**Teaching & Learning Guidance in the
School of Physics & Astronomy
PART 5: Guidance for lab demonstrating and reflecting on your teaching**

5A. Teaching in labs

5A.1 The structure of our labs

Many of the courses that we offer students in the School of Physics & Astronomy have a practical component, often in the form of a laboratory class. Probably more so than in any other aspect of our teaching, this area is *very* class specific. So the first important factor to remember is that you should always ask the relevant lab head how the lab you have been assigned to functions, and what your role within that lab is.

There is some variation in terminology, but for the most part teaching staff involved in a lab class are referred to as *demonstrators*. Demonstrators can be permanent members of academic staff (at any point in their career), Post-Doctoral Research Fellows or Assistants, or PhD students. This last group get paid an additional wage for undertaking demonstrator duties. Most lab sessions will have a team of dedicated demonstrators from a range of career stages. RAs are often expected to take a leadership role, as you typically have considerably more experience than the PhD demonstrators.

The most common duties of a lab demonstrator are to answer questions from students, provide feedback on their progress, make sure everyone is working safely and professionally, help identify problems with equipment[1] and ultimately participate in the assessment of the attempted work. In some labs everyone participates in the marking, in others it is a subset. Again, your lab head would be able to advise you.

Lab assessment takes many forms, including submitting lab books/records, writing formal reports, oral presentations to the class, Viva-like interviews and so on.

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[1] Whilst demonstrators are usually expected to understand how the equipment in their lab works, repairing it is NOT their responsibility – we have a dedicated Teaching Technician Team for this.

5A.2 Best practice for teaching in a lab

In many ways, teaching in a laboratory setting has many similarities with small group teaching. Much of what was discussed in the small group session applies here. Recall the "characteristics of a good tutor" we looked at:

- Organisation
- Clarity
- Knowledge and understanding
- Dynamism and enthusiasm
- Tutor-group/Tutor-individual interaction

All of these apply just as easily to the lab setting. One key difference though is a need to monitor *how* the students are working in labs. There are many more potential dangers in a lab setting than in a tutorial, simply by the fact that students are carrying out practical work. Every experiment has undergone a thorough health & safety check by our teaching technicians, but it is always important to keep an eye on your students.

Another area of overlap with our small group discussions is in terms of providing feedback. But whilst in a small group setting this could be quite informal as you explore problems they are encountering and trying to get them to draw out solutions themselves – in the lab setting the work they are carrying out counts to a student's final grade. This means that the feedback you give them must be *meaningful* and they must *understand* it, and how it relates to the mark they are given.

The traditional view of feedback is that teachers "transmit" feedback messages to students about what is right and wrong about the work they have done, how it can be improved, and that students then apply this feedback to improve themselves. The problems with this model are that it is teacher-centric, and with ever-growing class sizes[2] this means that the level of feedback available to individual students becomes quite low. It also assumes that students understand the feedback they receive, which is often not the case. It also does not

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[2] Which results in ever growing lab sections.

take into account the motivation and beliefs of the students. If, through the use of good feedback practices, we can help students to self-regulate – give themselves feedback, if you like – then many of these problems can be addressed.

Figure 1 below presents a conceptual model of self-regulation and feedback, derived by Nicol & Macfarlane (2006) from work by Butler & Winne (1995).
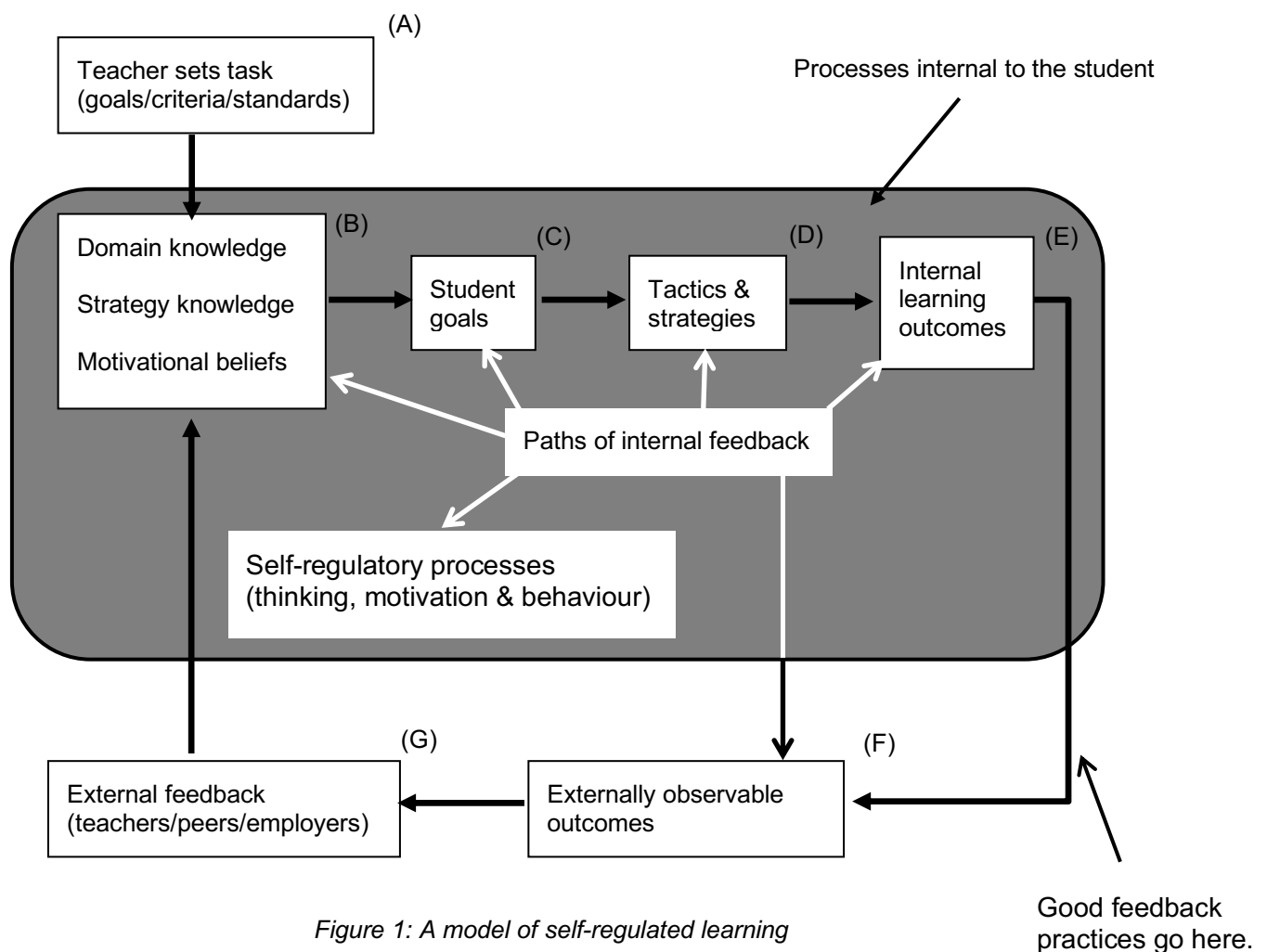

Figure 1: A model of self-regulated learning

The model begins with a teacher setting a task (A) – this is the trigger for self-regulatory processes in the student. Engaging with the task, the student draws on prior knowledge and motivation beliefs (B). This allows them to build a personal interpretation of the meaning and requirements of the task, and hence formulate their own task goals (C). Hopefully, the goals of teacher and student overlap, but the degree of overlap is not always high – indeed,

the student may not have a clear view of that the goal actually is. Anyway, those goals help to shape the strategies and tactics (D) that the student will use to tackle the task and generate internal (E) and external (F) outcomes. An internal outcome would be, e.g. increased understanding of a particular topic; an external outcome includes tangible products, e.g. completed exam paper. The student then receives external feedback (G) from, e.g. their teacher.

Between (E) and (F) is where self-regulated feedback comes into play. Such feedback could result in a reinterpretation of the task and hence new self-goals. It could be reinforced by the external feedback, or indeed contradicted by it.

So what are good feedback practices that could help benefit a students between (E) and (F)? Well, Sadler (1989) identified three key things feedback must have if a student is to benefit from it:

(i)   the student must know what good performance is – i.e. the student must have a concept of the goal or standard being aimed for;
(ii) the student must know how current performance relates to good performance;
(iii) the student must know how to act to close the gap between current and good performance.

Nicol & Macfarlane-Dick (2006) came up with 7 principles of good feedback practice that would facilitate self-regulation of a student's learning. Good feedback practice:

(1) helps clarify what good performance is (goals, criteria, expected standards);
(2) facilitates the development of self-assessment (reflection in learning);
(3) delivers high quality information to students about their learning;
(4) encourages teacher and peer dialogue around learning;
(5) encourages positive motivational beliefs and self-esteem;
(6) provides opportunities to close the gap between current and desired performance;
(7) provides information to teachers that can be used to help shape teaching.

5B. Reflecting on your behaviour

5B.1 Frameworks for reflection

A number of frameworks exist that can help you engage in structured reflection. We'll look at two.

5B.1.1 Hatton & Smith (1995)

Hatton and Smith (1995) splits reflection into 4 levels, based on the depth of thought that has gone into the reflection:

Level 1: Descriptive writing	*Level 2: Descriptive reflection*
▪ No reflection, description of events without reasons or justifications	▪ Description of events with reasons/recognition of alternate viewpoints
Level 3: Dialogic reflection	*Level 4: Critical reflection*
▪ Discourse with self; exploration of the situation	▪ Consideration of broader historical, social and/or political contexts

5B.1.2 Johns & Graham (1996)

This takes the form of a series of questions. It's been adapted from work carried out with nurse-practitioners, but the structure can easily be applied to any discipline.

Description

- ▪ Write a description of the experience.
- ▪ What are the key issues within this description that I need to pay attention to?

Reflection

- ▪ What was I trying to achieve?
- ▪ Why did I act as I did?
- ▪ What are the consequences of my actions
  - o for the student(s)?
  - o for myself?
- ▪ How did I feel about this experience when it was happening?

- How did the student(s) feel about it?
- How do I know how the student(s) felt about it?

Influencing factors

- What internal factors influenced my decision-making and actions?
- What external factors influenced my decision-making and actions?
- What sources of knowledge did or should have influenced my decision making and actions?

Alternative strategies

- Could I have dealt better with the situation?
- What other choices did I have?
- What would be the consequences of these other choices?

Learning

- How can I make sense of this experience in light of past experience and future practice?
- How do I NOW feel about this experience?
- Have I taken effective action to support myself, and others, as a result of this experience?
- Has this experience changed my way of understanding any aspect of my practice?

Assumptions, beliefs and ideology

- What do my practices say about my assumptions and beliefs about teaching?
- What views of power do they embody?
- Whose interests seem to be served by my practices?
- What is it that acts to constrain my views of what is possible in teaching?

Action

- Given the chance, what would I do differently next time?
- What changes will I make immediately in order to put my learning into practice?

5C. Reflecting on your teaching

In his 1983 book, The Reflective Practitioner: how professionals think in action, Donald Schön suggested that *professional practice is characterised by the capacity to reflect on one's own practice in order that one might learn and develop that practice.* He argued that there are two forms of reflection:

- reflection-in-action (while doing something)
- reflection-on-action (after you have done it).

We *reflect-in-action* constantly as we teach, whether we are aware of it or not. Reflection-in-action usually happens very fast, perhaps even intuitively and it can be transient and quickly forgotten. We respond to situations that arise in the classroom – an unexpected question or a puzzled look. As we become more expert teachers these unexpected situations are likely to become less frequent (though they never disappear completely) and our responses are better judged as we develop a repertoire of responses. It is only after a teaching event that there is time for in-depth reflection.

Here the teacher will have a unique perspective on the experience (the class). This perspective will be based on what have been described as 'interpretative filters.' These include: your own experiences of learning (and teaching if you've taught before), your experience of similar classes and assumptions about the students in your groups.

Whatever teaching you are involved in, reflecting on your actions and what you experienced can provide an invaluable learning tool when it comes to improving your skills and practice. One way to do this is to maintain a reflective journal – a grand title was what is simply a diary. Or, if you prefer to keep things physics-y, a lab record. Maintaining such a record is an example of *reflection-on-action*. When such reflection is rigorous, systematic and ongoing, teachers are acting as *reflective practitioners*.
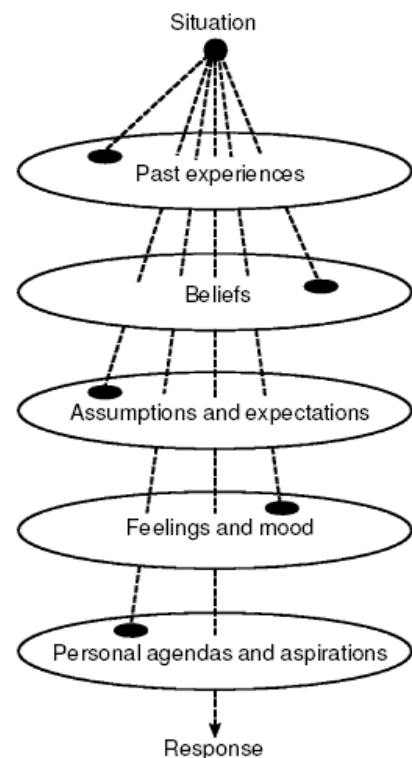
5C.1. How to do reflection

Barbara Larrivee (2000) states that there are 3 essential practices in becoming a critically reflective teacher:

- making time for (daily?) solitary reflection;
- becoming a (perpetual?) problem solver;
- questioning the status quo …..always?

To help you do this, here are four potential focusses you could use in your reflection.

5C.1.1 Exploring your expectations

When faced with unfamiliar situations we cannot help but imagine what is going to happen and what the experience is going to feel like:

- What expectations did you have before the class?
- Had you visualised yourself in the role of a peer tutor? What did that feel like?

5C.1.2 Exploring the experience

A useful start for the formal process of reflection-in-action is to address the following questions and note down your responses (as soon after class as possible!)

- What worked well in this class? Why?
- What did not work well? Why?

The 'why' elements are critical. Without asking *why* you are simply providing narrative. Using the John and Graham framework will help you to explore your beliefs about the experience and uncover assumptions you may have made.

These initial notes can help you write the more detailed reflective journal entry, one that moves up the Hatton and Smith levels:

Level 1: Descriptive writing	Level 2: Descriptive reflection
▪ What you did. What happened.	▪ What you did and why. What could you have done differently?
Level 3: Dialogic reflection	Level 4: Critical reflection
▪ Talk to yourself – link back to previous entries you've written. Explore your situation more deeply. Look for patterns/themes.	▪ All of the above, but taking into consideration factors outside of your immediate teaching environment. E.g. does University policy influence your approach/methods? Affect of Covid19, etc.

5C.1.3 Uncovering assumptions

There are many techniques and strategies that as teachers we tend to take for granted as good or bad practice. Stephen Brookfield, who has written considerably on reflection in learning and teaching, has coined the phrase 'hunting assumptions' to show that, when subjected to critical scrutiny, some of this taken-for-granted-ness starts to break down. Brookfield is not saying that these assumptions about good teaching are necessarily wrong, just that although they tend to be unquestioningly accepted, they are not necessarily right, or right for everyone, or right every time.

His technique is to take a 'common-sense assumption' and provide one or more perfectly plausible alternative interpretations, thus undermining the taken-for-granted-ness of the assumption.

Brookfield takes a commonly held assumption and tries to find alternative interpretations, for example:

> *"It's common sense to visit small groups after you've set them a task, since this demonstrates your commitment to helping them learn. Visiting groups is an example of respectful, attentive, student-centred teaching."*

- Would students agree with this assumption?

- What other interpretations might there be to 'visiting groups'?

5C.1.4 How are you going to keep your reflective journal?
When are you going to make entries and what format will you use?

References

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