Appendix 2: Guidance notes for aligning technology with the 'I-SEE' learning strategies.

Learning task* / Educational goal	Learning requirement		Technology affordance		
	Student considerations	**Staff considerations**	**Student perspective**	**Staff perspective**	***Specific examples of technology usage*** *(F2F examples included for consideration - blended learning)*
Learning journey: core student activity Authentic Complex Assignment / Project and Critical Reflection on Learning with associated learning tasks / activities. *Start with the end in mind - engage students in activities that involve social constructivist learning with creation and collaboration supporting deeper learning, achievement of the learning outcomes and development of 21st Century skills. Recognizes 'tripartite relationship between learner-tool-teacher' and the importance of agency both from student and staff perspectives (Elen and Depaepe, 2025).*					
Authentic complex assignment / project with creation of a final output (object for sharing) and involving group work.	Clear **real-life relevance** to promote engagement	**Complexity to provide challenge** and a necessity for collaboration to succeed. Final output that involves design / creation of an object for sharing	Incorporation of **engaging real-life materials** / links to enhance interest and engagement.	**Media affordances**. Ease of provision – **multiple formats**. Consider 'read-ability,' 'view-ability,' 'listen-ability,' 'watch-ability,' etc.	Use of **subject—specific examples**. Case study materials such as case records / reports / videos / audio files / photos etc. Provide editable files (CAST, 2024)
	Variable scaffolding - broken into manageable steps with gradual build in complexity.	Achievable with **realistic time input**	**Clear, easy to follow structure** that uses authentic design and resources to help students learn strategy use and self-regulation along with the development of subject-specific skills & knowledge.	**Ease of use** Practical format Easy and realistic use of time	**Checklists** and submission of mini assignments linked to **conditional release** of materials / additional information / **prompts** / use of **worked examples**. **Announcements / e-mails for guidance** Flexibility in timelines to allow self-regulation *Discussed further in Evaluating.*
	Clear **actionable feedback** to guide progress.	**Clarity in communication of expectations**	*Discussed further in Evaluating.*	*Discussed further in Evaluating.*	
	Mechanism for effective group discussion **Student engagement** with the group work process is important.	Need to incorporate a **practical approach for group work**. Pedagogically, important to consider **task ownership** (discussed in introducing), the **features of the task** (see above) and **task control** (Kirschner et al., 2004) Also type of **content** (factual/ conceptual etc.) and **overall pedagogy** (Bower et al., 2010)	**Gradual disclosure** mechanism to facilitate group work and provide feedback **Synthesis affordances** - the ability to combine multiple tools and create integrated combination of different media types Mechanisms to allow students to regulate their own approach to the project (**task control**)	**Social affordances** - mechanisms to promote active discussion, sharing and co-design between group members. **Consider requirement for synchronous / asynchronous interaction** Provide mechanisms that **allow students to plan and regulate** their own approach	Asynchronous group discussion via **discussion boards** or synchronous via **Virtual Classrooms, Zoom / Microsoft Teams** or similar. **Mechanisms for sharing** within these platforms or via stand-alone platforms such as Padlet or Mural. Students may also select to have group discussion face-to-face. Also explored in detail in this article (Bower et al., 2010)

Learning task* / Educational goal	Learning requirement		Technology affordance		
	Student considerations	Staff considerations	Student perspective	Staff perspective	*Specific examples of technology usage* *(F2F examples included for consideration - blended learning)*
Critical Reflection on Learning - creation of an output in which they self-appraise and reflect on their learning across the whole learning unit / module.	**Integration of thoughts on learning** across the whole module Broken down into **steps** **Clarity in expectations** **Formative feedback**	Model metacognitive thinking throughout module Communicate **expectation of high standards** - extended abstract SOLO Taxonomy (Biggs and Collis, 2014) / high level cognitive dimension Bloom' taxonomy (Krathwohl, 2002)	*Discussed further in Introducing and Enabling* **Clear**, easy to follow **structure** with clear **guidance and signposting** of expectations.	*Discussed further in Introducing and Enabling* **Practical format** for organising this **Easy and realistic use of time**.	*Discussed further in Introducing and Enabling* Upload as **short assignments** building to a larger final piece or use of **E-portfolio**.
	Students encouraged to generate **SMART goals**	Achievable with **realistic staff time input**	Provision and receipt of **peer feedback** helps with clarity around expectations.	Use of peer feedback can help **manage time pressure**.	**Use of VLE** to provide feedback in a variety of formats, to the group, individually and mechanisms for peer feedback (see below).
Individual assessment piece(s) relating to achievement of the learning outcomes.	**Clear understanding of why the assessment is relevant** and a valuable use of their time. Clarity in how it **relates to learning outcomes** **Clarity in expectations**	Clear **constructive alignment** of the assessment and learning outcomes (Biggs, 1996) Achievable with realistic time input	**Emphasis affordances** - possible to provide guidance materials and highlight their importance. Provision of clear accessible examples / instructions	**Time affordances:** Allows delivery of this information outside normal class time in clear format that minimises multiple individual enquiries from students. Ease of delivery outside normal class time	Use of **VLE to upload guidance material and links** to previous assessments (exam papers etc.) also **links to websites / YouTube videos** that explain approaches. Use of **discussion boards / announcements** to allow clear delivery of information to the whole group.
	Flexibility in the type of assessment in line with UDL 'multiple means of action and expression' provision of options for 'expression and communication' (CAST, 2024)	Consideration of **student choice** in assessment type for improved equity where this may be possible.	**Synthesis affordances** - Choice in the variety of software packages available to help them create their outputs.	The ability to collate the materials submitted by students. Cross-platform compatibility Freeware / license agreement for broad student use	Access to various tools, for poster / video editing etc. Use of the **VLE to allow submission of a variety of media formats** - posters / infographics / video / slides / text / audio. Creation of objects for sharing with authentic audiences

	Learning requirement		Technology affordance		
Learning task* / Educational goal	Student considerations	Staff considerations	Student perspective	Staff perspective	*Specific examples of technology usage* (F2F examples included for consideration - blended learning)
Introducing: *learning resources centred around setting the scene for metacognition and subject-specific learning, linking this to prior learning and then following through with a clear structure. This approach is then followed through as the learning unit progresses with modelling of metacognitive thinking.*					
Learning about metacognition - building towards students completing their Critical Reflection on Learning.	Appreciate the **importance & value of metacognition** in the context of their learning & future goals.	Consider ways to **introduce and situate metacognition** and its relevance to your students for their specific discipline	**Engaging, relevant examples** can be provided to introduce metacognition, growth mindset and to start students thinking about the value of feedback. **Multiple means of representation** not reliant on a single sense - alternatives for audio / visual information (CAST, 2024)	**Media affordances.** Ease of provision – **multiple formats**. Consider 'read-ability,' 'view-ability,' 'listen-ability,' 'watch-ability,' etc. Customisable content that users can adjust for themselves.	**YouTube** examples of metacognition in subject-specific settings. Provide editable files (CAST, 2024)
	Understand the concept and **importance of a growth mindset** with progression of knowledge and skills guided by feedback.	As above for **growth mindset, giving and responding to feedback** and what it will mean to them in their future careers.	As above. Particularly useful as it offers opportunities to **'show rather than tell'** students how things are important through stories and multimedia.	As above. The availability of pre-made materials on the web provide huge opportunities to improve student engagement.	**Austin's butterflies** as an example about constructive feedback. **Web pages** introducing metacognition, growth mindset and feedback.
	Understand planning, regulation and monitoring of learning Develop awareness of strategy use.	**Situated examples of strategy use following through with modelling and discussion of strategy use** throughout the learning unit / module.	As above	As above	**Introductory lecture / resource** introducing why metacognition is important linked situated for the subject area and linked to introduction of the learning unit / module.
	Encouragement to actively plan learning and effectively construct knowledge linked with prior learning	Introduce students to concepts such as **SOLO Taxonomy** or **Bloom's taxonomy, pre-reading** prior to class to aid their understanding of the expectations and to **help them develop linkages** and start to plan their learning.	**Metacognitive affordances** - aiding student ability to plan through clarity in structure and availability of lecture / practical class synopses etc.	Plan ways to present material in a **clear format** with information about **what to expect / how it links to previous material**	Examples of how to make this relevant are provided in example lecture slides by **Prof McGuire.** 'The Study Cycle' is also a good way to introduce some important metacognitive strategies practically to students. *This can be done face-to-face or online* **Provision of links** to pre-reading materials.

Individual work throughout the learning unit / module This links into learning tasks that build towards completion of the **subject-specific learning task(s) and Authentic Complex Assignment / Project** and hence achievement of the learning outcomes. This also links into **critical reflection on learning** and students progressing their metacognitive knowledge and skills through application in practice. Critical to link this to the subject-specific learning. *This section refers to the **overall design** of the learning unit / module. It also refers to **subject-specific content resources and lectures**.*	**Clarity** in the format of how learning resources are delivered. **Accessibility** of material Appealing to **different learning types.** **Engaging authentic** content that appeals to adult learners. Aligning with principle of multiple means of engagement (CAST, 2018) **Student-centered learning** with **choice** and **personalised learning** Help students link to **prior knowledge** knowledge and build **structured knowledge** Help students gain **ability to self-regulate learning.** (Addressed more in signposting).	Consider design of a **clear 'learning journey'** that makes sense to students and guides them through learning tasks highlighting the resources and supports available. **Consistent structure** to develop student trust. **General accessibility** relating to availability of resources such as internet speed etc. **Accessibility** relating to clarity in use of language, symbols or notations. Specific access requirements follow the **principals of universal design (CAST, 2024).** Awareness of affording flexibility to students supporting **different learning styles and abilities** **Enhance student's awareness of the relevance** of topics / concepts. Help promote deep learning with development of linkages and encouraging transferability Student choice / personalisation requires consideration as the **overall layout** is considered. **Provision of background information, pre-reading or lecture / class synopses** prior to event help students learn to link and plan	**Navigational affordances** - clear structure **Accessibility affordances** - varying learner requirements based on resource availability and ability. **Adaptation affordances** - ability of technology to adapt to user requirements. **Choice affordances**: Variety of formats - written / images / video **Media and choice affordances**, ability to link to engaging' real-life' content with clear relevance to the subject matter. Opportunity for open enquiry-based learning. **Personalisation affordances Navigation affordances** linear /non-linear progression through content - personally meaningful way **Emphasis affordances** - highlight important resources. Encourage revision prior to class activate prior learning. As above.	Ability to present variety or resources with good **media affordances** such as listen-ability / view-ability, good **spatial affordances** such as resize-ability to suit different devices. **Temporal affordances** - access anywhere / anytime / synchronicity Consider quality of internet connection and ability to work on/off-line. **Assistive technologies.** Consider design of documents for use with **screen readers** and provision of **editable documents** Provide 'multiple means of action and expression' -options for 'physical action' (CAST, 2018) **Multiple means of representation** - alternatives for audio / visual information (CAST, 2024) **Time affordances**: availability of pre-made materials, links to external content. Achievable within staff time constraints. Consider ways to promote meaningful connections between real-life scenarios and key concepts using **multiple media formats** Balance- best method for the subject; **linear progression vs exploratory approach.** Consider subject-specific requirements / adequate scaffolding. **Ensure clarity** around quantity of material still to release if done gradually to aid planning self-regulation.	Clear, consistent layout within **virtual learning environment** (VLE) with alternative pathways supported and considered. Avoid use of language descriptions such as link below – **use appropriately named hyperlinks**. For example, **YouTube adjusts for bandwidth** whereas video resources may have fixed quality slowing access. Use of **accessibility checkers** in VLE to provide equitable online learning experiences. **'Closed captions'** on YouTube etc. Consider the mechanisms for interaction with the VLE –use of assistive technology, voice commands etc. **Links to external websites / YouTube / Educational resources** for pre-made content. In addition to above, **relevant news articles / journal articles / images / audio recordings** etc. **Glossary of terms** for new technical words / symbols etc. consider multimedia use here. **Q and A list** for frequently asked questions **Gradual release** of materials with progression or release based on **personalisation and 'release conditions'** available within VLE. Provision of **links to pre-reading with reflective questions** linked to prior learning and self-assessment. Consider use of **multimedia examples** that emphasise linkage to prior learning, help students to link important concepts and aid their comprehension of the relevance of information.

	Learning requirement		Technology affordance		
Learning task* / Educational goal	**Student considerations**	**Staff considerations**	**Student perspective**	**Staff perspective**	***Specific examples of technology usage*** *(F2F examples included for consideration - blended learning)*
Group work throughout the learning unit - linking particularly the **Authentic Complex Assignment / Project, and Critical Reflection on Learning** along with **subject-specific learning task(s)**, (as above for individual learning tasks). *This section refers to the **overall design** of the learning unit / module, in particular **practical classes / tutorial classes / discussion groups***	Students **collaborating in effective groups** for the group project. Mechanisms to **promote effective sharing** of ideas within collaborative classes Awareness of **metacognitive strategies** and when to use them. **Gradually building skills and level of application** towards creating of the critical reflection on learning	Introduce a **structured approach to group work** - help students plan roles and task allocation. Consider ways to **facilitate and encourage engagement** and discussion. Important to incorporate ways to introduce **discussion around strategy use** and to **model metacognitive thought processes** throughout all practical / group discussion classes	**Mechanism** to aid student planning of group work and allow ways of effective collaboration. **Socialisation affordances** - important to allow ways that enhance discussion **Participatory affordances** - Opportunities to facilitate students working together on shared documents / online platforms / varied media types **Emphasis affordances** - draw students' attention to approaches with examples. **Engaging materials** delivered via flipped classroom approach. **Temporal affordances** - resources available to review whenever suits the student.	**Ease of delivery** **Practical** to manage **Clarity** in use Consider the requirement for **synchronous / asynchronous** interaction and how students will share materials. Use of the **flipped classroom** approach can help focus class time on the discussion of approaches and strategy use after students have tried tasks before class	**Checklists** to help student plan roles. **Guidance information** around effective group work. *In the blended situation - important to decide which classes will work better face-to-face and which work well online* **Discussion boards** or **within class synchronous discussions** for example Zoom / face—to—face Delivery of lectures / videos / multimedia within the VLE with task for students to complete prior to synchronous discussion in class

Learning task* / Educational goal	Learning requirement		Technology affordance		
	Student considerations	**Staff considerations**	**Student perspective**	**Staff perspective**	***Specific examples of technology usage** (F2F examples included for consideration - blended learning)*
Signposting: learning supports focused on the provision of clear instructions and guidance for students and the communication of expectations. Helping them to plan and structure their learning linking concepts and building connections.					
Individual and group work throughout the learning unit / module	**Awareness of requirements & expectations** for tasks / assignments and ultimately achievement of the learning outcomes. Guidance on the overall **learning context** and how it **links to prior learning.**	Consideration of how to clearly **communicate expectations** and why certain aspects are important. Consideration of how to **link to important foundational knowledge** and help students identify any **deficits / misconceptions in prior knowledge.**	**Metacognitive affordances** - allowing students to start planning. **Emphasis affordances Media and choice affordances**, ability to link to engaging 'real-life' content with clear relevance to spark interest and encourage connections	Ease of delivery with options for a variety of formats - **media affordances** and **access affordances**. **Ease of delivery**	**Guidance documents** and **exemplars** of previous students' work delivered through the VLE.
	Clarity about the assessment strategy	**Clarity in communication** of how material will be assessed. **Marking rubrics** using **clear accessible language** and **clear indicators of performance** Provision of **exemplars** Consideration of how to **communicate clearly, consistently and regularly**- helps students to navigate, find materials and plan. Grows trust.	**Metacognitive affordances** - allowing students to start planning and considering how to monitor their learning. **Emphasis affordances** **Metacognitive affordances** - allowing students to continue planning.	**Clarity** in how this is provided and linked to the various assessments / learning tasks **Time affordances** - achievable within available time constraints **Navigation affordances** - consider linear / non-linear pathways and how to maintain clarity.	**Marking rubrics** - can be attached to guidance documents / delivered linked to assessments in VLE. **Hyperlinks** to important information within the VLE. Regular **announcements** / **e-mail updates or prompts** with links to relevant materials in the VLE. Use of **hyperlinks** to enhance ease of access. *Also, reminders in class about important information & resources*
	Content easily **accessible** with timely delivery. **Guidance on progression** through the module / learning unit and its attendant activities **Learning pathway is clear and perceived as relevant** to the student. Learning pathway, content and activities are **accessible and inclusive**	Provision of a **clear learning pathway** considering how **engagement** can be increased by **connecting more personally and directly with students.** Enhance engagement by increasing direct relevance to students as individuals Follow **principals of inclusive design and ensure universal accessibility** (CAST, 2018).	**Emphasis affordances Personalisation affordances** - allow delivery of more targeted materials **Metacognitive affordances** - allowing students to continue planning and monitoring, particularly as they receive targeted reminders and prompts **Personalisation affordances** - allow delivery of more targeted interactions and prompts to students.	**Navigation affordances** - ability for students to browse between sections and resources following links and move linearly and non-linearly through materials. **Personalisation affordances** - allow delivery of learning in a way that is more appropriate and relevant to individual students. Enhance engagement. **Access affordances** - consider issues such as impaired vision / hearing / dyslexia etc. (CAST, 2018)	**General features within the VLE** also paying attention to overall layout and clear sections, links to materials, providing external links and short explanations to aid clarity. **Personalisation of emails / announcements / release conditions** linked to task completion or checklists. Use of **accessibility checkers** in VLE to provide equitable online learning experiences. **'Closed captions' on YouTube** etc.

	Learning requirement		Technology affordance		
Learning task* / Educational goal	**Student considerations**	**Staff considerations**	**Student perspective**	**Staff perspective**	***Specific examples of technology usage*** *(F2F examples included for consideration - blended learning)*
Group work throughout the learning unit	Working together in **effective groups** for the group project.	Support **structured approach** to group work and consider ways to support dialogue.	**Socialisation affordances.** Provide examples of effective group work	Provide structures to **support group cohesion and dialogue** Consideration of the requirement for **synchronous / asynchronous interaction**	**Guidance information / videos** to emphasise the importance of the group structure **Mechanisms for group discussion** for example Zoom / Microsoft teams of face-to—face. Use of **sharing platforms** such as Padlet or Mural.
Enabling: 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					
Individual work throughout the learning unit / module	**Mechanism to check in, plan and regulate** approach to learning Students need to learn to take responsibility for their learning and to start to plan and monitor Students need to see and experience **strategies in action.** **Learn and practice strategy use** in a setting that is relevant to their learning	Clear structure to help students plan tasks and **break them down into manageable sections** Consider ways to **scaffold tasks** appropriately - flexibility / gradually reducing Consider how to **identify key strategies** for students to recognise and start to apply. Provision of relevant, engaging assessments / assignments with mechanism to **allow students to start self-testing** -trying out skills and knowledge.	**Metacognitive affordances** - mechanisms to plan and monitor learning The **provision of prompts** to challenge students to think about their learning - **technology affords the ability for this to occur outside normal class time** **Emphasis affordances Media affordances** - variety of content used to promote authenticity and engagement **Temporal affordances** - can be completed whenever suits the student. **Personalisation affordances** ability to choose what is relevant to them	**Time affordance** - practical within time constraints Technology affords staff the ability to **influence over a longer period and outside normal class time** also to 'reach' students in a more targeted fashion. Use varied **authentic formative assessment** materials that are relevant to the learning outcomes and assessment strategy. As above, in each case considering '**multiple means of action and expression'** with varied use of media and tools for students to create with (CAST, 2024)	**Checklists** breaking down tasks into manageable chunks - within VLE or face-to face. Delivery of **personalised responses** or the **conditional release of content** based on checklist completion or the upload of assessments **Quizzes** with multimedia content **Reusable Learning Objects** that contain real-life content and situations. As above

Learning task* / Educational goal	Learning requirement		Technology affordance		
	Student considerations	**Staff considerations**	**Student perspective**	**Staff perspective**	*Specific examples of technology usage* *(F2F examples included for consideration - blended learning)*
Group work throughout the learning unit / module	**Appropriate mechanism to promote collaborative learning** Development of collaborative and communication skills Development of a sense of being part of a learning community	Consider mechanisms to encourage collaboration between students with attention to **provision of opportunities to discuss learning and model metacognitive thinking.** Consider mechanisms to support **a community of enquiry**	The provision of **prompts to challenge students to think about their learning** - technology affords the ability for this to occur outside normal class time. **Communication affordances.** Opportunities for students to interact and share ideas / discuss challenges	Consider how to deliver feedback or prompts in a way that **stimulates students to consider their learning** and discuss their learning and strategy use with peers. Consider ways to promote ongoing discussion and a sense of belonging	This can be achieved using synchronously and asynchronously through **in-class discussion**, **discussion boards** and via **targeted feedback** within the VLE. *Blended learning - consider inclusion of this within in-class discussions face-to-face.* **Discussion boards or 'blogs'** within the VLE.
Evaluating: 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.					
Individual work throughout the learning unit / module	**Mechanism to check in, plan and regulate learning through self-assessment** **Provision of timely actionable feedback to aid progression** Develop the ability to set **SMART goals** **Enhance student awareness of their learning and 'self-dialogue 'around learning**	Consider a **variety of ways in which relevant, personalised feedback** can be provided to enable students in management of their goals Balanced against time constraints. Formative feedback using a combination of **peer and staff-based approaches.** Aim for constructive, actionable, mastery-oriented feedback that helps students to develop and achieve SMART goals and promotes self-regulation. **Peer assessment** helps to enhance student self-awareness of learning	**Metacognitive affordances** - key to regulation of learning through ability to plan, monitor and reflect on learning **Emphasis affordances** - allows attention to be drawn to important features. **Personalisation affordances** - adapted to meet their requirements	**Synthesis affordances** - use technology to link different approaches. **Time affordances** - achievable with realistic staff time **Personalised formative feedback** in response to assignments from **staff or peer feedback**.	**Quizzes** and **Reusable Learning Objects** that deliver **relevant feedback that is specific and actionable by students.** Provision of **automated feedback** via quizzes and Reusable Learning Objects **linking to reflection on learning** **Feedback** either via assignments, discussion boards or 'live.' Also pre-recorded / pre-written material with automated release. Use of the **VLE to allow personalised feedback** to assignments and to **facilitate peer feedback** using applications like **Bongo** or **Peer Scholar.** *Some of these can also be achieved face-to-face with blended approaches*

	Learning requirement		Technology affordance		
Learning task* / Educational goal	Student considerations	Staff considerations	Student perspective	Staff perspective	*Specific examples of technology usage (F2F examples included for consideration - blended learning)*
Group work throughout the learning unit / module	Encouragement of **dialogue around learning** and self-assessment.	**Peer assessment** and **presentations to peers** very effective way of supporting dialogue	Affords mechanisms to **share a wide variety of student work** in **different formats** for peer-peer learning and peer assessment purposes	Affords ease of sharing in a variety of **engaging and authentic formats**	**Use of VLE to share student work Peer feedback tools** within the VLE. Allows students to share their 'objects for showing'
	Provision of timely actionable feedback to aid progression	Consider ways to **model dialogue around learning in practical / discussion classes**. For example, think aloud demonstration of strategy usage. Discussion of 'muddy points 'in class	**Metacognitive affordances** - regulation of learning through reflection on learning	**Emphasis affordances** - highlight important information and relate it to student learning. **Socialisation affordances** - to promote peer-peer dialogue	Use of the **discussion boards or announcements** to highlight important points / reflection on learning. *F2F feedback can also be provided during tutorials / practical classes.*
Learning journey: Overall, framed around reflection on learning emphasising growth mindset and progression of learning and skills. Encourage questioning and dialogue around learning, building linkages to prior learning and between concepts. Encourage completion of the feedback loop (Carless, 2019). Acknowledges the student-facing and staff-facing perspectives of the learning journey (Elen and Depaepe, 2025).					

* When designing a learning unit such as a module or course, learning tasks need to clearly mapped to and constructively aligned with the learning outcomes, so use of learning task here is the preferred approach. This table is designed to offer general guidance on this process, allowing adaptation into a variety of settings. In view of this, some of the examples provided are broader overarching educational goals which can then become more action oriented as they are developed for specific modules or courses.

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