How do instructor cues influence comment characteristics in an anchored environment xMOOC?

A case study of the TCD *Irish Lives in War and Revolution* MOOC

Doireann Wallace, BA, PhD (DIT)

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Declaration

I declare that the work described in this Dissertation is, except where otherwise stated, entirely my own work and has not been submitted as an exercise for a degree at this or any other university.

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Abstract

Providing discussion forums and comment platforms for learners to engage with course material and interact with one another is established practice in online learning, but MOOCs (massive open online courses) present new challenges due to the scale of enrolment and the consequent lower level of instructor involvement with learners. Research on pedagogical practice in MOOCs is still in its early days and to date relatively few empirical studies have been carried out on the role commenting activity plays within this learning environment or on the factors affecting commenting behaviour. Research into how the design of questions and instructor cues (understood as any prompts to encourage commenting) influence comment characteristics can productively inform pedagogically sound learning design for MOOCs. This research explores how instructor cues influence comment characteristics in an anchored environment xMOOC through a case study examining cue-comment relations in the *Irish Lives in War and Revolution* MOOC, developed by Trinity College, the University of Dublin, and delivered through UK-based MOOC platform FutureLearn.

The research is guided by a theoretical framework in which the cue-comment relation is seen as an 'adjacency pair' , where the communicative expectations of the cue should meet with an appropriate response in the comments. To develop an appropriate classification of instructor cues , a first phase of analysis uses a combination of open and directed coding (applying Anderson and Krathwohl's (2001) revision of Bloom's taxonomy of cognitive domain learning objectives) to analyse a sample of cues. The results of the cue analysis highlight the importance of the affective domain (Krathwohl et al., 1964), previously unexplored in the context of instructional questioning, to instructor cue design. A framework combining the revised affective and cognitive domain taxonomies is developed. A second phase of analysis applies directed coding using the combined framework to a sample of learner comments for each cue type, to explore the extent to which comments respond to the communicative expectations of the cues. Results suggest that cue affective or cognitive disposition does influence comment affective or cognitive disposition, although with varying degrees of strength.

The research contributes a novel understanding of the importance of the affective domain in MOOC cue design and makes a practical contribution in the form of a visual framework, informed by the analysis, to assist MOOC designers create instructor cues appropriate to both affective and cognitive learning objectives.

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Abbreviations

MOOC: Massive Open Online Course
TCD: Trinity College, the University of Dublin

AR: Responding (Affective Domain category)
AV: Valuing (Affective Domain category)
AO: Organising (Affective Domain category)
AI: Internalising (Affective Domain category)

CR: Remember (Cognitive Domain category)
CU: Understand (Cognitive Domain category)
CP: Apply (Cognitive Domain category)
CA: Analyse (Cognitive Domain category)
CE: Evaluate (Cognitive Domain category)
CC: Create (Cognitive Domain category)

Chapter One: Introduction

1.1 Background and Rationale

Massive Open Online Courses (MOOCs) are a relatively new educational form and have proliferated since their emergence (Baggaley, 2013; Decker, 2014). 'MOOC' usually refers to third-level-equivalent courses offered free online by higher education providers, often through dedicated platforms like Coursera, Udacity, edX and FutureLearn. Typically, MOOCs deliver structured content – often video lectures – to learners accessing courses asynchronously through networked computers. Most have start and end dates, include some form of assessment and a discussion forum. Discussion forums may be separate spaces where learners can ask and answer questions, or more artefact-centred 'anchored environments' where learners can comment directly on each course element, as in blogs with comments sections (see Figure 1.1). Commenting is generally encouraged to foster participation and engagement and lessen the isolation of distance learning.

Figure 1.1 Anchored Environment MOOC (*Irish Lives in War and Revolution*)

Interaction with instructors and fellow students has long been integral to classroom and closed online education but large-scale MOOC enrolment makes this challenging. Discussion forums are among the

few ways MOOC providers can hope to supplement this social support, yet most research on their pedagogical value has explored courses with fewer learners, where instructors interact regularly with students. Given the barriers to close instructor involvement in MOOC discussion forums, question design to foster learning arguably becomes more central. This research examines how instructional *cues*, understood as any utterance intended to signal to learners that they may comment (including but not limited to direct questions), influence comment characteristics.

1.2 Research Question

This research aims to develop a MOOC cue design framework, informed by analysis, to assist MOOC instructors design effective cues appropriate to their learning objectives. To achieve this, the following research question and sub-questions are explored:

- How do instructor cues influence comment characteristics in an anchored environment xMOOC?
    - What is an appropriate classification for instructor cues?
    - To what extent do learner comments respond to the expectations communicated by different cue types?

1.3 Methodology Overview

An exploratory case study design is adopted, examining cue-comment relations in the first delivery of Trinity College Dublin's *Irish Lives in War and Revolution* MOOC. Developed by the Department of History in conjunction with the Department of Online Education, the six-week course explores Irish history between 1912 and 1923, focusing on social history and ordinary citizens' experiences. It was first delivered in September and October 2014. Qualitative analysis was undertaken to develop a classification of instructor cues and then to analyse a sample of comments for each cue type, to explore connections between cue type and comment disposition. While content cannot be ignored entirely, the analysis focuses on the communicative strategies of instructor cues.

1.4 Chapter Outline

Chapter Two reviews the literature on MOOCs, establishing context and focusing on the pedagogical value of discussion for learning. It examines existing literature on the role of MOOC platform design, recommendations on instructional questioning and frameworks for analysing online educational discussion forums.

Chapter Three presents the research methodology, providing a rationale for the research design and discussing practical and ethical concerns.

Chapter Four details the process, findings and implications of the first phase of analysis, leading to a classification of instructor cues.

Chapter Five provides an account of the process, findings and implications of the second phase of analysis, where a sample of learner comments was analysed to investigate correspondences between cue and comment disposition.

Chapter Six synthesises the research findings to propose a visual framework for use in MOOC instructor cue design, along with an account of how the framework was developed.

Chapter Seven summarises the research contribution, outlines the limitations of this study and makes recommendations for future research to address these limits and build on the research findings.

Chapter Two: Literature Review

2.1 Approach

This chapter provides the background context for the research by reviewing and identifying gaps in the current literature on MOOC instructor cues. Relevant literature was identified by searching SCOPUS for papers on MOOC history and pedagogy, the pedagogy of discussion and online discussion forums, instructional questioning and question design, and frameworks for analysing online discussion quality. Bibliographic citations within the literature were also cross-referenced to extend the literature search. Following a broad review of MOOC literature, a gap was identified in the area of discussion forums and question design. Further literature on these topics from online education more generally was then reviewed. This chapter presents an overview of the emergence and current state of MOOCs and the pedagogical challenges posed by the MOOC format, then addresses the importance of discussion in learning, recommendations and frameworks for designing and classifying instructional questions, and frameworks for analysing online educational discussion. It concludes with a summary of the research questions emerging from the literature.

2.2 What is a MOOC?

MOOCs are online course distinguished by the attributes 'massive' and 'open' and differentiated by the meanings attributed to these terms. The 2008 course that inspired the coinage, Connectivism and Connective Knowledge (Haber, 2014), was something of a pedagogical innovation, modelled on the distributed network of the Internet and exploiting the social and content-authoring possibilities of Web 2.0. Connectivist pedagogy promotes learning through constructing or navigating social, technological and neural networks (Siemens, 2004; Tschofen & Mackness, 2012) and the course design was unprecedentedly 'bottom-up', with instructor material optional and students encouraged to form communities, produce and share their own content (Haber, 2014).

Interest in MOOCs surged in 2011, when 160,000 students enrolled on a free online course offered by Stanford University. The course comprised video lectures based on Stanford undergraduate courses, supplemented with quizzes and discussion forums. The scale of uptake of this and subsequent offerings sparked media hype about MOOCs, with 2012 dubbed 'Year of the MOOC' by the *New York Times* (Haber, 2014). As MOOCs based on more traditional instructional models proliferated, a terminological split emerged in the nascent academic discourse, with connectivist 'cMOOCs' distinguished from the instructivist 'xMOOCs' appearing on platforms like Coursera, edX and Udacity (Decker, 2014; Haber, 2014). xMOOCs typically have significantly higher enrolment and lower student contribution to course content, but perhaps the more important distinctions are between opposing ideas of how we learn (by exploration or assimilation) and of what constitutes 'openness'. In cMOOCs, openness is considered a

feature of the network and the community of learners it fosters, whereas in xMOOCs openness is more often taken to mean access (Decker, 2014; Rodriguez, 2012).

However, while relevant for establishing chronology and understanding some of the stakes in MOOC design and evaluation, such binary distinctions are reductive (Dillenbourg, Fox, Kirchner, Mitchell, & Wirsing, 2014; Ebben & Murphy, 2014; Rodriguez, 2012). xMOOCs need not be inherently behaviourist, as some have claimed (Rodriguez, 2012) and may mix instructor-led content with strategies to encourage critical reflection, metacognition or social learning rather than the mere assimilation of transmitted information (Ebben & Murphy, 2014). In reality, the 'moocspace' (Schneider, 2013) is a heterogeneous field informed by diverse pedagogical perspectives (Baggaley, 2013; Clark, 2013). Several more nuanced classifications of MOOCs have also been proposed, based on a range of technological, organisational, pedagogical and social features (Clark, 2013; Conole, 2014; Schneider, 2013).

As is common with technological innovations, the disruptive potential of MOOCs has received much attention (Baggaley, 2013). Proponents have focused on the potential for global learning communities and for democratising access to education, with MOOC instructors surveyed recently highlighting the provision of opportunities for 'intellectually curious adults' to 'learn new skills or explore new ideas' as one of the primary purposes of MOOCs, along with democratising education for the underprivileged and offering continuing professional development (Evans & Myrick, 2015; Macleod, Haywood, Woodgate, & Alkhatnai, 2015). Critics have pointed to high attrition (Clow, 2013; Kizilcec, Piech, & Schneider, 2013), lack of formal accreditation (Kolowich, 2013) and the fact that many MOOC learners are already graduates (Macleod et al., 2015) as indications their democratising potential had been exaggerated. The dangers of homogenisation in economies of scale (Baggaley, 2014) and a lack of attention to pedagogy and instructional principles in MOOC design (Billington & Fronmueller, 2013; Fischer, 2014; Jona & Naidu, 2014) have also been flagged. Even as MOOC public discourse exhibits increasing disenchantment (Kolowich, 2015; Kovanović, Joksimović, Gašević, Siemens, & Hatala, 2015), a review of over two hundred research proposals submitted to the MOOC Research Initiative shows a lively and diverse research agenda and the critical academic study of MOOC pedagogy is expanding. Emerging trends in MOOC research include: engagement and learning success; MOOC design and curriculum; self-regulated learning and social learning; social network analysis and networked learning; motivation, attitude and success criteria (Gasevic, Kovanovic, Joksimovic, & Siemens, 2014); learning analytics for evaluation; and critiques of the epistemological assumptions underlying knowledge transmission (Ebben & Murphy, 2014).

2.3 MOOC Pedagogy

As many have observed, MOOCs are not as novel as the public discourse around them suggests but are variants of older online learning formats, intensifying some features and diminishing others (Baggaley,

2013; Naidu, 2013; Rodriguez, 2012; Rubens, Kalz, & Koper, 2014). MOOCs thus belong within a longer history of distance education typically classified by the technologies used to deliver content and connect students, instructors and institutions remotely (Rodriguez, 2012). Online learning pedagogy addresses the conditions that best support learning through networked computing and MOOC course design can benefit from pedagogical practices based on established instructional principles (Margaryan, Bianco, & Littlejohn, 2015) and distance education (Rubens et al., 2014). While technology has made MOOCs possible, their development must be driven by pedagogy (Fischer, 2014; Terras & Ramsay, 2015).

Because the obvious comparison is with face-to-face learning environments, a central concern in online learning theories is distance and mediation; how the lack of direct social interaction with instructors or other students impacts on learning and how to overcome problems arising from this. Social interaction has been associated with information processing, learner agency, adapting to learner input, knowledge construction and community formation (Rubens et al., 2014) and the 'distance' referred to in distance learning is considered as much psychological as geographical – what Moore (1997) terms the 'transactional distance' between instructor and student. In MOOCs, text-based discussion forums and comment platforms allowing learners and instructors to communicate are the primary site where transactional distance might be eased through interaction.

The importance of social interaction between students and instructors is also central to the influential Communities of Inquiry (CoI) framework focused on the value of 'asynchronous, text-based group discussion' in online learning (Garrison, Anderson, & Archer, 2001b, 2010, p. 5). The framework proposes three interrelated modes of 'presence' – social, cognitive and teaching – found to influence the quality of learning in this context. Social presence refers to a reduction of psychological distance when learners feel they belong to a supportive community of peers (Oztok & Brett, 2011; Tu & McIsaac, 2002) and instructors (Rourke et al., 1999). It is understood as supporting active learning through peer interaction and enhancing motivation through feelings of social connectedness (Rourke et al., 1999). Cognitive presence and teacher presence are also understood as social. Cognitive presence is defined as a mode of inquiry (Garrison et al., 2010) entailing 'an exploration of ideas and points of view, a consensus on the points of view (reached by communication with and feedback from others), and then a testing and discussion of the found solution' (Kop, Fournier, & Mak, 2011, p. 78). Teaching presence refers to course design, administration, instruction and facilitation (Anderson, Rourke, Garrison, & Archer, 2001) and recent research has highlighted a need to explore in greater depth the role of instructor social presence in online learning (Pollard, Minor, & Swanson, 2014; Shea et al., 2010; Swan & Shih, 2003). Emphasising the linkages between the three, recent studies have found social presence operates as 'a mediating variable between teaching and cognitive presence' and 'teaching presence causally influenced social and cognitive presence' (Garrison et al., 2010, p. 7). This has particular relevance for MOOCs,

where instructors may struggle to manifest their presence in the learning environment. However, models for designing discussion to support community-formation in online learning environments, such as Salmon's (2004) influential five-stage model, have typically been developed in the context of smaller, closed online courses and place a strong emphasis on moderation and instructor presence. In MOOCs, much of this falls to the course design itself.

Asynchronous text-based communication notably lacks non-verbal cues used in face-to-face communication and research on the cognitive effects of multimedia learning has also identified a number of principles supporting the postulated importance of social presence. Efforts to bridge the gap created by technological mediation, including addressing learners in a conversational manner, using human and familiar-accented rather than computer-generated or foreign-accented voices, and ensuring avatars are designed to mimic human body language, have been associated with improved learning. These social cues are postulated to 'prime a social response in learners (i.e. a feeling of social presence) that lead to deeper cognitive processing and better learning outcomes' (Mayer, 2014, p. 348). Importantly, this suggests socially-oriented design cues, and not just ongoing interaction with peers and instructors, can contribute positively to a learner's experience of social presence.

Many pedagogical concerns about MOOCs relate to the exacerbated psychological distance the scale of enrolment creates between a small number of instructors and a vast student cohort, with both MOOC instructors and students reporting feeling isolated (Evans & Myrick, 2015; Kennedy, 2014). Most recommendations for good pedagogical practice in MOOCs include fostering forms of presence as a priority, including encouraging peer discussion and assessment, enabling learners to interact with one another and with instructors and to collaborate and contribute their own content (Bali, 2014; Conole, 2013; Downes, 2013; Margaryan et al., 2015; Rubens et al., 2014). A principal way MOOC providers aspire to do this is through the inclusion of discussion forums on courses to enable learners to connect with and support one another and engage with course material.

2.4 The Pedagogical Value of Discussion

Fostering discussion to support learning is established practice in both face-to-face and online environments (Andresen, 2009; Laurillard, 2012) as it is expected that 'the reciprocal critique of ideas […] leads to the development of a more elaborated conceptual understanding' (Laurillard, 2012, p. 142). Instructor involvement remains essential to avoid misunderstandings and ensure discussion progresses student understanding (Laurillard, 2012). While this may be easier to manage (depending on instructor skill and experience) in synchronous face-to-face classrooms, researchers suggest asynchronous, text-based, online discussion forums may yield more thoughtful responses and higher levels of critical thinking (Andresen, 2009; Garrison, Anderson, & Archer, 2000; Garrison et al., 2010; Salter & Conneely, 2015).

Findings on the value of online educational discussion forums for learners are mixed, with some studies seeing benefits to learner satisfaction and performance (Thomas, 2002; Andreson, 2009; Gao, Zhang & Franklin, 2013). Correlations have also been found between forum participation and higher completion rates and scores in MOOCs (Gillani & Eynon, 2014). Findings on cognitive engagement, critical thinking and peer interaction in discussion forums vary and it is unclear whether forums themselves impact these (Gao, Zhang, & Franklin, 2013; Naranjo, Onrubia, & Segués, 2012; Thomas, 2002). Discussions can flounder or fail for many reasons, including 'unrealistic expectations, lack of student preparedness, lack of ground rules, inappropriate reward systems, and ineffective or no teacher modelling' (Armstrong & Thornton, 2012, p. 2). Darabi, Liang, Suryavanshi and Yurekli (2013, p. 229) conclude from an extensive literature review that effective online discussion has:

> […] structure, elements of interaction, a certain level of complexity, task orientation, clear expectations, and personal involvement of the instructor in the course [including] personal interaction with students.

Online students themselves report high expectations for instructor involvement in discussion forums (Nandi, Hamilton, & Harland, 2012).

To date only a small body of literature addresses MOOC discussion forums, yet the scale of MOOCs creates new problems, making direct communication with instructors difficult. Most studies of online educational discussion forums have explored relatively small graduate student courses within Universities and many strategies used by instructors in closed online courses are unavailable to MOOC designers. For example, students on non-accredited programmes cannot be required to participate in or assessed on their contributions to discussion forums, eliminating one motivation to contribute. Patterns of participation also pose challenges to the formation of learner communities, with low overall participation (10-20% according to Sharif and Magrill (2015)) and even lower consistent participation from beginning to end, suggesting MOOCs may harbour 'crowds' rather than communities of learners (Gillani & Eynon, 2014). Even with this uneven participation, however, there are suggestions that posting activity by active users may support vicarious learning by 'invisible' (Mustafaraj & Bu, 2015) forum users who read but do not post comments. MOOC 'superposters' (the most frequent posters) positively impact overall forum activity, continuity and quality (Huang, Dasgupta, Ghosh, Manning, & Sanders, 2014), while almost half of non-commenting participants ('lurkers') in a large, closed online course reported not posting comments because they felt reading was adequate participation (Küçük, 2010). High quality contributions may then function as effective worked examples or models of engagement.

Given the relative dearth of research focusing on discussion forums in MOOCs, more empirical studies are needed to bridge the gap in the literature and consider how to support learning in this context. Discussion design to encourage participation is considered both crucial and difficult even in smaller online courses better suited to community-formation (Skinner, 2009). In a MOOC context, where

instructors cannot maintain the same presence, careful scaffolding of discussion through appropriate questions and cues may nonetheless improve the learning potential of discussion forums, with instructors moving toward preparation rather than participation in discussions (Andresen, 2009; Guldberg & Pilkington, 2007). Importantly, the literature on online educational discussion forums focuses on supporting explicit (and observable) interaction between students and other ways forums may support learning are overlooked. Contributing at all can be both motivating and beneficial, as writing to express a position has intrinsic value (Sautter, 2007). Additionally, the role of comments in supporting vicarious learning (including interior dialogue) is not addressed.

2.5 Platform Affordances and Conversational Structure

In some online learning environments a range of pedagogical and technological strategies are deployed to ensure students reap the social and cognitive benefits of learning with others (Kirschner & Erkens, 2013). Technological interventions, such as interface prompts to encourage metacognition and representations to model and guide task processes, have been explored in online courses with smaller student cohorts (Gao et al., 2013; Kirschner & Erkens, 2013). In MOOCs, however, discussion forums remain the primary way of encouraging learners to contribute and interact.

2.5.1 MOOC Discussion Forums

Most MOOC discussion forums are accessed in a space separate from the course content and students visit to answer instructor questions, ask their own questions and respond to peers. Typical platforms (Figure 2.1) allow students and instructors to initiate or participate in discussions. The structure is hierarchical, consisting of three basic interactions: 'A *thread* is created for initiating a new discussion. A *post* is a message for replying to a thread. A *comment* is a message used to reply to a post' (Wong, Pursel, Divinsky, & Jansen, 2015).

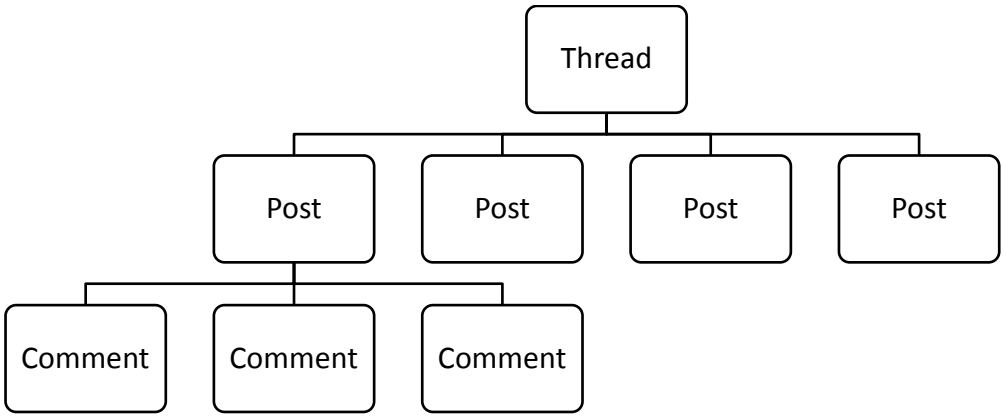

Figure 2.1 Structure of a Threaded Discussion

Threaded discussions can become increasingly fragmented and many posts may be isolated responses to the original post rather than dialogues with other learners (Thomas, 2002). This suggests forums may not deliver the expected benefits of learning through discussion. As Laurillard (2012, p. 145) highlights, in such instances students are 'learning through acquisition, not through discussion'.

2.5.2 Anchored Environment Comment Platforms

An 'anchored environment' is a variant on the threaded discussion forum in which each content element functions as a thread learners can comment on. Researchers have found both more frequent and more topically relevant discussions in anchored environments using text-based material and propose that the approach may be suitable for fostering discussion based around artefacts, such as videos or other resources (Gao et al., 2013). The FutureLearn platform through which the *Irish Lives* MOOC is delivered uses an artefact-centred anchored environment, in which each step of the course – usually a video, discussion question, set of resources or text – functions as a potential thread (Figure 2.2).

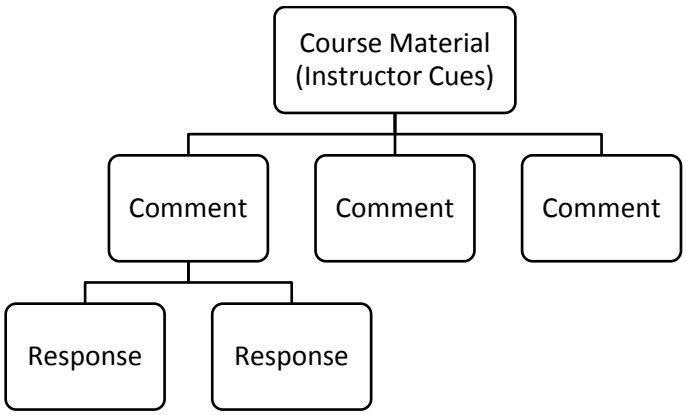

Figure 2.2 Structure of an Anchored Environment Discussion

Little research exists on the efficacy of this platform design in supporting the cognitive or social benefits of learning through discussion, or on how instructional questioning works in this environment. An analysis of the characteristics of learner comments in an anchored environment therefore has the potential to shed light on this.

2.6 Questions and Instructor Cues

In both face-to-face and online contexts, questioning is an essential instructional skill (Gayle, Preiss, & Allen, 2006). Initiating questions can establish tone and expectations while follow-up questions help sustain discussion (Brookfield & Preskill, 1999). Teachers also use questions 'to review, to check on learning, to probe thought processes, to pose problems, to seek out alternative solutions, and to challenge students to think critically and reflect on issues or values they have not previously considered' (Ellis, 1993). Questions can enhance learning by motivating students, highlighting relevant features of a topic,

encouraging deeper engagement and metacognition and enabling mastery through rehearsal (ibid.). Students asking questions is also central to the learning process (Tofade, Elsner, & Haines, 2013; Toledo, 2006), though it is beyond the scope of this research.

Classifications of instructor questions have frequently been influenced by Bloom's (1956) taxonomy of learning objectives and focused on improving instructors' ability to stimulate higher-order thinking (Dillon, 1982; Montello & Bonnel, 2009; Muilenburg & Berge, 2000). Lower-order thinking is associated with Bloom's first three categories – comprehension, understanding and application – and is thought to be engaged by questions requiring recall. Higher-order thinking is associated with his second three categories – analysis, synthesis and evaluation – and is thought to be encouraged by asking students to integrate, develop and reflect (Bloom, 1956). Although subsequent revisions of Bloom's taxonomy (e.g. Anderson & Krathwohl, 2001) have challenged the hierarchical nature of the original, the division into higher- and lower-order cognitive skills remains influential. Classifications of instructor questions are inseparable from constructs of quality learning, as questions are designed to elicit responses. Where individual learner responses are evaluated, quality is very frequently understood with reference to higher-order thinking in Bloom (see Section 2.7 below for further discussion). Variants of Bloom's cognitive domain taxonomy thus permeate much of the literature on instructional questioning and discussion scaffolding.

Findings from classroom studies on the effects of higher-order questioning on student performance or the cognitive level of answers are inconsistent, with meta-analyses showing at best moderate positive association (Gayle et al., 2006). Research into instructional methods in online discussion forums has established that question type and discussion scaffolding affects discussion quality (Andresen, 2009; Bradley, Thom, Hayes, & Hay, 2008; Dysthe, 2002; Gilbert & Dabbagh, 2005; Kanuka, Rourke, & Laflamme, 2007; Sautter, 2007; Yang, Newby, & Bill, 2005) and analyses of the link between higher-order questions and higher-order responses has been shown for some question types in online discussion forums (Bradley et al., 2008; Ertmer, Sadaf, & Ertmer, 2011; Sadaf, Richardson & Ertmer, 2011).

2.6.1 Recommendations on Instructional Questioning

Best practice recommendations for instructional questioning frequently advise combining initiating and follow-up questions to advance discussion (Brookfield & Preskill, 1999; Ellis, 1993; Muilenburg & Berge, 2000). Ellis (1993) reports on a summary of recommendations from the literature on classroom questioning, including clarity of phrasing, non-judgmental probing, consistent feedback and selecting questions appropriate to the cognitive level and goals of the students. Researchers recommend using question sequences to probe and deepen students' understanding as the discussion unfolds, as well as using a balance of questions at low and high cognitive levels to build confidence (Ellis, 1993; Tofade et al., 2013; Toledo, 2006). However, strategies involving ongoing instructor engagement are not feasible

in the large-scale asynchronous discussion forums of MOOCs. 'Posing compound questions that require multiple responses frequently leads to confusion'(Tofade et al., 2013, p. 6) and in an asynchronous text-based discussion an intended question sequence may manifest as a confusing cluster of compound questions instead.

Recommendations from the literature on instructional questioning applicable to large-scale asynchronous discussion are sparse. Clarity of purpose in developing questions and clarity of structure in communicating the nature and expectation of the question are cited by many as important (Andrews, 1980; Bradley et al., 2008; Milman, 2014; Tofade et al., 2013). Specific recommendations involve providing guidelines, goal instructions or worked examples to model appropriate responses (Beaudin, 1999; MacKnight, 2000; Nussbaum, 2005). Using higher-level question types and matching question types with desired response disposition is also recommended (Ertmer et al., 2011; Grabowski, 2011; Sadaf et al., 2011; Tofade et al., 2013).

Walsh and Sattes (2011, p. 31) recommend using a framework for question design as it enables instructors 'to be intentional and specific about expected student cognitive processing'. Several frameworks influenced by Bloom's taxonomy are available for classifying instructional questions according to cognitive level, knowledge domain, openness, focus and format (Anderson & Krathwohl, 2001; Andrews, 1980; Bradley et al., 2008). As one of the concerns expressed about MOOCs is that they lack sound pedagogical basis, exploring the relevance of Bloom's taxonomy of cognitive learning objectives for cue design and in learner comments is worthwhile and will inform the design of this research.

Although it is acknowledged that motivation is one important outcome of instructional questioning and some taxonomies of learning objectives include attitudes and values among their categories (e.g. Gagné, 1970), the literature on instructional questioning and the available frameworks focus exclusively on cognitive outcomes, such as those outlined in Bloom's cognitive domain taxonomy.

2.6.2 From Questions to Cues

In addition to explicit questions, this research proposes that in the anchored environment it is necessary to look at what can be termed instructor *cues* more widely. Drawing on conversation analysis, a cue is defined here as any chunk of discourse that performs the function of signalling to the 'hearer' (in this case, the learner) that their 'turn' to speak (or comment) has arrived (Levinson, 1983). This can be accomplished in a variety of ways, such as posing a question, summing up what was presented or directly soliciting comments. In this context, the relationship between cue and comment in an anchored environment MOOC can be understood as a kind of 'adjacency pair' – a term linguists use to describe basic conversational sequences consisting of 'paired utterances' such as 'question-answer, greeting-greeting, offer-acceptance' (Levinson, 1983; Schegloff, 2007). Adjacency pairs are governed by an

implicit expectation that once a speaker has produced the first utterance of a pair, 'the next speaker must produce at that point a second part to the same pair' (Levinson, 1983, p. 304). While only some learners comment on any given cue, those who do can be seen as activating a basic conversational structure by accepting the cue as the first part of an adjacency pair demanding a response; in other words, responding to the 'demand-quality' of the cue (Della Noce, Scheffel, & Lowry, 2014). Gibson (2009) draws on the concepts of turn-taking and adjacency pairs to explore how students negotiate whose turn it is to 'speak' in an online educational discussion thread. However, analysing discussion sequence in this way is beyond the scope of the research, which focuses on the cue-comment relationship. As this research is concerned with how instructor cues influence comment characteristics, the question of how comments respond to the perceived conversational demands of the cues is central to the analysis. The existing literature on instructional questioning has tended to focus exclusively on explicit questions, yet there are many ways to communicate a conversational expectation, so it is worth exploring the possibility of extending classifications to accommodate the construct of instructor cues.

2.7 Frameworks for Analysing Discussion Forums

There is considerable heterogeneity in theoretical approach, selection of framework and methodological approach across analyses of online educational discussion forums (De Wever, Schellens, Valcke, & Van Keer, 2006; Weltzer-Ward, 2011). Most studies explore whether 'quality' interactions are occurring, but few have considered the role of instructional questions in this. The anticipated value of learning through discussion is that students will develop more complex articulations of a viewpoint (Laurillard, 2012) and discussion quality has been theorised as meaningful peer interaction and/or level of cognitive engagement with course content.

Interaction quality is frequently operationalised as markers of knowledge co-construction (Gao et al., 2013; Gunawardena, Lowe, & Anderson, 1997; Ioannou, Demetriou, & Mama, 2014; Thomas, 2002). Where cognitive engagement is the primary concern, quality is operationalised as evidence of critical or higher-order thinking (Bradley et al., 2008; Gilbert & Dabbagh, 2005; Kanuka et al., 2007; Rourke & Kanuka, 2009; Schrire, 2006; Thomas, 2002). A smaller number of frameworks fuse elements of interactional and cognitive quality under the construct of socio-cognitive quality (Garrison, Anderson, & Archer, 2001a; Ho & Swan, 2007) and some efforts have been made to combine frameworks for better coverage or triangulation (Meyer, 2004; Schrire, 2006; Thomas, 2002) or to articulate mixed frameworks as a result of open coding (Nandi, Hamilton, & Harland, 2012). A summary of these frameworks is provided in Appendix A.

None of the frameworks reviewed have been deployed in MOOC-scale courses and little is currently known about commenting behaviour in MOOCs. As pedagogical goals are frequently implicit or unclear in MOOCs (Evans & Myrick, 2015) and motivation for participating may differ from student goals on

accredited University courses, it cannot be assumed that the same frameworks are suitable for analysing MOOC comments. As the current research is concerned with the effect instructor cues have on commenting behaviour, the selection of a framework for analysing learner comments must follow from the initial analysis of cues. These considerations are discussed further in Chapter Three.

2.8 Research Questions and Approach

This research asks how instructor cues influence comment characteristics in an anchored environment MOOC. The cue-comment relationship is understood as an 'adjacency pair' or minimal conversational structure within the learning environment. Cues are thus conceived of as both explicit (questions) and implicit (content), as any cue can occupy the traditional role of the question in prompting a response. To explore this question, it is necessary to classify cues used in the selected case (the *Irish Lives* MOOC), to analyse an appropriate selection of comments across a range of cue types and to compare the results of the comment analysis. The following research sub-questions have been identified:

What is an appropriate classification for instructor cues in MOOCs?

The literature on instructional questioning presents several frameworks for classifying questions by pedagogical intent, but no single framework is sufficient to classify instructor cues understood in the broader sense outlined above. As most instructor question classifications adopt or incorporate versions of Bloom's cognitive domain taxonomy of learning objectives (Bradley et al., 2008; Dillon, 1982; Ertmer et al., 2011; Montello & Bonnel, 2009; Muilenburg & Berge, 2000; Sadaf et al., 2011) and as this study aims to produce usable outcomes for improving instructor cue design, directed coding of instructor cues will be undertaken to explore the utility of this taxonomy. As no classifications of instructor *cues* have been identified, open coding of cues will be used to inductively extend and supplement this taxonomy. The approach to classification will be further developed in Chapter Three.

To what extent do learner comments respond to the expectations communicated by different cue types?

Because instructor presence is difficult to maintain in MOOCs, instructor cue design may be particularly important in communicating expectations to learners and prompting them to engage with course material. A small body of literature has found that question type and cognitive disposition (understood in terms of whether the question solicits lower-order or higher-order thinking, with reference to Bloom's cognitive domain taxonomy) can influence the quality of online educational discussion (Bradley et al., 2008; Ertmer et al., 2011; Sadaf et al., 2011). However, no research of this nature has explored MOOC-scale courses or a wider classification of instructor cues. The literature suggests the potential for further research 'analy[s]ing discussion as a conversation and tying discussion analysis to outcomes' (Weltzer-Ward, 2011, p. 70), yet this has largely been undertaken by examining individual threaded discussions and is not well-suited to the anchored environment xMOOC. Research has also found that learners more

often respond to the initial post than to other comments (Thomas, 2002), suggesting that the cue-comment relationship may be central to the learning experience. This research draws on conversational analysis to frame the cue-comment relation as a truncated conversational structure oriented towards learning objectives. From the literature, it is expected that cues establish communicative expectations which learners recognise and respond to in comments. Testing this hypothesis is important in establishing (or refuting) the importance of cue design. Comments will be analysed to explore the extent to which they correspond to these expectations, using directed content analysis informed by the instructor cue classification developed in a first analysis phase. Chapter Three discusses this approach in more detail.

Chapter Three: Methodology

3.1 Research Question

This study explores the following research question and sub-questions:

- How do instructor cues influence comment characteristics in an anchored environment xMOOC?
    - What is an appropriate classification for instructor cues?
    - To what extent do learner comments respond to the expectations communicated by different cue types?

An additional research objective is to design a framework, informed by the analysis and findings, that can be used by MOOC designers to improve cue design. However, this will be an output of the research and evaluating it in practice is beyond the scope of the current study.

This chapter presents the research design and methodology, outlines two phases of analysis and discusses some practical and ethical concerns and measures to improve validity.

3.2 Research Design

3.2.1 Case Study Design

The research adopts a case study design to explore the relationship between instructor cues and learner comments in the *Irish Lives* MOOC. A case study is 'a study of a singularity conducted in depth in natural settings' (Bassey, 1999, p. 47) and is distinguished by a focus on one particular 'bounded' phenomenon or experience that can be defined as a finite 'case' (Merriam, 1998). A case study 'is not a methodological choice but a choice of what is to be studied' (Stake, 1994, p. 236) and the definition of a case should be closely linked to the research question (Baxter & Jack, 2008), such that studying the particular case can reasonably be expected to provide insight into the question. A single delivery of the *Irish Lives* MOOC is defined as the case to be analysed, as it provides an opportunity for exploratory yet finite research on the cue-comment relation in an anchored environment xMOOC.

Some cases are studied for their own sake, to discover something of interest about their particularity; others are studied in the hope that they will yield insight into a research question or help develop a theory (Stake, 1995). This case study is of the latter kind – what Stake (1994, 1995) terms an *instrumental* case study. Though the case may be examined in depth, analysing it is a means to understanding something more general (Stake, 1994) and further methodological decisions about sampling and analysis are driven by this extrinsic objective. Though sometimes considered too singular to generalise from, case studies can, among other things, be used to both produce and evaluate hypotheses (Flyvbjerg, 2006). The goals and design of this case study are both exploratory and explanatory (Yin, 1994), as it seeks both to

generate and to test theory (Bassey, 1999). The case was selected as it facilitates testing the initial hypothesis that instructor cue communicative disposition would influence learner comment characteristics. Given the dearth of literature on instructor cues in MOOC contexts, however, the research design incorporates exploratory analysis to identify an appropriate classification scheme, alongside testing and refining an existing framework. Following cue classification, as described below, a comment analysis was conducted to test the hypothesis of a correspondence between cue and comment disposition.

3.2.2 Alternative Research Designs Considered

Several other research designs were considered:

- **Survey research designs** can illuminate aspects of MOOC participation and student experience. Questionnaires are valuable for gathering and comparing viewpoints and identifying trends across large groups, while interviews can investigate learner motivations, attitudes and experience in greater depth (Cohen, Manion, & Morrison, 2007; Creswell, 2011). An advantage both offer for studying online discussion forums lies in reaching non-commenting participants and discovering how a wider group of MOOC learners relate to forums. However, for understanding how learners respond to instructor cues, analysing existing comment data offers more naturalistic access to commenting behaviour, without the mediation of temporal delay and the possibility of post-hoc rationalisation yielding aggregate impressions. The case study design permits exploration of how learners actually behaved when presented with a given cue.

- **Ethnographic research design** is compatible with case study design but focuses more explicitly on the cultural context within which meaning-making occurs (Creswell, 2011; Merriam, 1998). Observing the culture of learner commenting during a MOOC could provide a developmental perspective on interactions between learners. However, the scale of participation in MOOCs could make it difficult to sustain the kind of detailed attention essential to ethnography. Additionally, it has been observed that MOOC forums tend to foster ‘crowds’ rather than communities of learners (Gillani & Eynon, 2014) and lack consistent membership over time (Kizilcec et al., 2013). While this may point to a need for ethnographic studies of MOOC learners, it also highlights difficulties in viewing MOOC learners as sharing a culture.

Most case studies in educational contexts adopt qualitative approaches to data collection and analysis on the basis that the particularity of lived experience is essential to understanding phenomena in depth (Merriam, 1998). This is well suited to studying human communicative behaviour and is appropriate for the present analysis of learner comments in MOOCs and their relationship to instructor cues.

3.2.3 Qualitative Content Analysis

A combined approach to qualitative content analysis was adopted for analysing cues and comments. Choosing or developing a framework is a crucial step in the research process (Gerbic & Stacey, 2005) and researchers have several options. Developing a coding framework from the data itself is useful where little theory exists on the phenomenon (Gerbic & Stacey, 2005; Hsieh & Shannon, 2005). Directed content analysis operationalises existing theory to develop a framework and is suitable where there are existing theories but no satisfactory frameworks (Hsieh & Shannon, 2005). Using existing frameworks is an appropriate option where they have been developed and deployed within the domain; as well as saving time, these have the merit of already incorporating salient features of the domain (Gerbic & Stacey, 2005) and enable meaningful comparison with previous research.

Two phases of analysis were undertaken – instructor cue classification and learner comment analysis. For the cue classification, a mixed analytical approach was adopted, combining existing frameworks with open coding. As discussed in Chapter Two, most analyses of online discussion forums have focused on interaction quality or cognitive engagement/critical thinking, or in some cases both (see Appendix A). It was originally intended to analyse both of these features in this study.

As versions of Bloom's taxonomy of cognitive domain learning outcomes have been used both for analysing discussion forum comments in smaller online courses and for classifying instructional questions based on learning objectives, it was decided to explore the applicability of a version of this taxonomy (Anderson & Krathwohl, 2001) in the novel context of an anchored environment MOOC. To supplement this and explore other relevant features, open coding of cues was also undertaken. This focused on the pragmatic rather than semantic aspects of the cues, by which is understood those features that shaped a cue's communicative disposition or apparent intent, rather than the content. A first stage of cue analysis revealed that values and attitudes played an important role in the demand-quality of cues, and Bloom and colleagues' affective domain taxonomy (Krathwohl, Bloom, & Masia, 1964) was adopted as a theory and inductively adapted and operationalised to account for this dimension of the cues. A final step in the cue analysis applied both taxonomies to create a classification of cues. The process and findings of this analysis are detailed in Chapter Four.

Given the often fragmented nature of discussion threads (Thomas, 2002) and the focus here on cue-comment relations, a framework Thomas (2002) developed to explore individual comments' relative independence or responsiveness (to the question or to other comments) was considered for exploring interaction quality. However, unexpected results from the cue classification led to a change in direction and it was decided to focus on the combined affective and cognitive domain taxonomies with a view to developing a usable framework for MOOC instructor cue design. The planned analysis of interaction quality was therefore not pursued.

In the second phase of analysis, directed content analysis is conducted on a sample of comments for each cue type, to explore correspondences and test, refine and corroborate the cue classification. The process and findings of the comment analysis are detailed in Chapter Five.

The research process is summarised in Figure 3.1 and the rationale for the coding approach in each phase is summarised in Table 3.1. The selection, adaptation and operationalisation of the affective domain taxonomy (referred to in Figure 3.1) were not planned prior to the analysis but emerged from the combined process of testing the application of the cognitive domain taxonomy and open coding to identify other salient communicative features of the cues. This will be elaborated on in Chapter Four.

Following these two phases of analysis, a framework was developed to provide a visual quick reference guide for MOOC cue design informed by the analysis. This is detailed in Chapter Six.

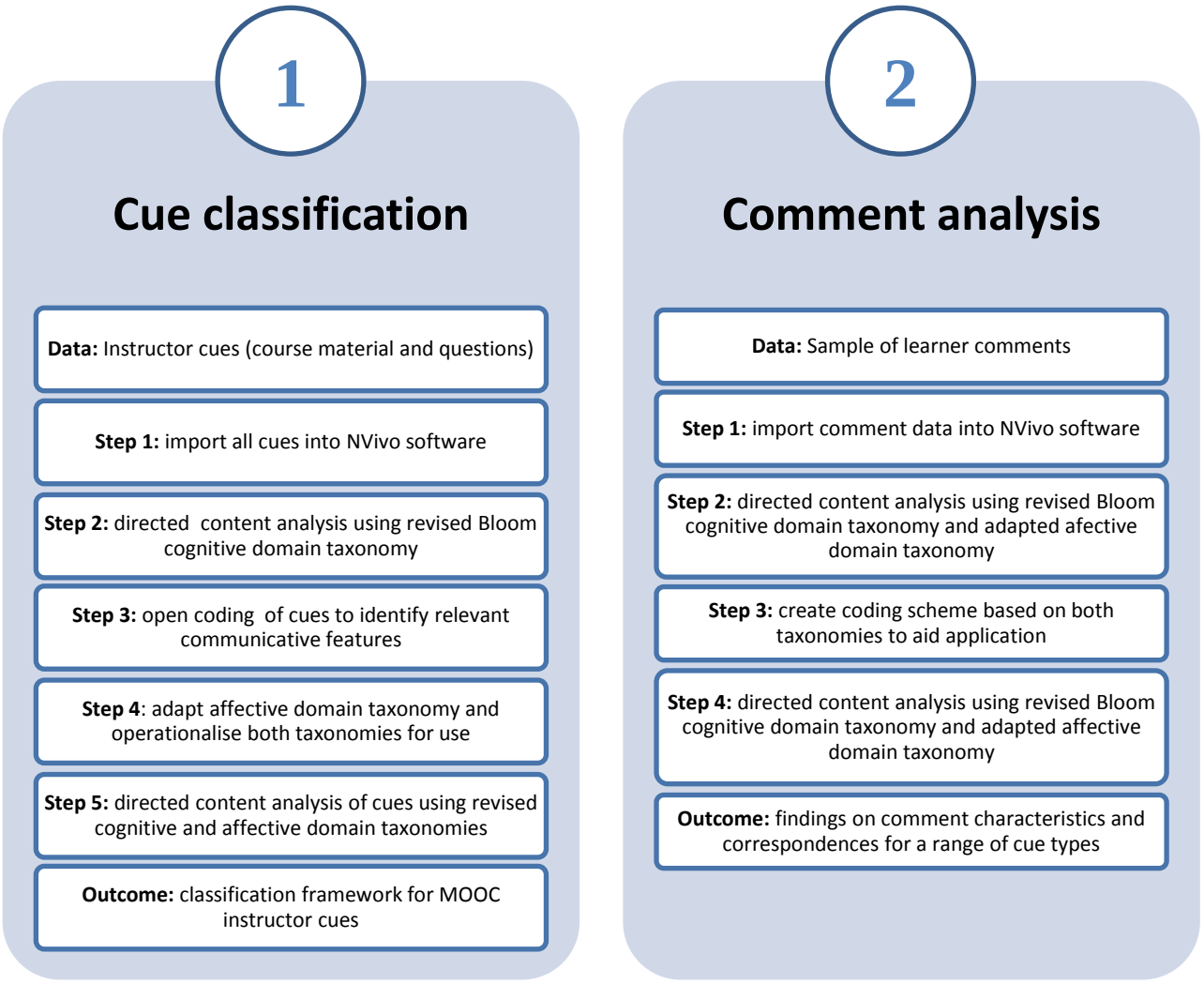

Figure 3.1 Research Process

	Data	Goal	Coding Approaches
Phase 1	Instructor Cues	Test best available framework in novel MOOC context	Apply existing framework based on revised Bloom's taxonomy of cognitive domain (Anderson & Krathwohl, 2001)
		Identify other features to extend framework	Open coding focusing on communicative disposition, not content
Phase 2	Learner Comments	Test extent to which cue disposition impacts comment disposition	Directed content analysis using framework derived from cue classification

Table 3.1 Coding Approaches

3.3 Data Selection

Educational research methods textbooks (e.g. Cohen et al., 2007; Creswell, 2011) often focus more on primary data collection for analysis (Andrews, Higgins, Andrews, & Lalor, 2012; Johnston, 2014). However, text-based discussion forums are a rich source of secondary data and have been extensively explored to gain insight into learner behaviour in online courses. Secondary data profits from unobtrusive collection and is arguably more reflective of human behaviour in a naturalistic setting (Johnston, 2014; Smith et al., 2011). Compared with data collection *for* research, efforts must be made to ensure the data is suited to addressing the research question and not just used because it is available (Smith et al., 2011). The *Irish Lives* dataset is well-suited to exploring cue-comment relations in MOOCs. Data collected in an anchored environment are particularly valuable as the platform ensures comments are associated with a particular cue (though of course they may not respond only to the cue).

3.4 Ethical Issues

The rise of Internet-based research complicates research ethics models, with theorists noting ambiguity as to whether online content-producers ought to be conceptualised as 'human subject' research participants or as authors of textual and multimedia content (Esposito, 2012). Research ethics is typically concerned with minimising potential risk to participants (weighed against the likely social benefit of the research) and ensuring informed consent. While conducting research on an existing dataset does not require active participant recruitment on the part of the researcher, it also precludes researchers from personally ensuring informed consent by outlining to participants the scope and purpose of the research and the manner in which their data will be used. This poses some distinct ethical challenges to research, particularly when working with user-generated content.

Usually, individuals contribute content – such as comments in a discussion forum – for reasons other than research participation and without expecting their contributions to be used for research. In online learning, their purpose may include responding to an assignment or question or engaging with peers –

activities course providers generally promote. This proliferation of user-generated content presents opportunities to explore learner behaviour in online courses, but such research must take care to protect contributors' identity, privacy, copyright and moral rights. While producing content while participating in free open online courses is arguably 'grounded in a culture of sharing' inherent to such environments (Esposito, 2012, p. 320), participants may not see their contributions as such and there is no clear demarcation of public and private space in shared online contexts. Research treatment of personal information may now need to consider not only explicit 'harm-based' but also 'dignity-based' conceptions of privacy, as the de- and re-contextualisation of personal information for research may compromise 'the subjects' human dignity and their ability to control the flow of their personal information' (Zimmer, 2010, p. 321).

The FutureLearn Research Ethics Framework (FutureLearn, 2014) outlines some of the ethical challenges facing MOOC research and commits to additional safeguards to ensure good ethical conduct.

3.4.1 Consent

The Framework states:

> By taking part in a free open online course, where they are informed that activities may be monitored for research purposes, participants can be assumed to have given consent for participation in research conducted according to these guidelines, so opt-in consent from each participant is not required (FutureLearn, 2014).

Despite this claim, the standard FutureLearn employ might better be described as 'assumed consent' than 'informed consent', as this information is never explicitly presented to learners enrolling on a course. To view it, learners must access website Terms (FutureLearn, 2015) from an inconspicuous link in the site footer. However, additional measures are advised to ensure protection of participants' identity and rights over their content.

3.4.2 Anonymity and Confidentiality

Following the Framework, learner comments are made available as an anonymised dataset with no identifying information. Participants are distinguished by a numerical ID not linked to any other stored information. The researcher signed a confidentiality agreement with the Department of Online Education, TCD, prior to being granted access to the dataset for analysis (Appendix B). The agreement includes a commitment to password-protect the data, supplied as Excel files, and to store the dataset in a password-protected computer. All data was therefore encrypted and stored in accordance with the Data Protection Act at TCD.

To further protect the copyright and moral rights of MOOC participants, who retain ownership of all content they contribute on the FutureLearn platform, the agreement commits to refrain from quoting user

comments directly in any publication of research findings, although they may be 'summarised or themed' for analysis. This measure ensures that individual comments cannot be used to directly illustrate research findings that the comment contributor may not wish to be associated with.

Ethical approval was granted by the TCD School of Computer Science and Statistics Ethics Committee.

3.5 Validity in Qualitative Research Design

In quantitative research, results are generally considered reliable when findings are replicable and deemed valid when it can be ascertained that 'the means of measurement are accurate' and 'are actually measuring what they are intended to measure' (Golafshani, 2003, p. 599). These concepts help ensure analytic rigour. However, researchers differ on how important validity and reliability are to qualitative research. While quantitative researchers have historically operated within a positivist paradigm, qualitative research is acknowledged to be inherently subjective and operates within a constructivist or naturalistic paradigm (Golafshani, 2003; Shenton, 2004). The question of validity is further complicated by the constructivist recognition that it is rooted in the epistemological problem of what is accepted as 'evidence' within a given paradigm (Lincoln, 2002; Miller & Fredericks, 2003). Following a review of many proposals for alternative formulations or outright rejections of the demand to meet quantitative research criteria, Golafshani (2003, p. 604) concludes that in qualitative research the terms must be reconceptualised as 'trustworthiness, rigor and quality'.

This research adopts several strategies to improve the credibility of findings:

- During analysis, a journal was used to document the researcher's reflections on the data, decisions about developing and applying codes and categories, problems encountered and hypotheses emerging from the analysis. Annotations were made in Nvivo during coding and review stages to highlight ambiguities and explain decisions about the application of codes. Both sources were used to develop a coding scheme to ensure more consistent application of codes.
- To increase transparency, this report endeavours to provide a clear rationale for each decision made during the research, from sample selection to the application of individual codes, and provides supporting documentation in Appendices where possible.
- Analysis is conducted iteratively, with checks built into the coding process at intervals, to ensure verification is central to the research design and not merely post-hoc (Morse et al., 2008).
- The comment analysis is undertaken to triangulate the findings of the cue analysis by testing and refining the codes and classification framework.

Chapter Four: Instructor Cue Classification

4.1 Introduction

This research explores how instructor cues influence comment characteristics in an anchored environment xMOOC. In the first phase of analysis, it attempts a classification of cues, as existing frameworks for classifying instructor questions have not been extended to cues more widely or utilised in MOOCs. This chapter details the selection and analysis of an instructor cue sample from the *Irish Lives* MOOC and discusses the findings. Figure 4.1 outlines this phase of analysis.

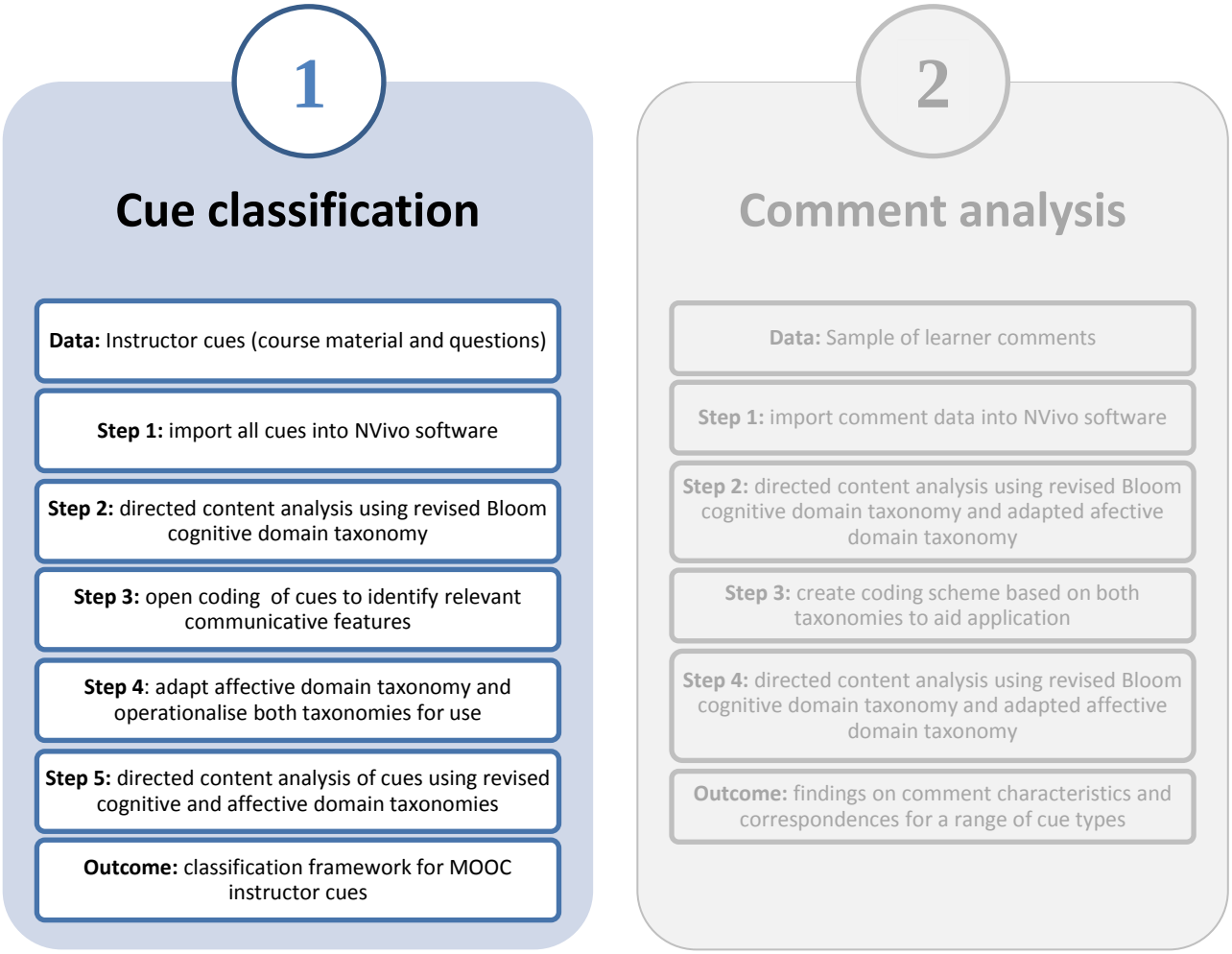

Figure 4.1 Research Process – Phase 1

4.2 Unit of Analysis

The *Irish Lives* MOOC contains 122 distinct 'steps' over 6 topically-demarcated weeks (Table 4.1). Each week includes 18-23 steps, comprising video and text content, introductory and summary articles, reference lists, orientation information, questions, research activities and assignments. Many steps are

compound, containing, for instance, a video followed by a paragraph of text, or a list of primary sources framed by direct requests to explore and comment on these.

Drawing on conversation analysis, a cue is defined here as any chunk of discourse that performs the function of signalling to the 'hearer' (in this case, the learner) that their 'turn' to speak (or comment) has arrived (Levinson, 1983; Schegloff, 2007). In an anchored environment xMOOC, this means both explicit questions and other linguistic signposts used to encourage learners to comment. While in principle learners may respond to any content, the definition of a cue is limited to those utterances that explicitly finalise the instructor's role and present some form of demand (whether direct or indirect) that the learner respond. Understood in terms of conversational demand, cues may vary in length and contain one or many distinct sentences, requests or questions. Demand quality may be clear or vague, explicit or implicit. Informed by this theoretical framework, the goal of the cue analysis is to arrive at a suitable classification for cues based on their demand quality. The following terminology is used:

- **Step**: a numbered activity in the course, which may consist of a text article, video, reference list, etc., with or without a cue (e.g. Figure 4.2 depicts Step 2.10).
- **Cue**: a discourse chunk with the function of signalling to the learner that their turn to respond has come, e.g. through summarising content or asking direct or indirect questions.
- **Question**: a single interrogative sentence that may be a cue in its own right or may form part of a cue comprising multiple questions or constative statements.

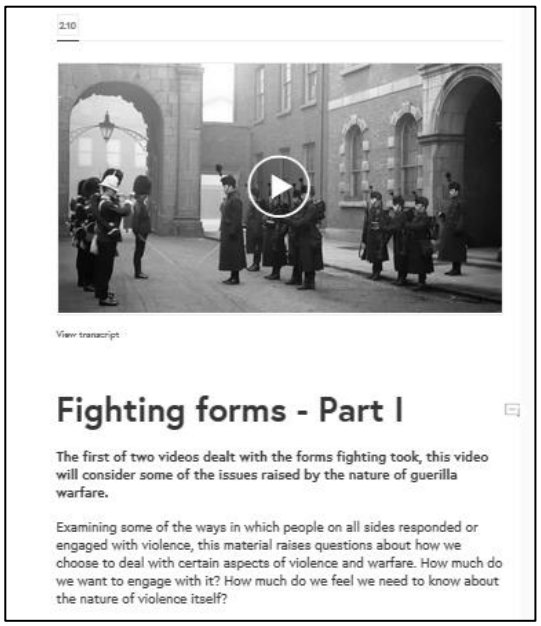

Figure 4.2 Step with Video and Instructor Cue

4.3 Sample Selection

A sample of steps was selected for cue analysis based on relevance to the research question. Step types are summarised in Table 4.1, with details of whether comments are permitted, how many comments they received and whether they are included in this analysis. Steps without comments were excluded; in this case, quizzes and other assignment-related steps. The remaining step types were text articles, videos, discussion questions, research activities and reference lists. Reference lists were excluded as less relevant to the research question as they contained little demand for response. Text-only articles were also excluded as less relevant here as they were mostly short articles introducing and concluding weekly topics. While text articles should not in principle be excluded from an analysis of cues, in this case their communicative function is primarily one of orientation. Reference lists and text articles also received fewer comments than other step types, arguably due to containing less explicit cues.

Step type	Number of steps	Comments	Number of comments	Average number of comments per step	Included in analysis
Article (text only)	16	Yes	5,943	371	No
Video (with text)	**39**	**Yes**	**20,871**	**549**	**Yes**
Discussion question	**16**	**Yes**	**23,012**	**1,438**	**Yes**
Research activity	**25**	**Yes**	**14,077**	**563**	**Yes**
Reference list	17	Yes	3,653	215	No
Quiz	3	No	-	-	No
Assignment	2	No	-	-	No
Peer review assignment	2	No	-	-	No
Reflect on assignment feedback	2	No	-	-	No
Total	**122**				

Table 4.1 Irish Lives MOOC Steps and Case Selection

Video, discussion question and research activity steps were chosen for cue analysis. Video steps usually include text to frame or summarise video content, pose questions and prompt further engagement. Discussion questions request responses to explicit questions. Research activity steps invite learners to conduct independent research using resources provided and comment on their discoveries. A generic video introduction to course navigation was excluded as irrelevant to the research question. Discussion questions received most comments per step, with video and research activity steps receiving similar numbers per step on average. In total, 38 video steps, 16 discussion questions and 25 research activity steps were analysed.

4.4 Content Preparation

Nvivo computer-assisted qualitative data analysis (CAQDAS) software was used for analysis. All text from selected steps was imported into Nvivo. Videos were imported separately and grouped with the corresponding text, as, although the focus of the current research is on linguistic cues, this would facilitate contextual analysis of cues linked to videos should the need arise.

4.5 Process of Analysis

A combination of open coding and applying an existing framework was used to analyse instructor cues. Anderson and Krathwohl's (2001) revision of Bloom's taxonomy of educational objectives (henceforth referred to as the revised taxonomy), which breaks learning objectives into categories based on cognitive dispositions (see Appendix C), was selected for exploratory application. Each cue was initially coded to locate its communicative expectation within this taxonomy, i.e. whether it contained an expectation that the learner show understanding, analyse, evaluate, etc. Open coding was then conducted on a sample of cues from each step type to identify emergent themes relevant to the cue's demand-quality. A research journal was maintained throughout (Appendix M presents sample pages from different stages in the process) and annotations were used to clarify the application of specific codes in Nvivo (see Appendix L). The process of analysis is summarised in Figure 4.3.

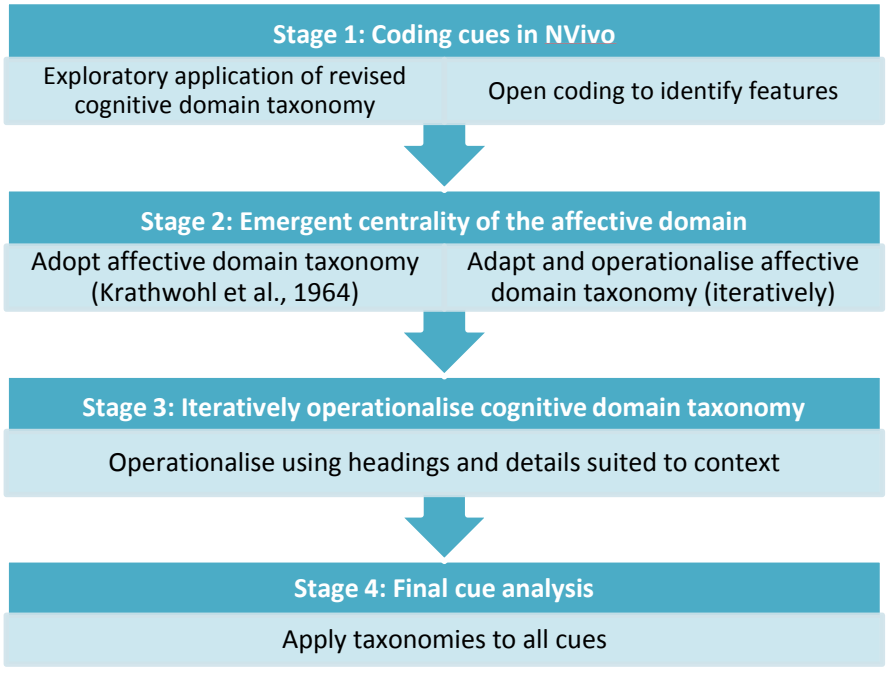

Figure 4.3 Cue Analysis Process

4.5.1 Video Coding

Open coding was also conducted on a sample of videos to explore communicative features that might influence comment analysis (see Appendix K for a list of codes). This was not pursued here as it was decided to focus on linguistic cues for an initial exploratory analysis. However, a simple classification of video steps was subsequently conducted (see Chapter Five), after comment analysis suggested that video tone and content may affect responses. Extending the analysis to videos is a promising direction for future research.

4.6 Stage 1: Coding Cues in Nvivo

4.6.1 Exploratory Application of Revised Cognitive Domain Taxonomy

Anderson and Krathwohl's (2001) revised taxonomy provides clear descriptions, synonyms and examples for each cognitive domain category: remember, understand, apply, analyse, evaluate and create. Applying this taxonomy to instructor cues nonetheless proved challenging. Firstly, many cues were compound, with question clusters making multiple requests (see Appendix N for examples). Secondly, the cognitive requirements for responses were often unclear. While any individual question might be assessed for implicit cognitive demand, a compound entity viewed as a mode of finalisation cannot be reduced to the sum of its individual demands. Thus, the revised taxonomy was deemed insufficient, at least in its current form, for classifying the compound cues common in video and research activity steps. Application to cues in discussion question steps was simpler but because demands were often unclear analysis involved inferring implicit cognitive demands. This suggested the need to operationalise the revised taxonomy, creating feature descriptions suited to identifying implicit cognitive demands.

4.6.2 Open Coding to Identify Features

Open coding was conducted to explore further possibilities for cue classification. For the current research, coding focused not on cue *content* (e.g. 'fighting' or 'everyday life'), but on *how* demands were made (e.g. questions, requests, clarity, directness).

Initial coding identified numerous features relevant to exploring demand quality, including:

- **Social inclusion:** 'you' (direct address), 'we' (inclusiveness), 'fellow students' (community).
- **Demand types:** questions, directives (imperatives, e.g. 'consider', 'discuss'), implied requests (e.g. 'we hope').
- **Demand focus:** clarity, singular/compound, direct/indirect (implied), convergent/divergent .

A difficulty in clustering these features into more general categories, which is the goal of analysis, is again the compound nature of many cues, with questions, directives and implied requests often clustered

together in a single cue. Whether cues are single or compound is linked to demand *clarity* and merits further investigation, but this does little to clarify a cue's communicative *expectations*. Social inclusion markers 'we' and 'fellow students' are of greater interest than 'you', as direct address is standard across the course, and are worth investigating to explore issues around social presence, but may modify the force of demands rather than aid in differentiating demand types.

The divergent character of many cues emerged as particularly interesting, not least because it raised most problems for analysis. Cues coded as divergent include clusters of questions, requests, directives and contextualising statements. Their demand quality is vague and they frequently use rhetorical questions and 'soft' imperatives like 'reflect' and 'consider'. It is often unclear how much they communicate the expectation to respond. On review, it was concluded that they asked learners to 'enter into' content or approaches to the subject empathetically, rather than perform any particular cognitive tasks. This connects to learning outcomes not covered in the revised cognitive domain taxonomy (or any studies of discussion quality in online courses) but included in other classifications of learning outcomes that recognise affective characteristics, such as attitudes, values and motivation (e.g. Gagné, 1984; Kraiger, Ford, & Salas, 1993). These findings suggest that learners may be encouraged to undergo what might be termed an *affective apprenticeship* in a subject as well as developing cognitive skills appropriate to the domain. This is particularly interesting for MOOCs, whose purpose may be to introduce students to a subject or approach and where developing interest in the subject may be a primary, if implicit, learning objective.

4.7 Stage 2: Emergent Centrality of the Affective Domain

4.7.1 The Affective Domain

In extending the original literature search to seek an appropriate framework for explaining these findings, an affective domain taxonomy, developed by Bloom and colleagues (Krathwohl et al., 1964) after the original cognitive domain taxonomy, was identified. The authors consider affective objectives essential to successful learning in many areas but highlight that, though implicit in most fields, they are seldom made explicit. An affective 'continuum' is developed to describe a gradual five-stage process by which students move from initial awareness of a set of values to completely internalising and being guided by them. The continuum describes an affective apprenticeship, with learners developing interest, commitment, skills (organising values more systematically) and eventually mastery (adopting the position of the domain or value system consistently) over the relevant values or attitudes. The authors provide a detailed description and examples of each stage (Table 4.2).

1.0 Receiving	1.1 Awareness 1.2 Willingness to receive 1.3 Controlled or selected attention
2.0 Responding	2.1 Acquiescence in responding 2.2 Willingness to respond 2.3 Satisfaction in response
3.0 Valuing	3.1 Acceptance of a value 3.2 Preference for a value 3.3 Commitment
4.0 Organisation	4.1 Conceptualisation of a value 4.2 Organisation of a value system
5.0 Characterisation by a value complex	5.1 Generalised set 5.2 Characterisation

Table 4.2 The Affective Domain Taxonomy (Krathwohl et al., 1964)

As no subsequent efforts to develop the taxonomy were identified, this account was operationalised for the current analysis.

4.7.2 Operationalising the Affective Domain Taxonomy

The original affective domain taxonomy consists of five stages, each with several sub-sections (see Table 4.2). To operationalise this, an initial feature description was developed from Krathwohl et al.'s (1964) detailed account and inductively adapted through further coding of cues. The first stage, 'receiving', was judged not to be meaningful for classifying instructor cues. Receiving is defined as a passive encounter with stimuli, prior to responding. Cues contain an implicit or explicit requirement to respond and comments necessarily involve active response. Affective apprenticeship is therefore conceptualised here as beginning with an active response and the taxonomy has been reduced to four stages for analysis. For clarity, the 'characterisation' stage has been re-named 'internalisation'. Descriptions were developed for cue features and pedagogical strategies, to facilitate application of the taxonomy. To aid in this, ideal responses for learners at any stage were also considered, as the cue-comment adjacency pair is conceptualised as a relation between expected and presented response. Classifying cues using this taxonomy can thus be approached from several different points of view, which improves the possibility of consistent application.

The operationalisation of the Affective Responding category is presented in Table 4.3, to demonstrate the headings and details used. A full operationalisation table for the affective domain taxonomy is available in Appendix D.

Heading	Detail
Description	beginning of affective apprenticeship; openness to new points of view and material
Features	curiosity, tolerance, interest, appreciation
Pedagogical strategy	present diversity to move learner from comfort zone; exposure to or immersion in different worlds or points of view
Cue features	divergent presentation, e.g. reflective question clusters; low demand imperatives such as 'consider', 'reflect on', 'think about', that ask learners to enter into a set of concerns or viewpoints empathetically; rhetorical questions
Ideal response	learner empathises with different points of view; attitude is accommodating; interest in understanding the motives of others
Associated codes	'challenge', 'different perspectives', 'enter into'

Table 4.3 Operationalisation Template Applied to Affective (Responding)

4.8 Stage 3: Operationalising the Cognitive Domain Taxonomy

Because initial application of Anderson and Krathwohl's (2001) revised taxonomy showed cognitive demands in cues were often implicit, this taxonomy was operationalised using the template developed for operationalising the affective domain taxonomy. Initial descriptions were adapted from Anderson and Krathwohl's work and developed, where possible, through inductive adaptation in conjunction with coding cues. No cues were categorised as 'remember' or 'apply' so indicative theoretical descriptions were created for these. The full operationalisation table for the cognitive domain taxonomy is available in Appendix E.

For each category, a two-letter code has been created for convenient reference, e.g. AR for Affective Responding, CU for Cognitive Understanding. Abbreviations will be used henceforth and are listed in Table 4.4:

Affective Domain		Cognitive Domain	
Category	**Abbreviation**	**Category**	**Abbreviation**
Responding	AR	Remember	CR
Valuing	AV	Understand	CU
Organising	AO	Apply	CP
Internalising	AI	Analyse	CA
		Evaluate	CE
		Create	CC

Table 4.4 Abbreviations for Affective and Cognitive Domain Categories

4.9 Stage 4: Final Cue Analysis and Findings

Following the operationalisation of both domains, each cue was analysed again and compared to others within the same category for consistency. Codes associated with each category are summarised in Appendices F, G, H and I and examples of the application of codes are illustrated in Appendices N, O, P and Q. A protocol was adopted whereby a cue had to be coded by at least one code from a domain category to be classed within that category. Where cues had codes from two categories they were classed as both but also coded as 'mixed cue'. This was most common in research activity steps focused on inviting participation (AV) but including queries about how material had changed the learner's viewpoint (AO) (see Appendix J). As the affective domain is conceptualised as a continuum, it is unsurprising to see overlaps in adjacent categories.

Overall, findings showed a strong association between step and cue type, with video text mostly classified as AR, all research activity steps classified as AV (with around a third mixed with AO), and discussion questions mostly classified across several cognitive domain categories. Table 4.5 summarises the distribution of cue types across steps, with overlaps due to mixed cues in parenthesis.

	Video	**Research activity**	**Discussion question**
Affective Domain Cues			
• **Responding (AR)**	**25** (2 CU)	1 (1 AV)	0
• **Valuing (AV)**	1 (1 AO)	**33** (1 AR, 10 AO, 1 CU)	0
• **Organising (AO)**	8 (1 AV)	10 (10 AV)	2 (1 CE)
• **Internalising (AI)**	2	0	1
Cognitive Domain Cues			
• **Remember (CR)**	0	0	0
• **Understand (CU)**	3 (2 AR)	2 (1 AV)	5
• **Apply (CP)**	0	0	0
• **Analyse (CA)**	0	0	4
• **Evaluate (CE)**	0	0	3 (1 AO)
• **Create (CC)**	0	0	1

Table 4.5 Steps Classified by Cue Type

4.10 Discussion of Instructor Cue Analysis

The key finding of this analysis was the unexpected discovery of cues that appeared more emotive than cognitive in their communicative intent and the subsequent identification of the affective domain taxonomy (Krathwohl et al., 1964). Although affective dimensions are acknowledged in many taxonomies of learning objectives (see Anderson & Krathwohl (2001) for a review), the literature on instructional questioning was found not to consider such objectives, perhaps due to an emphasis on response *quality*, frequently theorised as higher-order thinking, referencing the original cognitive domain

taxonomy (Dillon, 1982; Montello & Bonnel, 2009; Muilenburg & Berge, 2000). Open exploration of cue characteristics has revealed the centrality of the affective domain in the case study.

The affective domain taxonomy complicates some recommendations on instructional questioning. For example, AR cues flout recommendations that questions be clear in purpose and structure (Andrews, 1980; Bradley et al., 2008; Milman, 2014; Tofade et al., 2013). They are inherently divergent, including open-ended instructions such as 'reflect on' and multiple loosely related statements. However, where the aim is to encourage student interest and empathetic engagement with a subject, this may be an appropriate communicative strategy. The diffuse nature of such cues may present a low bar for initial participation and motivate learners to persevere. While motivation is only one of many potential benefits of instructional questioning (Ellis, 1993), it may be particularly important for MOOC cue design due to the social distance between students and instructors. Soliciting interest and commitment may sometimes be as important as encouraging cognitive development.

In accounting for motivation and interest as foundations for learning, the affective domain may also be considered an important component of instructional design, and it is notable that the sequential design of the course adheres in part to the pathway of affective apprenticeship. Steps in the course are thematically clustered, with a video presentation followed by a related research activity and a related discussion question after two or three such pairs. The most common cue type for video steps was AR, the first stage in affective apprenticeship where learners open up to new perspectives. The most frequently identified cue type for research activities was AV, the second stage of affective apprenticeship, where learners demonstrate commitment through greater independent effort (in this case, through independent research). The pathway is less clear for discussion questions, which are more frequently classified as cognitive. However, at the organising stage of affective apprenticeship (AO) learners undertake more explicitly cognitive activities to develop the skills necessary to organise values (Krathwohl et al., 1964), so a shift towards cognitive demands following an initial opportunity to engage in affective apprenticeship is consistent.

The identification and operationalisation of the affective domain can inform the analysis and design of MOOC instructor cues and the framework presented in Chapter Six is substantially based on the analysis described in this chapter. In the second phase of analysis, a comment analysis was undertaken to test the findings of the cue analysis. This was designed to clarify the extent to which instructor cue disposition influences learner comment disposition (e.g. to what extent cues classed as AR typically elicit AR-type comments) and to provide supporting evidence for the cue design framework by yielding insight into the relationship between cue design and comment cognitive and affective dispositions. Chapter Five reports on the comment analysis and findings.

Chapter Five: Comment Analysis

5.1 Introduction

Chapter Four detailed the analysis of instructor cues in the *Irish History* MOOC to develop a classification framework. The second phase of analysis aims to test and refine this framework by analysing a sample of learner comments for each cue type. Analysing comments can illuminate the extent to which learners respond as expected to cues with a particular cognitive or affective disposition. Through developing and applying a coding scheme, it will also enhance understanding of commenting behaviour and of how the classification scheme can be applied, providing empirical support for the design of a framework for instructor cue design. A comment analysis based on the combined affective and cognitive domain taxonomies is also a novel approach and promises to offer some insight into MOOC commenting behaviour in its own right. This chapter presents the process and findings of the comment analysis (see Figure 5.1).

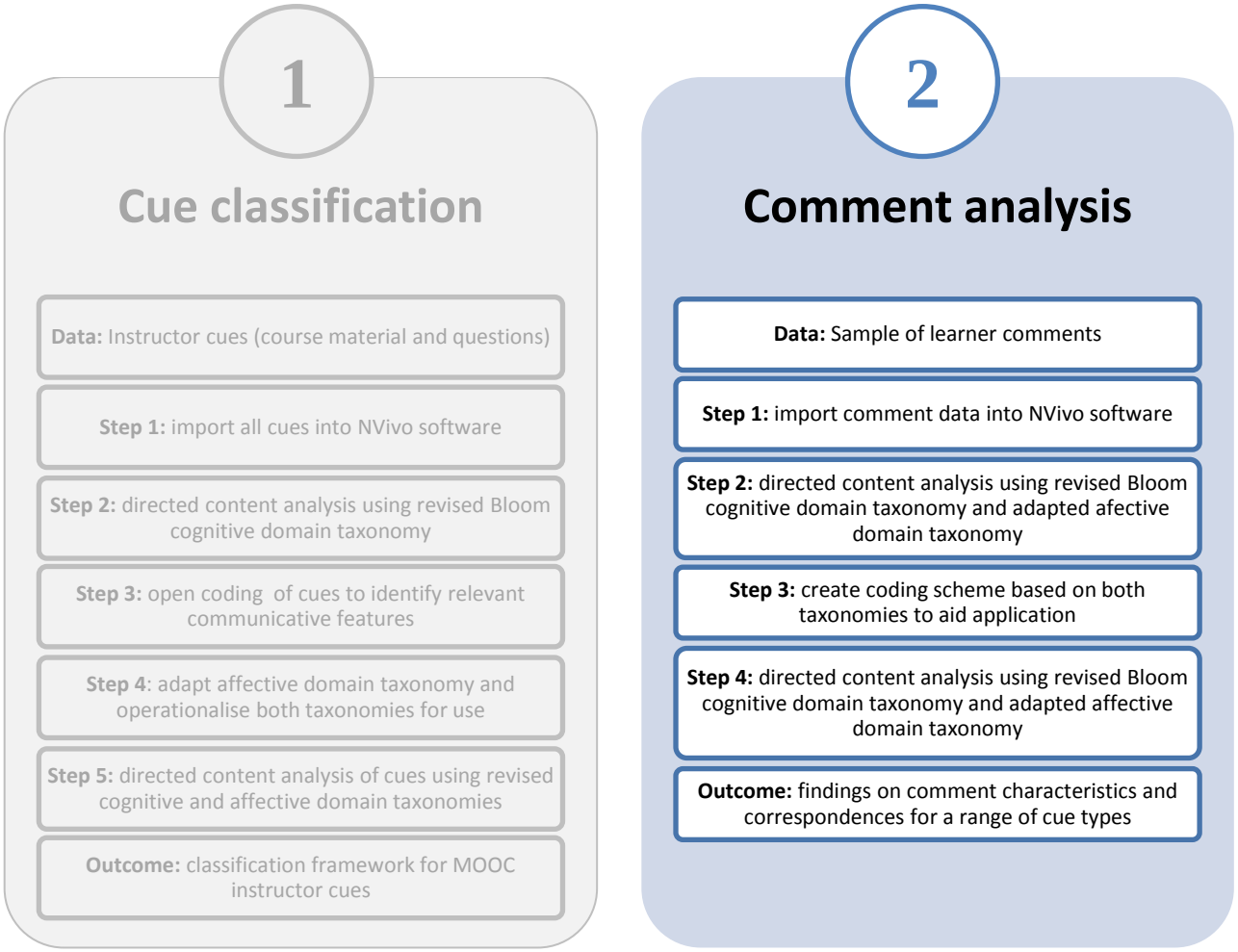

Figure 5.1 Research Process – Phase 2

5.2 Sample Selection

Selecting a comment sample for qualitative analysis involves competing demands. Sufficient comments must be included to feel confident findings are reasonably representative. At the same time, the sample must be manageable to ensure attention can be paid to the rich nuances present in qualitative data. For this analysis, as the goal was to substantiate and refine the classification framework rather than explore the comment data itself, it was decided to select the minimum sample size that still provided insight into each cue type. This involved first identifying an appropriate sample of classified cues to cover all cue types for subsequent comparison (Figure 5.2), then choosing an appropriate comment sample for each selected cue (Figure 5.3).

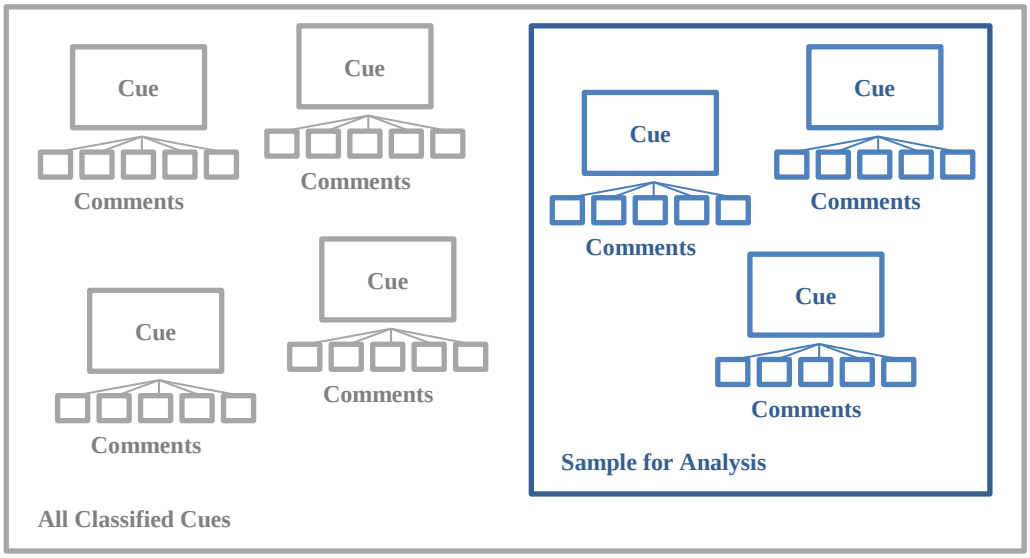

Figure 5.2 Cue Sample Selection for Comment Analysis

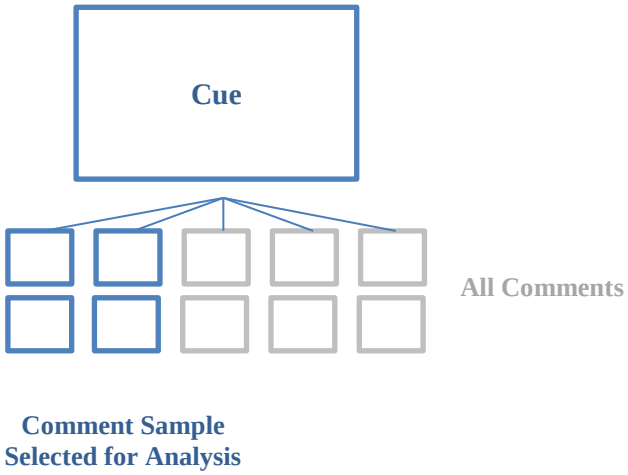

Figure 5.3 Comment Sample Selection for Analysis

5.2.1 Cue Sample Selection

As discussed in Chapter Four, the instructor cue analysis classified 79 out of a total of 122 distinct steps in the *Irish History* MOOC, including video, research activity and discussion steps. Cues corresponding to each affective domain category and four of six cognitive domain categories were identified (see Table 4.5).

It was initially decided to select three cues from each category as a sample for comment analysis. Where fewer than three were available, all cues would be selected. For categories with more cues, iterative sampling would be undertaken if the results of the first three samples were not consistent, to further explore any inconsistencies. For AO, four cues were selected initially to enable comparison of two video cues with two discussion cues.

Where more than three samples were available, options were evaluated for prototypicality. Cues classified as mixed (i.e. assigned an additional category) were first excluded. Of those remaining, cues displaying most features described in the classification framework were selected, e.g. AR cues featuring divergent question clusters and low-demand imperatives like ‘consider’ or ‘reflect on’ (see research notes in Appendix R (a)).

Where possible, cues from different course weeks were selected to provide more even coverage and obviate topic-specific effects. An initial analysis of comments anchored to video cues suggested video tone or topic may influence commenting behaviour, so further samples were included to ensure a spread of video tone and topic in the two relevant categories (AR and AO, described below).

One category, AV, was excluded from the comment analysis. ‘Valuing’ involves learners choosing to further their knowledge through independent effort. Cues classified as AV in this case invite learners to conduct independent research on primary sources. Consequently, engaging with these sources at all qualifies as an AV response and analysis of these comments would be useful only if the goal was to evaluate quality. Furthermore, the plurality of external sources learners might explore to respond to these cues introduces too many unknown variables and would not support the research objective of exploring cue-comment relations.

Table 5.1 outlines the cue sample selected for comment analysis, including whether the sample was chosen initially or added after initial analysis to gain further insight into a category. A total of 25 cues – 10 discussion and 15 video cues – were chosen.

Step	Cue	Step Type	Video Tone	Topic	Topic Domain	Selection
1.15	AR	VIDEO	FN	Personal diary	A	Initial
3.4	AR	VIDEO	CN	Party politics	C	Initial
5.4	AR	VIDEO	AN	Interrupting daily lives	A	Initial
1.11	AR	VIDEO	FN	Personal diary	A	Added
4.6	AR	VIDEO	CN	Loss	A	Added
4.13	AR	VIDEO	AN	Economics and compensation	C	Added
2.7	AR	VIDEO	AN	What does it feel like to fight	A	Added
3.6	AR	VIDEO	CN	Politics (parties and elections)	C	Added
2.2	AO	VIDEO	AF	Meaning of fighting	A	Initial
5.12	AO	VIDEO	AN	Social lives	A	Initial
3.13	AO	VIDEO	CN	Political lives	C	Added
4.2	AO	VIDEO	CF	Economics	C	Added
5.14	AO	DISCUSSION	N/A	Social lives (fun)	A	Initial
6.3	AO	DISCUSSION	N/A	Historical investigation	C	Initial
6.5	AI	VIDEO	AN	Loss (families)	A	Initial
6.12	AI	VIDEO	AN	Loss (personal)	A	Initial
6.14	AI	DISCUSSION	N/A	Burden of conflict	A	Initial
2.12	CU	VIDEO	CN	Ways of fighting	C	Initial
2.14	CU	DISCUSSION	N/A	Meaning of fighting	C	Initial
1.21	CU	DISCUSSION	N/A	Sum up events (word/phrase)	C	Initial
1.16	CA	DISCUSSION	N/A	Key turning point	C	Initial
4.8	CA	DISCUSSION	N/A	Measuring loss	C	Initial
6.11	CA	DISCUSSION	N/A	Social revolution	A	Initial
5.8	CE	DISCUSSION	N/A	Social life	A	Initial
4.15	CC	DISCUSSION	N/A	Economic effects	C	Initial

Table Legend

Cue types: AR = Responding (Affective); AO = Organising (Affective); AI = Internalising (Affective); CU = Understand (Cognitive); CA = Analyse (Cognitive); CE = Evaluate (Cognitive); CC = Create (Cognitive)

Video tone: AF **=** Affective Framing; AN = Affective Narration; CF = Cognitive Framing; CN = Cognitive Narration; FN = Fictional Narration

Topic domain: A = Affective Domain; C = Cognitive Domain

Table 5.1 Cue Sample Selection

5.2.2 Comment Sample Selection

The *Irish Lives* MOOC received 67,556 comments across all steps, ranging from 1-245 words in length. The mean comment length was 65 words, with a standard deviation of 52. Word count was used to exclude exceptionally long and short comments. The comment sample was filtered to include comments with word lengths between 13 and 117 words, i.e. the mean plus or minus the standard deviation. Almost 50,000 comments fell within this range. Although word count is not inherently meaningful in qualitative

analysis, this was done to exclude many comments with scant content and those that would be especially time-consuming to code, while retaining diversity. As the analysis is concerned with the cue-comment relationship, comments responding to other comments were excluded by filtering out all comments with parent IDs in the dataset. Comment number also varies substantially across individual steps, so for the purpose of comparability a fixed number of comments was selected for each sample. It was decided to analyse 50 comments from each sample (around 10% of the overall median number of comments per step (497) across the entire course) and to extend the sample if necessary during the analysis. A total of 1,250 comments were analysed.

5.2.3 Unit of Analysis

An individual comment was defined as the unit of analysis, irrespective of length. To capture the richness of individual responses, comments were assigned multiple categories and coded as 'mixed' where appropriate.

5.3 Content Preparation

All comments for each cue sample were copied from the original dataset spreadsheet to a separate spreadsheet, edited to retain only step name, comment text and word count. After importing into Nvivo, each sample was filtered by word count (as described above) and the first 50 comments coded.

5.4 Comment Analysis

Directed content analysis was undertaken of one sample at a time using the taxonomies as a guide (part C in Figure 5.3). Codes were not adopted directly from the cue analysis but were developed and assigned to categories inductively during the coding process. Each comment was read and coded with a verb describing the commenter's activity, e.g. empathising, inferring, differentiating (see Appendix S). These codes were reviewed against the category descriptions and assigned a category.

Where possible, for consistency, codes were given names that existed within the taxonomy descriptions. As coding progressed, fewer new codes were created and existing codes were applied to comments. It was found that codes were valuable when they were intuitively accessible as descriptions of comments, as they are used to assign a broader category. For this reason, ensuring codes were in the right category was deemed more important than mutual exclusivity between codes in a category. The cluster of codes within a given category were treated as a kind of net, the goal of which was to capture the disposition of the comment in question. If a single term was felt to capture this characteristic, no further terms were used. If there were ambiguities or if the comment was more complex, several terms might be used. Synonyms and overlapping terms were therefore used where they were felt to be useful. As in the previous stage, a research journal was maintained and notes were made on emerging codes during the

process (see Appendix R (b) for an example from coding AR). A coding scheme was iteratively developed through this process and revised through several checks built into the research design (see Figure 5.3, parts E and F).

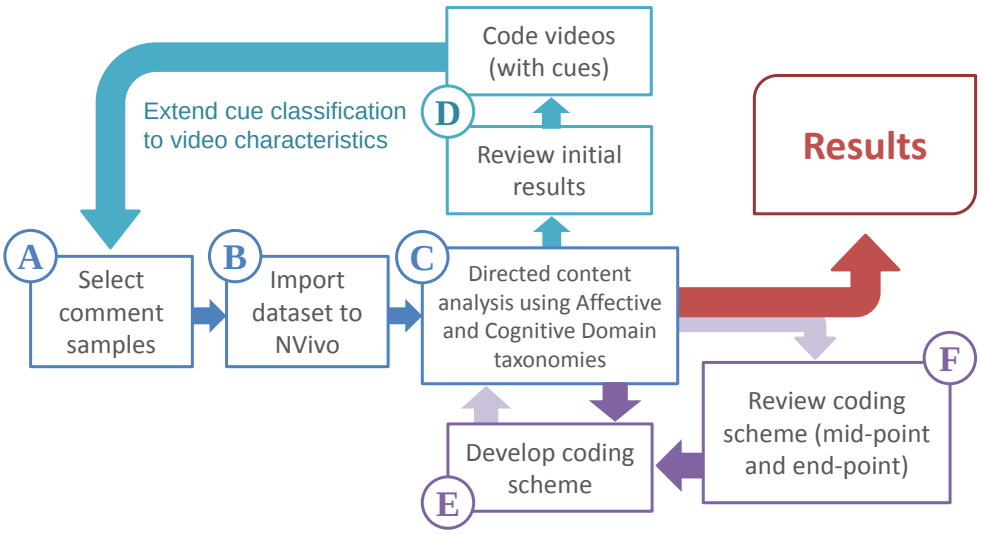

Figure 5.4 Comment Analysis Process

5.4.1 Extending Cue Classification to Video Characteristics

Early in the analysis, inconsistent results from AR comments anchored to video steps suggested that videos should be classified to explore their influence on commenting behaviour. The comment analysis was halted while all videos were analysed for overall cognitive or affective disposition and for whether their purpose was to *frame* or *narrate* events (see Figure 5.3, part D). Videos were coded as either affective framing (AF), affective narrating (AN), cognitive framing (CF), cognitive narrating (CN) or fictional narrating (FN). FN refers to week 1 videos, in which first-person characters narrate events. Video and cue topics were also coded as either affective (A) or cognitive (C) to aid in the interpretation of findings (see Table 5.1 and research notes in Appendix R (c)). Additional samples of cues associated with videos of different dispositions were then added to the sample for comparative purposes.

5.4.2 Coding Scheme

During analysis, a coding scheme was developed to describe how comments were assigned to categories, through reflection on and refinement of the coding process. This involved recording new codes as they were created along with notes on why they were selected, using a research journal and annotations in Nvivo, then periodically organising (and revising) the descriptions and codes in tabular form. For example, the scheme for AR includes all codes used and a description to aid recognition of an AR comment (see Table 5.2). The development of the coding scheme was also informed by the

operationalisation tables developed in the cue analysis phase. Application of codes was guided by the question 'what verb best describes what the respondent is doing in this comment?'

Category	Codes	Application
AR	Empathising; personal story; entering into; expressing appreciation; emotional; considering; responsive question; different voices; personal association; curiosity; showing interest	Response are clearly empathetic, often referring to the video content and the lives of the characters (fictional or factual); longer responses are divergent and atmospheric rather than converging on a particular interpretation or conclusion; responses may contribute personal stories, e.g. anecdotes from own experience or family members

Table 5.2 Sample from Coding Scheme (AR)

The complete coding scheme is reproduced in Appendix S.

A coding scheme helps ensure greater consistency in the analysis and is useful for further refining the kinds of response associated with each, which can inform the development of a framework for cue design. It also facilitates re-application of this method for further research on this or other datasets.

5.4.3 Reviewing the Coding Scheme

After coding half the sample (600 comments), a review was conducted to check for consistency in coding and revise the coding scheme (see Figure 5.3, part F). Each category (e.g. AR) was separately reviewed in Nvivo and a placeholder code created to flag any comments about which there was uncertainty. Flagged comments were then reviewed. Notes were made on decisions, the coding scheme was adjusted to provide clearer guidance on ambiguous cases, and comments were re-coded where necessary. In most cases, ambiguity arose because comments exhibited features of both affective and cognitive engagement, so were re-coded as both and assigned a 'mixed' classification. A small number of comments were re-coded to adjacent categories, e.g. CU to CA. This procedure enabled revision and clarification of the coding scheme.

On completion of the sample (1,250 comments), a second review was conducted, addressing two categories – AI and CE – for which few comments had been identified at the mid- point and about which some confusion prevailed (see research notes in Appendix R (d)). For Krathwohl et al. (1964), these occupy parallel positions in the affective and cognitive domains (see Table 5.2, left; the revised taxonomies are mapped on the right).

Original Cognitive Domain Taxonomy (Bloom, 1956)	Original Affective Domain Taxonomy (Krathwohl et al., 1964)	Revised Affective Domain Taxonomy (this researcher)	Revised Cognitive Domain Taxonomy (Anderson & Krathwohl, 2001)
Knowledge	Receiving	Responding (AR)	Understand (CU)
Comprehension (CU)	Responding (AR)		
Application (CP)	Valuing (AV)	Valuing (AV)	Apply (CP)
Analysis (CA)	Conceptualisation (AO)	Organising (AO)	Analyse (CA)
Synthesis	Organisation (AO)		
Evaluation (CE)	Characterisation (AI)	Internalising (AI)	Evaluate (CE)
			Create (CC)

Table 5.3 Correspondences between Cognitive and Affective Domain Taxonomies

While it may seem clear that AI covers axiological judgments, this category is explicitly described as the end point in an apprenticeship, where the individual has arrived at a consistent 'life philosophy', so simpler moral judgments had originally been included in CE as they contained implicit criteria or standards against which judgments were made. The review concluded that all axiological judgments would be categorised as AI, regardless of their perceived 'quality'. The implications of this are further discussed below. Having revised the coding scheme for these categories, the sample was once again reviewed and problematic comments flagged and re-coded. Approximately half the comments coded at CE were recoded to AI as a result of this review.

A list of all codes used for comment analysis is available in Appendix T.

5.4.4 Exclusions During Coding

A small number of comments were excluded during analysis as they were poorly written and difficult to understand. Comments explicitly responding to another comment were also excluded, as were several duplicates and comments noting factual errors in course material. These were coded as 'exclude' and annotated with an explanation.

5.5 Findings

The full results of the analysis are summarised in Table 5.4. Shaded boxes highlight key findings. Green shading indicates where the largest number of comments correspond to the cue category. Pink shading highlights where the largest number of comments does not match the cue category.

Orange shading shows two areas where there was an overall lack of correspondence but still more comments than usual within the cue category. Purple shading highlight samples where the majority of comments were coded as Affective Domain (any category) and blue shading highlights samples where the majority of comments were coded as Cognitive Domain (any category).

Overall, the results support the original hypothesis that cue disposition would influence comment disposition, although the data shows that this effect varies in strength and is not evident to the same extent for all cue types.

Step	Cue Code	Cue Type	Video Code	AR	AV	AO	AI	CU	CA	CE	CC	Total	mixed	A	C	Topic Code
1.15	AR	VID	FN	33	4	2	4	4	2	2	0	51	1	43	8	A
3.4	AR	VID	CN	13	3	0	2	23	8	2	0	51	2	18	33	C
5.4[1]	AR	VID	AN	33	1	1	5	7	3	1	0	51	1	40	11	A
1.11	AR	VID	FN	29	4	0	2	5	9	1	0	50	0	35	15	A
4.6	AR	VID	CN	27	6	2	2	13	3	0	2	55	5	37	16	A
4.13	AR	VID	AN	14	2	3	13	11	6	4	0	53	3	32	21	C
2.7	AR	VID	AN	26	1	1	2	14	5	0	1	50	0	30	19	A
3.6	AR	VID	CN	24	2	0	0	15	9	1	0	51	1	26	25	C
2.2	AO	VID	AF	16	6	17	0	8	7	1	0	55	5	39	16	A
5.12	AO	VID	AN	12	2	3	2	27	4	0	0	50	0	19	31	A
3.13	AO	VID	CN	4	1	12	2	11	21	0	1	52	2	19	32	C
4.2	AO	VID	CF	15	0	7	3	12	17	0	0	54	4	25	29	C
5.14	AO	DISC	-	1	0	11	2	22	14	0	0	50	0	14	36	A
6.3	AO	DISC	-	0	0	50	0	0	0	4	0	54	4	50	4	C
6.5	AI	AN	AN	20	4	4	22	3	1	0	0	54	4	50	4	A
6.12	AI	AN	AN	4	0	4	22	13	5	3	0	51	1	30	21	A
6.14	AI	DISC	-	3	0	1	20	6	18	5	0	53	3	24	29	A
2.12	CU	CN	CN	8	1	8	10	16	6	2	0	51	1	27	24	C
2.14	CU	DISC	-	3	0	0	4	26	17	0	0	50	0	7	43	C
1.21	CU	DISC	-	7	0	0	12	19	8	5	0	51	1	19	32	C
1.16	CA	DISC	-	1	0	0	3	3	44	1	0	52	2	4	48	C
4.8	CA	DISC	-	8	1	5	11	7	19	1	0	52	2	25	27	C
6.11	CA	DISC	-	4	2	1	3	15	22	7	0	54	4	10	44	A
5.8	CE	DISC	-	4	0	1	6	9	2	29	2	53	3	11	40	A
4.15	CC	DISC	-	5	3	1	0	22	14	2	4	51	1	9	38	C

Table 5.4 Comment Analysis Findings

5.5.1 Corresponding Cue-Comment Pairs

AR cues from video steps are associated with a high number of AR comments. In AR cues, the presence of a cognitive orientation in the video tone or topic (3.4, 4.13, 3.6) is linked to an increase in Cognitive Domain categories, and more so when both tone and topic are cognitively oriented (3.4, 3.6).

[1] Steps are displayed in order of analysis. After Step 5.4, the comment analysis was paused in order to classify video tone and topic.

AI cues were found to correspond to a prevalence of AI comments in both video and discussion step cues. These results are not entirely consistent when the next most prevalent comment type is examined, with AR a close second in 6.5 and CA almost as common in 6.14. However, given that AI comments are relatively uncommon in most non-AI samples, it is still reasonable to assert a connection between cue and comment disposition here. It is also worth noting that more AI comments are present when CU and CA cues are used, though not always.

CU and CA cues were found to correspond to a prevalence of CU and CA comments, respectively. Only one CE sample was available for analysis but it was associated with a majority presence of CE comments. Though difficult to draw conclusions from a single instance, cue clarity may have influenced this result, as the CE cue was explicitly evaluative and direct.

5.5.2 Non-Corresponding Cue-Comment Pairs

AO cues either anchored to video material or presented as separate discussion questions show the least direct influence on comment disposition of any cue type. However, two of the six samples analysed (2.2, 6.3) do still show a prevalence of AO comments and two more (3.13, 5.14) show more than appear in other samples. Those that lack correspondence show a high prevalence of either CU or CA comments, suggesting that the cue is influencing some kind of general disposition. As AO is at a later stage in the affective apprenticeship and involves building a value system by negotiating different values and handling the tensions between them, it is not unexpected that it would yield more cognitively-oriented responses. In the most prototypical AO cue (6.3), which asked learners directly about what is desirable in historical research, all responses were classified as AO, though some also showed characteristics of CE.

One CC sample was also available for analysis and showed no correspondence between cue and comments. Again, only so much can legitimately be inferred from a single example, but it is worth noting that the CC cue was somewhat ambiguous. It asked learners to 'imagine the possible effects of war on the daily lives' of several hypothetical individuals, which may have been interpreted as a request to infer from material encountered (CU) or, as there were a number of characters mentioned, to differentiate between individuals' prospects (CA). This would explain the prevalence of CU and CA comments.

5.6 Discussion of Comment Analysis and Findings

The comment analysis outlined in this chapter was undertaken to test the hypothesis that the affective or cognitive disposition of instructor cues would influence the prevalence of those dispositions in learner comments. It was hoped that this would corroborate and help refine the combined affective and cognitive domain taxonomies and support the development of a framework for MOOC cue design. As the literature review found no examples of taxonomies including affective objectives or considerations being used to analyse comments in discussion forums, a second goal of the comment analysis was to test the

application of the revised affective domain taxonomy in practice and iteratively develop a coding scheme that could streamline the process of coding for this domain.

On the whole (and within the limits of the case study context) findings support the hypothesis that expected a correspondence between cue and comment disposition. This suggests that theorising the cue-comment relationship as an adjacency pair, in which cues establish communicative expectations that are identified by learners and influence their responses, is plausible. However, even where a correspondence is present overall, the effect is not so uniformly strong to suggest that this is the only factor affecting commenting disposition. While cue disposition does appear to make a difference, it must be emphasised that this suggests a possible *influence* rather than a determinant. It is also worth considering that cue disposition may have a filtering rather than (or as well as) an influencing effect on learner commenting behaviour, and that learners may choose to comment or not in part based on whether they accept the communicative demands of the cue.

One of the more untidy results is the inconsistent findings for cues classified as AO, where some samples show very little correspondence, some more correspondence than average for this category and others (notably 6.3) the highest level of correspondence for any pair in the sample. Some of this can be understood with reference to the parallels between the affective and cognitive domains discussed by Krathwohl et al. (1964) when outlining the original affective domain taxonomy. At the stages referred to here as AO and AI, the authors observe that 'the behaviour described by the affective domain is at least in part cognitive, as the student conceptualizes a value to which he has been responding, and this value is in turn integrated and organized into a system of values which comes eventually to characterize the individual' (p.51). With this in mind, it is not necessarily unexpected that more CU and CA activity might be observed for an AO cue.

However, the differences identified here are also useful for clarifying guidelines on cue use. In this category, a direct relationship is observable between how specific and concise a cue is and how many comments in the sample correspond to the cue disposition. The fact that 6.3 showed almost complete correspondence between an AO cue and the comments analysed, with a small overlap where some cues were also coded at CE, is insightful in this respect. This cue was explicit in requesting that learners specifically respond to whether studying private lives is desirable in the context of historical research, thus clearly establishing a requirement to consider the values of the domain, which is central to the definition of the AO category. The cue was secondarily coded as CE as it included a second question about whether this approach is *feasible*, but as is evident from the small number of mixed responses, the first part of the cue seems to have had more influence on expectations.

By contrast, 5.12 and 4.2 are more diffuse in their presentation. Although they contain questions about our perception of historical events that fit the AO category, the presence of multiple questions appear to

dilute the effect. 3.13 and 5.14 are somewhat diffuse but more concise than the aforementioned cues and show a greater than usual number of AO comments, though they are not in the majority. These findings make a valuable contribution to the goal of developing a framework for cue design by clarifying the importance of being clear and specific in AO cues.

Overall, the results of the comment analysis are consistent enough to provide some support for the hypothesis that instructor cue disposition influences that of learner comments. This means the results can also plausibly inform developing a framework to guide MOOC cue design. The findings also highlight specific cue design strategies that may be more useful, as some cues appear to have been more successful than others. This can also inform the framework in providing guidelines on how to design a more effective cue. The next chapter will discuss the implications of these findings and propose a framework informed by the results of both the cue classification and comment analysis.

Chapter Six: MOOC Instructor Cue Design Framework

6.1 Basis for a Framework

Although the current research gives methodological priority to analysis, the research was motivated by an interest in developing practical guidelines for MOOC cue design. This is needed to address the dearth of research and recommendations on designing instructor cues for MOOCs. A framework for question design enables instructors 'to be intentional and specific about expected student cognitive processing' (Walsh & Sattes, 2011, p. 31). While existing frameworks, such as versions of Bloom's cognitive domain taxonomy, have proved useful in other contexts, they had not been tested in an anchored environment MOOC. In exploring the applicability of the revised cognitive domain taxonomy (Anderson & Krathwohl, 2001), this research discovered the centrality of affective cues in the case study and adapted and operationalised Bloom and colleagues' affective domain taxonomy (Krathwohl et al., 1964) for application to MOOC cues. As discussed in Chapter Four, this is a potentially valuable contribution to understanding MOOC instructor cues, as it enables designers to be conscious and intentional about both affective and cognitive goals in course and cue design.

It was decided to produce a simple visual quick-reference guide to make these findings practically accessible to MOOC cue designers. The framework includes both the adapted affective domain developed in the cue classification phase and a simplified version of Anderson and Krathwohl's (2001) revised cognitive domain taxonomy. While evaluating this artefact is beyond the scope of the current research, there is potential for further research to do so. This chapter presents the cue design framework and provides a rationale for the decisions informing its development.

6.2 Design Requirements

Designers of anchored environment MOOCs have the opportunity to produce a cue for every step. This potentially creates a burdensome workload, which in turn may make it more difficult to give adequate thought to each cue. To aid this process, an effective visual framework must offer the shortest possible route to suggestions while presenting enough information to be applicable in a range of contexts.

It was decided that the design should enable users to follow a simple two-step process to select an appropriate cue type based on their expectations of what the learner should do in response; and then to view guidelines on how to formulate such a cue (see Figure 6.1).

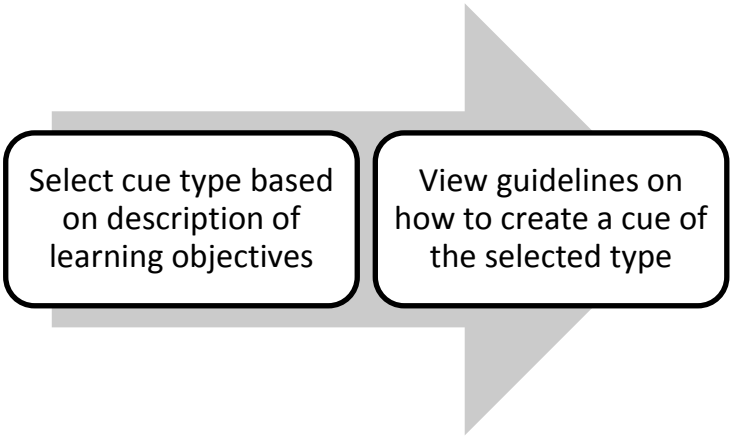

Figure 6.1 User Requirements for Framework Design

The following visual design requirements were identified:

- All information should be accessible on a single page
- No unnecessary information should be presented (text kept to a minimum)
- Recommendations should be clear and concise
- Recommendations should be specific enough to be adopted (provide examples)

It was also decided that the affective and cognitive domain taxonomies should be visually distinct but on a continuum, so that both are accessible from the same starting point. For clarity, it was also decided to present the categories within each taxonomy in the order that they appear (i.e. Respond, Value, Organise, Internalise, for the affective domain; Remember, Understand, Apply, Analyse, Evaluate, Create, for the cognitive domain). However, it was decided to avoid presenting the categories hierarchically (as in Bloom's original hierarchical pyramid), as the framework is intended to aid the design of individual cues rather than impose any suggestions as to the overall instructional design of the course.

6.3 Design Prototype

A radial design was selected as it facilitates a non-hierarchical organisation of information with a central starting point for the user and allows several levels of information (i.e. the two-step process identified in the design requirements) to be presented on the same page (see Figure 6.2).

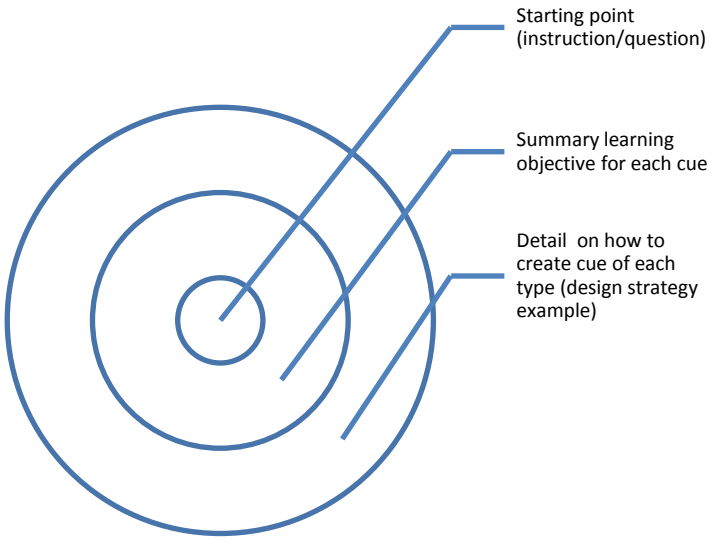

Figure 6.2 Radial Information Design for Framework

It was decided to use a star graph diagram style to connect the central prompt to statements representing each cue type and a connecting line to link each of these to a brief description comprising points on cue design with examples (Figure 6.3). Colour coding was used to separate affective from cognitive cues.

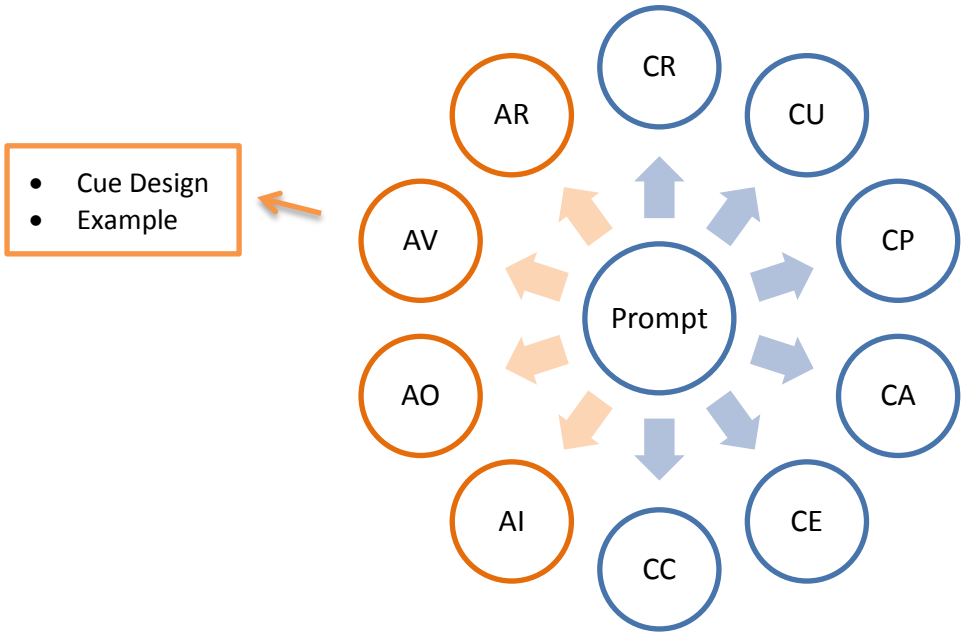

Figure 6.3 Star Graph Design for Separating and Connecting Information

6.4 Framework Design

Having decided what kinds of information would be included in the visual guide, textual content was developed. It was decided to use the following central prompt:

Which statement best describes what you hope learners will be able to do after this activity?

A learning objective and design guide with features and examples was developed for each cue type by editing the appropriate content from the operational descriptions of the two domains developed during the cue classification phase of analysis (see Appendix U).

The design plan and text were combined in a visual framework depicted in Figure 6.4. It is proposed that the framework be printed in colour on a single A4 page and used by MOOC designers to help focus learning objectives and design strategies for a given cue. To give an example from another subject area, the designer of a course on healthy eating might present a step on reading food labels. They might consult the framework and decide they wish learners to move beyond general interest and commit to looking into this subject themselves. This would lead the designer to select ‘Value’ from the framework. Following the recommendations, they might design a cue that encourages learners to read the food labels in their own cupboard and share something they found surprising with other learners.

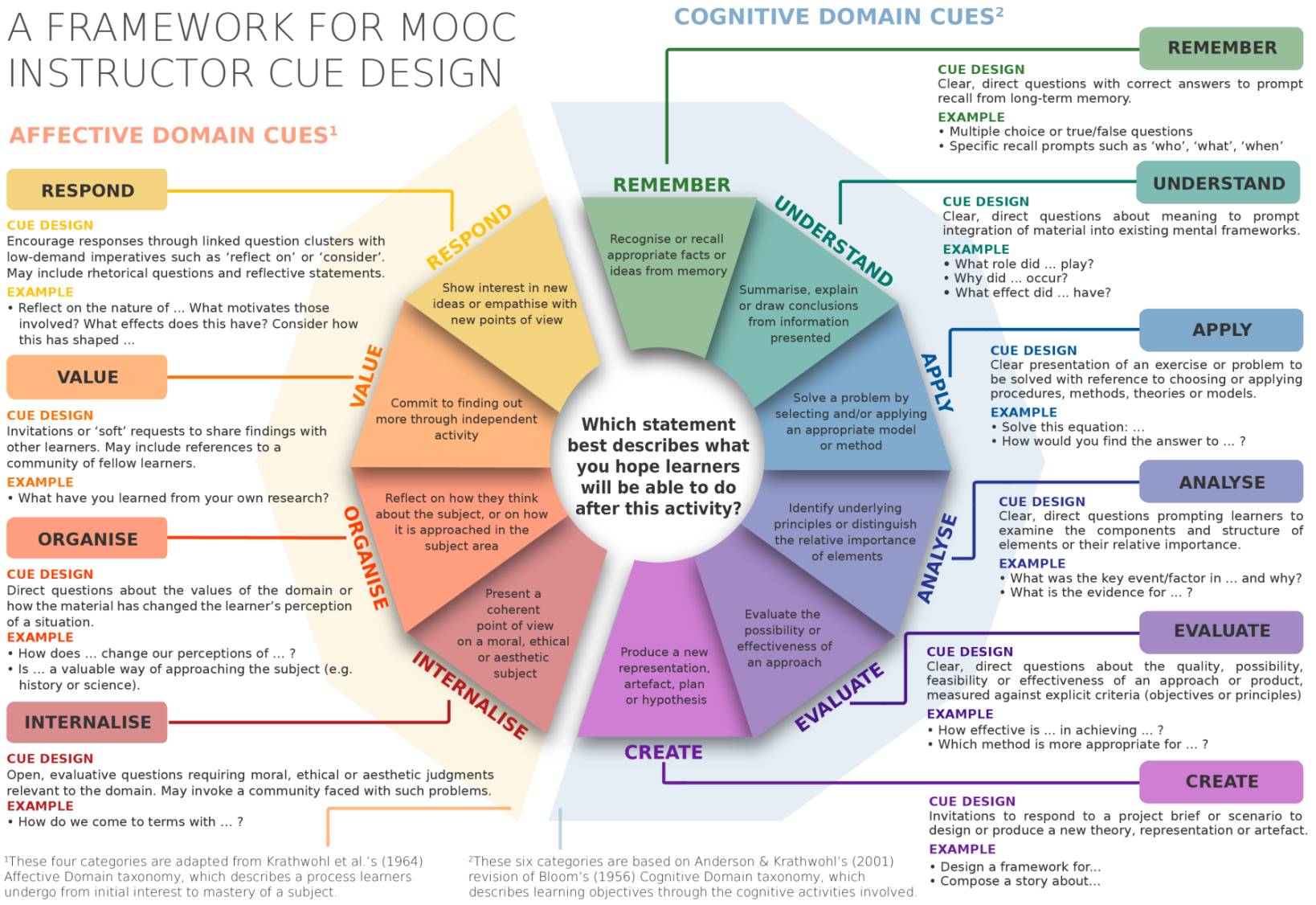

Figure 6.4 A Framework for MOOC Instructor Cue Design

Chapter Seven: Conclusion and Future Work

7.1 Summary of Findings

This research set out to explore how features of instructor cues influenced features of learner comments, through a case study of TCD's *Irish Lives in War and Revolution* MOOC. To approach this question, the cue-comment relation in an anchored environment MOOC was conceptualised as an adjacency pair or paired utterance, where the expectations communicated by the former were hypothesised to affect the latter. To begin with, these features were not clearly defined. Versions of Bloom's (1956) cognitive domain taxonomy were found to be commonly used for classifying instructional questions in classroom and smaller online course contexts. As no frameworks for instructor cues more generally or for MOOCs in particular were identified, an analysis of instructor cues was undertaken to test the application of a revised cognitive domain taxonomy (Anderson & Krathwohl, 2001) in the novel context of the anchored environment MOOC and to explore other features that might be useful for a classification.

The analysis found that the revised cognitive domain taxonomy had partial applicability but did not account for some cue features and apparent communicative intentions, which were more affective in nature. An affective domain taxonomy also developed by Bloom and colleagues' (Krathwohl et al., 1964) but not previously used for classifying instructional questions was adapted and operationalised to suit the purpose. The combined affective and cognitive domain taxonomies were found useful for classifying the expectations communicated by cues. A second phase of analysis carried out directed coding of a sample of learner comments from different cue types to test the hypothesis that they would be impacted by the disposition of cues and to further explore the cue classification through its effects. In most cases a correspondence was found between the affective or cognitive disposition of the cue and the prevalence of that disposition in the comment sample, although the association varied in strength.

Finally, a visual framework design was proposed to support the application of the findings to the practice of MOOC cue design.

7.2 Research Contribution

This research makes both theoretical and practical contributions to MOOC pedagogy, in particular the design of instructional cues for MOOCs.

7.2.1 Theoretical Contribution

The discovery of the importance of the affective domain for MOOC cue classification is a significant finding with implications for MOOC research and design. The literature on instructional questioning was found to focus predominantly on cognitive learning objectives and ignore the affective domain, although

affective and cognitive dispositions are typically intertwined in learning (Krathwohl et al., 1964). In a MOOC context, where cue design to some extent supplements aspects of instructor-student interaction, giving due consideration to the affective dimension of communication may be particularly important. In the course of the cue analysis, the affective domain was adapted and operationalised through iterative coding of cues in the MOOC context, resulting in the production of a coding scheme that may be applied or developed in future research in the area.

7.2.2 Practical Contribution

A visual framework modelling the application of both the revised cognitive domain and adapted affective domain taxonomies for MOOC cue design was proposed, implementing the research findings in a representation that may be directly useful for cue design or evaluated in future studies.

7.3 Limits of the Research

Several limitations to the current findings must be highlighted:

- Case studies have limited generalisability and the singularity of the course and the learner cohort may limit the application of findings to other MOOCs. The course topic – Irish history during a particularly tumultuous period in which lives were disrupted and lost – is also inherently emotive, which may make the course atypical in its use of affective cues. However, qualitative research is concerned with the nuances and particularity of lived experiences (Merriam, 1998) and this instrumental case study has facilitated new discoveries about the affective domain. Irrespective of prevalence, there are arguably many situations in which affective cues are suited to supporting learning objectives, even where they are not currently explicitly used.
- Certain learning objectives could not be explored in this analysis as no instances were identified. Cues encouraging basic recall (Remember) or problem-solving through a method or procedure (Apply) were absent, although they may be highly prevalent in MOOCs focused more on procedural knowledge and skills, such as Computing or Mathematics. Consequently, these categories have not been revised for the MOOC context. Only one cue was classified as Creating, so this category is also inadequately explored here.
- The analytical focus on the cue-comment relation has afforded certain discoveries but has meant that other possible influences on commenting behaviour remain unexplored. The extent to which cues or other factors (such as other comments or personal disposition) are responsible for the observed tendencies remains unknown. Similarly, although provisional coding of video material revealed some interesting categories, these have not been explored here due to the research focus.
- There are inherent limits to inferring cognitive and affective dispositions from written discourse, as vicarious learning taking place through reading and internal dialogue cannot be observed.

- This exploratory study has focused on a broad classification of cues and comments based on learning objectives, but the classification does not explicitly account for one important pedagogical aspect of learning discussion – how to distinguish higher and lower quality responses to evaluate the depth of learning taking place.

7.4 Future Work

MOOC research is still an emerging area and there is ample scope for future research on the pedagogical features of all aspects of course design. Some specific recommendations for future research emerge from this study, both in terms of further testing and developing its findings and to address gaps.

Further research is needed to evaluate the applicability of the classification framework and coding schemes in MOOCs across a wider range of subject areas to address the limits identified above. This work should test, refine and extend the findings of the current research, particularly in relation to the role of affective cues across domains.

Work is also needed to develop a deeper contextual understanding of the cue-comment relation, particularly in considering how the communicative features of videos, such as mode of address, narrative mode, tone and other social cues, contribute to learner expectations and responses. Ideally, a theory of cues would be better able to account for these relationships. The relationships between learner comments (both direct rejoinders and more subtle tonal or thematic repetitions) also merits further exploration as part of the communicative ecology of commenting in MOOCs.

The cue design framework proposed as an output of this research has not been tested and further research is recommended to explore and develop its utility. This could incorporate research into how MOOC designers currently develop instructional cues, through interviews and questionnaires, and pilot the use of the framework with participants engaged in cue design.

Further exploratory research is needed to arrive at a deeper understanding of the affective domain, particularly in relation to differentiating comment quality and identifying successful cue design strategies for encouraging deeper engagement. This research would focus on developing quality frameworks around the expanded classification framework.

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Appendix A:
Quality Frameworks for Online Educational Discussion Forums

Name/Author	Focus	Categories		
Interaction Analysis Model for Examining Social Construction of Knowledge in Computer Conferencing (Gunawardena et al., 1997; used in Yang, Newby, & Bill, 2005)	Interaction	*sharing/adding* (e.g. making statements)		
		negotiating meaning (e.g. agreeing or disagreeing)		
		elaborating (e.g. building or clarifying)		
		evaluating or testing a proposed synthesis (e.g. reviewing with intention to finalise)		
		consensus/application (e.g. summarising agreements, applying agreed knowledge, reflecting on process or outcome)		
Productive Online Discussion Model (Gao, Wang, & Sun, 2009; Gao et al., 2013)	Interaction	*Discuss to comprehend* (interpret, elaborate, reference prior knowledge)		
		Discuss to critique (engage with peer perspectives)		
		Discuss to construct knowledge (negotiate and reconsider meanings and viewpoints)		
		Discuss to share (support one another to further understanding)		
Unnamed Framework (Thomas, 2002)	Interaction	*Independent* (not referencing peers' messages)		
		Quasi-interactive (referring briefly to another post as a point of departure but not engaging with it)		
		Interactive (elaborative) (referring to and developing the theme of another post)		
		Interactive (negotiating) (fully engaging with another post by negotiating meaning, understanding or agreement)		
Structure of Observed Learning Outcome (SOLO) (Biggs & Collis, 1982) (used in Kanuka et al., 2007; Rourke & Kanuka, 2009; Schrire, 2006; Thomas, 2002)	Cognitive Engagement (task)	*Prestructural* (on task but lacks focus on relevant aspects)		
		Unistructural (focus limited to single relevant area)		
		Multistructural (multiple relevant features engaged with but not well integrated)		
		Relational (parts integrated into coherent whole)		
		Extended abstract (structure generalised to incorporate additional features; displays a capacity to abstract)		
Bloom's Taxonomy of Learning Objectives (Krathwohl, Bloom, & Masia, 1956; used in Schrire, 2006) and adaptations (Gilbert & Dabbagh, 2005; used in Bradley et al., 2008)	Cognitive Engagement (learning outcomes; higher-order thinking)	Original Bloom	Gilbert & Dabbagh (2005)	Level
		Knowledge	Reading citation	Lower-order
		Comprehension	Content clarification Prior knowledge	
		Application	Real world examples Abstract examples	
		Analysis	Making inferences	Higher-order
		Synthesis		
		Evaluation		
Practical Inquiry Model (Garrison et al., 2001a)	Cognitive presence via	*Triggering event* (recognising problem, expressing sense of puzzlement)		

	interaction (based on CoI theory)	*Exploration* (divergence from group/message, exchanging information, brainstorming, jumping to conclusions)	
		Integration (convergence on message or within group, connecting ideas, synthesis, arriving at solutions)	
		Resolution (testing hypothesis or defending solutions)	
Gricean Cooperative Principles (Ho & Swan, 2007)	Interaction and cognitive engagement	*Quantity* (sufficient not excessive quantity of information)	
		Quality (originality, appropriate supporting evidence)	
		Relevance (on topic – both thread and post replied to)	
		Manner (clear and well written)	
Unnamed Framework (Nandi et al., 2012)	Content and interaction quality; objective participation	Content	Clarification
			Justification
			Interpretation
			Application of knowledge
			Prioritisation
			Breadth of knowledge
		Interaction	Critical discussion of contributions
			New ideas from interactions
			Sharing outside knowledge
			Using social cues to engage others
		Objective	Rate of participation
			Consistency of participation

Appendix B: Agreement for using TCD/FutureLearn MOOC Data

Trinity College Dublin
Coláiste na Tríonóide, Baile Átha Cliath
The University of Dublin

Department of Online Education

Agreement for using Trinity College / Futurelearn Massive Online Open Course Data

The following document is an agreement between the Research Applicant and the Department of Online Education which outlines the parameters for correct usage of Massive Online Open Course (MOOC) data. MOOC learner data will be provided to the Research Applicant with the following stipulations:

- Data will be provided in Excel files. These files should be password protected and stored in a password protected computer. The Research Applicant is free to use data within these Excel files in other software programmes.
- MOOC data will not be shared to any other party without prior consent of the Department of Online Education.
- The ethics board of Trinity College, The University of Dublin will be contacted prior to any research using this data. However, prior consent to contact the ethics board must be granted by the Department of Online Education.
- All research data should be processed in anonymised form.
- No personal information, comments, or identifying information will be disseminated in any published or public space. This includes
    - Comments from learners
    - Names of learners
    - Non-aggregated data from learners (i.e. demographic data)
- All MOOC comment data will be fully anonymised within any publications.
    - Comment information can be summarised or themed however no extracts can be used in any published documentation.
- If the Research Applicant wishes to publish specific quotations from learners in academic works, e.g. in papers or conference presentation, then they must acknowledge the learner by name as the author of their comment.
    - The researcher must contact the individual learner prior to publishing their comment, and gain permission to use that comment. However, prior consent to contact MOOC learners must be granted by the Department of Online Education.
- By signing this agreement the Research Applicant agrees to adhere to the Futurelearn Ethics Code and the Futurelearn Terms and Conditions.

Signed (Research Applicant)

DOREANN WALLACE

Print Name (Research Applicant)

Date: 8/10/15

Signed (DOE Staff)

Silvia Gallagher

Print Name (DOE Staff)

Date:

Appendix C: 'The Cognitive Process Dimension' (Anderson & Krathwohl, 2001)

Categories and Cognitive Processes	Alternative Names	Definitions and Examples
Remember – Retrieve relevant knowledge from long-term memory		
1.1 Recognizing	Identifying	Locating knowledge in long-term memory that is consistent with presented material (e.g., Recognize the dates of important events in U.S. history)
1.2 Recalling	Retrieving	Retrieving relevant knowledge from long-term memory (e.g. Recall the dates of important events in U.S. history)
Understand – Construct meaning form instructional messages, including oral, written, and graphic communication		
2.1 Interpreting	Clarifying Paraphrasing Representing Translating	Changing from one form of representation (e.g., numerical) to another (e.g., verbal) (e.g., Paraphrase important speeches and documents)
2.2 Exemplifying	Illustrating Instantiating	Finding a specific example or illustration of a concept or principle (e.g., Give examples of various artistic painting styles)
2.3 Classifying	Categorizing Subsuming	Determining that something belongs to a category (e.g. concept or principle) (e.g., Classify observed or described cases of mental disorders)
2.4 Summarizing	Abstracting Generalising	Abstracting a general theme or major point(s) (e.g., Write a short summary of the events portrayed on a videotape)
2.5 Inferring	Concluding Extrapolating Interpolating Predicting	Drawing a logical conclusion from presented information (e.g., in learning a foreign language, infer grammatical principles from examples)
2.6 Comparing	Contrasting Mapping Matching	Detecting correspondences between two ideas, objects, and the like (e.g., Compare historical events to contemporary situations)
2.7 Explaining	Constructing	Constructing a cause-and-effect model of a system (e.g., Explain the causes of important 18th-century events in France)
Apply – Carry out or use a procedure in a given situation		
3.1 Executing	Carrying out	Applying a procedure to a familiar task (e.g., Divide one whole number by another whole number, both with multiple digits)
3.2 Implementing	Using	Applying a procedure to an unfamiliar task (e.g., Use Newton's Second Law in situations in which it is appropriate)
Analyze – Break material into its constituent parts and determine how the parts relate to one another and to an overall structure or purpose		
4.1 Differentiating	Discriminating Distinguishing Focusing Selecting	Distinguishing relevant from irrelevant parts or important from unimportant parts of presented material (e.g., Distinguish between relevant and irrelevant numbers in a mathematical world problem)
4.2 Organizing	Finding	Determine how elements fit or function within a structure

	coherence Integrating Outlining Parsing Structuring	(e.g., Structure evidence in a historical description into evidence for and against a particular historical explanation)
4.3 Attributing	Deconstructing	Determine a point of view, bias, values, or intent underlying presented material (e.g., Determine the point of view of the author of an essay in terms of his or her political perspective)
Evaluate – Make judgments based on criteria and standards		
5.1 Checking	Coordinating Detecting Monitoring Testing	Detecting inconsistencies or fallacies within a process or product; determining whether a process or product has internal consistency; detecting the effectiveness of a procedure as it is being implemented (e.g., Determine if a scientist's conclusions follow from observed data)
5.2 Critiquing	Judging	Detecting inconsistencies between a process or product; determining whether a process or product has internal consistency; detecting the effectiveness of a procedure as it is being implemented (e.g., Determine if a scientist's conclusions follow from observed data)
Create – Put elements together to form a coherent or functional whole; reorganize elements into a new pattern or structure		
6.1 Generating	Hypothesizing	Coming up with alternative hypotheses based on criteria (e.g., Generate hypotheses to account for an observed phenomenon).
6.2 Planning	Designing	Devising a procedure for accomplishing some task (e.g., Plan a research paper on a given historical topic)
6.3 Producing	Constructing	Inventing a product (e.g., Build habitats for a specific purpose).

Appendix D: Affective Domain Operationalisation Table

(adapted and developed from Krathwohl et al.'s (1964) affective domain taxonomy)

1. RESPONDING (AR)

- **Description**: beginning of affective apprenticeship; openness to new points of view and material
- **Features**: curiosity, tolerance, interest, appreciation
- **Pedagogical strategy**: present diversity to move learner from comfort zone; exposure to or immersion in different worlds or points of view
- **Cue features**: divergent presentation, e.g. reflective question clusters, low demand imperatives such as 'consider', 'reflect on', 'think about' that ask learners to enter into a set of concerns or viewpoints empathetically, rhetorical questions
- **Ideal response**: learner empathises with different points of view; attitude is accommodating; interest in understanding the motives of others
- **Associated codes**: 'challenge', 'different perspectives', 'enter into'

2. VALUING (AV)

- **Description**: believing in the importance of field; wanting to participate in its modes of practice
- **Features**: identification, fidelity, commitment
- **Pedagogical strategy**: providing an opportunity for students to display their commitment through personal initiative (e.g. research) or reflection on learning journey
- **Cue features**: invitations or soft requests to share or participate; evocation of a community, e.g. reference to fellow learners
- **Ideal response**: signs of effort; evidence of independent activity; participation beyond personal expression (e.g. sharing other resources)
- **Associated codes**: 'what have you learned', 'independent research', 'taking ownership'

3. ORGANISING (AO)

- **Description**: identifying assumptions underlying positions within the field
- **Features**: prioritising, arranging values in a system, handling tensions between values, challenging preconceptions
- **Pedagogical strategy**: questions or activities requiring learners distinguish and evaluate values and approaches; evaluating personal own values/perceptions and how they might be changed
- **Cue features**: direct questions or question clusters with focused request to evaluate how learner ('you'/'we') looks at things (but cognitive requirements may be diffuse/unclear)
- **Ideal response**: demonstrating an understanding of the differences between values in the field; evaluating the merits and limits of an approach
- **Associated codes**: 're-evaluate', 'your perception'

4. INTERNALISING (AI)

- **Description**: internalising values within the field in a consistent manner
- **Features**: consistency, individuation, 'life philosophy', principles robust enough to provide general guidance in new situations
- **Pedagogical strategy**: challenging problems requiring the application of consistent principles (acquired through successful apprenticeship)
- **Cue features**: direct questions or question clusters of an open, evaluative nature, concerning complex matters of value and morality
- **Ideal response**: thoughtful response consistent with internalised values of field
- **Associated codes**: 'how do we fathom' (in vivo)

Appendix E: Cognitive Domain Operationalisation Table

(based on Anderson and Krathwohl's (2001) revised taxonomy of the cognitive domain)

1. REMEMBER* (CR)

- **Description**: 'retrieving relevant knowledge from long-term memory' (L. W. Anderson & Krathwohl, 2001, p. 66)
- **Features**: recognising, identifying, recalling, retrieving
- **Pedagogical strategy**: questions or tasks that prompt recall from long-term memory (activating prior knowledge); may be simple or embedded in more challenging tasks
- **Cue features**: direct questions with correct answers, e.g. verifying whether a statement is true or false, terms prompting specific recall such as 'who', 'what', 'when', 'how many'; would be suited to MCQ or T/F assessment (when not embedded)
- **Ideal response**: retrieval of appropriate and correct knowledge
- **Associated codes**: N/A (always embedded except for quizzes)

2. UNDERSTAND (CU)

- **Description:** integrating new knowledge into 'existing schemas and cognitive frameworks' **(L. W. Anderson & Krathwohl, 2001, p. 70)**
- **Features:** connecting empirical data to concepts and principles (similarity/difference, examples, generalisations, logical or causal inferences based on rules/experience)
- **Pedagogical strategy:** direct questions prompting learner to *make sense of* material presented, asking to infer motivations, draw conclusions, give reasons or examples, generalise, summarise
- **Cue features:** direct questions about meaning, e.g. the *role* something played, the *reasons* someone acted, the *significance* of events, the *nature* of an experience
- **Ideal response:** using concepts to make connections and organise new information
- **Associated codes:** causal connection, clarifying concepts, drawing conclusions, generalising or exemplifying

3. APPLY* (CP)

- **Description:** 'using procedures to perform exercises or solve problems' **(L. W. Anderson & Krathwohl, 2001, p. 77)**
- **Features:** selecting and using an existing procedure, method, theory or model to perform a familiar or unfamiliar task
- **Pedagogical strategy:** exercises or problems requiring appropriate selection and application of procedure, method, theory or model
- **Cue features:** clear presentation of a problem to be solved by application of appropriate procedural or conceptual knowledge
- **Ideal response:** use appropriate procedure, method, theory or model to solve problem
- **Associated codes:** N/A

4. ANALYSE (CA)

- **Description:** seeking underlying or systematic relations, i.e. constituent parts and their structural connections **(L. W. Anderson & Krathwohl, 2001, p. 79)**
- **Features:** prioritising concepts, e.g. identifying better examples, events with greater significance, identifying rules/heuristics (rather than just applying them), organising concepts into a system, identifying bias, weighing evidence for different positions
- **Pedagogical strategy:** question or task that directs learner to identify *most* relevant or significant features from a source (prioritise), structural organisation of a source, or underlying assumptions
- **Cue features:** use of words like 'key' or 'most' with request to select from material/events
- **Ideal response:** demonstrates ability to differentiate features, represent structure and identify techniques and biases in a message
- **Associated codes:** select evidence

5. EVALUATE (CE)

- **Description:** 'making judgements based on criteria and standards' **(L. W. Anderson & Krathwohl, 2001, p. 83)**
- **Features**: assessing a representation, process or product for consistency, effectiveness; identifying inconsistencies; applying and evaluating against external standards
- **Pedagogical strategy**: questions concerning whether a product, process or representation is good enough (based on objective standards, e.g. cost-effectiveness, efficiency)
- **Cue features**: questions concerning quality and/or feasibility, with explicit or implied comparison against standards or alternatives
- **Ideal response:** demonstrates ability to identify inconsistencies and measure outcomes against objectives
- **Associated codes:** feasible

6. CREATE (CC)

- **Description**: combining elements (theories, concepts, representations, materials) to form coherent whole, new pattern, structure, etc. **(L. W. Anderson & Krathwohl, 2001, p. 84)**
- **Features**: generating new hypotheses (substantiated, not opinionated); planning or designing procedures; producing new representations or artefacts
- **Pedagogical strategy:** project-based activity requiring independent planning and production (including written composition)
- **Cue features**: invitation to respond to a brief to produce a new representation or artefact
- **Ideal response:** coherent resolution of project in terms of conception, substantiation and production, as appropriate
- **Associated codes:** imagine

*** No examples of these categories were found in the case analysed, so descriptions are theoretical and could not be developed inductively alongside the process of coding**

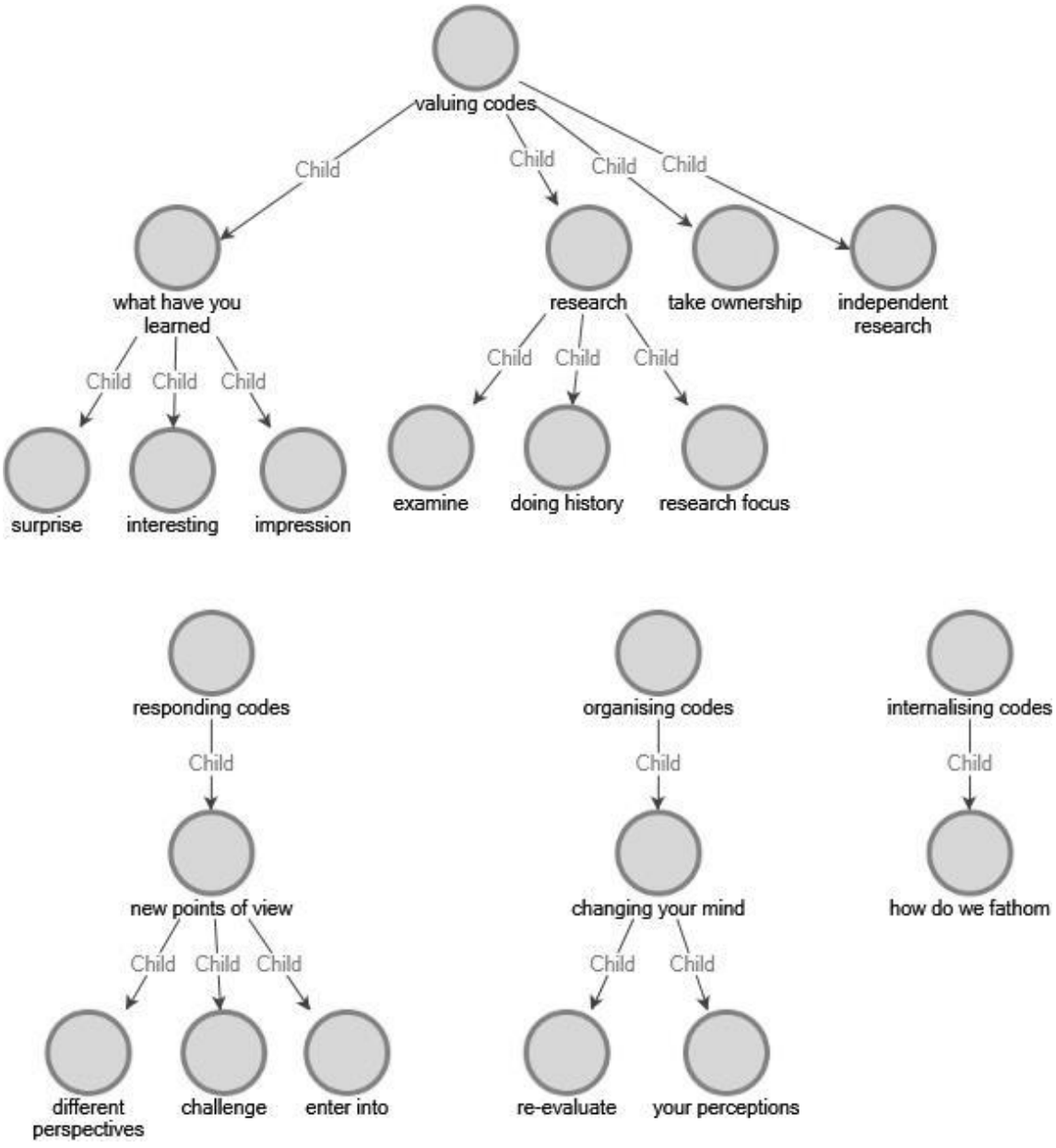
Appendix F: Affective Domain Codes (Cue Classification)

Name	Sources	References
valuing codes	42	145
research	39	68
examine	20	24
doing history	3	5
research focus	1	1
what have you learned	24	52
interesting	24	40
surprise	10	10
impression	2	2
independent research	13	19
take ownership	6	6
responding codes	36	47
new points of view	36	47
different perspectives	21	22
enter into	13	13
challenge	11	12
organising codes	18	20
changing your mind	18	20
re-evaluate	15	15
your perceptions	5	5
internalising codes	3	3
how do we fathom	3	3

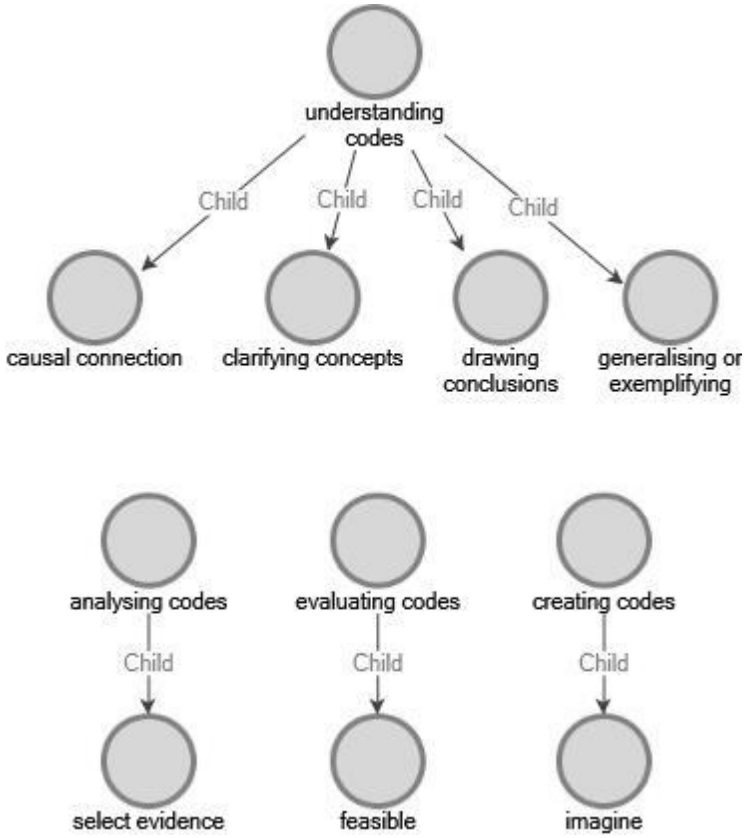
Appendix G: Cognitive Domain Codes (Cue Classification)

Name	Sources	References
understanding codes	9	9
causal connection	3	3
generalising or exemplifying	3	3
clarifying concepts	2	2
drawing conclusions	1	1
analysing codes	3	3
select evidence	2	2
most	1	1
evaluating codes	3	3
feasible	2	2
worthwhile	1	1
creating codes	1	1
imagine	1	1

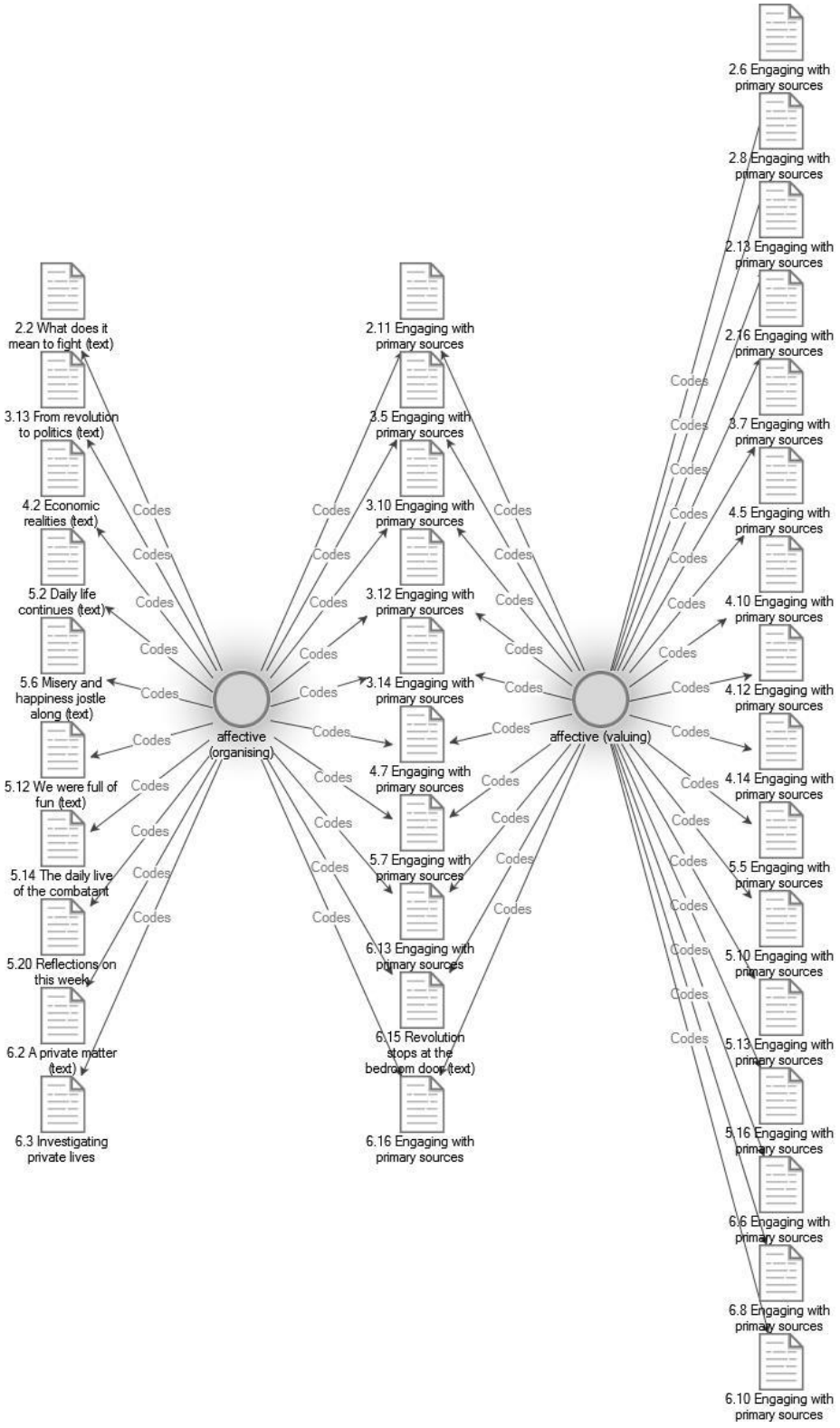
Appendix H: Visualisation of Affective Domain Codes



Appendix I: Visualisation of Cognitive Domain Codes



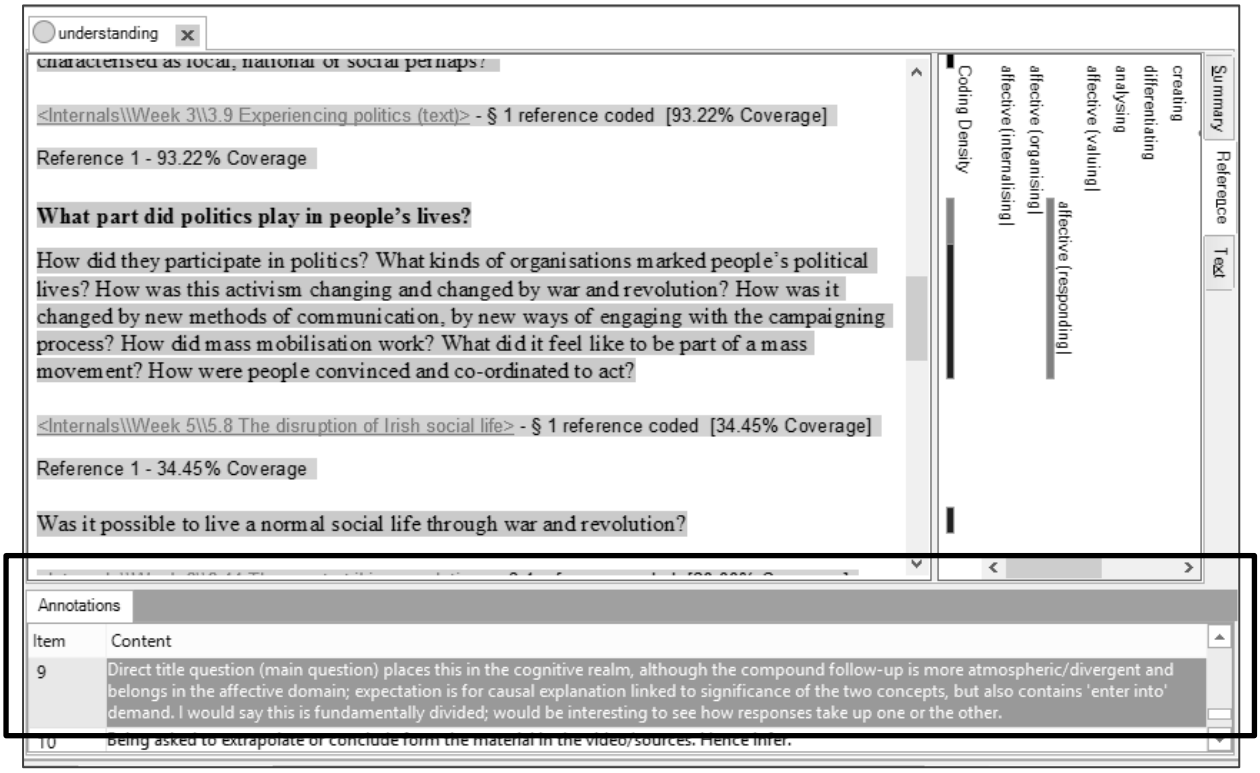
Appendix J: Mixed Cues in Research Activity Steps - Valuing and Organising



Appendix K: Codes Developed From Provisional Analysis of Video Content

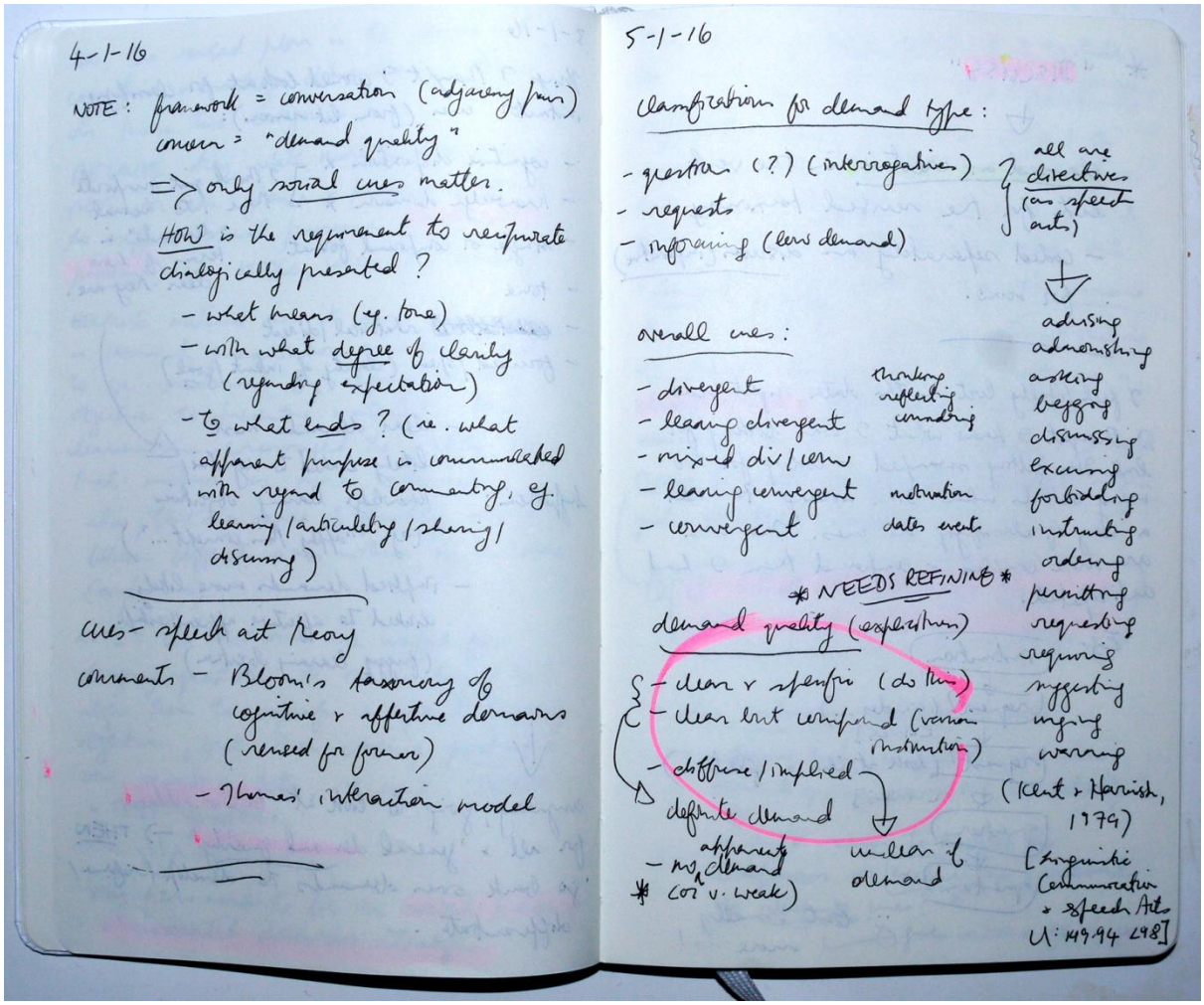
Name	Sources	References
narrative codes	8	36
contrasting point of view	7	7
events unfolding	7	7
fiction	7	7
narrating	8	8
personal opinion	7	7
visual codes	8	19
archive footage	8	12
character photos	1	1
contemporary scene	1	1
talking head	1	5
voice codes	7	7
emotive tone	7	7

Appendix L: Use of Annotations to Clarify Coding in NVivo

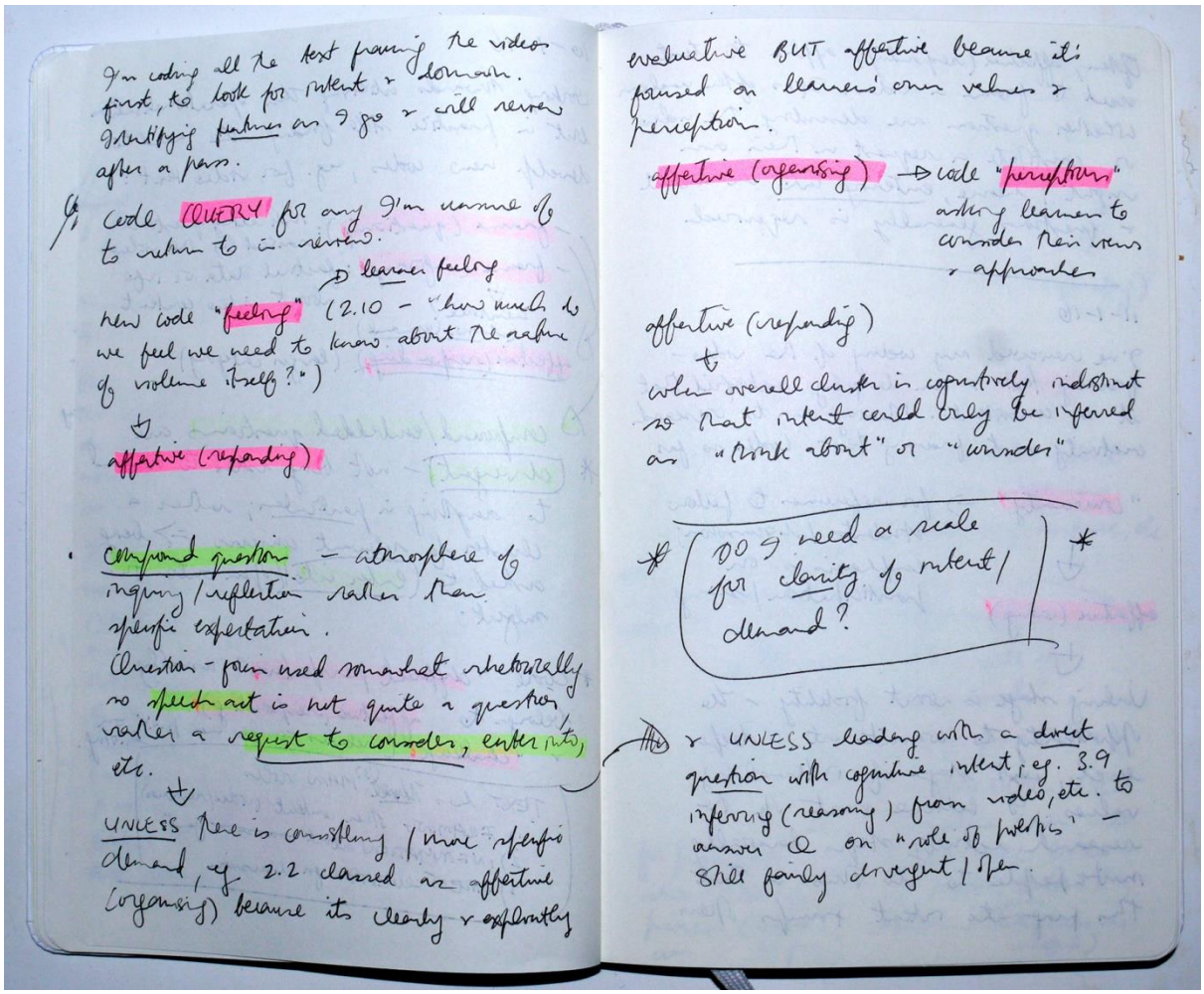


Appendix M: Research Notebook – Sample Pages from Cue Analysis Phase

a) During initial open coding

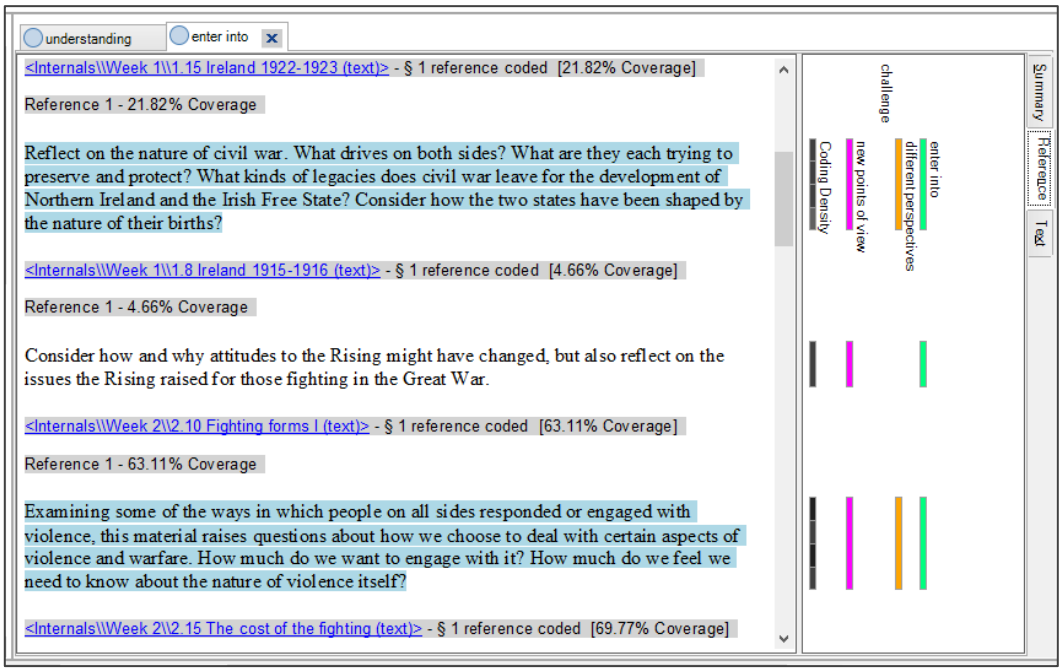


b) During inductive operationalising and open coding for affective domain



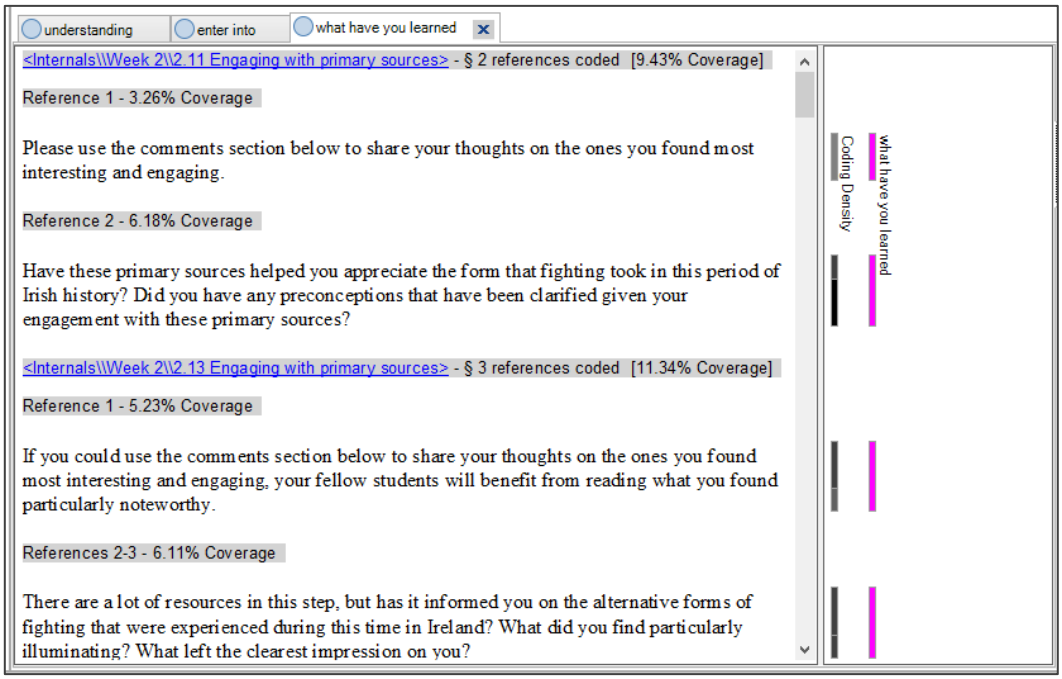
Appendix N: Sample of Cues Classified as Responding (Affective Domain)

Coding strips on right hand side show application of codes associated with responding: ‘new points of view’, ‘different perspectives’ and ‘enter into’



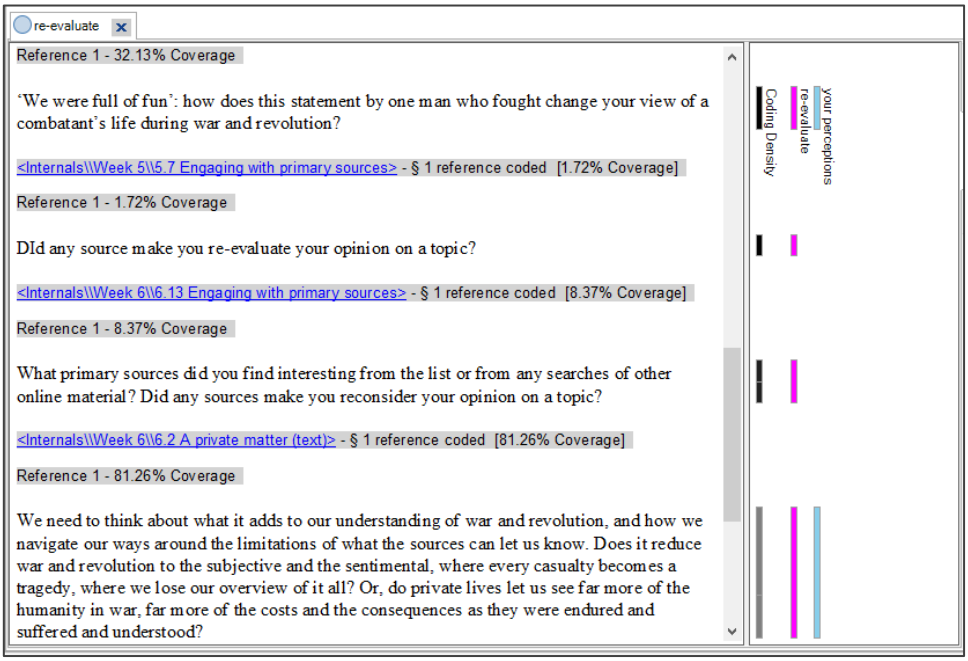
Appendix O: Sample of Cues Classified as Valuing (Affective Domain)

Coding strip on right shows application of code associated with valuing: ‘what have you learned’



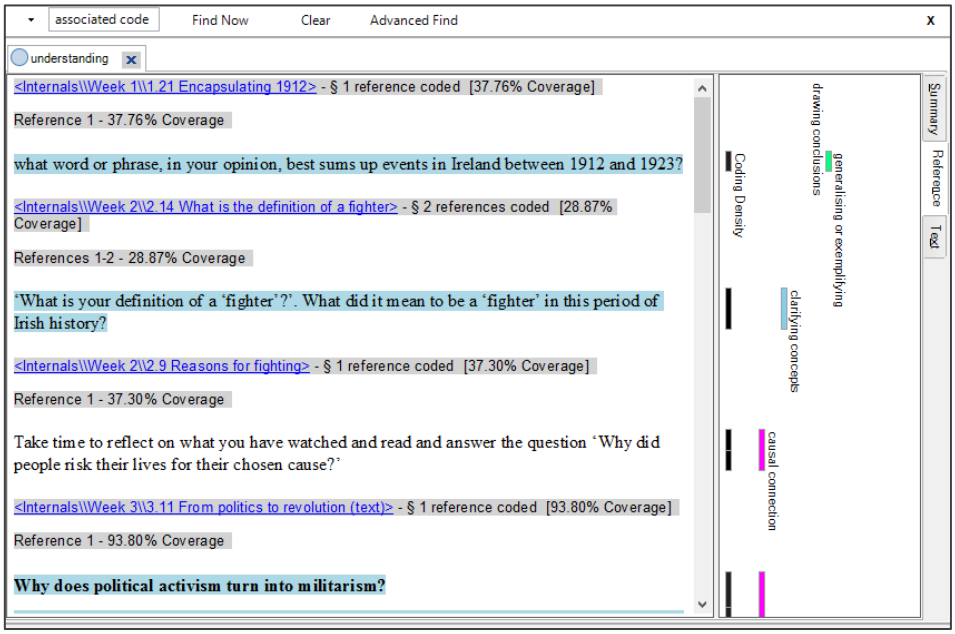
Appendix P: Sample of Cues Classified as Organising (Affective Domain)

Coding strip on right shows application of code associated with organising: ‘what have you learned’



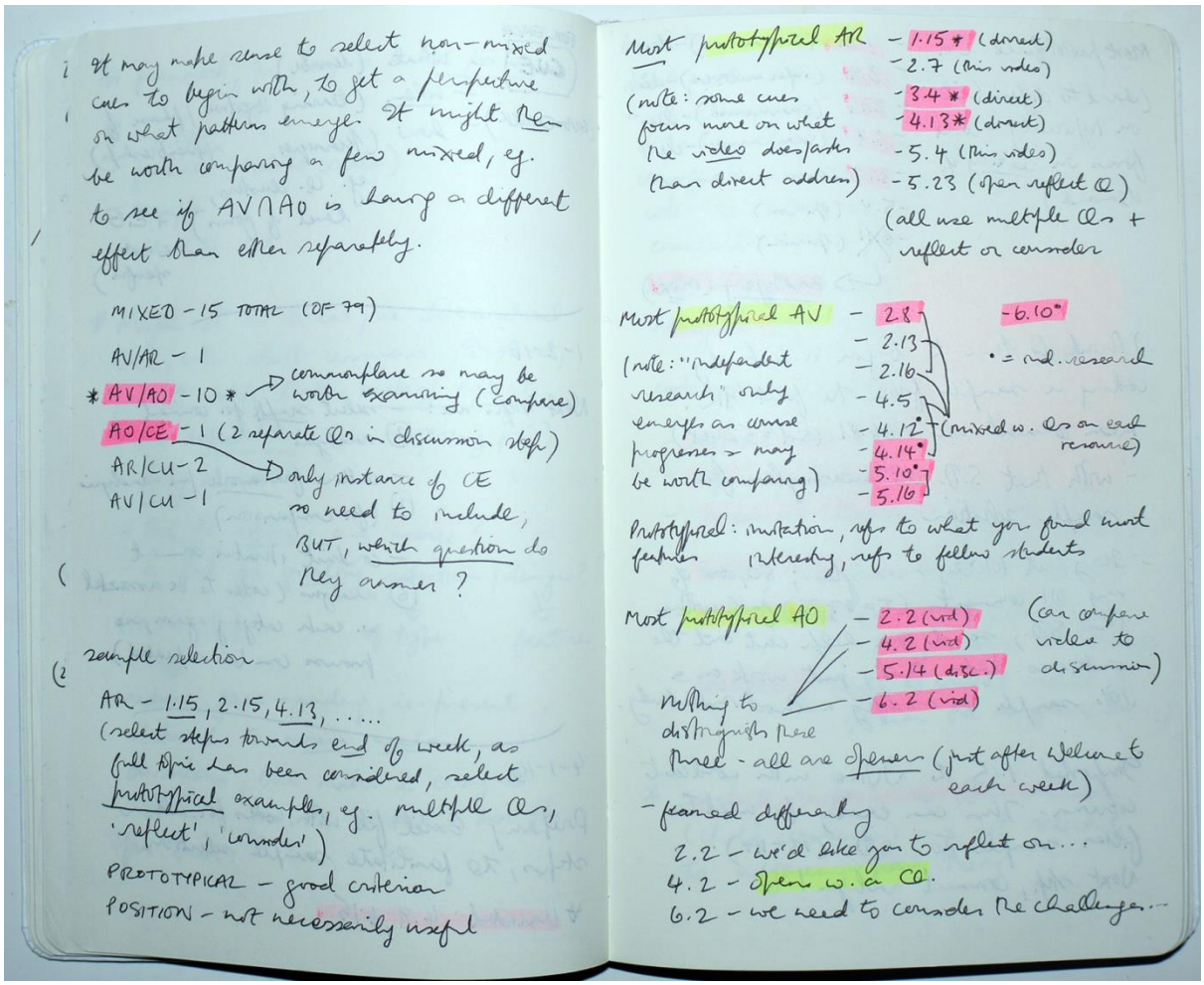
Appendix Q: Sample of Cues Classified as Understanding (Cognitive Domain)

Coding strip on right shows application of codes associated with understanding: ‘generalising or exemplifying’, ‘clarifying concepts’ and ‘causal connection’

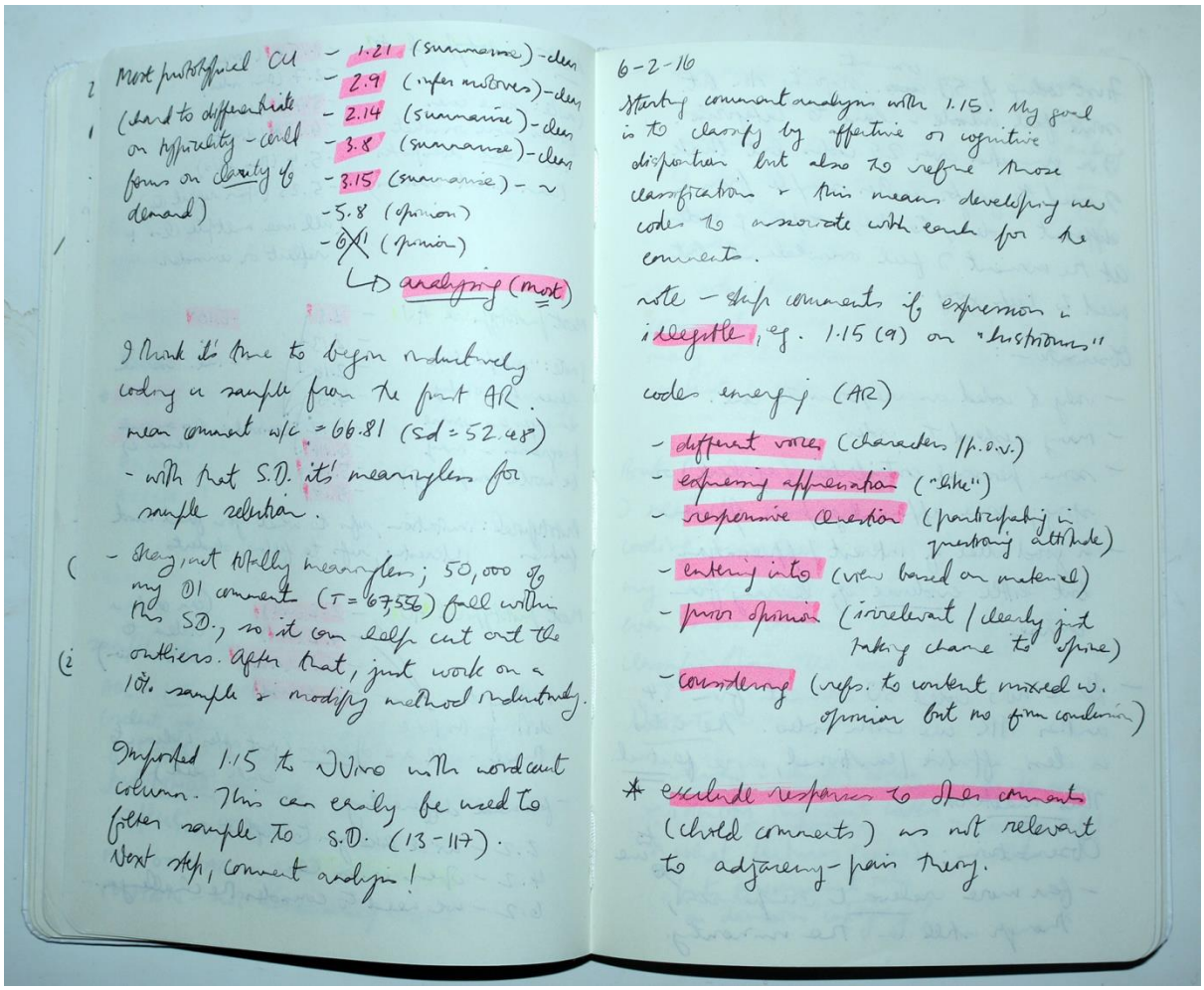


Appendix R: Research Notebook – Sample Pages from Comment Analysis Phase

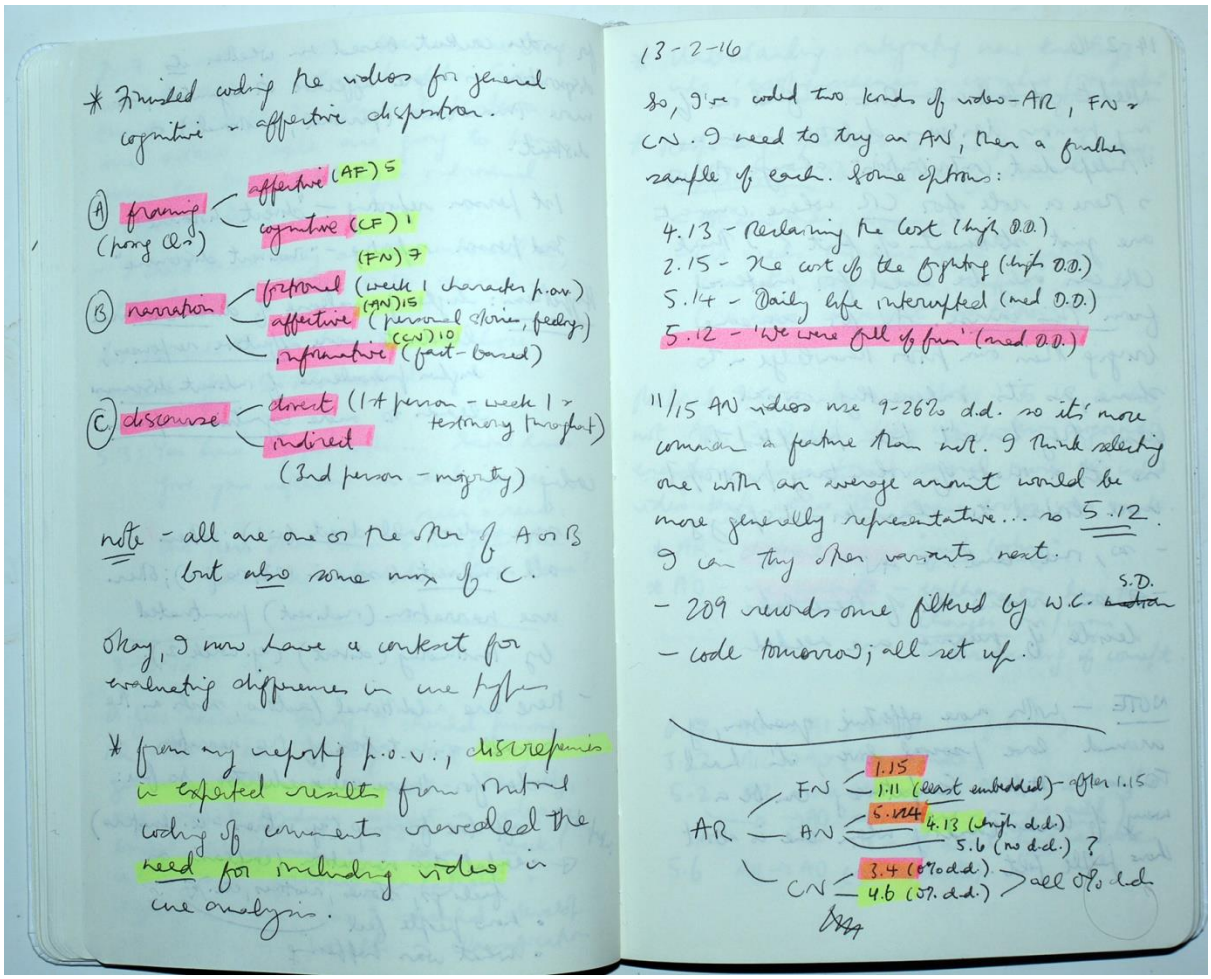
a) Notes on cue sample selection for comment analysis (see Section 5.2.1)



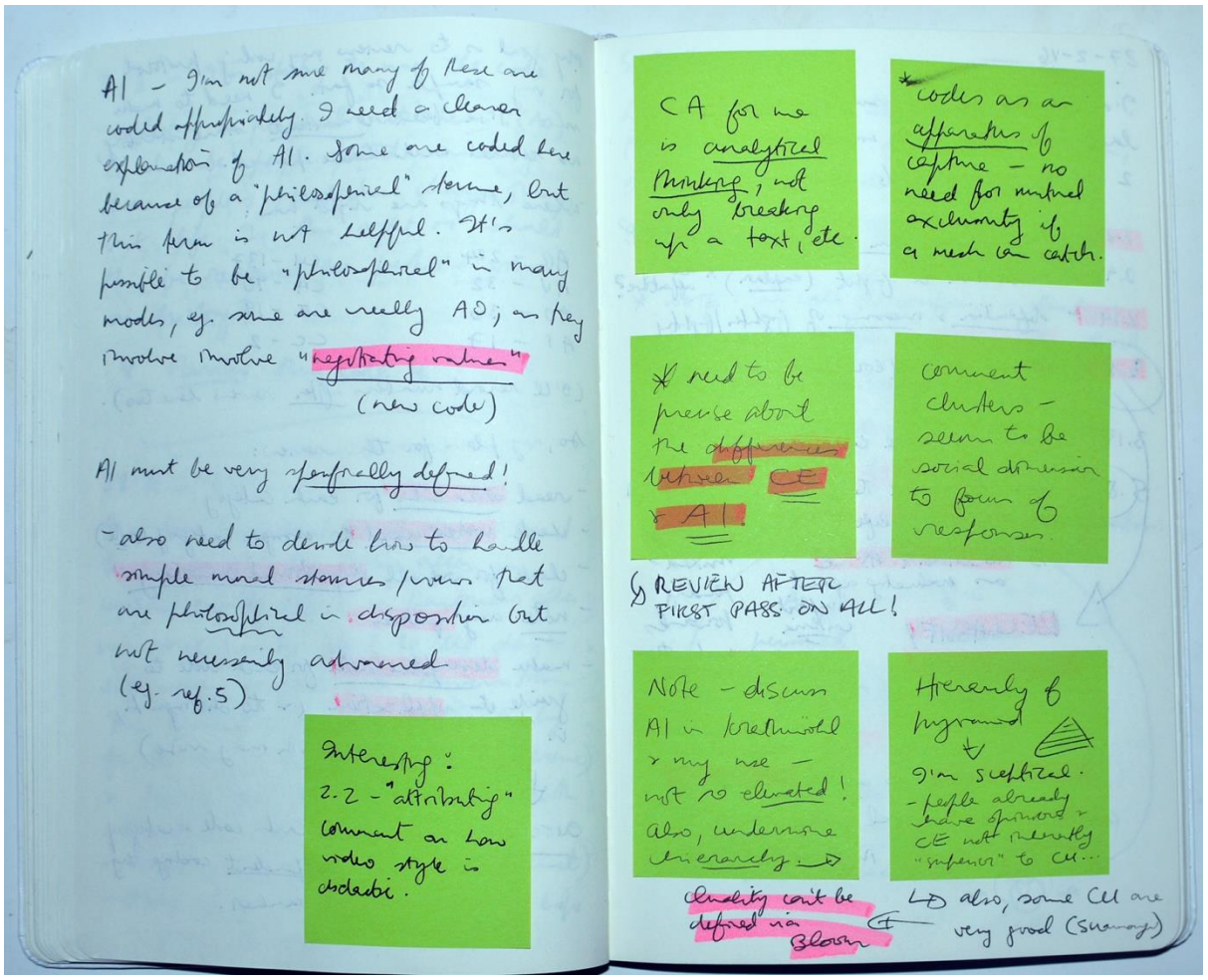
b) Notes on cue sample selection for comment analysis (left) and codes developed during initial coding of AR cues (right) (see Section 5.4)



c) Reporting on video coding process (see Section 5.4.1)



d) Notes made during comment coding scheme review (see Section 5.4.3)



Appendix S: Coding Scheme for Comment Analysis

Category	Codes	Application
AR	Empathising; personal story; entering into; expressing appreciation; emotional; considering; responsive question; different voices; personal association; curiosity; showing interest	Response are clearly empathetic, often referring to the video content and the lives of the characters (fictional or factual); longer responses are divergent and atmospheric rather than converging on a particular interpretation or conclusion; responses may contribute personal stories, e.g. anecdotes from own experience or family members
AV	Independent contribution	Response demonstrates interest beyond the scope of the material supplied by providing additional material in the form of links or personally known information (not including personal stories) (e.g. more information about something mentioned or a URL)
AO	Our evaluation; approaching history; negotiating values; reflecting on personal attitudes	Response negotiates the relationship between competing values (e.g. violence or politics as a means); may consider from a personal or historical point of view, i.e. how individual or collective view situation
AI	Axiology; maxim; how do we fathom; learning from history	Response include any judgments in the realm of ethics, values, morality, from the simple to the complex; may consider the difficulty of making such judgments or axiological maxims derived from history, literature or experience (e.g. what ought to be)
CU	Inferring, summarising, comparing, interpreting, explaining, classifying, exemplifying, generalising, clarifying	Response involves making connections related to material encountered that show an effort to converge on a meaning or interpretation; on a spectrum with CA but does not go as far as discriminating between different ideas and prioritising
CA	Weighing up; organising; differentiating; prioritising; identifying principles; missing perspectives; identifying bias; questioning evidence	Response is more elaborate than CU and involves identifying different elements of a concept and how they relate; can discriminate between ideas/factors and may notice bias, underlying rules and omissions
CE	Evaluating possibility; evaluating outcomes; evaluating strategy; evaluating effectiveness; critiquing course content	Response refers (implicitly or explicitly) to conditions and measurement (in history this can include possible conditions, e.g. what if… this happened instead of that); measures effectiveness, possibility, etc.; axiological evaluations are excluded
CC	Imagining; metaphor	Response produces a somewhat original idea or representation, e.g. for a cartoon to represent something, a poetic depiction or metaphor

Appendix T: Codes Used in Comment Analysis

a) Cognitive domain categories

Name	Sources	References
CU codes	24	333
inferring	21	126
summarising	18	65
comparing	21	38
interpreting	16	33
explaining	12	26
classifying	3	25
exemplifying (conceptual)	6	11
generalising	3	4
clarifying	4	4
CA codes	24	297
weighing up	18	79
organising	19	69
differentiating	20	57
prioritising	6	39
identifying principles	7	27
missing perspectives	13	17
identifying bias	5	8
questioning evidence	1	1
CE codes	17	73
evaluating possibility	3	33
evaluating outcomes	10	26
evaluating strategy	6	6
critiquing course content	3	4
evaluating effectiveness	3	4
CC codes	5	10
imagining	4	9
metaphor	1	1

b) Affective domain categories

Name	Sources	References
AR codes	24	419
empathising	20	110
personal story	19	74
entering into	16	52
expressing appreciation	14	50
emotional	12	34
considering	10	22
responsive question	7	15
different voices	4	14
personal association	6	12
curiosity	10	11
showing interest	9	9
AV codes	16	43
independent contribution	16	43
AO codes	19	153
approaching history	13	62
reflecting on personal attitudes	11	38
our evaluation	12	30
negotiating values	8	23
AI codes	21	159
axiology	21	116
maxim	10	23
how do we fathom	6	13
learning from history	5	7

Appendix U: Text for Framework Design

Cue Type	Objective	Cue Design	Example
Remember (CR)	Recognise or recall appropriate facts or ideas from memory	Clear, direct questions with correct answers to prompt recall from long-term memory	Multiple choice or true/false questions; specific recall prompts such as 'who', 'what', 'when'
Understand (CU)	Summarise, explain or draw conclusions from information	Clear, direct questions about meaning to prompt integration of material into existing mental frameworks	What role did … play? Why did … occur? What effect did … have?
Apply (CP)	Solve a problem by selecting and/or applying an appropriate model or method	Clear presentation of an exercise or problem to be solved with reference to choosing or applying procedures, methods, theories or models	Solve this equation: … How would you find the answer to … ?
Analyse (CA)	Identify underlying principles or distinguish the relative importance of elements	Clear, direct questions prompting learners to examine the components and structure of elements or their relative importance	What was the key event/factor in … and why? What is the evidence for …?
Evaluate (CE)	Evaluate the possibility or effectiveness of an approach	Direct questions about the quality, possibility, feasibility or effectiveness of an approach or product, measured against explicit criteria (objectives or principles)	How effective is … in achieving …? Which method is more appropriate for … ?
Create (CC)	Produce a new representation, artefact, plan or hypothesis	Invitations to respond to a project brief or scenario to design or produce a new theory, representation or artefact	Design a framework for … Compose a story about …
Respond (AR)	Show interest in new ideas or empathise with new points of view	Encourage response through linked question clusters with low-demand imperatives such as 'reflect on' or 'consider'. May include rhetorical questions and reflective statements.	Reflect on the nature of … What motivates those involved? What effects does this have? Consider how this has shaped …?
Value (AV)	Commit to finding out more through independent activity	Invitations or soft requests to share findings with other learners; references to a community of fellow learners	What have you learned from your independent research on this subject?
Organise (AO)	Reflect on how they think about the subject, or on how it is approached in the subject area	Direct questions about the values of the domain or on how the material has changed the learner's perception of a situation	How does … change our perceptions of … ? Is … a valuable way of approaching the subject (e.g. history or science).
Internalise (AI)	Present a coherent point of view on a moral, ethical or aesthetic subject	Open, evaluative questions requiring moral, ethical or aesthetic judgments central to the domain. May invoke a community faced with such problems	How do we come to terms with … ?