to re-watch the points that they missed, something that would not be possible in a typical face-to-face-lecture. This type of delivery can be categorised as "Aquisition" in the ABC Model of Young and Perović [2016] and provides great flexibility for diverse learners [UKPSF, 2011, V1, V2]. I have already elicited and received useful feedback from the students about this form of delivery [UKPSF, 2011, K5, K6]) and most of them clearly prefer it to the traditional classroom lecture.

Accompanying every recorded lecture, I have designed unmarked quizzes [UKPSF, 2011, A4, V3]. that test the students' immediate familiarity with the material they have just been taught, in a similar manner that in-class questions would. This relates to the "Practice" part of the ABC Model, and is useful for the students to receive instant feedback and possibly watch the appropriate parts of the lectures again, and for me to keep track of the progress of the students and adapt the teaching delivery and the content accordingly [UKPSF, 2011, A5, K5, K6]. I have also set up several discussion topics on Canvas, which the students use to ask questions, but also answer to the questions of other students.

To make sure that the students stay motivated and engaged with the module, I have also designed two synchronous activities: a weekly Q&A session and a biweekly tutorial session. The Q&A session is also a form of "Aquisition" but it is also certainly part of the "Discussion" aspect of the ABC model. During the tutorials, the students have to work in groups and solve exercises, therefore capturing the "Collaboration" and "Practice" parts of the ABC model. The "Investigation" and "Production" aspects are captured by the Continuous Assessment tasks, in which the students are asked to put what they have learned to practice, and produce written solutions to a set of marked exercises.

Although the migration to this highly hybrid form of teaching was done out of necessity, it effectively solved several of the problems that I was facing. That being said, several new challenges were introduced. For example, I noticed that some students are "falling behind", as they are not committed to approaching the online lectures the same way that they would approach a face-to-face lecture, i.e., watching new material every week. This potential demotivation is a well-documented issue, e.g., see [Berge, 1999; Hara and Kling, 2001; Dumford and Miller, 2018]. Several works (e.g., [Berge, 1999; Northrup, 2009] suggest that this can be prevented via the design of good interactive and collaborative activities. As a matter of fact, I designed such an activity this year, in which the students were asked to form groups and prepare short videos on relevant topics not covered in the lectures, "mimicking" the lectures. These presentations would be peer-reviewed, and I would provide feedback as well. This was an unmarked activity, as otherwise it would require approval from the board of studies, and unfortunately none of the students engaged in the activity. I will look into making this a marked activity for next year's iteration of the module.

Patch 3 - Digital Case Study: Learning Environments and Curriculum

My digital case study is structured around the use of new learning environments (related to Day 5 of the workshops) for the delivery of the module, but it is also directly connected to the topic of curriculum design (related to Day 3 of the workshops). The reason for choosing this topic is that it is directly related to the most fundamental challenge that I faced after my first year of teaching at the University of Liverpool. This is a challenge that I am still currently trying to overcome, and which I am now consciously approaching by means of the reflective cycle of Gibbs [1988].

In more detail, I was assigned a module on Advanced Algorithms, taught at the postgraduate level exclusively for students with a computer science background. It became clear rather quickly however that the students did not have the necessary background to support their learning of the advanced topics of the module, and therefore a significant portion of the module is devoted to going over the basic material, that one would normally encounter in an undergraduate programme. In turn, this left only limited time for the teaching of the advanced topics, which resulted in the students not achieving the learning outcomes for those parts of the module. This was evident from their overall marks, as well as the student feedback, [UKPSF, 2011, K5], which clearly highlighted the lack of depth in the latter parts of the module.

Via the use of appropriate learning environments [UKPSF, 2011, A4, K4], I already addressed the issue partially and with clear signs of success so far. In particular, the use of online recorded videos adhered to the individual needs of the students [UKPSF, 2011, V1, V2]; students with a background in basic algorithms could now watch these videos quickly and move to the more advanced material, rather than having to sit through 5-6 weeks of lectures on topics they were already quite familiar with. My Q&A sessions were open to questions from any part of the module (present, past or future), thus breaking the "linear" progression of a traditional module. As highlighted in the Digital Case Study, I emphasised on the notion of "connectedness" [Fung, 2017], perhaps narrowed down to its application to "connectedness between the various components of the curriculum"; I firmly believe that my lectures are "parts of a whole" and a bigger picture is revealed step-by-step, as the student dives more into the different components of the module [UKPSF, 2011, K1]. The effectiveness of the new approach was evidenced by very positive student feedback, as well as much improved marks on the first Continuous Assessment task compared to last year [UKPSF, 2011, K5].

Perhaps more importantly, this new form of delivery will allow me to implement significant and necessary changes going forward. With the video recordings available, I could restructure the curriculum to focus more on advanced topics; the basic topics would be covered only during the first couple of weeks, and the videos and the associated quizzes would serve as aides to the students that do not have the necessary background. Building on this idea, I engaged in discussions with several people in the department (including the Head of Department and the Director of Postgraduate Studies) [Brookfield, 1998, Lens 3], as I firmly believe that such drastic changes to the curriculum should be evaluated at the programme (the "macro") level, rather than just the module (the "micro") level (the "concentric rings" in the tree metaphor, see also [Fung, 2017, Chapter 4]), to make sure that the learning outcomes are constructively aligned to those of other modules [Chalmers and Hunt, 2013, Chapter 6]. We are currently devising a plan to move forward with a rather major revamp of the curricula of two related modules, aiming at a more consistent and directed learning experience for students [UKPSF, 2011, A5, V4, K3, K5]

Patch 4 - Reflection on Peer Observation

For the peer observation, I asked the assistance of Dr. Giorgos Christodoulou, an experienced faculty member of the Computer Science Department at the University of Liverpool and a Fellow of the Higher Education Academy. I also asked the assistance of Dr. Alkmini Sgouritsa who is a new faculty member

at the University of Liverpool and who is therefore facing similar challenges to mine. In addition, Dr. Sgouritsa is currently also enrolled in the PGCAP module, so she was quite familiar with the concept of peer observation and very willing to give me detailed feedback.

The topic of the observation was *"How to explain complicated theoretical notions to the students"* and *"How to deliver and develop advanced proofs in a way that can be understood"*. This is a real challenge for my module because the curriculum covers advanced topics in algorithms, which require the development of formal mathematical proofs and correctness arguments, which many of the students are not very familiar with, especially those that do not have the background in mathematics or the theory of computation [UKPSF, 2011, V1]. For this reason, I asked Dr. Christodoulou and Dr. Sgouritsa to watch some (different) pre-recorded videos presenting the most mathematically advanced parts of the module and provide feedback on those. I summarise and discuss the highlights of that feedback below.

The overall impression was that the quality of delivery was already quite good, especially given the nature of the material presented. The observers appreciated the fact that proofs were developed step-by-step, and that the material was connected to the previous parts of the module, with appropriate references. It was also pointed out as a strong point that, although the material was presented as a pre-recorded video, interaction was encouraged - I achieved this by asking concrete questions and prompting the students explicitly to stop their videos and think about them before they proceed to see the answer [UKPSF, 2011, V2, K4].

There were also some concrete suggestions for improvement. It was pointed out that it would help to have more running examples while explaining a difficult concept. An important remark was that some details of the proofs were not explained (e.g., a known mathematical identity is given without proof), and while this was by design, it can cause uncertainty and frustration to the students, who are not sure whether they should know this, or whether this will be part of the exam and so on. This is an extremely valid point which I will certainly correct in the next iteration of my module, following the suggestions of the observers, i.e., by providing references to the proofs of these statements and clearly explaining to the students what is important to remember and what is not. On the more practical side, there was some very justified criticism about the content of the slides, either that there are too many fonts or colours, or that there are mistakes, which although I corrected in the video, might still be confusing to students who examine the slides independently afterwards. This is indeed true, and I was in fact aware of these mistakes when I was recording the videos, but I did not have the time to correct them. Looking back, this is clearly a time management issue, since these mistakes were present in the previous iteration of the module, and they should have been corrected then.

Another important point that was raised by the observers was more fundamentally the use of appropriate methods for teaching this type of material. In the discussion I had with Dr. Christodoulou, we both agreed that *"it is hard to replace the value of presenting a proof on the blackboard"* [UKPSF, 2011, K2, A4, V3]. While the traditional teaching style of "chalkboard teaching" might have been scrutinised in light of its more modern counterparts, I believe that there is still something fundamental about mathematics that make chalkboards more appropriate; in fact, this has been advocated by several studies (e.g., see [Billman et al., 2018; Szabo and Hastings, 2000; Greiffenhagen, 2014]) and is attested by the fact that so many lecturers in theoretical sciences still use the chalkboard as their preferred option. Clearly, teaching on the blackboard in the classroom has been impaired by the pandemic, but technology has evolved to a point where a "virtual whiteboard" lecture is very much possible [UKPSF, 2011, K2, K4, A4]. In fact, the concept of teaching via "interactive whiteboards" dates back to the early 2000s [Glover et al., 2005; Wood and Ashfield, 2008] and has been advocated as a tool for teaching even in the theoretical sciences. Several of my colleagues have in fact successfully used this approach and I plan to consult them to share their experiences and highlight potential challenges that they faced [Brookfield, 1998, Lens 4]). Although it is likely that the next iteration of my module will be face-to-face, I believe that it is important for my professional development as a teacher to become proficient with the effective use of these technologies, which might prove to be very useful in the future [UKPSF, 2011, A5, K6].

Patch 5 - Changes to the Structure of Teaching

In Patches 2 and 3 above, I highlighted how the use of online learning environments (e.g., Canvas, pre-recorded videos, online quizzes etc) seemed to be a promising remedy to the main challenges that I faced during the previous (and first) iteration of my module. Since then, I have received much more useful data, from interacting with students, but primarily from *the results of their assignments* and the *student feedback for my module* [UKPSF, 2011, K5, K6]. Based on this information, I have reassessed my plan for the next iteration of the module even further. To put it simply, these environments can indeed significantly help, but some of the main problems persist, and need to be addressed in different, more effective ways.

Starting from the results of the second written assignment, and contrary to the first assignment, the students did not do that well overall (an average of 52, when 50 is the passing mark for MSc modules like my module). The material covered by the assignment was quite similar to that of last year's assignment, but the assignment itself was much more structured, with multiple sub-questions aiding the students to the right answer. This was a change that I implemented this year based on the feedback that I received from last year's assignment results, when the average mark was below 50. In that regard, the changes that I implemented resulted in improvements, but further action is needed.

Last year, I attributed the inability of students to achieve passing marks to the fact that the assignment was rather "open-ended" and required significant creativity and critical thinking. While this is generally desired and in line with the "Research Connected Teaching" and "Authentic Assessment" part of C2021 in an academic context, it was evidently too demanding and had to be toned down a bit, as the students found it difficult to sometimes even understand what was required of them (related to "assessment literacy" [Smith et al., 2013]). However, it turned out that in the much more structured, "aided" assignment, the students still struggled. Given that the students did quite well in the first assignment, it is clear that it is the material itself that makes it hard for the students to achieve good marks, since it is naturally more advanced as it appears later during the course of the module. Since this material is a pivotal part of the students' learning of the core knowledge of theoretical computer science [UKPSF, 2011, K1, V4], the challenge here is *"how to deliver this more advanced material in a way that the student will learn how to apply these principles to new problems and test cases?"* This is in fact related to the "Practice" and "Production" parts of the ABC Model of Young and Perović [2016], and is clearly connected to the theme that I chose for the Peer Observation (see Patch 4 above).

To identify where I went wrong, the student feedback for my module (which only very recently became available) was very useful. Some students pointed out that they found that while faced with the second assignment, they were not equipped with the right tools to approach it; they had not seen enough examples and they had not practiced enough on related concepts. Looking back at my experiences as a student [Brookfield, 1998, Lens 1], I faced the very same problems with some of my lectures, whereas I truly understood these concepts when I was teaching them as a TA and had to solve a wide range of exercises. I clearly learned through *practice*, but yet somehow I have not given enough opportunity to my students to do the same.

As a response to this, ideally more fundamental changes to the structure of my module, but actually even to the structure of the MSc programme should be made [UKPSF, 2011, A5, V5]; as I explained in Patch 3 above, I am currently in discussion with the appropriate people to implement those changes. The high-level idea is to "move" a significant part of the basic material from my module to other modules, and leave much more time to go into more depth on the more advanced topics. If this is made possible, then my concrete plan is to reduce the hours of lecturing every week from 3 to 2, and use the extra hour for in-class workshops, where I will present examples, exercises and practical applications of the theory in an interactive manner, prompting student participation (an approach perhaps more in line with Constructivism rather than Behaviorism [Chalmers and Hunt, 2013]). For now, the this is supposed to be the role of the tutorials, but they are evidently not sufficient for the more advanced concepts.

Patch 6 - Designing Better Assessments

In the previous patch, I touched upon the issue of assessment design, explaining how I had to redesign one of the assignments for my module based on the results from last year's iteration. In this patch I will highlight some further action that I believe could be taken into making the assessments a more effective way of enabling the students' learning.

I am confident that the assessment tasks that I have designed work very well as a means of meeting the requirements of the module and the learning outcomes [Boud and Falchikov, 2007]. To put it simply, a student that has done well in the assessments (including the exam) will most definitely have acquired a high level of proficiency when it comes to advanced algorithmic techniques, and will be very well equipped to use them either in practice or further in academia (e.g., PhD studies) [UKPSF, 2011, K5, V4]. However, I believe that this type of assessment might fall short of being useful devices for *assessment for learning (Afl)* [Wiliam, 2011; Knight, 2012; Sambell et al., 2012], at least not to the extend that I would like it to be. This is to be expected to a degree, since the module has only two continuous assessment tasks and the final exam. Students will receive feedback for the first assignment, which they will have very limited time to incorporate for their second assignment. In the midst of multiple requirements from different modules, the students might not even have time to critically evaluate their work based on the feedback, on which any effective changes are contingent.

The theory underlying the concept of Afl suggests that this type of assessment is *formative* [Black and Wiliam, 2009], meaning that it is usually not marked and serves as a quick exchange of information about the students' performance between the students and the lecturer. My module in fact already had this type of assessments integrated in it, in the form of tutorial exercises that the students would have to work on each week. What I quickly realised though after teaching at the University of Liverpool is that the approach of the students on average is markedly different from those of students in Aarhus University or the University of Oxford, where I had taught before. In particular, I noticed that the students in my module here could not quite comprehend the importance of working on the formative assessments on their potential success in the marked assignments and the exam. I tried to emphasise that verbally, but it was grimly clear that very few of them had even attempted working on these assessments. It would be easy to say that "students in Oxford are simply better", but that would be in a sense a convenient simplification. It is possible that students at the University of Oxford are indeed much more self-aware and determined in their studies, whereas students in other institutions might still have what I like to call the "high-school mentality", meaning that they expect the lecturer, just like as school teacher, to always be by their side, even for things that they should ultimately discover themselves. Our roles as educators is to help those students realise how working independently will benefit them in the future [UKPSF, 2011, V1, V2].

As I mentioned briefly in Patch 2, I did design such a peer-reviewed assessment activity, which was however not marked, and thus it was optional; sadly, no students elected to participate in the activity. I would ideally like to design several such activities, but it seems critical that they should be marked (even with a small percentage of the total mark), to incentivise the students to engage in them. Unfortunately, given the current system in the University of Liverpool (and typically in most UK Universities) any such endeavour will be impeded by several rules and bureaucracy, meaning that they have to be approved by the board of examiners way in advance of the next iteration of the module; this effectively makes any such experimentation very cumbersome and discourages lecturers from implementing such improvements. Given the above, my short-term plan is to work on improving my formative assessments. I will set weekly assignments for the students to submit and I will provide as incentive the opportunity to get individual and personalised feedback [UKPSF, 2011, A3, V2], besides simply the general explanation/solution that will be provided during the tutorials. I will also use past exam questions as questions for those assignments, which hopefully will convince the students of their importance. I will also look into the literature to extract ideas for more engaging and active assessments [Sambell et al., 2012; Bloxham and Boyd, 2007], and see if any of those are applicable to

more theory-oriented modules like mine [UKPSF, 2011, A1, A4].

Patch 7 - Designing a New Module

Up until this point, I have only discussed changes that I will make in order to improve the learning in the module that I am teaching. As lecturers at the University of Liverpool, we normally teach two modules per year; I have only been teaching one for the first two years, since I am an Early Career Researcher (ERC). While I do not know what I will be teaching as a second module, I have been in contact with the Director of Postgraduate Studies [Brookfield, 1998, Lens 3] and I have strongly expressed my willingness to design an entirely new module from scratch, one on "Computational Complexity".

The idea for this module originated by the feedback (direct or indirect) that I received from students in my Advanced Algorithms module. Many of the topics on Advanced Algorithms are intertwined with the theory of computational complexity in theoretical computer science, and I was surprised to find out that several students had not followed such modules in their undergraduate degrees. I do cover some of the necessary material in my module, but this is mostly geared towards students that do have the background and just need a "refreshing". In the spirit of reducing the breadth of topics in my algorithms module, I suggested the introduction of a new MSc module on Computational Complexity, which would serve the following two purposes. First, it would cover these topics in detail, allowing students without the necessary background to appropriately learn all the necessary concepts [UKPSF, 2011, V1, V2]. Additionally, it would also cover more advanced topics, which could be of particular interest to students pursuing a career in theoretical computer science.

To present a more global picture of what I have in mind, this new module would be a Semester 1 module, alongside a more basic module on Algorithms (geared towards students in conversions' programmes but open to CS students that might not have the appropriate background) which would "inherit" some of the material that would be removed from my Advanced Algorithms module, as well as a module on Optimisation that is already offered in Semester 1. Then, my Advanced Algorithms MSc module would be a Semester 2 module, alongside other more advanced algorithmic modules (e.g., Algorithmic Game Theory), and all the necessary background (basic algorithms, computational complexity, optimisation) will already have been offered in Semester 1. An interested student could therefore follow all of these modules and obtain an extremely solid specification in theoretical computer science and algorithms. This is perfectly in line with the new MSc programme on "Theoretical Computer Science" which will be offered in the academic year 2021/22 by the Computer Science Department, and is a good example of changes in the curriculum implemented in the programme or department level, rather than the module level [Fung, 2017]. It is also very much in line with the strength of the computer science department research-wise, which is research on theoretical computer science (adhering also to the "Research-Connected Teaching" of C2021). In particular, strong students from this MSc programme could be encouraged to apply for PhD positions within the relevant groups.

Of course, designing a new module is not an easy task. Following what I have learned in the PGCAP module, I will put significant emphasis on coming up with appropriate learning outcomes [Lea, 2015]. Given the wide-spread employment of learning outcomes in teaching all over the world, I will first examine the most prominent similar modules from other universities "to get a taste", and then I will carefully adapt them to be appropriate for the type of students that I will expect to have. I will also consult the relevant theory (e.g., [Bloom, 1956] and the SMART goal [Doran et al., 1981] approach to designing learning outcomes[1]).

[1] https://uncw.edu/career/documents/writingsmartlearningobjectives.pdf

Patch 8 - Reflection on Continuing Professional Development

My involvement in the PGCAP module has helped my re-evaluate my practices as a teacher, and become much more aware of all the different components of what constitutes a good educator [UKPSF, 2011, A5, K6, V4]. Obtaining the accreditation of Fellow of HE is part of my probation agreement, as it is typically the case with most UK Universities. The reason for requiring this qualification as a "blanket" approach, rather than judging teaching qualities on an individual level is that it is required by the metrics laid out by the UK Teaching Excellence Framework (TEF)[2]. This can be inherently problematic, as highlighted in Paul Ashwin's lecture at Lancaster University [Ashwin, 2017], as it focuses on the qualification rather than the learning or the skills themselves. Indeed, I am aware of colleagues in other UK Universities that received similar qualifications as required by the probation agreements within only a few weeks of related training.

In the case of the PGCAP, I believe that the curriculum, as well as the assessments were aligned with the goal of enabling the students to become better educators, and to learn all the necessarily principles that will aid them in achieving this goal. In that sense, the module was educational on a "meta" level, as it demonstrated the principles that were presented to us as examples of good practice. Through the course of the module, I identified good practices that I have already been employing (e.g., the 360° feedback, Research-connected Teaching and Authentic Assessment (C2021), use of learning environments, providing useful and informative feedback [UKPSF, 2011, A3, A4, K2, K3, K4, V3]) and also some others were I could certainly improve (designing better curricula or better assessments, putting more emphasis on active learning and interactive activities, taking the learners' diverse backgrounds into account [UKPSF, 2011, A5, V1, V2, V4, K6]). More than anything, the learning process helped me identify that all the different parts of teaching are very much interconnected [Fung, 2017] and that they need to be tackled as a whole, rather than within each individual component.

In terms of the the development in my subject area, I have been very fortunate to be teaching a module that is broadly related to my research, which is centred around the design and analysis of algorithms for a plethora of different scenarios. This allowed me to revisit some of the material that I was taught as a graduate student, and deeply comprehend them, to the extent that also helped me improve as a researcher. Additionally, I believe that having to explain this type of material, which is sometimes abstract, mathematically involved and seemingly detached from practice, to students who are naturally skeptical about *why* they need to learn it, has prepared me for when I will need to present my research (which is very much of the same nature) to people from other academic fields, with different backgrounds, or people from the industry. This is something that I will most likely have to do as my career develops, to make it easier to attract funding, which in turn will enhance my chances of moving forward in my development within the university. In terms of Boyer's Four Scholarships [Boyer, 1990], I now consider myself to be very much a *Scholar of Discovery*, aiming to become a *Scholar of Integration* and a *Scholar of Application* in the forseeable future. The learning experience of the PGCAP has given me the initial tools towards becoming a *Scholar of Teaching* as well, which I will continue to apply in my professional development as a teacher.

Wraparound Reflection

I would say that the biggest take-away from my experience with these reflective tasks is centred around the reflective cycle of Gibbs [1988], which I was already implicitly following in my practice, before I even learned about it. I have always been a big proponent of "learning via experience", which I learnt that is related to Cognitivism [Chalmers and Hunt, 2013]. I have done it in the past as a teaching assistant, and I have seen it work very well. However, after teaching at the faculty level, I soon came to realise that there so many factors that one has to take into account, e.g., the design of the curriculum and the assessments,

[2]https://www.officeforstudents.org.uk/advice-and-guidance/teaching/about-the-tef/

the diverse students' backgrounds and how each individual person learns, the learning environments, the design of the learning activities, or the appropriate way to give and receive feedback, among others. What this reflective summary and the PGCAP module in general has helped me tremendously with is to be aware of all these different factors and of the theory and studies that underpin them. What I identified as a seemingly isolated problem in my teaching practice turned out to be part of a more general issue with many interconnected components which need to be assessed at the module level, at the programme level, or even at the university level. Perhaps more than anything though, they have to be assessed at the personal level, as I evaluate and reassess my teaching practice. I always considered myself to be an excellent teacher, and this has been attested by multiple accounts of students and colleagues in the past. What I realised after following this module is that I am at the moment only a potentially excellent teacher, but there are many things that I need to think of, understand, and try out in practice before I can realise this potential. This is very much work in progress, and I am excited to see where it leads me.

References

Paul Ashwin. Measuring teaching excellence: Challenges and possibilities. 2017.

David P Ausubel. A cognitive structure theory of school learning. *Instruction: Some contemporary viewpoints. San Francisco: Chandler*, 1967.

Zane L Berge. Interaction in post-secondary web-based learning. *Educational technology*, 39(1):5–11, 1999.

Anneli Billman, Ansie Harding, and Johann Engelbrecht. Does the chalkboard still hold its own against modern technology in teaching mathematics? a case study. *International Journal of Mathematical Education in Science and Technology*, 49(6):809–823, 2018.

Paul Black and Dylan Wiliam. Developing the theory of formative assessment. *Educational Assessment, Evaluation and Accountability (formerly: Journal of Personnel Evaluation in Education)*, 21(1):5, 2009.

Benjamin Samuel Bloom. Taxonomy of educational objectives: The classification of educational goals. *Cognitive domain*, 1956.

Sue Bloxham and Pete Boyd. *Developing Effective Assessment In Higher Education: A Practical Guide: A Practical Guide*. McGraw-Hill Education (UK), 2007.

David Boud and Nancy Falchikov. *Rethinking assessment in higher education: Learning for the longer term*. Routledge, 2007.

Ernest L Boyer. *Scholarship reconsidered: Priorities of the professoriate.* ERIC, 1990.

Stephen Brookfield. Critically reflective practice. *Journal of Continuing Education in the Health Professions*, 18(4):197–205, 1998.

Jude Carroll and Janette Ryan. *Teaching international students: Improving learning for all*. Routledge, 2007.

Denise Chalmers and Lynne Hunt. *University teaching in focus: A learning-centred approach*. Routledge, 2013.

Hans De Wit. Globalisation and internationalisation of higher education. *Internationalisation of universities in the network society*, 8(2), 2011.

George T Doran et al. There'sa smart way to write management's goals and objectives. *Management review*, 70(11):35–36, 1981.

Amber D Dumford and Angie L Miller. Online learning in higher education: exploring advantages and disadvantages for engagement. *Journal of Computing in Higher Education*, 30(3):452–465, 2018.

Dilly Fung. *A connected curriculum for higher education*. Ucl Press, 2017.

Graham Gibbs. Learning by doing: A guide to teaching and learning methods. *Further Education Unit*, 1988.

Derek Glover, David Miller, Doug Averis, and Victoria Door. The interactive whiteboard: a literature survey. *Technology, Pedagogy and Education*, 14(2):155–170, 2005.

Christian Greiffenhagen. The materiality of mathematics: Presenting mathematics at the blackboard. *The British journal of sociology*, 65(3):502–528, 2014.

Noriko Hara and Rob Kling. Student distress in web-based distance education. *Educause Quarterly*, 24 (3):68–69, 2001.

Peter Knight. *Assessment for learning in higher education*. Routledge, 2012.

John Lea. *Enhancing learning and teaching in higher education: Engaging with the dimensions of practice*. Open University Press, 2015.

Sharan B Merriam and Laura L Bierema. *Adult learning: Linking theory and practice*. John Wiley & Sons, 2013.

Pamela T Northrup. Online learners' preferences for interaction. *The perfect online course: Best practices for designing and teaching*, pages 463–473, 2009.

Kay Sambell, Liz McDowell, and Catherine Montgomery. *Assessment for learning in higher education*. Routledge, 2012.

Calvin Douglas Smith, Kate Worsfold, Lynda Davies, Ron Fisher, and Ruth McPhail. Assessment literacy and student learning: the case for explicitly developing students 'assessment literacy'. *Assessment & Evaluation in Higher Education*, 38(1):44–60, 2013.

Attila Szabo and Nigel Hastings. Using it in the undergraduate classroom: should we replace the blackboard with powerpoint? *Computers & education*, 35(3):175–187, 2000.

UKPSF. The uk professional standards framework for teaching and supporting learning in higher education, 2011.

Dylan Wiliam. What is assessment for learning? *Studies in educational evaluation*, 37(1):3–14, 2011.

Ruth Wood and Jean Ashfield. The use of the interactive whiteboard for creative teaching and learning in literacy and mathematics: a case study. *British journal of educational technology*, 39(1):84–96, 2008.

Clive Young and Nataša Perović. Rapid and creative course design: as easy as abc. *Procedia-Social and Behavioral Sciences*, 228:390–395, 2016.