Feedback is Integral: Using a Revised ICAP Framework to Achieve Active Learning in an Asynchronous Online Course

Vikki Pollard
Christine Armatas
Centre for Education and Innovation, Australian Catholic University

Abstract

The Interactive, Constructive, Active, Passive (ICAP) Framework (Chi & Wylie, 2014) is used to review and develop active learning in higher education. It is a hierarchical model based on overt behaviours seen by the teacher in the classroom. This principle is acknowledged as a limitation, especially in the case of online modes of study. In this paper, we revise the ICAP Framework to fit an asynchronous mode of online learning by introducing formative feedback to each ICAP mode, arguing the most active mode results in a student-produced output with evidence of having reflected on feedback. We then use the revised framework to review a course of study consisting of eight units of an asynchronous online post-graduate degree and then recommend ways in which to apply the revised ICAP Framework more generally to enhance the level of active learning in the asynchronous, online mode.

Keywords: Active learning; asynchronous online learning; ICAP Framework

Pollard, V. & Armatas, C. (2025). Feedback is integral: Using a revised ICAP Framework to achieve active learning in an asynchronous online course. *Online Learning*, *29*(3), 236-254. https://doi.org/10.24059/olj.v29i3.4555

Introduction

Active learning is essential in higher education as students need to be “active agents in the process of knowledge acquisition” (Bada, 2015, p. 66). Considerable effort is spent designing and reviewing university courses (i.e., sequences of study that are completed to obtain a specific award), to ensure there are active learning opportunities. This is done best at a course level to provide an understanding of the student experience (Meyers & Nulty, 2009) and allowing alignment across units (i.e., discrete, standalone components of a course with prescribed learning outcomes), at the same level and between units at different levels. The design and review of active learning often occurs at the level of learning activities, which are specifically designed to enable knowledge acquisition (Chi & Wylie, 2014). The Interactive, Constructive, Active, Passive (ICAP) Framework, as developed by Chi and Wiley (2014), is useful for reviewing learning activities and designing more active ones. The framework was designed for face-to-face learning and includes a focus on behaviours as literally “seen” by teachers (p. 22). In this paper, we revise the ICAP Framework to understand how “seen” can be interpreted in the asynchronous online mode.

Our revision recognises the importance of interaction to online learning (Cho & Kim, 2013; Moore, 1989; Su et al., 2005). We incorporate the element of feedback as integral to higher modes of active learning in delivery of asynchronous online learning, then report on an audit of eight units of a post-graduate course designed for asynchronous, online delivery using the revised ICAP Framework (Chi & Wylie, 2014) to show what the "cumulative experience" (Meyers & Nulty, 2009) is for the students who take units in this course. We also discuss how the learning activities could be revised to shift them towards higher modes of active learning. Finally, we explore how to revise the course to achieve a higher level of interaction to which feedback is integral.

In conducting the course audit using the ICAP Framework (Chi & Wylie, 2014), our aim was to address these research questions:

1. How effective is the ICAP Framework for assessing the potential for students to exhibit active learning in an online, asynchronous learning environment?

2. In what ways can using the ICAP Framework to categorise the level of active learning in an activity help improve learning design and student engagement?

3. What value does the adding of feedback to the ICAP Framework have for enhancing active learning in asynchronous, online learning?

Literature Review

Online Active Learning

An important aim of teaching and learning in higher education is "to guide students to create increasingly complex knowledge structures [and this] requires us to progressively scaffold their thinking" (Meyers & Nulty, 2009. p. 565). The scaffolding of thinking includes the construction of carefully considered learning outcomes (Armatas & Spratt, 2019), the development of considered curriculum (Meyers & Nulty, 2009), and the design of learning activities that result in students engaging in particular behaviours, with the latter considered essential. "It seems central […] that it is only by ensuring that students engage in behaviours (cognitively) that the quality of their learning outcomes can be guaranteed" (Meyers & Nulty, 2009, p. 567). Rather than simply soaking up knowledge, learners need to actively "confront their understanding in light of what they encounter in the new learning situation" (Bada, 2015, p. 67). Students need to be active and engaged to learn, hence the focus on what is known as "active learning" which has "gained widespread attention and acceptance in the last few decades" (Prince, Felder & Brent, 2020, p. 4).

Active learning is as important in online learning as it is in other learning modes and activities must be specifically tailored to the online context (Garratt-Reed, Roberts & Heritage, 2016). The key to online learning for students is interaction (Su et al., 2005) which is important to student retention (Cho & Kim, 2013) and knowledge acquisition. Interaction is essential in designing engaging learning activities and, in the online environment, "interactions may be either synchronous (the instructor and all students are gathered at two or more sites simultaneously for

class sessions) or asynchronous (instructional materials reside online and are accessed by students at times convenient to them)" (Prince et al., 2020, p. 5).

An active online experience requires the design and delivery of learning activities tailored to that mode which encourage and facilitate students' interactions, "such as inquiry, collaboration, and reflection" (Shi, Hur, Tang & Dennen, 2023, p. 272). These types of activities allow students to gradually increase their abilities to think in complex ways. The review of the types of learning activities present in an online course can therefore be used as one measure of course quality.

A course approach to understanding how active learning is, or is not present across the units that make up the course, is preferable to a unit-by-unit one because a whole-of-course approach allows for an understanding of "the cumulative nature of the students' experience of the course" (Meyers & Nulty, 2009, p. 569). A comparative approach, unit-by-unit across a course of study, allows for targeted revision. It can help to make "decisions about what subjects need revision and how to prioritize these revisions" (Armatas & Spratt, 2019, p. 247). In the next section we examine the ICAP Framework (Chi & Wylie, 2014) as a highly useful tool towards this type of course review.

The ICAP Framework

It is important to understand what constitutes active learning in order to enable educators to develop active modes of learning. The ICAP Framework (Chi & Wylie, 2014) is an important and often used (Farrow, Moore & Gašević, 2022) system of categorisation used to rate and design learning activities according to the type of activity required by the student. In the Framework, active learning has been defined as "overt behaviors *seen* either during instruction or while students are undertaking specific instructor-designed learning activities" (Chi & Wylie, p. 220, emphasis added). The Framework is used as an "independent quality measure" (Farrow et al., 2022) to review courses, as well as for "guiding instructional design" (Chi & Wylie, 2014). It has a taxonomy of four modes of engagement with each mode eliciting different cognitive processes and behaviors; these are Passive, Active, Constructive, and Interactive (Chi & Wylie, 2014, pp. 221-223), summarised by Prince et al. (2020, p. 19) as

> in increasing order of effectiveness, student engagement may be passive (the student is a passive recipient of information), active (the student does something with the information but does not generate new material from it), constructive (new material is generated), or interactive (new material is generated interactively with other students).

The ICAP Framework is based on the proposition that active learning is best understood as part of a set of knowledge change processes that can predict the amount of learning and that higher modes of engagement lead to more learning occurring with a deeper understanding and comprehension. Learning activities are defined by Chi and Wylie (2014, p. 219) as "the large collection of instructional or learning tasks from which teachers or educational designers can choose for students to do (e.g., reading, solving problems, learning to understand charts and diagrams, etc.)." Such activities aim at increased engagement, which is defined "in terms of overt behaviors that students can undertake, and teachers can *see*" (Chi & Wylie, 2014, p. 220, emphasis added). Further, "overt behaviors are '*seen*' either during instruction or while students

are undertaking specific instructor-designed learning activities" (Chi and Wylie 2014, p. 220, emphasis added). The behaviours that can be seen include reading, taking notes, underlining, drawing concept maps, rotating an object, defending a decision, and debating.

The focus on "seen" in the ICAP Framework is due to the emphasis on teacher practices in the classroom, which Chi and Wylie (2014) acknowledged is a limited context but nonetheless useful. "Although far from perfect, overt [seen] behaviors are a good proxy to reflect different modes of engagement that teachers can use to ascertain whether a student is in fact engaged in a specific mode for a given activity" (Chi & Wylie, 2014, p. 220). The framework was developed based on laboratory and classroom studies (Rakovic, et al., 2020; Atapattu, Thilakaratne, Vivian & Falkner, 2019) hence the focus on observable activities. This, for us, raises the important issue of how educators can observe behaviours in the online mode where they are not present to "see" what students do. While there is some research that has addressed online learning and the ICAP Framework, we believe there is a gap in the literature around the problem of "seen." We argue that the ICAP Framework is not as effective for assessing the potential for students to exhibit active learning in an asynchronous online learning environment as it relies too heavily on the notion of "seen." We propose a way for what students do asynchronously online to be "seen" so activities can be designed specifically for this mode.

Farrow et al. (2022) argue that Chi and Wylie's (2014) ICAP Framework can be applied to both in-person and online learning. Their research focused on coding online asynchronous discussion threads in a fully online distance-learning course in real time applying a "label indicating the relevant mode of cognitive engagement from the ICAP framework" (Farrow et al., 2022, p. 46). Their findings aimed to support instructors to change behaviours during a course. In their case, "seen" refers to comments in discussions in an online course. While their work adds to understanding what "seen" can mean, we argue there is a need to move beyond discussion posts as "a major concern about asynchronous interactions such as discussion boards is the difficulty of getting students to participate in them" (Prince et al., 2020, p. 8). Our work addresses these issues, allowing a greater appreciation of different types of learning activities specifically within the asynchronous online mode. Following Johnson, Seaman, and Poulin (2022, p. 104) we define asynchronous online learning as where "all classes or instructional activities happen online; there is no on campus requirement […] instruction is available for students to access at a time that works best for them." We are interested in this specific mode of online learning because it has exponentially increased and because active learning is as important to learners in the asynchronous online mode as it is in all others (Baker & Tukhvatulina, 2023). Further, there is a research gap in active asynchronous online learning (Lim & Lim, 2021), to which our work aims to contribute.

Interpreting "Seen" in Previous ICAP and Asynchronous Research

Online learning elicits the same level of student satisfaction and academic performance as other modes (Prince, et al. 2020). However, when online learning does not include synchronous learning opportunities, e.g., video classes, there is a risk of "lack of learning engagement" (Hefter, Kubik & Berthold, 2023, p. 2). Returning to our research question, a problem faced when implementing active learning to the asynchronous online mode, is how to "see" behaviours. Learning analytics can provide evidence of what students have done but not necessarily what else they have done (Vale & Falloon, 2024). For example, we can tell they have

watched a video for a certain number of minutes, but we cannot always know what other activities were performed as they watched, e.g., did the student take notes or pose questions to be answered (Dodson et al., 2018; Vale & Falloon, 2024). The challenge then is how to "see" students in such an environment; i.e., to see both the student actions and to evaluate any output from learning activities.

Next, we review previous research on the use of the ICAP Framework (Chi & Wylie, 2014) in online study modes to further understand how we can "see" students' engagement. Previous research of reviewing and designing active learning activities has interpreted "seen" to mean primarily engagement in asynchronous discussion boards (Ahmad, Junis & Santoso, 2022; Atapattu et al., 2019; Farrow et al., 2022). In this sense "seen" means posting comments and responding to others and the Framework has been used to gauge "depth and quality" through labelling (Farrow et al., 2022, p. 129). Atapattu and colleagues (2019) applied the ICAP Framework to classify online discussions in a Massive Open Online Course (MOOC). While their work is limited to online discussions, in respect to the issue we have described above, they advanced the use of the Framework by automating the data collection, noting that previous studies relied on manual analysis. Ahmad et al. (2022) conducted a literature review of 54 articles to measure learner engagement in discussion boards arguing that these support students to interact, engage with content and for teachers to monitor, direct, and encourage deeper learning.

Some research has moved beyond discussion boards to understand "seen." For example, Galatsopoulou, Kenterelidou, Kotsakis, and Matsiola (2022, p. 13) analysed asynchronous viewing of videos followed by "peer discussions and collaborative analysis." The work by Hefter et al. (2023) focused on university students' engagement with recorded video lectures and then took a quiz or wrote a self-explanation. Vale and Falloon (2024) used a modified version of the ICAP Framework (Chi & Wylie, 2014) with the modifications focused on differing activities related to watching videos. This allowed them a more nuanced understanding, but they did not specifically mention the problem of "seen." Findings from their study included that the ICAP Framework was valuable in evaluating data collected as part of learning analytics. In particular, learning analytics data alone were more effective at identifying lower level forms of engagement, such as Active, but not the higher order levels of Constructive and Interactive. They concluded that a more accurate picture of student engagement with video-based learning objects could be obtained by using the ICAP Framework to determine active learning. While these authors concluded that learning analytics is generally effective for identifying active learning behaviours when viewing videos, it is "greatly strengthened when mapped to a well-researched pedagogical model like the ICAP framework" (Vale & Falloon, 2024, p. 62).

Common to this "seen" research are interactions involving teachers and fellow students. It is argued that such interactions are key to online learning, "and there should be an interaction between students, students with instructors, and students with the course content" (Galatsopoulou et al. 2022, p. 4). While we agree, we also align with Garrison and Cleveland-Innes (2005) who argue that interactions per se are not enough and that they "must be more structured and systematic" (p. 134) and further, there is a need for "a qualitative dimension […] where interaction is seen as communication with the intent to influence thinking in a critical and reflective manner." (p. 134). Thus our work aims to encourage structured and systematic

activities that influence thinking to higher modes. To this end, in the next section, we have identified that an important qualitative dimension is formative feedback, from teachers and peers, and accordingly apply this to our revised version of Chi and Wylie's (2014) ICAP Framework.

Revising the ICAP to Embed Formative Feedback as "Seen"

Formative feedback, either from self (i.e., reflection), peers, or from the teacher is an essential element in our revised ICAP Framework (Chi & Wylie, 2014). Feedback is included in the original framework where there is discussion of a classroom-based study that found students who self-explained but did not receive feedback (Constructive) did not perform as well as those who self-explained and did receive feedback (Interactive). However, feedback is not explicitly described as part of the four ICAP modes, except in Interactive where students who engage in dialogue provide feedback. The importance of feedback in designing ICAP-aligned synchronous and asynchronous activities is recognised by Prince et al., (2020, p. 8) who argue, "the point is not to require activity for its own sake, but rather to provide guidance, practice, and *feedback* in your targeted skills" (emphasis added). Revisions such as ours are expected when the framework is applied to different modes of delivery (Farrow et al., 2022).

Shute (2008, p. 152) defines formative feedback as "information communicated to the learner that is intended to modify his or her thinking or behavior for the purpose of improving learning." Specifically, we are interested in "task-level feedback [which] typically provides more specific and timely (often real-time) information to the student about a particular response to a problem or task." There are different types of formative feedback and we use the term *feedback* to indicate that task-based formative feedback needs to be designed into learning activities. Our second research question relates to the ways in which use of the ICAP Framework (Chi & Wylie, 2014) to categorise the level of active learning in an activity can help improve learning design and student engagement, and we argue that it can be used to improve design and engagement by explicitly designing in the element of feedback.

In revising the ICAP Framework (Chi & Wylie, 2014), we add the element of feedback, or the lack of feedback, to each mode. This ranges from Passive, with no feedback, to Interactive, which is a collaborative activity in which the incorporation of feedback on an external output to a new external output, or double-loop learning, is essential. Double-loop learning "involves reflection" (Greenwood, 1998, p. 1048), therefore evidence of reflection on feedback received on an external output is afforded the highest ICAP mode. Our revision to Chi and Wylie's (2014) ICAP Framework for asynchronous, online learning is as follows, with our additions in bold:

> *Passive* refers to "a passive mode of engagement [such] as learners being oriented toward and receiving information from the instructional materials without overtly doing anything else related to learning (Chi & Wiley, 2014, p. 221)." **No feedback.**
>
> *Active* refers to "if some form of overt motoric action or physical manipulation is undertaken" (Chi & Wiley, 2014, p. 221). **No feedback from others/ some self-feedback.**

Constructive refers to "constructive behaviors [such] as those in which learners generate or produce additional externalized outputs or products beyond what was provided in the learning materials" (Chi & Wiley, 2014, p. 222). **Feedback provided on external output by either peers, teacher or other external party.**

Interactive refers to "interactive behaviors to dialogues that meet two criteria: (a) both partners' utterances must be primarily constructive, and (b) a sufficient degree of turn-taking must occur" (Chi & Wiley, 2014, p. 223). **Feedback on an external output from peers etc. that is then incorporated in the development of another output (Double-loop learning).**

We adapted the table of typical examples of activities in Chi and Wylie's paper (2014, p. 22) to our revised version of the ICAP Framework (see Table 1). Looking at our third research question regarding the value that adding feedback to the Framework has for enhancing active learning in asynchronous online learning, we can see that adding in feedback allows each mode to have an output (or no output) that is then used for moving thinking to a higher level. That is, it is not simply an output that counts but how that output is used and the term "feedback" determines usage.

Table 1

Modes of Engagement in Asynchronous Online Learning Mapped to ICAP Modes

Mode	Behaviour	Feedback provided
Passive-Receiving	Watching a video/narrated PowerPoint.	None
Active-Manipulating	Taking notes following prompts, manipulating the videos.	Student may reflect on their own work (self-feedback).
Constructive-Generating	Reflecting/note-taking and producing evidence for feedback following prompts, posting in discussion boards, explaining concepts in a video.	Feedback designed—either a fellow student or a teacher provides feedback, or it is part of an interactive element.
Interactive-Dialoguing	Joining a small group for asynchronous idea sharing/formation/defending. Posting in a discussion board, receiving feedback and responding to it. Developing collaborative artifacts, such as concept maps that evidence feedback.	Receiving feedback and responding, evidenced through a new external output. Double-loop learning.

Aims

Our aim was to use our revised version of Chi and Wylie's (2014) ICAP Framework to delineate the cumulative nature of the learning activities upon the student experience across a course, as opposed to individual units of study. To do this we used the Framework to rate and label the learning activities on the assumption that "good" educational design aims for "more" engagement from students, therefore activities in the Constructive and Interactive modes are of more educational benefit than the two lower modes. To address our research questions, we were specifically interested in what types of activities are most common in the asynchronous online course we audited and how this impacts the student experience.

Data

The data we analysed were all the learning activities in one asynchronous online course. We had access to the course, and permission to use it for this purpose, from the Director of the program. Ethics permission was not required as we did not use any data from students and no human participants were involved in the research. Instead, we reviewed the learning activities, assessing each of them using our revised ICAP Framework. The course was very similar to the one described by O'Connor (2022, p. 103):

> Subjects were offered asynchronously and were based around weekly learning objectives and *targeted activities* which scaffolded toward the assessment. Each week, students were expected to engage in related discussion activities via discussion forums. These discussions were supported by online tutors who were required to guide the student interactions based upon the weekly activities and additional instructions from the lecturers (emphasis added).

Method

A Case Study of an Audit

We used our revised ICAP Framework (Chi & Wylie, 2014) as an auditing tool. This work was influenced by the work of Farrow et al. (2022), who labeled learning activities according to the Framework. They argue that this is a common approach to understand the content of discussion forums and we found that it is readily adapted to other forms of learning activities. We acknowledge that this type of labeling is time-intensive, but we found getting close to the activities in this manner allowed us to fully appreciate the look and feel of a course. We used the audit to suggest how the course currently stands in terms of being Constructive and Interactive and to show changes that can be implemented. The audit was undertaken on the latest, archived version of the unit; in some cases, the unit had been delivered three times. We had access to archived versions of all the units (subjects) that had been offered in the course. This course was chosen because it had run several times and was due for a review.

Unit design was done using a template to help achieve a similarity of learning design patterns across all units and courses (Bearman, Lambert & O'Donnell, 2021). This includes the labeling of activities with icons and headings such as "Watch," "Read," and "Reflect." For our audit we took a course-level approach, meaning we reviewed all eight units which make up the course, each of which consists of eight weekly modules. The number of pages in each module varied, with some having as few as six pages per module and some having as many as 20. We

reviewed each page looking for learning activities as there was no automated way to find these activities. Instead, we clicked through each page of every module looking for "activities." For most of the activities identified, the templated labels had been used and their use (e.g., Watch, Read, Reflect) assisted in identifying other learning activities that were not labeled but still met Chi and Wylie's (2014) definition of a learning activity.

Two of the authors undertook the unit audits and met twice to ensure reliability and consistency of each other's audits. An audit consisted of four steps, the identification of learning activities being the first. In defining a learning activity, we checked that it satisfied the ICAP (Chi & Wylie, 2014) description of a learning activity. All the units audited had been developed using a template, providing some regularity in the sign posting of learning activities by "calls to action," making identification of learning activities easier. Once a learning "activity" was identified in a module, following Farrow et al. (2022, p. 129), we "annotated each message [activity] with a label indicating the relevant cognitive engagement mode from the ICAP framework." We also used the framework to categorise the activity in respect to the scaffolding of tasks via use of prompts, external output as a result of completing the learning activity and presence of feedback, each of which are described in more detail next.

Categorising the Learning Activities

There were three elements to the categorisation of learning activities:

Prompts

As well as defining an activity, we looked at the prompts associated with the "call to action" or equivalent to see what students were asked to do for the activity. In a classroom, teachers will provide students with scaffolding such as directions, prompts, questions, and feedback to help them undertake a learning activity. Scaffolding "enables learners to do more advanced activities and to engage in more advanced thinking and problem solving than they could without such help" (Shute, 2008, p. 162). In the asynchronous online mode, this sort of scaffolding can "encourage students to deeply process the material" (Hefter et al., 2023, p. 2) and to produce self-explanations that contribute greatly to knowledge acquisition. Thus, directions and prompts contributed to the categorisation of the activity according to its level on the ICAP Framework (Chi & Wylie, 2014); for example, directions such as "answer these questions while watching" were considered at a higher mode of ICAP than simply "watch."

Creation of an External Output

Units were reviewed for external output from learning activities, and if present, we analysed what type of output it was, who was involved in developing it, what students were asked to do with the output and evidence of the knowledge thus generated being useful towards other ends. For example, students were often asked to "Reflect" using their own notes. This was considered at the lowest level of the ICAP Framework (Chi & Wylie, 2014).

Presence of Feedback

Finally, we looked for feedback. Was there feedback available for the activity? Who gave it? Was there feedback on an external output? What type of feedback? What happened to the output once feedback was received? The answers to these questions assisted in determining

whether the learning activity could be categorised as Constructive or Interactive according to the ICAP Framework (Chi & Wylie, 2014).

Once all of the units in the course had been audited, the results were collated to show the number and type of learning activities for each unit and their categorisation to provide a picture of the level of active learning across the course as a whole.

Results

Number and Types of Activities

Overall, we categorised 619 learning activities in the eight units. On average, each unit had 40 learning activities across the eight weeks of teaching, however, the number did vary with some units having 60 and one having 218, most of those being passive video watching. We found only a small number of types of learning activities and the majority were categorized as Passive (*n* = 289, 47%), with the next most frequent category being Active (*n* = 250, 40%). Only 61 (10%) and 19 (3%) were categorised as Constructive and Interactive respectively. Categorisation of the types of learning activities using the ICAP Framework (Chi & Wylie, 2014) is shown in Table 2 below.

Table 2

Examples of Activities Categorised Using the Revised ICAP Framework

ICAP mode	Activity	Scaffolding and Feedback	Examples from units
Passive	Watch - Video – YouTube, PowerPoint	No prompts, questions or directions and no feedback.	Watch this video.
Active	Take notes /reflect/ watch	Prompts/questions and some self-feedback incorporated.	Refer to X article and identify Y and Z as part of your own study notes. Reflect on your notes.
	Click and reveal /Multimedia assets	Prompts, questions or both provided but no feedback.	Information placed into a “click and reveal” or a multimedia asset - no feedback, no external output.
	Quiz	Prompts, questions or both provided but no feedback.	Quiz, no answers provided.
Constructive	Quiz	Prompts or questions and feedback on answers.	Quiz, answers provided allowing for feedback.

	Discussion board post with possible feedback	Prompts/questions but feedback not given (i.e., peers/teacher might respond, they might not).	Post in the discussion board answer to the following question(s).
	Calculations with solutions	Prompts/questions with feedback (e.g., answers).	Students given calculations to complete, and answers provided on next page or in click and reveal.
	Click and reveal	Prompts/questions with feedback on answers.	Students write an answer in their personal notebooks which are not seen by the teacher, then check using a click and reveal.
	Multimedia interactive asset	Prompts and feedback but no external output.	Multi-media assets made by the university interactive development team that require student input and provide feedback upon input but no external output results e.g., drag and drop.
Interactive	Discussion board post with feedback	Prompts and questions with output shared and feedback provided.	Post a response to questions then comment on a fellow student's post (may or may not be an assessment).
	Multimedia interactive asset	Prompts and feedback in response to what student has done.	Multi-media assets made by the university interactive development team or a private company (e.g., simulation) that require students to input, with an external output or feedback on choices/input.

Types of Passive Activities

Many activities were categorized as Passive. In Table 2, we have described these as engaging students in the mode of "Watch" without any scaffolding to direct attention or support knowledge acquisition while watching. However, it should be noted that these results were

somewhat skewed as one unit had over 100 “Watch” activities in the passive mode. Similarly, reading a paper or other text without scaffolding would be categorised as Passive.

Types of Active Activities

The second highest mode was Active activities and consisted primarily of activities that invited students to “Reflect” or “Take notes” for their own use. There were questions or prompts but no feedback on the notes and only occasional directions as to how the notes might prove useful to knowledge acquisition or assessments. Also included as an Active activity were several multimedia assets, developed by the central design team, that required students to click on icons to reveal further information. We counted these as Active, as opposed to Constructive as they were simply “click and reveals” and students were not required to further integrate the information obtained and no feedback, such as “Wrong answer, try again,” was part of the asset. As such, these activities were simply a way to provide information in a more active manner than reading it on a screen.

Types of Constructive Activities

There was a relatively low number of Constructive activities and these consisted primarily of discussion board posts, with questions and prompts, that required students to respond to other students’ comments. A standard discussion board post description for the course was “Post a response to this question and respond to one of your peers.” What happened after the posts and response was not made clear as students were not asked to collate their posts and responses for further feedback.

Other Constructive activities included quizzes, calculations with answers provided, and multi-media assets that produced an external output, e.g. a “drag and drop” concept check where students were asked to put the correct term in the correct place. The wrong answer was rejected. The completed asset comprised a new external output that could be downloaded. However, nothing else was done with the output, such as receiving feedback which would have placed it in the highest mode.

Types of Interactive Activities

There were relatively few Interactive activities. An example of one was a multimedia asset developed by the university learning design team that required students to undertake a branching scenario from which an external text was developed that students were required to post and discuss in a discussion board for feedback. Another example was an externally developed simulation that students undertook for the whole term, with weekly activities and posting to discussion boards. It was also part of the assessment.

Opportunities for Feedback on External Outputs

As can been seen in the types of Constructive and Interactive activities found in these units, there is a limited type of external output to which feedback is assigned, this being external output from a university-developed multimedia asset that students posted in a discussion board and a simulation that involved, again, output that was posted and discussed. In terms of the simulation, these discussions were developed in the assessment tasks.

Discussion

There were three research questions of interest in our study. The first related to the effectiveness of the ICAP Framework (Chi & Wylie, 2014) for assessing the potential for students to exhibit active learning in an asynchronous online learning environment. We found the Framework to be very effective in this regard as it provided a codified and objective way of assessing the level of active learning required for the activities in the audited course. The audit demonstrated that overall, the course tends to the Active mode of engagement as defined by the ICAP Framework. This is similar to Vale and Falloon (2024) in their analysis of videos in learning activities wherein they found that students tended towards the Active mode. They found that when codifying activities using the Framework, their interviews with students uncovered more of the higher level modes. Our finding thus agrees with their study and we suggest that ways other than codifying activities are necessary to more fully understand nuances.

We found that across the course, students experience a limited variety of activities and there were many passive activities in some units. Su et al. (2005), in their review of interactivity in an online course, found a similar lack of variety of activities, with online discussion, instructor feedback, and summaries of key points dominating. Activities that could be considered at a higher mode such as peer evaluation and inter-team feedback were used sparingly, despite students interviewed asking for more such interactions. Su et al.(2005) argue instructors are less skillful in providing student-led interactions which "suggests the importance of faculty training and support when it comes to online education" (p. 10). It is interesting that given their work was almost twenty years ago, we have found a similar pattern of passive activities.

Additionally, an uneven distribution of modes was found, with some units rated as Interactive and some entirely Passive. The small variety of activities may partly be due to the template used to develop the units which has icons and verbs to be used when signposting an activity; this "shorthand" may make it more difficult to develop active learning tasks that are outside the template. To address this difficulty may require further development of the template. There is also a need to consider how to make activities such as those labelled "Watch" more constructive or interactive and less passive as there were far more passive activities, primarily—"Watch"—than any other activity. While this may partly be due to the template, it could also be due to the time pressures associated with the development of activities for these units, with lower level activities being easier and quicker to design. In addition, the transition to asynchronous delivery can be challenging and may require a longer period of development time and professional support to help teachers design learning activities that are at the higher end of the ICAP Framework (Chi & Wylie, 2014).

Our second research question related to the ways that using the ICAP Framework (Chi & Wylie, 2014) to categorise the level of active learning in an activity could help improve learning design and student engagement. We found the ICAP Framework very useful for working out how active a course is and where improvements can be made. This is a similar finding to other research in the field such as Atapattu et al. (2019), who applied the ICAP Framework to identify cognitive engagement by MOOC participants. We found it particularly useful for identifying which units needed more active learning activities to promote student engagement, activities that could be modified to shift them to a more active mode according to the Framework, and the

distribution of active learning across the course. We suggest that the Framework must be adapted to the online mode in order to explicitly address what is meant by “seen.” We also suggest that the work needs to take a whole-of- course approach and must move beyond discussion boards.

Some units in the course we audited did have learning activities we categorised at the higher modes of active learning. This was encouraging but one unit had considerably more interactive learning activities than the other units as this unit had an externally produced simulation as well as several university-produced multimedia assets and the requirement to post and respond to peers. Limited opportunities for feedback on external outputs was also identified as an area requiring attention to produce higher modes of activity and feedback. Simulations and multimedia assets that produce an external output that can be reviewed by peers and then used in assessments is present in two units. Further development of such learning activities, particularly multi-media assets bespoke to the unit and the course, is warranted. Overall, a whole-of-course approach to the placement and building of such learning activities could be undertaken to ensure that effort is used to develop higher modes of activity and a more consistent distribution of types of activities across units. While there is a place for simpler learning activities, such as click and reveals, there needs to be a coherent approach to ensure variety and higher modes with feedback.

Another area where enhancements can be made to promote higher levels of active learning is in the template and the use of prompts for consistency. The design template allowed for clear and consistent signposting of activities using icons. However, we found that the template was used inconsistently at times. For example, the Activity icon might signal a passive reflect/take notes or an activity in the Interactive mode of the ICAP Framework (Chi & Wylie, 2014). We argue that lower levels of activities should be signaled differently thus alerting students to the amount of time and knowledge acquisition that might be expected. An improvement would be to develop prompts using the ICAP Framework. Hefter et al., (2023) argue that carefully constructing prompts based on the ICAP Framework can increase active learning, in their case self-explaining. They argue that instructors should spend time constructing such prompts.

These findings point to a need for professional development for those designing online courses. Chi and Wylie (2014, p. 238) note that their “framework, on the other hand, can provide specific guidelines for how to create lessons that incorporate overt behaviors that are associated with higher levels of engagement and their associated knowledge-change processes.” Such guidelines need to be developed in specific contexts. These guidelines would be useful for both academic staff and learning designers in conceptualising units and for course coordinators who can work with their teams in a whole-of-course approach. Professional development will also allow for an understanding of the constraints to the template and the possibilities for teams to develop different types of activities using the template. Like Chi and Wylie (2014, p. 238), we have “developed an online module containing information about ICAP” for academic staff undertaking unit development with the learning design team. Although too soon to evaluate, there has been some uptake, but the challenge is for academic staff to do this professional development given time constraints. Professional development with learning design teams may not face this constraint as it could be scheduled as part of their workload. Another strategy for raising awareness of how to design active learning using ICAP is to pilot an exemplary course. This would include the use of the guidelines and professional development for the staff involved.

Our third research question concerns the value of adding feedback to the ICAP Framework (Chi & Wylie, 2014) for enhancing active learning in asynchronous online learning. Based on our audit results, we believe feedback to be a critical to allow students' behaviour to be "seen" in a learning mode where the teacher is not physically present. For many of the activities in the course, without an output that received feedback, the information about what the student did would be limited. By including feedback in a learning activity, analysis of learner behaviour through learning analytics will be greatly enhanced as it will provide outputs that help to show what the student has done.

Limitations and Future Research

A limitation to our methodology relates to the manual categorisation of all the units, the time this took, and the opportunity for differences in categorisation between coders. We had to actively look for activities in the units. Sometimes, following the template, these were obviously labelled, sometimes not.] There is a margin of error in activities not being identified, especially due to the amount of time it took to audit each unit. The meeting of the researchers to check each other's categorisation twice helped to address any differences, but the argument can be made that activities were missed or mis-labelled. Our suggestion to support this type of auditing and to make activities stand out more is to keep a record of every activity in every unit and store these as part of the design process. Further, we suggest that labels for activities in templates are regularly reviewed and updated where necessary to help the design of more cognitively challenging activities.

Our study applied the ICAP Framework (Chi & Wylie, 2014) to course design, demonstrating it to be an effective and valuable tool for this purpose. Further studies validating and refining our audit methodology would provide clarity and guidance on its application when conducting course reviews. In addition, we categorized learning activities and not students' behaviour when completing those activities. Validation of our revisions to the Framework to add feedback so what students do in an online, asynchronous learning environment can be "seen" is a logical and fruitful area for future research. As the work of Vale and Falloon (2024) has shown, the use of learning analytics in combination with the ICAP Framework provides valuable insights into what students do and what they have learnt. This requires learning design that includes a digital footprint of learning activity and outputs that feedback is provided on to evaluate the extent of active learning occurring and what students did and learnt.

Conclusion

The ICAP Framework (Chi & Wylie, 2014) is used to review and design learning activities. In this paper, we revised the Framework for use with the asynchronous online learning mode, arguing that formative feedback and an external student output is the highest mode as it allows what students do to be "seen" when completing a learning activity. Feedback is also expected at the lower modes but need not involve an external output. The audit of the course revealed a large amount of activity required by students across all ICAP Framework levels. However, the nature of the learning activities is such that modifying them so that they move to a higher mode of the Framework is not onerous, particularly for passive activities. To support

designing more active learning activities, we argue there is a need to develop guidelines for specific instances, which would be useful for improvements to learning activities, introduction of more authentic tasks, and professional development opportunities that can be included to support academic staff. The challenge is one of developing a course that has well distributed examples of learning activities at the various levels of the (revised) ICAP Framework. Based on the work presented here, we believe that the production of course-specific guidelines for the application of the ICAP Framework— including the revised version presented here—would be beneficial. However, more work is needed to validate the revised version of the Framework, particularly in respect to its efficacy in revealing what students do in online, asynchronous learning environments where teachers are not there to "see" them.

Declaration of Competing Interests

The authors declare that they have no competing interests.

References

Ahmad, M., Junus, K. & Santoso, H.B. (2022). Automatic content analysis of asynchronous discussion forum transcripts: A systematic literature review. *Education and Information Technologies*, 27, 11355–11410. https://doi.org/10.1007/s10639-022-11065-w

Armatas, C. & Spratt, C. (2019). Applying learning analytics to program curriculum review. *The International Journal of Information and Learning Technology*, *36*(3), 243-253. https://doi.org/10.1108/IJILT-11-2018-0133

Atapattu, T., Thilakaratne, M., Vivian, R., Falkner, K. (2019). Detecting cognitive engagement using word embeddings within an online teacher professional development community. *Computers and Education*, 40, pp. 1-12. https://doi.org/10.1016/j.compedu.2019.05.020

Bada, S.O. (2015). Constructivism learning theory: A paradigm for teaching and learning. *IOSR Journal of Research & Method in Education*, *5*(6), 66-70. https://iosrjournals.org/iosr-jrme/pages/v5-i6.v.1.html

Baker, J. T & Tukhvatulina, S. (2023). Reflections of adult learners in asynchronous online degree programs. *Journal of Effective Teaching in Higher Education*, *6*(1), 47-65. https://doi.org/10.36021/jethe.v6i1.344

Bearman, M., Lambert, S. & O'Donnell, M. (2021). How a centralised approach to learning design influences students: a mixed methods study. *Higher Education Research and Development*, 40(4), 692–705. https://doi.org/10.1080/07294360.2020.1792849

Chi, M. & Wylie, R. (2014). The ICAP framework: Linking cognitive engagement to active learning outcomes. *Educational Psychologist*, *49*(4), 219-243. https://doi.org/10.1080/00461520.2014.965823

Cho, M.H, & Kim, B. J. (2013). Students' self-regulation for interaction with others in online learning environments. *The Internet and Higher Education*, 17, 69-75. https://doi.org/10.1016/j.iheduc.2012.11.001

Dodson, S., Roll, I., Fong, M., Yoon, D., Harandi, N. M., & Fels, S. (2018, June). An active viewing framework for video-based learning. In *Proceedings of the Fifth Annual ACM Conference on Learning at Scale* (pp. 1–4). https://doi.org/10.1145/3231644.3231682

Farrow, E., Moore, J. & Gašević, D. (2022). Markers of cognitive quality in student contributions to online course discussion forums. *The Journal of Learning Analytics*, *9*(2), 38–65. https://doi.org/10.18608/jla.2022.7250

Galatsopoulou, F., Kenterelidou, C. Kotsakis, R. & Matsiola, M. (2022). Examining students' perceptions towards video-based and video-assisted active learning scenarios in journalism and communication courses. *Education Sciences,* (12)74. https://doi.org/10.3390/educsci12020074.

Garratt-Reed, D., Roberts, L., & Heritage, B. (2016). Grades, student satisfaction and retention in online and face-to-face introductory psychology units: A test of equivalency theory. *Frontiers in Psychology*, 7, 1-10. https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2016.00673/full

Garrison, R. & Cleveland-Innes, M. (2005). Facilitating cognitive presence in online learning: Interaction is not enough. *The American Journal of Distance Education, 19*(3), 133-148. http://dx.doi.org/10.1207/s15389286ajde1903_2

Greenwood, J. (1998). The role of reflection in single and double loop learning. *Journal of Advanced Nursing, 27*(5), 1048–1053. https://doi.org/10.1046/j.1365-2648.1998.00579.x

Hains-Wesson, R., Pollard, V. & Campbell, A. (2017). A three-stage process of improvisation for teamwork: Action research**.** *Issues in Educational Research, 27*(1), 82-98. https://www.iier.org.au/iier27/hains-wesson.pdf

Hefter, M., Kubik, V. & Berthold, K. (2023). Can prompts improve self-explaining an online video lecture? Yes, but do not disturb! *International Journal of Educational Technology in Higher Education, 20*(15). https://doi.org/10.1186/s41239-023-00383-9

Johnson, N., Seaman, J. & Poulin, R. (2022). Defining different modes of learning: Resolving confusion and contention through consensus. *Online Learning, 26*(3), 91-110. https://olj.onlinelearningconsortium.org/index.php/olj/article/view/3565/1193

Lim, J. Y. & Lim, K. Y. (2021). Engagement patterns in an asynchronous virtual classroom: Different use of active observation and ICAP framework. In de Vries, E., Hod, Y., Ahn, J. (Eds.), *Proceedings of the 15th International Conference of the Learning Sciences - ICLS 2021*. (pp. 945-946). Bochum, Germany: International Society of the Learning Sciences. https://repository.isls.org//handle/1/763

Moore, M. (1989). Three types of interaction [Editorial]. [*American Journal of Distance Education*, 3(2), 1-7. https://doi.org/10.1080/08923648909526659

Meyers, N. & Nulty, D. (2009). How to use (five) curriculum design principles to align authentic learning environments, assessment, students' approaches to thinking learning outcomes. *Assessment and Evaluation in Higher Education, 34*(5),5 65-577. https://doi.org/10.1080/02602930802226502

O'Connor, K. (2022). *Unbundling the university curriculum: MOOCs, online program management and the knowledge question*. Springer, Singapore. https://doi.org/10.1007/978-981-19-4656-1

Prince, M., Felder, R. & Brent, R. (2020). Active student engagement in online STEM classes: Approaches and recommendations. *Advances in Engineering Education,* 8(4). https://doi.org/10.1111/1541-4329.12219

Rakovic, M., Zahia Marzouk, Z., Liaqat, A., Winne, P. & Nesbit, J. (2020). Fine-grained analysis of students' online discussion posts. *Computers in Education*, 157, 1-8. https://doi.org/10.1016/j.compedu.2020.103982

Shi, H., Hur, J., Tang, Y. M., & Dennen V. P. (2023). Instructional strategies for engaging online learners: Do learner-centeredness and modality matter*? Online Learning*, *27*(4), 271-294. https://doi.org/10.24059/olj.v27i4.4038

Shute, V. (2008). Focus on formative feedback. *Review of Educational Research, 78*(1), 153–189. https://doi.org/10.3102/0034654307313795

Su, B., Bonk, C., Magjuka, R., Liu, X., Lee, S. (2005). The importance of interaction in web-based education: A program-level case study of online MBA courses. *Journal of Interactive Online Learning*, *4*(1-19). https://www.ncolr.org/issues/jiol/v4/n1/the-importance-of-interaction-in-web-based-education-a-program-level-case-study-of-online-mba-courses.html

Vale, E. & Falloon, G. (2024). Using learning analytics to understand K–12 learner behavior in online video-based learning. *Online Learning*, *28*(1), 44-68. https://doi.org/10.24059/olj.v28i1.3675