Appendix 1
Guidance notes for creating Metacognition Design Sequences

These guidance notes outline key considerations when using the Metacognition Design Framework 'I-SEE' Learning Strategies to create a Metacognition Design Sequence for use in a specific educational setting. The 'Metacognition Design Sequences Workflow' graphic on our website provides an overview of the process. The Metacognition Checklist (included at the end of this document) provides a quick prompt to ensure broad application of the five metacognitive themes.

Learning Journey:
The overall aim is to engage students in activities that involve social constructivist and constructionist learning with creation and collaboration supporting deeper learning, clear achievement of the learning outcomes, and the development of 21st Century skills supporting Education for Sustainable Development. The intention is to achieve this through creating a blended learning environment that draws on the advantages afforded by both face-to-face and online learning.

Core student activities comprising an Authentic Complex Assignment / Project involving group work and a Critical Reflection on Learning, along with additional supporting learning tasks / activities that help to scaffold the overall process, building skills and knowledge to support achievement of the final assignments.

Authentic Complex Assignment / Project.
Start with the end in mind: design a project in clear constructive alignment with appropriately planned learning outcomes for the module / learning unit (J. Biggs, 1996), that involves students in the creation of a tangible output or 'object for sharing' with clear relevance to their overall program outcomes. *For example, in the Veterinary Clinical Neurology module, students worked through a gradual disclosure clinical case using real case materials, such as clinical examination findings, laboratory reports, and imaging studies, learning clinical problem solving and progressing towards the diagnosis and management of the case. They presented this process, and the key required prior knowledge, to peers (same year and a younger year who were learning the relevant pre-clinical material) in the form of an infographic with an associated short oral presentation.*

- The aim is to place student activity central to the learning process and engage them in inquiry-based activities that involve social constructivist (Bruner, 1996; Dewey, 1966; Piaget, 1973; Vygotsky, 1978) and constructionist learning (Papert, 1993) with creation of an object to explain and discuss with peers, presenting to an authentic audience (Lee & Hannafin, 2016).
- Ensuring authenticity with obvious 'real-life' relevance, and clear linkage to program outcomes, encourages student engagement (Herrington, 2005) and meaningful learning (Hannafin & Land, 1997), aligning with the principals of andragogy for adult learners (Huang, 2002) and 'inquiry dynamics' referred to in the seven principles of blended learning from the CoI framework (Veenman, Van Hout-Wolters, & Afflerbach, 2006).
- Creating a project with collaboration supports deeper learning and social metacognition (Stanton, Sebesta, & Dunlosky, 2021), driving metacognitive skill development, in addition to other 21st Century skills, such as teamwork and communication (Jaques & Salmon, 2006).
- The assignment / project should have sufficient complexity to provide challenge to students (Kavousi, Miller, & Alexander, 2020) and hence a necessity for them to collaborate (Almaatouq, Alsobay, Yin, & Watts, 2021). This complexity is also important to afford them the opportunity to try out and practice learning strategies and develop metacognitive skills (Overton & Potter, 2008). 'Messy problems' also help them to start dealing with complexity and uncertainty (Bohm, Klaassen, van Bueren, & den Brok, 2024; Quintana, Zhang, & Krajcik, 2005).
- The final output from this process should require design / creation, equating with extended abstract level for SOLO Taxonomy (J. B. Biggs & Collis, 2014) or a higher level in the revised Bloom's Cognitive domains (Krathwohl, 2002). The former equates most appropriately with a stepwise build in cognitive complexity, the aim over the course of the learning unit. However, educators more familiar with Bloom's Revised Taxonomy may elect to take this approach as a way of framing and planning learning tasks that require higher order cognitive processes and

knowledge construction, being aware that the steps may not show a strict hierarchical progression in this model.

- Gradually building complexity of the project, through flexible scaffolding (Azevedo & Hadwin, 2005) of the process that gradually reduces, is key to helping students progress effectively (Vygotsky, 1978). Students need sufficient metacognitive and subject-specific knowledge to start using and developing their regulatory skills (Alexander & Judy, 1988; Ku & Ho, 2010). Appropriate scaffolding of tasks has been shown to be extremely important in online learning (Sharma & Hannafin, 2007) and is considered further in additional sections.
- It is also important to consider ways to support effective group work (see Introducing section)
- These approaches align with the universal design for learning principle of providing 'multiple means of engagement' (CAST, 2024) with provision of options for 'recruiting interest' and 'sustaining effort and persistence.'

Critical Reflection on Learning.

Students actively and effectively reflecting on their learning is core to the development of metacognitive skills (Rhem, 2013). Positioning this as one of the core student activities communicates the importance of this process to students (J. Biggs, 1996). This whole process also requires appropriate scaffolding as many students have limited experience of reflective practice and critically reflecting on their learning (Coulson & Harvey, 2013).

- Students need to be offered guidance on reflection (Coulson & Harvey, 2013) and effective reflective writing in the form of exemplars and feedback (Gunderson, MacDonald, & Gunderson, 2021) (see I-SEE elements below).
- Reflective components to tasks added to course work to prompt them to consider their learning at each stage help them to learn the process. Tanner provides a series of questions that educators might pose or provide students with to support this process (Tanner, 2012).
- It is important to link this into the discussions about metacognition so that students are aware of the purpose and value of this process (Chaffey, de Leeuw, & Finnigan, 2012). The overall aim is to create an ethos of metacognitive discussion within class (Tanner, 2012) and in turn links to students' reflective practice outside class, and helping to build 'shared metacognition' (D. R. Garrison & Akyol, 2015).

Introducing:

This section refers to learning resources centered around setting the scene for metacognition and subject-specific learning, linking this to prior learning and then following through with a clear structure. This overall approach is then followed through as the learning unit progresses, ensuring that modelling of metacognitive thinking is a recurrent theme.

Introduce metacognition and metacognitive strategies

- Introduce the concept of metacognition and metacognitive strategies to students and explain, or better still show them, why they are important to them through use of situated examples (Tanner, 2012). This concept of showing rather than telling is explored further in our online learning resource (accessed via our website).
- Communicate the importance and value of metacognition to students within the context of their learning and future goals. Look for ways to frame this so it has clear relevance to the module / the overall program they are enrolled in. Professor Saundra McGuire (McGuire, 2015) discusses a variety of methods for achieving this with students, for example during an introductory lecture. Examples she uses include, referring to Bloom's taxonomy to explain to students about the expectations they should have of their learning and when completing assignments. Additionally exploring the difference between learning and studying. (A variety of usable examples are available in her book (McGuire, 2015) and via our online learning resource.
- Introduce the concept and importance of having a growth mindset and learning how to progress their knowledge and understanding through receiving and responding to feedback (Bloom, 1973).
- Consider ways to include situated examples of strategy use following through with modelling and discussion of strategy use throughout the module / learning unit (Muijs & Bokhove, 2020). Some of these may be generic strategies, such as spacing of learning units rather than blocking and

cramming (Yuan, 2022). Others may be more subject specific, for example in Veterinary Medicine we use mnemonics (Odigwe & Davidson, 2005) to help prompt students to remember and consider a broad range of potential causes for particular clinical signs and strategies for approaching clinical cases. Other practical examples for integrating strategies into teaching tasks are provided by Staunton and colleagues (Stanton et al., 2021). Finding ways to explicitly teaching strategies use is beneficial and does not always occur unless deliberate attempts are made to achieve this (Kistner et al., 2010).

- Plan ways to include opportunities to encourage a dialogue around learning (Burbules, 1993) wherever possible, for example within class discussions (Tanner, 2012) (also link to feedback - see later). Introduce the concept of students progressing their learning through reflection on mistakes or successes and metacognitive approaches (Stanton et al., 2021), with an emphasis on analysis and understanding how to apply strategies, self-monitor, adjust and improve (Schraw, Crippen, & Hartley, 2006). This can be done through discussion online or face-to-face through, for example, case based learning or using approaches like exam wrappers (Pate, Lafitte, Ramachandran, & Caldwell, 2019).

Clearly structured delivery of learning resources to aid integration of knowledge.

- Consider ways to structure the learning resources in a clear, logical fashion that provides clarity to students (McGee & Reis, 2012). This may involve ordering by topics, sessions or weekly, whatever is most appropriate for the subject matter and enhances coherence. A review of effective strategies for promoting student engagement in blended learning identified this as an important theme (Heilporn, Lakhal, & Bélisle, 2021).

- Plan how the face-to-face learning links with the online resources and supports available to students, being clear of the distinct purpose that each of the components performs and communicating this to students (McGee & Reis, 2012; Oliver & Herrington, 2003).

- Pay attention to the timing and delivery of materials (online and face—to-face) so this helps to scaffold student learning as they progress through the module / learning unit (McGee & Reis, 2012).

- Consider the type of prior knowledge that you consider important as students start the module / learning unit, and how you can get them to refresh this knowledge and relate it to new content going forwards (Hattan, Alexander, & Lupo). This might include provision of relevant background information or pre-reading materials, with linked quizzes. The limitations of novice learners need to be considered, for example the accuracy of their prior knowledge (McCarthy & McNamara, 2021) and their ability to process a lot of information at once, particularly when dealing with new and unfamiliar material (cognitive lead theory) (Sweller, 1988). This all requires clear attention to scaffolding and the provision of prompts to help students reflect on and link information (Land, 2000). Prompting students to consider prior knowledge (Tanner, 2012) and helping them to start linking their new knowledge to this, emphasizing the construction of clearly structured knowledge, will heighten their understanding (Tarchi, 2015). *I use a flipped classroom approach to discuss 'muddy points' with students in Veterinary Clinical Neurology to help them clarify learning gaps and create links to prior knowledge.*

- Consider what knowledge and skills they will need to develop and at what stage and how to support their progression as the scaffolding is gradually reduced. For example, are there any threshold concepts (Barradell, 2013) that students really need to grasp to progress to the next stage?

- Pay attention to the use of accessible language and terminology or symbols as new information is introduced and discussed (CAST, 2024). Consider providing a glossary of terms or links to resources that can help students understand new terminology and avoid problems arising from language barriers.

- These approaches align with the universal design for learning principle of providing 'multiple means of representation' (CAST, 2024) with provision of options for 'language and symbols' and 'comprehension.'

- The overall aim is to support students in taking ownership of their own learning; that is far easier for them to do if they know how to find things and understand the logical flow of the learning. Overall, you are aiming to help them develop well-structured knowledge with clear integration of concepts.

Varied learning resources

- Ensure the provision of a variety of learning resources; key to student-centered approaches (Hannafin, Hill, Land, & Lee, 2014). The aim is to appeal to different types of learning styles and abilities and to ensure the accessibility of the materials. The latter should be ensured by following the principals of inclusive design (CAST, 2024) and is considered further in Appendix 2.

- Engaging, authentic content to appeal to adult learners and enhance engagement (Huang, 2002; Knowles, Holton III, & Swanson, 2014); students are far more likely to engage with content when they can clearly appreciate its relevance to them.

- The overall aim is for student-centered learning with choice and personalization. Considering the latter in detail is beyond the scope of these guidance notes, however interested readers are referred to this review (Bernacki, Greene, & Lobczowski, 2021). Personalization with respect to responsiveness to student prior knowledge, the provision of student choice and flexible scaffolding, along with personalized feedback, are all important areas for consideration (Azevedo & Hadwin, 2005; Bernacki et al., 2021; Sharma & Hannafin, 2007). The use of personalized greetings in announcements and general emails are all ways of building 'social presence' online, one of the three key components for supporting a Community of Inquiry (COI) highlighted in the COI framework (D Randy Garrison, Anderson, & Archer, 1999).

- Overall, these approaches all enhance both accessibility and student engagement.

Structure to support effective collaboration

- Social constructivism is an important component of the framework with student collaboration key for completion of the complex assignments / projects. It is important to consider ways to support effective group work and collaboration, through consideration of the educational design, the social structure to support it and the technological perspectives (Kirschner, Strijbos, Kreijns, & Beers, 2004). The overall aim is to promote 'open communication and trust', aligning with seven principles of blended learning from CoI framework (Vaughan, Cleveland-Innes, & Garrison, 2013).

- One aspect of educational design was already considered within the learning journey section; the choice of a challenging and authentic assignment / project that requires the generation of a 'real' output by the students (Lee & Hannafin, 2016). The character and complexity of the chosen task is important on many levels (Almaatouq et al., 2021). It not only helps students to understand the relevance, enhancing intrinsic motivation (Lee & Hannafin, 2016), but is also important from the perspective of transfer-oriented learning (D'Eon, 2005) and the requirement for students to both adopt strategy use (Muijs & Bokhove, 2020) and collaborate in order to succeed (Saleh & Large, 2011). It also helps them to start dealing with complexity and uncertainty (Bohm et al., 2024).

- Task ownership within the group is also important to consider from a pedagogical perspective, the accountability of individual students and 'positive interdependence,' or the positive gain derived from working together, are two key components (Kirschner et al., 2004). This can be supported through guiding students to assign meaningful roles and promoting active discussion and feedback between students (Oakley, Felder, Brent, & Elhajj, 2004).

- Linked to task ownership, learner control is also important. Students respond positively to being able to play an active role in determining their own learning. The provision of flexibility and a more student centered approach will allow students to plan and work together more effectively as they become more invested in the process (Lee & Hannafin, 2016).

- The social aspects of the group work require consideration (Oakley et al., 2004). The provision of guidance on effective group work, communication of the expectations for mutual respect, accountability, and active participation, along with clear channels to pursue in the event of problems are things to consider.

- The technological aspect of this process is considered more in Appendix 2.

Integrate metacognitive strategy use with subject-specific material

- Initially students learn metacognitive skills most effectively through active use in a specific setting (Gutierrez, Schraw, Kuch, & Richmond, 2016), as their metacognitive knowledge grows and their skills progress, they start to learn more general knowledge about metacognition and learn to transfer the strategies they have learnt, applying them in different settings (Neuenhaus, Artelt,

Lingel, & Schneider, 2011; Schraw & Moshman, 1995) Hence, it is important to offer the opportunities to learn and practice their skills in authentic settings (Ben-David & Zohar, 2009).

- It is important to think about highlighting metacognitive strategies that are likely to help students, by actively referring to them as subject-specific topics are discussed (Tanner, 2012). Examples might include the use of mnemonics or the creation of patterns to aid learning (discussed further in the examples provided by McGuire in our online learning resource (McGuire, 2015)), encouraging students to question why and how things occur and to explain out loud to peers or as if presenting to peers to ensure they really understand (Ku & Ho, 2010, Wulfemeyer, 2019 #54).
- The modelling of metacognitive thinking by the educator throughout the module / learning resource is fundamentally important (Muijs & Bokhove, 2020; Tanner, 2012). For example, consider highlighting how to approach tasks using worked examples and 'thinking out loud' approaches (Poorman & Mastorovich, 2008), explaining your thought processes and the learning strategies that you have used or found useful when you originally approached the topic.

Signposting:

This section refers to learning supports focused on the provision of clear instructions and guidance to students and the communication of expectations. All aimed at helping them to plan and structure their learning, linking concepts and building connections. As for introducing, this overall approach is then continued through the module / learning unit.

Clearly communicate requirements and expectations for learning tasks

- Clearly explain how the learning tasks relate to achievement of the learning outcomes (J. Biggs, 1996). Explaining why a task is being done and its true relevance promotes student engagement; it is important for adult learners to understand why particular knowledge is important (Halupa, 2015).
- Provide clear guidance information, exemplars and marking rubrics to clearly indicate to students what is expected of them and how their work will be evaluated (Chickering & Gamson, 1987; Gunderson et al., 2021).
- The communication of an expectation of high standards is one of the seven principles identified for the achievement of good practice in undergraduate education (Chickering & Gamson, 1987) and then their updated version for blended learning (Chickering & Ehrmann, 1996).
- This provision of clarity in expectations allows students to start actively planning their learning and is a key to them starting to learn and develop regulatory metacognitive skills (Gunderson et al., 2021; Muijs & Bokhove, 2020).
- This approach, along with reflective practice and discussions about progression of learning and a growth mindset, all align with the universal design for learning principle of providing 'multiple means of engagement' (CAST, 2024) with provision for opportunities for 'self-regulation.'

Clear regular announcements / e-mail updates

- This also provides an important way of guiding students and helping them plan their learning. It can also be used to form an effective part of the scaffolding process.
- These approaches can be used as a way of drawing student's attention to key materials / learning activities as the module progresses and to help to keep them focused on important areas.
- Regular announcements or emails can also play a key role in the establishment and maintenance of a channel of communication with students. Garrison and colleagues highlighted the importance of 'Social Presence' in their Community of Inquiry Model (D Randy Garrison et al., 1999); regular announcements offer one component that can help in building this 'presence,' particularly if they are personalized and aim to develop a rapport with students.

Support clear effective knowledge construction

- Assimilation theory states that an important part of effective learning is accurately and appropriately connecting and relating new information and concepts to those already known, building structured knowledge and developing a new understanding based on this (Ausubel, 2000). This process is far more effective in an active learning environment, particularly if students are

supported and prompted to consider linkages and prior learning and the process is actively scaffolded (Tian, Zhang, Zhang, Dai, & Lin, 2020).

- The accuracy and depth of student's prior knowledge is crucial; if there are deficits or misconceptions, this will hinder future learning (Ambrose, Bridges, DiPietro, Lovett, & Norman, 2010). Hence, helping students to embrace and challenge their prior learning as they start new topics is critical.

- Linked with the comments in *Introducing*, actively consider how linkages can be highlighted to students, for example by linking back to prior knowledge and foundational concepts introduced in earlier modules. Highlighting the importance of this approach is an important part of *signposting* and helping students learn how to learn effectively and to self-regulate.

- Additionally, the way students organize their knowledge has a huge impact on their ability to retrieve, effectively utilize, apply, and transfer this knowledge (Novak, 1980). Hence, offering opportunities for them to develop well-structured knowledge with meaningful and accurate linkages of concepts and information is also important (Tian et al., 2020). Prompting students to consider how topics relate to each other by asking open-ended questions in class or within weekly announcements / emails updates can keep challenging students to keep thinking about linkages.

Support dialogue around metacognition

- The provision of materials that clearly explain expectations to students (see above) is helpful to allow them to start planning and examining their learning approach against a guide; important as they practice metacognitive regulatory skills (Gunderson et al., 2021).

- Use of the online environment to prompt students offers an opportunity to 'have their ear' outside normal class time, for example, including prompts in e-mails / announcements to remind them to link components or reflect on certain aspects or discussion boards, promoting and supporting dialogue around learning. In essence, drawing of some of the many benefits of blended learning (D Randy Garrison & Kanuka, 2004).

Enabling:

This section refers to learning resources designed to help students consider and discuss their learning as they actively progress with learning tasks and activities, thus learning and practicing metacognitive strategies whilst effectively building their subject knowledge and skills.

Providing opportunities for students to plan, monitor and assess their learning

- Consider provision of checklists that simply highlight the tasks students need to complete or, in the case of more complex tasks, help to break them down into more manageable 'chunks.' This helps students to learn this as a strategy for making complex tasks more achievable and helps them to learn to plan and self-regulate their learning; it also helps students learn to work within their cognitive load (Nückles, Roelle, Glogger-Frey, Waldeyer, & Renkl, 2020; Sweller, 1988).

- The provision of reusable learning resources that provide students with ways of trying out learning approaches and self-testing (Hardie et al., 2021). *For example, this approach was used in the Veterinary Neurology Module to allow students to progress through worked case examples and in the DigiLife module as a way of allowing them to practice key skills.*

- Plan relevant multiple choice or single best answer questions for them to check in and test themselves on low-stakes tests that they can discuss the answers to in class (Pate et al., 2019). Placing these strategically through the module with increasing complexity allows students to stay on track with their learning plan and is another way to scaffold learning. This approach can also be used as an effective way of spacing learning and helping students to move away from just cramming learning of facts prior to an end of trimester exam (Yuan, 2022).

- These approaches and those in the evaluating section align with the universal design for learning principles of providing 'multiple means of engagement' and providing 'multiple means of action' (CAST, 2024) through provision of options for 'self-regulation' and 'executive functions.'

Scaffolding of tasks which progressively increase in complexity

- Consider how to plan learning tasks so they start more simply and gradually increase in complexity to support learner progress this avoids the tendency for cognitive overload in novice learners (Sweller, 1988).

- The use of checklists can also provide an effective way of scaffolding tasks. One approach is to start with detailed checklists that are gradually reduced, or another approach is to link the gradual release of materials to goal achievement and the completion of structured tasks. *For example, this approach was used in the Veterinary Neurology module as a way of framing the approach to a complex clinical case. New case information was released as students complete tasks on the checklist and progress through a case as they would in a practice setting. This offers a powerful way of modelling the approach to clinical cases and scaffolding it for students with limited experience of the process. The amount of support can be reduced as their skills improve.*
- Having students complete small components of the overall task and submit short commentaries on their progress allows the educator to gauge their progress and provide individual or group guidance as necessary. This allows the provision of variable scaffolding that has been shown to be far more effective than fixed scaffolding (Azevedo & Hadwin, 2005).

Opportunities for discussion and a dialogue around learning

- Planning ways to provide students with opportunities for discussion and application of the subject material whilst actively applying learning strategies allows them to experience metacognitive strategy use in the subject-specific setting (Tanner, 2012). *For example, in Veterinary Neurology a flipped classroom approach was used to introduce how to perform a detailed neurological examination of the patient. Students watched videos and identified 'muddy points' for discussion in class helping them to identify areas they had not understood and needed to discuss for clarification. During class discussions, the educator modelled their own approach by 'thinking aloud' and highlighting their thought processes as they completed the examination and identified where in the nervous system the problem was likely to be occurring. Additional sessions were used to discuss the approach to clinical reasoning and planning of clinical investigations, each modelling strategies applicable to the specific setting and used to highlight students considering their learning. These discussion classes all link into the overall complex project and students working to problem solve their own clinical cases.*
- This discussion of areas of confusion or 'muddy points' can be a very effective way of helping students to start identifying areas they find challenging and then helping them to troubleshoot (Tanner, 2012).
- They also require opportunities for developing shared understanding of their subject-specific and metacognitive knowledge (D. R. Garrison & Akyol, 2015) through discussion (synchronous and / or asynchronous), modeling of metacognitive thinking (for example, educator modeling, reflective questions), and practiced and refined application through learning activities.
- Considering ways to link each class back to students checking in with their learning and reflecting on their progress is fundamentally important (Medina, Castleberry, & Persky, 2017). This process can be aided by the educator highlighting through role modeling in class how they use reflective practice to plan ahead, check in on their progress and reflect on how it went (Chaffey et al., 2012). It is also important to link this to the students' Critical Reflection on Learning, having them write short reflective pieces at strategic points through the module is one way of scaffolding this overall process. Tanner refers to this type of approach when she refers to getting students to 'think like biologists' and role modelling of this type of thinking to students (Tanner, 2012).

Evaluating:

This section refers to learning supports designed to help students to grow their metacognitive regulatory skills through assessing, monitoring, and regulating their own learning using feedback and dialogue around learning.

Provision of timely, targeted, actionable feedback providing opportunities for students to assess, monitor and reflect on their progress

This is the key to this component of this 'I-SEE' learning strategies, designed to help students to effectively check in with their learning and accurately assess their progress then then can learn to self-regulate and adjust their learning approaches as necessary. This very closely links to the resources provided for enabling but considers the types of supports that can be used to effectively deliver feedback. The opportunities for students to start to self—assess are very important as often they do not accurately self-assess and need to work at developing this skill (Hacker, Bol, & Bahbahani, 2008).

- Automated feedback can be a very effective way to deliver timely, targeted feedback (Cavalcanti et al., 2021), for example as students approach multiple choice or single best answer questions. This can be in the form of very specific granular feedback about specific answer choices, more general hints or explanations about the correct / incorrect answer choices or global feedback on their performance over a series of questions. This approach is a very effective, time efficient way for staff to achieve all important timely feedback (Nicol & Macfarlane-Dick, 2006), particularly when there are large numbers of students.
- Peer feedback provides a very effective way of helping students to learn, particularly if they provide their feedback based on evaluation of their peers against structured marking rubrics (Gunderson et al., 2021). This approach aids clarity around the criteria that should be used, draws student's attention to the marking rubric and enhances awareness of their own performance in addition to exposing them to the work of others which broadens their learning and self-awareness. It can be an effective way of helping them develop greater accuracy in their self-assessment, which can be a problem with weaker students (Kruger & Dunning, 1999), and aiding development of shared metacognitive knowledge (D. R. Garrison & Akyol, 2015).
- Educator feedback can be provided in a variety of formats, such as verbal, written or video, all appealing to different learning styles and preferences. It can be provided to individuals or groups, again utilizing educator time effectively. However, consideration also needs to be given to how best to engage students in the process to ensure it is as effective as possible (Carless, 2022).

Opportunities for discussion and a dialogue around learning

- There needs to be consideration given to the supports required to continue to promote dialogue around learning, whether internally within the learner or through discussion with their peers or instructors (Burbules, 1993; Hajhosseiny, 2012). This does not necessarily happen just because a student receives feedback. They need to be encouraged to 'complete the feedback loop,' considering and acting on the feedback they have received (Carless, 2019).
- Consider highlighting the expectation that responses to feedback should be discussed within their Critical Reflection on Learning or broadly link the consideration of responses to feedback to class discussions / discussion boards.

Learning journey:

Returning to the concept of the learning journey; it is important that the whole approach to student activity is framed around reflection on learning, emphasising the importance of a growth mindset and the active progression of learning and skills. It is important to encourage an ethos of questioning and dialogue around learning, building linkages to prior learning and between concepts. It is also important to find ways to encourage students in completion of the feedback loop, that is, actively responding to feedback and using it to regulate their learning. The use of blended learning and online learning supported through technology offers a unique opportunity to extend the period over which educators can have 'metacognitive influence'.

As you, the educator, plan your approach for this learning journey, you should consider ways in which technology can aid you in achieving this, both from your students' perspective and your own perspective. The technology you use should offer a particular affordance, that is, serve a specific purpose – explored in Appendix 2.

Metacognition checklist:

This checklist offers a series of questions to ask yourself as you design each component of your module / learning unit. The aim is that it helps you to ensure broad application of the five metacognitive themes throughout the Metacognition Design Sequence that you are creating. Talking a holistic approach that targets multiple aspects of metacognition, including knowledge, regulation and, social components, is likely to have a far greater impact on learning (Donker, De Boer, Kostons, Van Ewijk, & van der Werf, 2014; Tanner, 2012). This checklist can be a very useful way of becoming metacognitive about one's own teaching and as Tanner suggested, "cultivating a metacognitive lens towards one's teaching" (Tanner, 2012).

- **Have opportunities been made to explicitly teach metacognitive strategies?**
  The aim is to make opportunities to discuss metacognition and strategy use in context as content knowledge and skills are developed.

- **Have opportunities been included that allow modelling of metacognitive thinking?**

- **Do learning tasks / assessments pose the appropriate level of challenge?**
  The aim is to set overall tasks with a level of complexity that requires students to work together and invoke strategy use to be able complete them. However, they should be appropriately scaffolded to allow students to work towards their successful completion.

- **Are you promoting and developing metacognitive dialogue?**
  The aim is to engender an ethos of questioning and discussion, aiming to probe students to think about their learning and level of understanding.

- **Are you explicitly teaching students to manage / organize of their own learning?**
  The overall aim is to provide opportunities for guided, progressing to independent practice for your students.

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