Principles in Patterns (PiP): Evaluation

WP7:37 Evaluation of systems pilot

Phase 2: User acceptance testing of Course and Class Approval Online Pilot (C-CAP)

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1. Introduction

The PiP Evaluation Plan [1] documents four distinct evaluative strands, the first of which entails an evaluation of the PiP system pilot (WP7:37 – Systems & tool evaluation) (Figure 1). Phase 1 of this evaluative strand focused on the heuristic evaluation of the PiP *Course and Class Approval Online Pilot* system (*C-CAP*) and was completed in December 2011. A report documenting the principal findings is available from the PiP project website [2]. Phase 2 is the final phase of the system and tool evaluation (WP7:37) and forms the basis of this report.

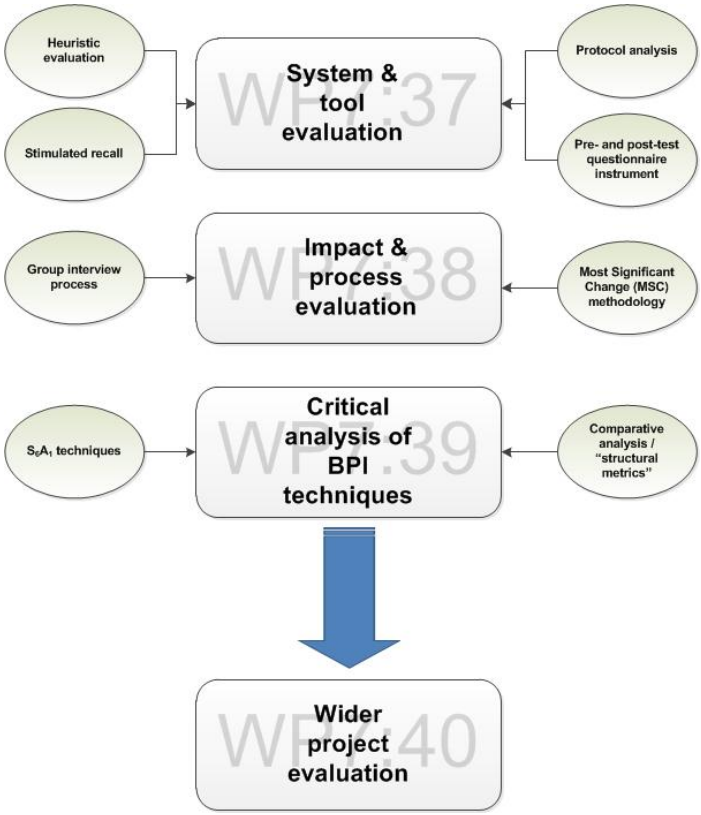

Figure 1: Overview of evaluative strands and evaluative sub-phases of PiP.

Smith and Brown [3] and Lai [4] discuss the importance of technology facilitated approaches to design and approval for the purposes of improving pedagogy and, in Lai's case, in increasing the portability and sharing of curricula within specific educational contexts. With the exception of PiP [5] and T-SPARC [6] - both funded under the JISC Institutional Approaches to Curriculum Design Programme [7] - very little is available in the literature to influence the development and evaluation of technology supported approaches to curriculum design and approval. Smith and Brown [3] and Lai [4] merely discuss the theoretical opportunities of technology supported curriculum design. PiP therefore represents a unique testbed with little academic research upon which to guide the evaluative approach adopted for such a project.

Phase 2 of the evaluation is broadly concerned with "user acceptance testing". This entails exploring the extent to which C-CAP functionality meets users' expectations within specific curriculum design tasks, as well as eliciting data on C-CAP's overall usability and its ability to support academics in improving the quality of curricula. The general evaluative approach adopted therefore employs a combination of standard Human-Computer Interaction (HCI) approaches and specially designed data collection instruments, including protocol analysis, stimulated recall and pre- and post-test questionnaire instruments. This brief report summarises the methodology deployed, presents the results of the evaluation and discusses their implications for the further development of C-CAP. It is anticipated that some solutions will be implemented within the lifetime of the project. This is

consistent with the incremental systems design methodology that PiP has adopted. However, it should be recognised that the implementation of some solutions may not be feasible, either because there are insufficient project resources to implement them or because they lie outside the project scope.

2. Methodology

2.1 Aims

The PiP Evaluation Plan details the wider objectives of the project evaluation [1]. The aim of this phase of the evaluation was to expose C-CAP to facets of HCI testing in order to validate aspects of phase 1 and evaluate C-CAP within in a real user context, including C-CAP's ability to support academic participants in the design of curricula. The following broad research questions influenced the evaluative design:

1. The extent to which C-CAP functionality meets users' expectations within specific curriculum design tasks
2. Assessing the performance of C-CAP in supporting the participants in curriculum design task and approval process and its potential for improving pedagogy
3. Eliciting data on current approval process and how C-CAP could contribute to improvements in the process (i.e. its fitness for purpose).
4. Measuring the overall usability of C-CAP (e.g. interface design and functionality instinctive, navigable, etc.) and capture data on users' preferred system design/features

Details of the study participants are provided in section 2.3 and an overview of the procedure adopted in section 2.4.

Phase 1 of the evaluation formed an important basis for preparing the C-CAP system for phase 2. The following section (2.2) summarises the role of the heuristic evaluation in preparing for the user acceptance testing.

2.2 Phase 1: C-CAP interface improvements for optimising data collection

The use of heuristic evaluation in phase 1 was an integral part of ensuring C-CAP demonstrated a high degree of heuristic compliance prior to commencing phase 2. Heuristic compliance was considered imperative for two related reasons: minimising users' extraneous cognitive load during user acceptance testing, and; optimising user acceptance testing data.

"Intrinsic cognitive load" pertains to the inherent difficulty of a task while "extraneous cognitive load" relates to the task presentation, which is normally controlled by the task designer [8]. If the intrinsic cognitive load of a task is high, and extraneous cognitive load is also high, then problem solving or task completion may fail to occur. Adjusting the presentation of the task to lower extraneous cognitive load can facilitate task completion or problem solving if such adjustments mean that the resulting total cognitive load falls within the mental resources of the user [9]. A prominent theme in recent HCI research therefore pertains to how best to minimise the extraneous cognitive load users often experience as a result of interface or system design. Poor system usability and design has been shown to increase users' disorientation and cognitive load during system use [10–12]. As extraneous cognitive load increases so the cognitive resources available to the user to complete their primary task (e.g. locating information, interacting with a system to complete a work task, booking flights, etc.) decreases.

Systems that expose users to high levels of extraneous cognitive load as a result of poor system design and usability have been shown to erode human cognitive processing. This generally manifests itself in a measurable decline in task performance, inefficiency in task completion, increased error rates and user frustration [11–15]. In some user task settings a decline in higher-level metacognitive skills can also be observed [12]. Any system engaging users in high levels of intrinsic

cognitive load (i.e. a system engaging academics in curriculum design) must therefore strive to minimise extraneous cognitive load if the system is support them in task completion. Given the frequent complexities and intellectual demands associated with the curriculum design process [16], any system has to ensure a high level of usability if it is to truly support and inspire academics in the curriculum design process. Failure to address the threat of extraneous cognitive load in this instance could potentially have resulted in poor task performance.

The above noted threat of extraneous cognitive load also has implications for the quality of data gathered during user acceptance testing. A system demonstrating high levels of extraneous cognitive load generally fails to engage the user with the primary task sufficiently [12]. The consequences for typical HCI testing is that user participants are therefore more likely to comment on trivial or superficial interface issues, or system errors that could easily be debugged prior to user exposure, rather than deeper system issues, or aspects of how the system supports them in the primary task (which, in this context, would be the curriculum design and approval process). A valid data collection environment is consequently not achieved and data can become skewed towards superficial system problems which are often not indicative of a system's wider raison d'être.

Phase 1 (heuristic evaluation) was therefore used to optimise C-CAP and ergo the data collection environment, thus minimising the potential for extraneous cognitive load during user acceptance testing. Phase 1 detected 27 heuristic violations in the C-CAP system [2]. Of these violations, 67% (n = 18) were classified at a mean severity rating of ≤ 2.67, and of these 11% (n = 3) were classified at severity rating 1 (Cosmetic problem only). Only 33% (n = 9) were classified at a mean severity rating ≥ 3. Over 93% of all detected heuristic violations were resolved prior to commencing user acceptance testing, leading to numerous system and interface improvements. Unresolved violations were attributable to factors outside the control of the PiP team, e.g. University process issues or the limitations of InfoPath. Appendix E provides indicative screen dumps of the C-CAP system as deployed for this phase of the evaluation.

2.3 Participants

The evaluation participants were drawn from the academic departments of the University of Strathclyde. Early outreach and stakeholder activity meant that many participants were already familiar with PiP and its work; however, participants for this evaluative phase were recruited via faculty list emails (circulated on behalf of the evaluator by faculty managers) and an all-staff announcement via the Weekly Digest[†] [*]. To be eligible participating academics were required to have experience of the curriculum design and approval process and to have been involved in the creation of new classes and/or courses in within last 2 years. In reality, almost all participants had been involved in either class or course design within the past 6 months. It was originally the intention of phase 2 to include faculty managers in the user acceptance testing; but since faculty managers only become involved with C-CAP to administer the approval process *after* curricula have been designed their involvement would amount to using a single interface screen. Faculty manager involvement was therefore considered unproductive at this stage and was deferred until WP7:38 when faculty piloting is scheduled to take place.

Ten academic participants agreed to participate in the study. Table 1 sets out participants' faculty, departmental and discipline affiliations. Despite the small sample numbers, the group originated from a broad range of academic backgrounds, including physics, economics, mathematics and statistics

[†] http://www.strath.ac.uk/weeklydigest/

[*] Phase 2 of the evaluation plan was required to be considered by the University Ethics Committee (UEC). The UEC mandated adjustments to the methodology to further protect the anonymity of academic participants. This included no direct recruitment of participants.

and biomedical sciences. Unfortunately no Humanities & Social Sciences (HaSS) faculty were recruited[‡].

Table 1: Faculty and departmental affiliations of study participants.

Participant No.	Faculty	Department / subject
1	Strathclyde Business School	Management Science
2	Faculty of Science	Department of Physics
3	Strathclyde Business School	Economics
4	Faculty of Science	Strathclyde Institute of Pharmacy and Biomedical Sciences
5	Strathclyde Business School	Management Science
6	Faculty of Engineering	Department of Mechanical and Aerospace Engineering
7	Faculty of Science	Department of Computer and Information Sciences
8	Strathclyde Business School	Economics
9	Strathclyde Business School	Management Science
10	Faculty of Science	Department of Mathematics and Statistics

2.4 Procedure

The user acceptance testing sessions were designed to include four distinct sections: Pre-session questionnaire instrument, protocol analysis, stimulated recall, and a post-session questionnaire. Each session was circa 60 mins in duration, including ethical conditions (e.g. signing of consent form, explanation of research scope, etc). Data collection was conducted throughout January 2012 in a controlled IT lab setting.

The following sections detail the methods used and describes the overall procedure.

Protocol analysis

Protocol analysis (also known informally as the "think aloud protocol") is a frequently deployed user testing methodology for software, interfaces, systems, etc. in which participants are asked to complete a series of tasks with the test/pilot system while simultaneously verbalising their thoughts. Verbalisations (or protocols) are sound recorded and transcribed for analysis. Additional data may also be gathered (e.g. screen captures, evaluator logs, etc). The methodology is considered to have a high level of face validity as the data captured tends to focus on the *actual use* of a system rather than on user judgements concerning its *perceived* usability or efficacy. Protocol analyses are based on direct participant observation and attempt to model users' real world interaction with a system. As such, evaluators gain an insight into users' cognitive processes as the methodology tends to expose a wide variety of user problems, assumptions or misconceptions, many of which would otherwise go undetected. Protocol analysis was originally formalised by Ericsson and Simon [17] and later van Someren et al. [18] and has since become a widely used technique in user testing studies in a wide variety of system contexts [19–27].

To best model a genuine curriculum design process and test the C-CAP system in supporting curriculum design and approval, participants were asked to bring a recently drafted curriculum design form with them to the session. Participants were then instructed to replicate their form using the C-CAP system while thinking aloud, recognising that the form structure in C-CAP was different and often more detailed than existing curriculum design forms. For example, C-CAP offers a more structured approach by using efficiency tools [28] to accelerate form completion (e.g. drop down lists, auto-calculation of teaching hours / assessment weightings, etc.) and imposes some basic principles of curriculum design theory (e.g. adherence to constructive alignment [29], greater consideration of learning activities, etc.). Participants were briefed on the process of thinking aloud, which was in line with established protocol analysis procedures [18], [24]. Screen capture software was used to record both participants' C-CAP interface interaction (visual data) and to sound record their "think aloud"

[‡] Two HaSS participants were originally recruited but for external reasons were unable to participate.

protocols (audio data). Screen capture and associated audio data from the protocol analysis were uploaded into QSR NVivo 9 for content analysis, coding and further analysis (Figure 2). Data analysis was conducted according Holsti's [17] methodologies for content analysis and van Someren et al.'s techniques for category creation [18]. NVivo 9 was also used for audio transcription.

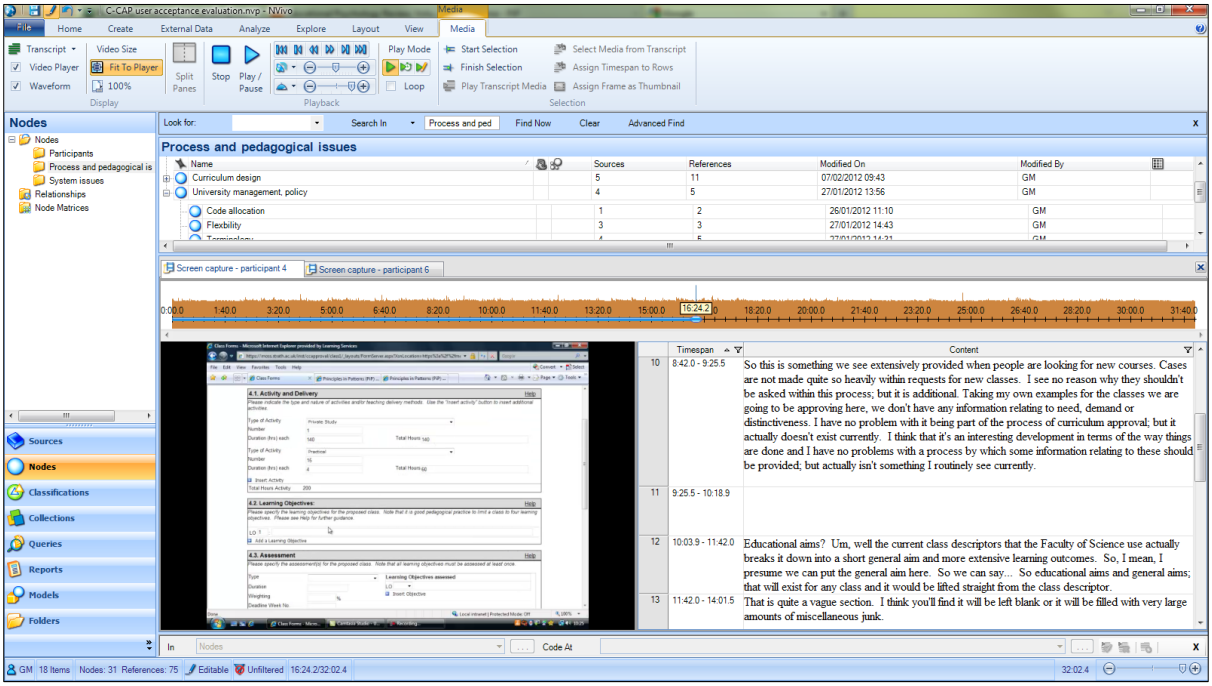

Figure 2: Screen capture data and transcribed audio as prepared for analysis in NVivo 9.

Throughout the protocol analysis session evaluator logs were used to record "significant events" that occurred during participants' interaction with the C-CAP system. "Significant events" can be defined as those moments where C-CAP was especially difficult for the participant to use or where C-CAP did not function as they expected (e.g. navigation was not located where the participant anticipated, C-CAP experienced a system error, participant experienced difficulty using the drop down menus for aligning assessment with learning objectives, etc.). The logs were created and maintained in MS Excel and included a time stamp and a brief description of the significant event (see example log in Appendix D). The overall purpose of the log was to record any events which might otherwise go unnoticed through the protocol analysis or to mark significant events worthy of further exploration via stimulated recall.

Stimulated recall

The stimulated recall technique (or "retrospective think aloud") is similar to protocol analysis but differs in that data are not collected until after the participant has completed their primary task [20], [24]. Often researchers use one or the other, normally owing to cost considerations; but research studies report on the benefits of both in identifying different HCI issues [28]. In stimulated recall a recorded screen capture of the participant's system interactions is played back to the participant who is then asked to articulate their cognitive processes and actions at specific points of the recording. Stimulated recall is generally considered favourable because although the participant is asked to verbalise after they have completed the task, they are often able to provide more detailed verbalisations owing to reduced cognitive load.

Stimulated recall was used immediately after participants had completed their "think aloud" curriculum design task using C-CAP (i.e. after the protocol analysis). A common drawback of protocol analysis is that some verbalisations can be inadequate. This is often the case when the user is engaged in cognitively onerous tasks, e.g. when the user is asked to verbalise while using a complex system

interface [24]. Since participants in the user acceptance testing were engaging in the fictional but nonetheless cognitively onerous process of curriculum design with C-CAP, it was important that a brief stimulated recall phase be included in the testing session. Participants were only asked to engage in stimulated recall if significant events were logged during the "think aloud" curriculum design task. Stimulated recall would therefore focus the nature of those significant events and seek to tease out participants' thinking at the relevant stage of the screen capture video.

Stimulated recall was conducted immediately after the collection of protocol analysis data in order to review participants' system behaviour, thus teasing out potentially important data which may have been missed during protocol analysis. A total of six participants provided stimulated recall data. Stimulated recall data were sound recorded and uploaded to NVivo 9 for transcription and analysis alongside protocol analysis data.

Pre- and post-session questionnaire instruments

A pre-session questionnaire was administered prior to the commencement of the protocol analysis session in order to collect basic demographic information* and capture participants' IT efficacy. IT efficacy was measured using an adapted version of Murphy et al.'s [30] original Computer Self-Efficacy (CSE) scale, modified by Torkzadeh et al [31]. The instrument was also designed to elicit from participants their opinions and perceptions of the current curriculum approval process and its current issues.

The post-session questionnaire was administered after the completion of stimulated recall (if applicable). The post-session instrument was designed to capture data on users' success with the system and gather definitive data on the aspects of the system that participants perceived most favourably and those they did not. This was based on a customised version of the standard System Usability Scale (SUS) post-test instrument, first proposed by Brooke [32] and subsequently developed, deployed and validated by other usability researchers (e.g.[33], [34], [35], [36]). Brooke's instrument comprises a 10 item questionnaire using 5 point Likert scale response options. The post-session questionnaire also sought to capture perceptions of how C-CAP supported them in the curriculum design process and its potential for improving approval processes at the University of Strathclyde.

Both questionnaire instruments were administered using Bristol Online Surveys (BOS), an online survey tool [37]. Data from BOS was exported to a .csv file for analysis in MS Excel and in SPSS. The post-session instrument was also imported to NVivo 9 for analysis of open-ended question responses (i.e. Q.3).

Screen dumps of the questionnaire instruments as displayed in BOS are available in Appendices F and G.

Procedure summary

To summarise, the following data collection methods were used in the following order:

1. Pre-session questionnaire
2. Protocol analysis using C-CAP ("think aloud" curriculum design task)
3. Stimulated recall (based on recording playback of "think aloud" curriculum design task using C-CAP).
4. Post-session questionnaire

* The demographic information requirements of the questionnaire instruments were reduced in line with UEC requirements.

2.5 Methodological restrictions and limitations

The methodological approach adopted for this phase of the evaluation was subject to a variety of restrictions which, in turn, constitute limitations to the present design. This phase of the evaluation was ideally suited to a repeated measure approach in which participants would be exposed to alternative versions of C-CAP, thus permitting statistical inferences to be made between treatments. Unfortunately the timetable for the PiP project precluded the use of an additional development phase between treatments. It is also worth noting that the participant recruitment restrictions would have rendered such an approach untenable even if the timetable for evaluation was favourable. The current approach is therefore a compromise, with a suite of data collection techniques administered instead in order to gather rich data about participant interactions with C-CAP.

An additional limitation relates to the artificial nature of the curriculum design task that participants were asked to engage in during the testing session. To best model a genuine curriculum design process and the extent to which the C-CAP system can support academics in curriculum design and approval, participants were asked to replicate an existing curriculum design form within C-CAP. The new form structure and the peculiarities of C-CAP meant that this task was more than simply cutting and pasting, or re-typing from a hard copy. However, this nevertheless represents a compromise on requiring participants to draft curricula from scratch, which was deemed unfeasible as it would require excessively long protocols and would not necessarily capture the genuine drafting process, which is often incremental and protracted. It is anticipated that the piloting of C-CAP within faculties as part of the next evaluative strand (WP7:38 - Impact & process evaluation – see Figure 1) will better expose C-CAP to the verities of curriculum design and approval. Rich qualitative data is expected to be gathered for this strand, via group interviews and Most Significant Change (MSC) stories [1].

3. Results and discussion*

3.1 Questionnaire instrument data

Owing to the detail of the qualitative data gathered during the user acceptance testing it is necessary to first summarise the findings from both the pre- and post-session questionnaire instruments.

Pre-session questionnaire data

Table 2: Computer Self Efficacy (CSE) results.

Computer Self Efficacy (CSE) scale - statements†	Participant results		
	M	***Mdn***	***SD***
a. I feel confident calling up a data file to view on the monitor screen	4.9	5	0.32
b. I feel confident working on a personal computer or laptop	4.7	5	0.48
c. I feel confident getting software up and running	4.4	5	0.84
d. I feel confident using the user's guide when help is needed	4.9	5	0.32
e. I feel confident entering and saving data (numbers or words) into a file	4.9	5	0.32
f. I feel confident escaping / exiting from a program or software	4.9	5	0.32
g. I feel confident calling up a data file to view on the monitor screen	4.6	5	0.52
h. I feel confident understanding terms/words relating to computer hardware	4.6	5	0.52
i. I feel confident understanding terms/words relating to computer software	4.6	5	0.70
j. I feel confident handling a CD-R/DVD correctly	4.7	5	0.48
k. I feel confident learning to use a variety of software applications	4.8	5	0.42
l. I feel confident making selections from an on-screen menu	4.9	5	0.32
m. I feel confident copying an individual file	4.8	5	0.42
n. I feel confident adding and deleting information from a data file	4.9	5	0.32
o. I feel confident moving the cursor around the monitor screen	4.9	5	0.32
p. I feel confident using the computer to write a letter or essay	4.6	5	0.52
q. I feel confident seeking help for problems with my computer	4.8	5	0.42
r. I feel confident using the computer to organise information	4.6	5	0.70
s. I feel confident getting rid of files when they are no longer needed	4.9	5	0.32
t. I feel confident organising and managing files	4.4	5	0.84
u. I feel confident troubleshooting computer problems	4.8	5	0.42
v. I feel confident browsing the World Wide Web (WWW)	4.8	5	0.42
w. I feel confident surfing the World Wide Web (WWW)	4.7	5	0.48
x. I feel confident finding information on the World Wide Web (WWW)	4.9	5	0.32
Results across participant group	***4.74***	***5***	***0.34***

† CSE uses a 5-point Likert scale where 1 = *I have very little confidence* and 5 = *I have a lot of confidence*. Adapted version of Murphy et al.'s [30] original Computer Self-Efficacy (CSE) scale, modified by Torkzadeh et al [31].

Recall that the purpose of the pre-session questionnaire was to collect basic demographic information and was designed to capture data on participants' IT efficacy and their perceptions of the current curriculum approval process. IT efficacy was measured using an adapted and modified version [31] of the CSE scale [30]. Internal consistency of the scales was tested using Cronbach's alpha and demonstrated "excellent" reliability (α= 0.952) [38]. Table 2 sets out the results of the CSE instrument used within the pre-session questionnaire. CSE results across the group revealed a high level of efficacy (*M* = 4.74; *Mdn* = 5). The ICT efficacy of participants was found to be very high across all CSE scale items, with little variation across the participant group (*SD* = 0.34). Such a high CSE score was anticipated given the academic composition of the participants.

Participants' perceptions of the existing curriculum approval process is summarised in Table 3. With such ordinal data it is conventional to consider the median values, which were largely neutral in nature (M_{ub} = 2.88; Mdn_{ub} = 3; SD_{ub} = 0.31). It should be noted that an unbalanced ($_{ub}$) Likert scale was used for this section owing to difficulties in positively wording those statements pertaining specific aspects of the curriculum approval process (i.e. *I, j, k, l*). Table 3 therefore separates positively and

* The extended nature of the results is such that their presentation has been combined with their discussion.

reverse coded results. Balanced ($_b$) results for the reverse coded results and balanced ($_b$) results across the entire participant group are also presented.

Scale reliability using Cronbach's alpha was found to be high (α= 0.862) and well above recognised reliability thresholds [38]. Balanced results across the participant group for all statements suggests a negative profile with general dissatisfaction with the current process (M_b = 2.68; Mdn_b = 2.5; SD_b = 0.55).

Examining the results for the positively coded statements separately reveals a negative profile for statements *a – h* with limited dispersion *(M* = 2.66; *Mdn* = 2.5; *SD* = 0.50). The profile of the reverse coded statements (*i – l*) almost mirrors the positively coded (*M* = 3.3; *Mdn* = 3.5; *SD* = 0.39). This can be verified by the balanced reverse coded results (M_b = 2.7; Mdn_b = 2.5; SD_b = 0.39). With the exception of statement *b* - which only demonstrated moderate approval (*M* = 3.3; *Mdn* = 4; *SD* = 0.95) - it is interesting to note that no single mean response suggested outright satisfaction with the current curriculum approval process, with participants inclined to view the current process as onerous and stifling class/course design (*k*) (Mdn_b = 4), or in needing improvements to render it more efficient (*l*) (Mdn_b = 4). This appears to be corroborated by statements *c* (*Mdn* = 2) and *g* (*Mdn* = 2).

Table 3: Results for the participant perception statements on the current curriculum approval process.

Current curriculum approval process: participant perception statements*	**Participant results**		
	M	***MDN***	***SD***
a. The curriculum approval process at the University of Strathclyde is an efficient process	2.6	2.5	0.97
b. The curriculum approval process at the University of Strathclyde is simple to understand	3.3	4	0.95
c. The curriculum approval process at the University of Strathclyde is a trivial process	1.8	2	0.79
d. The curriculum approval process at the University of Strathclyde is a process that demonstrates a quick turnaround time (i.e. time from submission to final approval)	2.3	2.5	0.82
e. The curriculum approval process at the University of Strathclyde is an effective process	3.1	3	0.74
f. The curriculum approval process at the University of Strathclyde is a process that is easy to manage	3.1	3	0.88
g. The curriculum approval process at the University of Strathclyde is a process that is well placed to respond to the demands from industry and the employment market	2.4	2	0.84
h. The curriculum approval process at the University of Strathclyde is a process that ensures quality teaching is delivered	2.7	2.5	1.06
Positively coded results	***2.66***	***2.5***	***0.50***
i. The curriculum approval process at the University of Strathclyde is a process requiring too many decisions by other people	2.9 (3.1)	3	0.88
j. The curriculum approval process at the University of Strathclyde is a convoluted process	3.1 (2.9)	3	0.74
k. The curriculum approval process at the University of Strathclyde is onerous and stifles innovation in course/module design	3.4 (2.6)	4 (2)	1.07
l. The curriculum approval process at the University of Strathclyde is a process requiring improvements to enhance efficiency	3.8 (2.2)	4 (2)	0.63
Reverse coded results	***3.3***	***3.5***	***0.39***
Reverse coded results ($_b$ = balanced)†	***2.7***	***2.5***	***0.39***
Results across participant group ($_{ub}$ = unbalanced)	***2.88***	***3***	***0.31***
Results across participant group ($_b$ = balanced)†	***2.68***	***2.5***	***0.55***

*Curriculum approval process perception statements use a 5-point Likert scale where 1 = *Strongly disagree* and 5 = *Strongly agree*. **Note** that statements *I, j, k,* and *l* were reverse coded.
† Reverse coded results balanced: *reverse score(x) = max(x) + 1 - x*

Post-session questionnaire data

Brooke's [32] System Usability Scale (SUS) formed the focus for the post-session questionnaire. The SUS instrument experiences wide use and has been subsequently developed, deployed and validated by other usability researchers (e.g. [33], [34]). The version of SUS used in this study

included an adjustment to item 8, supplanting the word “cumbersome” for “awkward”, as per the findings of Finstad [35] and research of Bangor et al. [33].

The results from the SUS are presented in Table 4 as are the individual SUS scores for each participant. SUS scores are calculated as follows: odd numbered items in the SUS are scored as the item score minus 1 and even items are scored as 5 minus the item score. This balances all scores and permits zeroes at the bottom of the range. The sum of the scores is then multiplied by 2.5. The resulting SUS score has a range of 0 to 100. The higher the SUS score, the easier a user feels it is to operate a system (i.e. C-CAP). SUS scores for individual items are included in Table 4 but are not in themselves meaningful; SUS produces a single value representing a combined measure of the overall usability of the system being studied.

Table 4: SUS scores per participant and group SUS results.

Brooke’s System Usability Scale (SUS)[32]	**Individual participant SUS scores**			**Bangor et al’s Adjective Rating Statement (ARS)**[33]
	#	***Faculty affiliation***	***SUS score***	***ARS score***
1. I think that I would like to use this system frequently	1	Strathclyde Business School	85	6
2. I found the system unnecessarily complex	2	Faculty of Science	67.5	5
3. I thought the system was easy to use	3	Strathclyde Business School	42.5	1
4. I think that I would need the support of a technical person to be able to use this system	4	Faculty of Science	80	6
5. I found the various functions in this system were well integrated	5	Strathclyde Business School	55	4
6. I thought there was too much inconsistency in this system	6	Faculty of Engineering	97.5	5
7. I would imagine that most people would learn to use this system very quickly	7	Faculty of Science	67.5	5
8. I found the system very awkward to use	8	Strathclyde Business School	77.5	5
9. I felt very confident using the system	9	Strathclyde Business School	75	5
10. I needed to learn a lot of things before I could get going with this system	10	Faculty of Science	87.5	5
	Group score (M)		***73.5***	***4.7***
	SD		***16.12***	***1.42***
	IQR		***16.25***	

The post-session questionnaire yielded an overall mean SUS score of 73.5 (*SD* = 16.12; *IQR* = 16.25). Researchers note [33] that “promising” SUS scores are generally > 70. A SUS score of 73.5 therefore places participants’ perceptions of C-CAP at a favourable level. This SUS score increases to 77 when the outlying score for participant #3 is removed. It is also interesting to note that 40% of participants yielded SUS scores ≥ 80. Lowering the threshold further we note that 70% of participants generated SUS scores > 60. To supplement the SUS instrument and triangulate its findings, Bangor et al.’s [33] Adjective Rating Statement (ARS) was used (see Appendix G). The ARS is administered after the SUS questionnaire items and uses a 7-point scale from “Worst imaginable” to “Best imaginable”, with the numeric values of 1 to 7 assigned respectively. This provides a qualitative response that can be used in combination with the SUS score to better interpret participants’ overall experience with C-CAP.

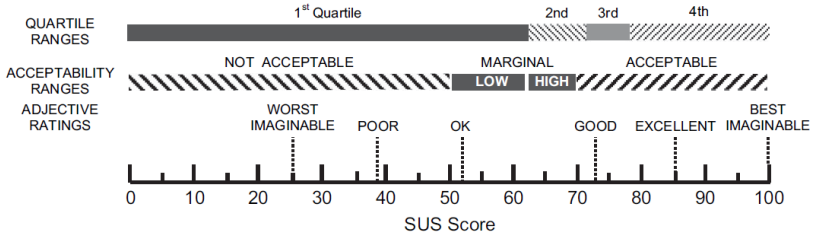

Figure 3: Comparative figure of SUS scores (by quartile), ARS and Bangor et al.'s [33] acceptability.

The post-session questionnaire yielded a mean ARS rating of 4.7 (*M* = 4.7; *SD* = 1.42), placing C-CAP within the "Good" ARS user-friendless category. Again, the ARS score increases and demonstrates less dispersion when outlying data are removed (*M* = 5.1; *SD* = 0.6). The mean ARS rating is consistent with Bangor et al.'s [33] validation of ARS with SUS and maps perfectly to Bangor et al.'s [33] SUS score guide and acceptability ranges (see Figure 3). Regression analysis appears to support the overall assertion that SUS scores predict ARS ratings in this instance (R^2 = 0.61, $F_{1,8}$ = 12.419, p < 0.01). It is nevertheless interesting to note that the SUS scores for participants #6 (*SUS* = 97.5; *ARS* = 5) and #10 (*SUS* = 87.5; *ARS* = 5) do not map comfortably to these acceptability ranges. This is borne out by the associated chart (Figure 4). For example, the SUS score for participant #6 was exceptionally high (*SUS* = 97.5) inferring an associated ARS score of 7 ("Best imaginable"; predicted *ARS* = 6.34); yet this participant represented a statistical anomaly by assigning an ARS score of 5 ("Good"). The lack of synergy between the SUS and ARS scores of participant #10 is less severe (*SUS* = 87.5; *ARS* = 5). Bangor et al.'s data is based on a far larger participant group (*n* = 212) which reveals levels of data variability not dissimilar to those presented in Table 4. It could be suggested that within a larger group the individual results of participants #6 and #10 would appear less anomalous. Such an anomaly in this case could therefore be attributable to the small participant numbers and the consequent lack of predictive power [39]. It should nevertheless be remembered that the overall SUS score for the participant group maps comfortably to Bangor et al.'s anticipated ARS rating and acceptability range. This places C-CAP within the 3rd quartile. It is possible that the perceived "goodness" of C-CAP is partly attributable to the high computer efficacy of the participant group, as demonstrated by a group CSE score of > 4.7.

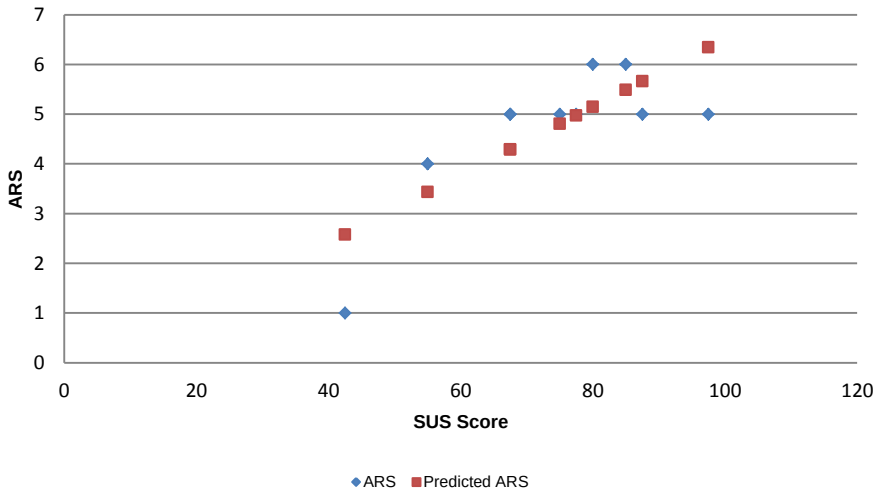

Figure 4: Predicted and actual ARS rating based on SUS score.

Recall that the post-session questionnaire also sought to capture perceptions of how C-CAP supported them in the curriculum design process and its potential for improving approval processes at the University of Strathclyde. Table 5 sets out the results for this section of the questionnaire instrument. Although positive values can be observed for statement *a (M* = 3.5*; Mdn* = 4*; SD* = 0.97*)*,

the overall results for this section were neutral (*M* = 3.12; *Mdn* = 3.2; *SD* = 0.91). The relatively high standard deviation reveals a high level of variation between participant responses, three of which were > 1. Such variability in the perceived potential of C-CAP to support participants in curriculum design and improve the approval process was a general theme that emerged from the protocol analysis and stimulated recall data, and appears to reinforce a dichotomy that emerged between participants' acceptance of the system and their understanding of the approval process.

Table 5: Post-questionnaire instrument: C-CAP participant statements.

C-CAP participant perception statements†	Participant results		
	M	***Mdn***	***SD***
a. The PiP system supports the curriculum design and approval process	3.5	4	0.97
b. The PiP system could greatly improve the curriculum design and approval process at the University of Strathclyde	2.9	3	1.10
c. The PiP system could support me in improving the pedagogical quality of curricula I design	2.9	3	0.88
d. The PiP system could support me in making curriculum design more efficient	3.3	3.5	1.16
e. The PiP system is sympathetic to the needs of my discipline	3	3	1.15
Results across participant group	***3.12***	***3.2***	***0.91***

† C-CAP participant perception statements use a 5-point Likert scale where 1 = *Strongly disagree* and 5 = *Strongly agree*.

3.2 Protocol analysis and stimulated recall data

Analysis of the qualitative data captured by the "think aloud" protocols, stimulated recall and open-ended questionnaire item (Q.3 of the post-session questionnaire) generated a detailed hierarchical coding framework (see Appendices A and B). This framework directed further querying of the data. Two super-nodes emerged from the data: *system issues*, and; *process and pedagogical issues*. These super-nodes contained 32 and 18 sub-nodes respectively and reflected the nature of the user acceptance evaluation, which was deliberately designed to elicit data on the extent to which C-CAP could support participants in the curriculum design and approval process. It was also designed to expose system and usability issues which were not identified during the heuristic evaluation (Phase 1). Interestingly, the qualitative data exposes among participants a dichotomy between the system and the curriculum design and approval process. This dichotomy will be explored in more detail later in this report.

Table 6: General word frequency query, including synonyms. (Top ten only.)

Word	Length	Count	Weighted Percentage (%)	Similar Words
class	5	246	2.43	*categories, category, class, classes, courses, forms, sorts, years*
think	5	159	1.26	*believe, consider, considered, guess, guessed, guessing, imagine, intended, means, reason, reasonably, recall, remember, remembering, suppose, supposed, think, thinking, thought*
assessment	10	112	1.18	*assess, assessed, assessment, assessments, evaluated, evaluation, value, values*
learning	8	144	1.15	*checking, determine, knowledge, knows, learn, learning, reading, readings, scholarships, seeing, study, teach, teaching*
students	8	63	0.69	*student, students*
hours	5	59	0.59	*hours, minutes*
objectives	10	54	0.59	*objective, objectives*
should	6	51	0.56	*should*
number	6	82	0.52	*amount, amounts, comes, coming, counts, figure, figures, issue, issued, issues, listing, lists, number, numbers, numerical, routinely, total*
activity	8	49	0.51	*activities, activity, dynamic, dynamics, participants*

Appendices A and B present the coding frameworks for the super-nodes. These frameworks detail all sub-nodes, node codes (to indicate hierarchical level), node definitions and indicative supporting quote(s). Columns for data references are also provided using the following definitions:

- **Sources:** Sources refers to the number of individual data sources (e.g. protocol analysis data, stimulated recall data, open-ended questionnaire responses) within which data has been coded at the associated node.
- **References:** References is a count of the number of selections within the source(s) that have been coded at a particular node.
- **Unique sources:** A unique source refers to the number of unique participants whose data has been associated with a particular node. Since most participants are associated with two or more data sources (e.g. protocol analysis data, stimulated recall data, open-ended questionnaire responses) and since multiple references to the same node may exist within any given source, a unique source count provides a means of determining how many participants have referred to particular node in their data.

For example, *Class rationale* (PPI:2.1 – Appendix A) has 9 sources, 14 references and 8 unique sources. This means that there exists 9 sources (likely a mixture of protocol analysis and stimulated recall data) within which 14 references to the node PPI:2.1 have been made. However, a unique source figure of 8 indicates that one participant has in fact referred to this node twice: once during protocol analysis and once during stimulated recall.

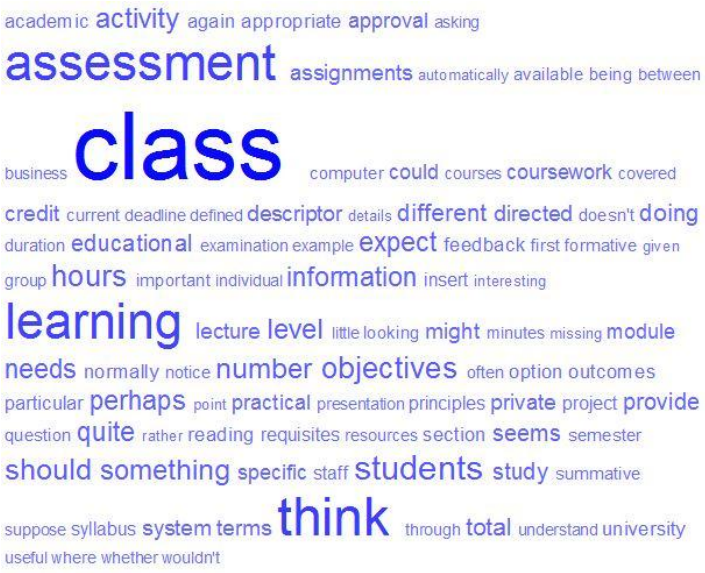

Figure 5: General word frequency query, including synonyms, diagrammed as a cloud.

A tree map diagramming the hierarchical nodes within the coding framework is provided in Appendix C. The result of a general word frequency query (with synonyms) is provided in Table 6 and is diagrammed as a cloud in Figure 5. These tend to reflect those aspects of the curriculum design process that participants found most difficult during the sessions (e.g. the design assessments and aligning them to stated learning objectives and/or outcomes, participant uncertainty over the credit-to-hours mappings used, etc.). Some of these issues will be revisited when the *process and pedagogical issues* super-node is discussed later in this section.

The following additional super-nodes were also created: *participant*; *participant attitudes* (i.e. mixed, negative, neutral, positive), and; *interesting quotes*. These additional super-nodes were used to facilitate data querying and did not to reflect the intellectual content of the data. They have therefore been omitted from the framework.

Although comprising 32 sub-nodes, the *system issues* framework primarily captures those C-CAP system issues that evaded exposure via the heuristic evaluation. Many of the nodes therefore address specific C-CAP functionality or system issues (e.g. *System navigation* [SI:2.9] or *Form submission errors* [SI:5.2]) or capture user requirement issues necessitating further investigation (e.g. *Dummy codes* [SI:2.3]). The *process and pedagogical issues* super-node comprises fewer sub-nodes, although some capture broader issues which are less conducive to enumeration. The nodes are too numerous and many are too trivial to discuss in detail here; for example, to facilitate the resolution of many interface or systems focused issues a table was derived from the protocol analysis data to assist in their prioritisation (see example in Appendix H). This table followed a format similar to the heuristic evaluation in phase 1 [2] and adopted a severity ratings system [28]. Suffice to state that the coding framework and its nodes will direct future C-CAP development work (to be completed prior to departmental / faculty piloting). We therefore restrict ourselves to further discussion of those nodes of substantive value.

Analysis of the data exposed participants' overall perception of the C-CAP system (*C-CAP perceptions* [SI:2]). C-CAP perceptions were generally positive, triangulating the positive SUS score from the post-session questionnaire instrument. Some participants frequently made positive comments throughout their interaction with the C-CAP system, with participants #9, #6 and #10 providing indicative comments:

> *It's actually very easy to use, in terms of development. It's quite intuitive. Ahhhh, much better... […] Generally the system is quite intuitive to use, so it's easy, it's straightforward.* (Participant #9)

> *So... read the information at the start is the first thing to do! It seems you can edit, which is quite useful. And there's help information as we go along. Good.* (Participant #6)

> *Lectures. Okay, so, this is lectures in hours, of which there are 48. But I guess we're going to have 24 lectures at 2 hours. Oh, it even does the maths for me! Splendid!* (Participant #10)

Some participants also commented in more detail on why their perceptions of C-CAP were generally positive. These more detailed comments often emerged from stimulated recall when the participant had an opportunity to reflect on their interactions with C-CAP. These comments were often more holistic insofar as they also considered the potential of C-CAP to improve the curriculum approval process. Said participant #4, for example:

> *It [C-CAP] has the potential to become a very efficient system in terms of both creating the approval system and going all the way to having a formalised descriptor document that one can present to staff and to students, saying "This is the class, this is what the class is about...". So in approving a class one has done the next step. Which, in a sense, we are already doing but in a paper based system. This is a draft class descriptor which is going to an academic committee tomorrow, and we will look at it and we will say "yes, that sounds like a very sensible class to be running". You can now apply for a class code, you now put it in the calendar. It now exists! Then they'll take that away, they'll update it and shove it all on the VLE. This can completely automate that process!*

However, the data also exposed participant hostility to the use of any system to aid the curriculum design and approval process. Participant #3 was perhaps most vocal in their disdain for the C-CAP system; and it should be noted that such fierce critiques were confined to this participant. The following illustrative quote from participant #3 was motivated by a C-CAP form submission error:

> *You see, this bothers me... This always bothers me about these things where you have these pre-set forms and you're entering information. I mean, it's easy for me to just use a form*

> *because when I'm sticking to a pre-set piece of software, y'know, I can't really see very well what I've written. And I hate that. If you can imagine, I did this under great pressure of time, um, and so that last thing I want to do is spend my time trying to figure out what it is I've just written. And then if I accidentally erase it...*

The aspect of C-CAP that perhaps inspired most comment from participants related to their experiences while using C-CAP to complete learning activity and assessment details. Sections 4.1 (Activity and delivery) and 4.3 (Assessment) require users to indicate the nature of the intended learning and assessment activities for the proposed class. Both sections were driven by drop down menus to promote efficiency in use and to minimise user error [28]. A notes box was also provided in section 4.3 to allow users to insert additional comments about their intended assessment activities. Although the values for these drop down menus mapped to the QAA's indicative learning and teaching methods list [40], almost all participants commented on the appropriateness of these values for their particular discipline and suggested alternatives (coded at *Option values* [SI:1.3] and *Learning activity options* [SI:4.2]). For example:

> *So these are very generic categories. So, "individual assignment", "group assignment", "group work", "group presentations"; all these things are all missing.* (Participant #5)

> *I was looking for a debate or presentation... It's quite narrow in terms of your descriptions of assessment. I would expect to see a break down between… A case study and a project are relatively similar, in a business context perhaps. Essay, report, presentation. Other formats we may use are debate, as I say; but we also... If you have an attendance requirement, in terms of they have to come to compulsory tutorials then that needs to be in as an assessment weighting as well because it tends to have marks attached to it.* (Participant #9)

In total 21 different learning activity types* and 16 different assessment activity types† were proposed by participants during the sessions. Data querying suggests that those participants proposing alternative learning or assessment activities were from outside the Faculty of Science and – although their proposed learning and assessment activities could be captured by the list and notes field – there was a perception that the values failed to reflect the "non-standard" teaching delivery methods or assessment techniques used by these faculties. Think aloud protocols from the following Strathclyde Business School participant were typical in this respect:

> *We've got labs, we've got tutorials, we've group activities, activity sessions, there's... It is, in essence... Everyone does lectures. We don't really have placements. Practicals? We don't do practicals - that's an Engineering view of the world. Fieldwork? Some courses do in the Business School, but not that many. That's more for HASS faculty staff. So, this should be a lot more extensive.* (Participant #5)

In other instances data suggest that the issue was primarily terminological. For example, some participants would not make the conceptual link between specific learning activities, such as a lab, and its practical nature ("Practical" – list value):

> *Right, okay, for the activity, actually, we've got a lecture, and also we have, from, erm, tutorial, which incorporate a lab as well. But, actually, but I cannot find this [lab] option for me; it doesn't provide other types of class session.* (Participant #1)

* Lecture, Tutorial, Seminar, Computer lab, Group work, Activity session, Group work, Group activities, Assignment, Individual reading, Interactive discussion, Class test, Site visit, Laboratory, Project work, Crit, Private study, Field work, Placement, Workshop, Presentation, Self-study

† Examination, Coursework, Class test, Lab books, Individual assignment, Group assignment, Group work, Group presentations, Debate, Presentation, Essay, Report, NCQ exam, Short answer exam, Attendance, Project

> *I would call them "computer labs". It doesn't really fit anywhere under those topics there. I would like to have "computer lab" added to the list of activities. Can I add it in manually? In that case, I will call my computer lab a "practical".* (Participant #6)

Others were also influenced in their suggestions by the way in which they perceived their teaching practice to differ from prevailing practice. In some instances this even called into question the legitimacy of the term “lecture” to describe a delivery method where an academic introduces ideas or delivers facts to a large group of students:

> *Probably I would put in there "Interactive discussion"; because when I lecture it's more a seminar than a lecture. Students come back and the pre-set lecture format often disappears. I am often sure I impart the analytical material I need to but students will ask questions... There's leeway. I would maybe put in a "Seminar", or something like that too.* (Participant #3)

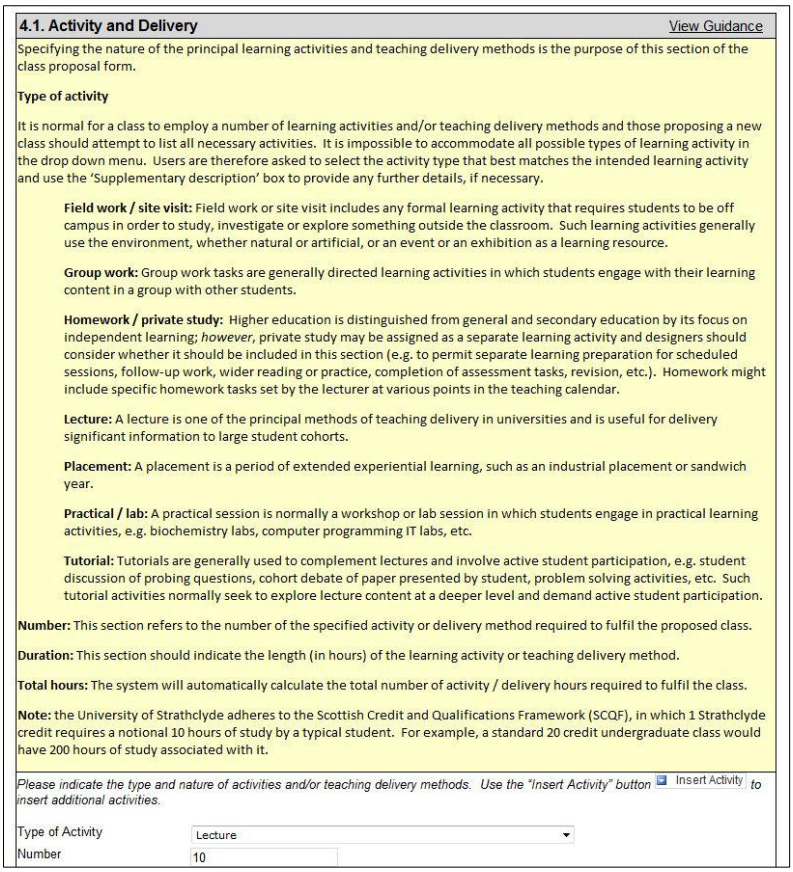

Figure 6: Example of contextual help / guidance provided in section 4.1 (Activity and delivery) of C-CAP.

Kolås and Staupe [41] note the difficulties in attempting to systematise pedagogical design patterns in online contexts and it is therefore conceivable that similar issues were encountered when attempting to do the same with more traditional forms of pedagogy in C-CAP. One possible explanation could be participants’ resistance to using the context sensitive help, available in the top right hand corner of every section of C-CAP (Figure 5). Only one participant used the context sensitive help (participant #6), which included detailed guidance on the learning activity values available and their scope. Had participants been more inclined to view this help then they may have been more likely to perceive their peculiar teaching delivery methods to fall within the scope of C-CAP’s values. It may be that future C-CAP development work should better expose context sensitive help, either by pre-expanding the help sections so that users have to collapse them thus revealing its content, or by improving the visibility of the help features in a collapsible state. It is clear, however, that the large number of disparate list values (as proposed by a small number of participants) precludes inclusion as it would

render sections of C-CAP unusable. Data derived from the list would also lack the specificity required for institutional reporting and wider curriculum management.

Aspects of section 4.3 (Assessment) that caused further confusion for many participants (n = 6) pertained to assessment deadline. The collection of such data is intended to encourage curriculum designers and course leaders to consider cohort assessment load during semesters. Many participants considered the collection of such information to be undesirable:

> *Again, the coursework would be issued across the entire duration of the semester, so there would be no specific deadline week. Y'know, it could be weeks three, five, seven, nine - so specifying the deadline week number doesn't help.* (Participant #2)

Or they considered it be unfeasible, because assessment activities and their deadlines are often only decided immediately prior to class delivery:

> *Deadline week numbers may vary, again, depending on how the coursework is split up. We don't know precisely how many pieces of coursework there might be. But the expectation is that there would be a minimum of two but probably a maximum of three. That's something that we might decide early on once we saw the number of people attending the course.* (Participant #7)

Others were more circumspect for reasons of teaching flexibility:

> *I'm fairly flexible with some the deadlines, actually. I wouldn't like to be prescriptive about it because I think it would vary a little bit according to the progress you make in terms of the lectures and labs. And that depends on the cohort of students and how quickly they learn. I do adapt it a bit in practice. I don't like these being too prescriptive. So I'd rather not have to have fixed deadlines.* (Participant #6)

Negative comments about these information requirements in C-CAP were a component of broader data themes pertaining to flexibility in teaching practice (coded at *Flexibility* [PPI:3.2]) and the perceived pointlessness of some curriculum design requirements in C-CAP (coded at *Form requirements* [SI:2.4] and [SI:2.10] *Unnecessary information*). Many participants reported their unease with drafting overly prescriptive curricula which might in future restrict their teaching practice and lead to further bureaucracy, whilst others felt it was disingenuous to provide prescription so far in advance of teaching delivery. The following protocol excerpts illustrate these varying participant viewpoints:

> *I want to just say there are four classes that take place this week, this week, that week. You know? It's almost as if there's too much information being asked in this. Some of this information should be given to the students by the department when they are delivering the class, rather than going in... making up the approval form.* (Participant #2)

> *Assessment description… Hmmmm… A general point here... The more detail we have to put in here in terms of the assessment, the more it becomes necessary to update this every year. Because, typically, you'd have maybe different assessments. That means modifying all these forms. So I'm not convinced a highly specified description of the assessment and when it's due is a good idea. It means more work and having to update it more regularly.* (Participant #6)

> *Typically you would want to be able to say what the assessment is, how long it lasts, if it's an exam, although that can't be a mandatory field. It's weighting. Timetabling information I wouldn't think is part of the approval process. Really the only timetabling information one needs at the approval process is whether it's an end of class examination or piece of in-class*

> *coursework, which is defined by the type of assessment. I'm not sure at the stage people are planning classes they would know enough about the structure of the class to be able to say, "Oh we're going to have a deadline in week 6 or 7". That, to me, is not relevant.* (Participant #4)

Finding a balance between the needs of the University (and ergo C-CAP) to improve pedagogy (e.g. promote more 'high impact' learning activities, greater alignment of assessment with stated learning objectives, etc.) and the information requirements of the centre (e.g. timetabling, estates management, library, procurement, etc.) on the one hand, and what academics are prepared to tolerate during curriculum design on the other, is clearly an area that requires further investigation by PiP. The curriculum descriptor structure and information requirements within C-CAP were derived from a number of extant forms used within the University and modelled the stated information requirements of key stakeholders (e.g. Educational Strategy Committee [42], Student Experience & Enhancement Services Directorate (SEES) [43], etc.). Restructuring of the forms in C-CAP and Phase 1 of the evaluation helped to rationalise the information demanded from users. Usability engineering techniques (such as heuristic evaluation) promote the use of efficiency tools to accelerate the speed with which users can complete tasks [28]; and it is possible that C-CAP requires further refinement in this respect in order to make the collection of such information less onerous for users. The role curriculum information can perform in improving the operational efficacy of the University was not fully recognised by several of the participants. Only those participants with administrative experience at higher academic levels (e.g. HoD) appreciated the significance of such information gathering by C-CAP. It is therefore possible that groups such as the Educational Strategy Committee need to better communicate the importance of such information for institutional monitoring, portfolio management and resource planning.

The *process and pedagogical issues* super-node contains 18 sub-nodes. The PiP project focuses on the potential of C-CAP to improve curriculum approval processes; but it is also within the remit of the project to explore the role C-CAP can perform in delivering new paths through which the University's range of policies and best practice guidelines on curriculum design can be brought to the fore in the minds of designers. Curriculum design represents a key "teachable moment" that is rarely exploited [44]. Indeed, it is often one of the few opportunities to influence the quality of the curricula that will eventually be delivered. One aspect of curriculum design that dominates educational literature is the idea of constructive alignment [29], [45], [46]; optimising assessments to best measure student learning against the stated learning objectives. The version of C-CAP used for the user acceptance evaluation therefore required participants to engage in constructive alignment (i.e. explicitly stating which assessments will assess which learning objectives); however, few participants viewed this requirement favourably. Data coded at *Aligning learning outcomes* [PPI:2.6.1] indicated that the majority of academics either considered their learning objectives to be assessed by all stated assessments, or felt it was irrelevant to include such detail as it can be highly ephemeral. For example:

> *So what do we mean by learning objectives assessment? It's actually all of them! Yeah, because I think it needs to reflect all objectives not just some.* (Participant #1)

> *For most of our classes the examination and coursework are essentially going to assess all of these things. So do I have to click four times to put them all in? It would be nice to have them altogether, I think. Because the exam is essentially going to assess the whole course...* (Participant #10)

> *It's not possible to pre-determine which learning objectives would be assessed by coursework. Because this may change from year to year… We don't pre-determine that. It's unlikely it would be all the learning objectives but I couldn't say in advance which it would be.* (Participant #7)

The process of aligning assessments with learning objectives in C-CAP was driven by inserting a new objective and then selecting from a drop down menu the objective which was to be aligned (Figure 6). There were indications from the protocol data and the screen capture videos that the hostility towards aligning learning objectives was occasionally motivated by the awkwardness and tediousness of the alignment process in C-CAP:

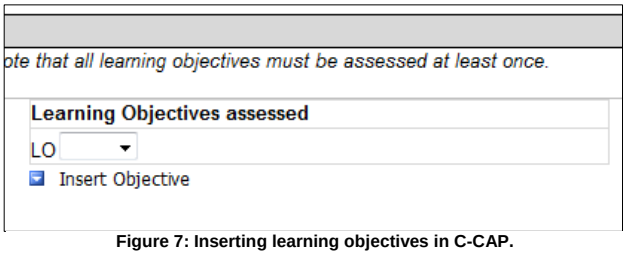

Figure 7: Inserting learning objectives in C-CAP.

> *And again, the examination is designed to assess all the learning outcomes, so I don't think that it's a helpful... well, from my point of view, it's a not a helpful thing. There should be a box that says "All". And that way you don't have to enter all five.* (Participant #2)

> *There is unnecessary repetition of clicking to add, e.g. learning outcomes to assessment*… (Participant #9)

It is possible that this aspect of C-CAP exerted higher levels of extraneous cognitive load on the participant, which in turn forced many to abandon the process of alignment altogether to seek interface options that would facilitate an "all objectives" solution. It is also possible that the artificial nature of the curriculum design task limited participants' potential for creativity in this instance. Participants were replicating existing designs in C-CAP and although many had not explicitly aligned assessments with learning objectives in their original designs, many attended the testing session with the majority of their creative work essentially completed. These participants may therefore have felt disinclined to use C-CAP's functionality in this respect. General participant antipathy towards rigorous adherence to standard curriculum design principles cannot be discounted either.

Neither did mandating constructive alignment appear to support C-CAP's ability to promote greater reflection of assessment strategy [*Inspiring reflection* [PPI:2.5] AND *Aligning learning outcomes* [PPI:2.6.1]). Querying of the data indicates that only one participant considered C-CAP to inspire reflection during constructive alignment. This participant had experience of HoD responsibilities and was appreciative of C-CAP's ambitions in this respect; but even this participant recognised the difficulties in implementing such a system more widely:

> *Learning objectives... assessment. I think... Interesting that one. It is clearly something which is beneficial to understand how the class works, and the students would better understand the linkage between what the class is meant to achieve and the assessment, but it's not something we routinely list. It is an additional and new idea. It [C-CAP] would force people to think a bit harder about their assessments and their learning objectives. I can see it being met with some... Hmmmm... worry, shall we say! Or people will simply say "all learning outcomes" and it will degenerate into an uninformative piece of information.* (Participant #4)

The data presented in Table 5 suggested that participants were generally positive about the potential of C-CAP to support them in curriculum design (M = 3.5; Mdn = 4; SD = 0.97) but were generally indifferent about the potential of C-CAP to improve their pedagogy or the quality of the curricula they design. Whilst some (like participant #4 above) could appreciate the potential of C-CAP in improving aspects of curriculum design or its potential to improve the departmental efficiency, data querying (*Curriculum approval* [PPI:1] AND *C-CAP perceptions* [SI:2]) appears to corroborate participants' indifference, with only two participants commenting, one positively and one negatively. Participant #9 was positive about a relatively superficial aspect of the C-CAP system (i.e. form design) rather than the system itself:

> *I like this one, "Justify the need for the new course...", which is good. That first box makes you go through... makes you think clearly, erm, why the class is there in the first place [..]*

> *because there are too many classes that are put on the books with very small numbers. So... it's good.* (Participant #9)

Participant #3 (captured during stimulated recall) was vehement in their view that such a system usurped the creativity inherent to the curriculum design process and restricted innovative practice:

> *I found that this was a hindrance to good course design, because it was first of all tedious and everything is pre-set. I mean, just the thing about not being able to cut and paste things easily. You've got to type them in. And it comes back with errors, which is irritating. So, I found it wasn't conducive to thinking in an innovative way about a course the way I could when I sat down and.... Because originally, what I did, was I sat down and I just wrote down a course proposal. And then I was given a template which I was able to cut and paste things into. But if I had to sit and do it... I would never sit and do it from here. So what this is going to do is.... I will do this first and then I'll just have to sit down and do even more work, cutting and pasting and putting this in. So... And it's just.... You just feel that everything is standardised. There's no leeway to add something that is distinctive about the course. So I found it kind of like a straitjacket.*
>
> *[…]*
>
> *If we're going to be forced to fill these things out… I will not work from this to design a course so, for me, it's useless. I would just do it this way [in MS Word] and then I would.... So it's really for the people who are approving the course, from my point of view. In my opinion I would not have come up with the courses I did if this was what I was working from, for sure - no way! And I think I've designed an excellent course, as external experts in the field have said; so I think it could suffer as a result.* (Participant #3)

Again, it is interesting to note that in many cases the depth of information requested via C-CAP – and the structure of the information requested - was consistent with several extant curriculum descriptors used at the University of Strathclyde or was rendered more efficiently for users (e.g. accelerators to speed up interaction with C-CAP). It is therefore apparent that negative comments such as those from participant #3 are more a consequence of the approval requirements mandated by the institution than C-CAP. Stimulated recall with participant #3, for example, sought further clarity on the participant's issues with the University's 12 Principles of Assessment and Feedback [47], which provoked the following response:

> *The idea, the innovation in the course; the thing that's going to make this course different from a course offered anywhere else is nothing to do with whether I'm able to think about the University's Principles of Assessment. It's completely convoluted. […] There's too much emphasis on this sort of stuff. I just think back to my own background, where I was taught at a university where professors had Nobel prizes. They were not sitting down designing the fantastic courses that I took with them with this sort of stuff. It's just... It's always this thing that "we're not doing enough"; this second guessing. This thing where you have to put everything in the form of language that really... You're often struggling to understand what they are getting at. Where the most important thing - the substantive content of the course - it comes secondary. I won't use it. Honestly. I wouldn't have designed the course, as I said, as I did.* (Participant #3)

It should be noted that the views of participant #3 were exceptional and no other participant commented quite so negatively during protocol analysis or stimulated recall. Nevertheless, this participant represents a particular academic viewpoint about which the PiP project needs to be cognisant. Communicating to similarly-minded academics of the benefits to curriculum design and approval, institutional monitoring of students' educational experience, portfolio management, resource

planning and the operational efficiencies to be achieved with C-CAP will be essential to ensure successful advocacy were such a system to be implemented across the institution.

Participants often expressed uncertainty about aspects of the approval process and certain information requirements. An aspect of the design process which caused uncertainty among participants - and area in which C-CAP could incorporate additional user support – pertains to the relationship between credit weightings of the class being proposed and the required number of student study hours. Many participants (n = 6) discussed this aspect of design in their protocols extensively, such that it is reflected in Table 6 (which notes “hours” and “numbers” as two of the most mentioned words in the qualitative data). This issue was perhaps most acute in the number of student study hours associated with 20 credit classes. Although participants were replicating an existing curriculum approval form in C-CAP, many descriptors had originally been ambiguous about the number of student study hours associated with their class, perhaps because faculty administration or academic quality teams clarified the study hour expectations after the substantive content had been submitted. The uncertainty experienced by participants in some cases appears to be attributable to their reliance on faculty staff; but their uncertainty also appears to validate an original aim of PiP: to provide academics with a suite of discipline specific curriculum designs (i.e. patterns) that could be used as the basis for pedagogical innovation and the development of new curricula. Such designs would enable academics to focus on innovative curriculum design safe in the knowledge that the ‘foundations’ were sound.

The University of Strathclyde adheres to the Scottish Credit and Qualifications Framework (SCQF) [48] which, in turn, maps to the European Qualifications Framework (EQF) [49]. The SCQF promotes a notional 10 hours of study by a typical student per academic credit [50]. This means that a typical 20 credit class should have 200 hours of student study associated with it. Data querying extracted two passages that illustrate the uncertainty some academic staff have about University curriculum approval requirements:

> *I don't know if I've ever seen it written down, exactly how many hours there should be for 10 credits; but I've heard informally that it should be about 100 hours. And I assume that that includes students doing their assessments... assessment activity. I may be wrong, but that's what I've heard.* (Participant #6)

> *Perhaps if there's a standardised model in terms of the number credits that you put in? Perhaps there should be a total hours of activity that you've got to get to?* (Participant #9)

As might be expected, the protocols also revealed inconsistent practices between faculties and across a number of areas; however, this appeared to extend to what academics considered to constitute compulsory study activity when assigning class study hours. For example, some included hours towards summative assessment, while others expected the time spent on completing assessments to be in addition to the stated study hours. Some participants also acknowledged the disparate practice and its absurdity from an operational perspective:

> *We expect you to spend two hours on them, so there would be 24 hours load associated with that. It's not covered there, and if you look at the way our form is laid out. You've "Practical"... It's specific to Science, I suppose. If that wasn't running.... Erm, the devolved nature of the University allows different Faculties to do different things, which is stupid!* (Participant #2)

Improved guidance and support tools to flag when classes are under or over the credit-to-hours threshold would therefore be a useful addition to C-CAP, and would help to reduce the faculty burden associated with resolving trivial curriculum design errors. However, there is clearly a need to clarify curriculum design practice across the institution to, a) make the process and its requirements more transparent to academics, and b) to establish equitable learning pathways for students, particularly as

radical differences in assessment practice and study hours allocation can be found within small investigations such as this. It is apposite to note that previous work conducted under the auspices of PiP [51] found that one of the principal obstructions to efficient curriculum approval was the failure of academics to meet the faculty paperwork requirements. This frequently creates additional work for faculty staff and often delays the approval process unnecessarily as staff are then required to pursue academics for clarification on the details of the proposed curricula, or to deliver feedback to the authors of rejected submissions. Supporting faculty in the approval process is an important aspect of C-CAP. C-CAP, for instance, uses techniques to reduce careless errors in forms and promotes "good" curriculum designs; but clearly there is a wider need to better communicate the expectations of the curriculum design and approval process, and to make the requirements of design more transparent to academics, many of whom are misinformed about the process [51]. C-CAP can be viewed as vital to achieving this since C-CAP exemplifies - and seeks to standardise - the curriculum approval process. This assumption will be tested during the next evaluative strand of PiP (WP7:38 - Impact & process evaluation).

4. Conclusion

This report has sought to summarise the methodological approach and principal findings of phase 2 of WP7:37. This phase was principally concerned with assessing the extent to which C-CAP functionality met users' expectations within specific curriculum design tasks and evaluating the performance of C-CAP in supporting curriculum design tasks and the approval process, as well as its potential for improving pedagogy. Measuring the overall usability of C-CAP (e.g. interface design and functionality instinctive, navigable, etc.), capturing data on users' preferred system design/features, and eliciting data on current approval processes and how C-CAP could contribute to improvements in the process, were also an additional aims of this evaluative phase. This phase of evaluation has therefore focussed on a small but nevertheless important aspect of the overall PiP evaluation plan [1]. Piloting of C-CAP within faculties will form the basis for the next evaluative strand (WP7:38 - Impact & process evaluation) in which rich qualitative data is expected to be gathered (via group interviews and MSC stories).

In this phase of evaluation C-CAP, as a system, was positively received, achieving a positive SUS score and ARS rating. Whilst this could be partially attributable to the high computer efficacy of the participants, protocol and stimulated recall data did reveal that participants were, in general, favourably disposed to the C-CAP system. Numerous problems with the usability of C-CAP were nevertheless identified and it is the intention of PiP to implement appropriate modifications to enhance user acceptance. Users' preferences will also be incorporated where possible.

It is clear, however, that a dichotomy exists between the *system* (which received generally positive feedback) and the overall curriculum design *process*, which was less well received. Although no such data was collected from participants, anecdotal evidence indicated that those participants who had been exposed to the curriculum approval process from a managerial perspective (e.g. as a Head of Department or Vice Dean) were the most encouraged by the potential of C-CAP to assist in the approval process; their views clearly influenced by their professional practice and an holistic understanding of the approval process issues involved. Whilst other users lacked this insight, data from both quantitative and qualitative sources indicated that all participants were dissatisfied with the existing process, tacitly acknowledging that adjustments and improvements were justified. At many stages in their interactions with the C-CAP system, participants were not required to produce more information than they otherwise would; yet the demands of the University's policies and regulations on curriculum approval meant that many participants were unconvinced of the overall process, as facilitated by C-CAP. In this respect it could simply be that the forms served by C-CAP – although based on existing curriculum descriptors – were sufficiently different to give the impression that large amounts of additional data was being collected. It could also be surmised that the pressures of increased teaching loads and departmental research expectations have made academics increasingly sceptical of the merits of new IT systems; but, as we have also observed, hostility to improved specificity in curriculum design has links to strongly held views on academic freedom and attitudes that novel educational concepts are antithetical to HE teaching contexts. There is therefore a need to clarify curriculum design practice across the institution to render the process and its requirements more transparent to academics, and to establish equitable learning pathways for students, particularly as radical differences in assessment practice and study hours allocation were found to exist. From this perspective, C-CAP can, over the longer term, be viewed as integral to achieving this since it embodies and seeks to standardise the curriculum approval process.

Given the methodological restrictions imposed on the PiP project, the evaluative approach adopted was of value and exposed rich data on a multitude of systems focussed and process issues which can guide further development prior to departmental / faculty piloting (WP7:38). Data will also inform wider recommendations to key stakeholders, such as the SEES Directorate [43] and the Educational Strategy Committee [42], on how best to advocate C-CAP as a tool to improve operational efficiency and educational quality.

Future research attempting to test the efficacy of technology supported approaches to curriculum design should seek to model the 'real world' design process more accurately. Perhaps the most disappointing finding was C-CAP's failure to inspire reflection or creativity among the majority of participants during the curriculum design process (leading to improved designs). Whilst the results and discussion section of this report (section 3) identified areas of C-CAP that could be improved to inspire such creativity, it is probable that the artificial nature of the curriculum design task compromised our ability to engage participants in the task sufficiently, particularly as many would have already invested creativity in their original curriculum designs. It is nevertheless hoped that the next evaluative strand (WP7:38) will enable an improved understanding of C-CAP's potential in this respect. Future work should instead employ 'design diaries' in which participants would note or verbalise their experiences designing curricula with C-CAP. Verbalisations and reflections could be captured via video diary [52]. Such an approach would lack the control enjoyed by the current study but would, a) yield useful data on how C-CAP can stimulate new curricula, b) would allow time for users to improve their C-CAP efficacy, and c) would enable participants to reflect upon their designs and how C-CAP inspired the adoption of innovative designs. Participant numbers need not exceed ten, as patterns in participant responses quickly emerge; but recruiting participants with greater knowledge of the administrative bottlenecks involved in curriculum approval would also yield richer data on the merits of the system in expediting the approval process.

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6. Appendix A: Coding framework: Process and pedagogical issues (super-node)

Table 7: Coding framework for the super-node "Process and pedagogical issues" only.

Super-node: Process and pedagogical issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
PPI:1	Curriculum approval	Content coded at this node captures participant views on the current curriculum approval process, or the potential for C-CAP to impact upon a future approval process.	*"It [C-CAP] has the potential to become a very efficient system in terms of both creating the approval system and going all the way to having a formalised descriptor document that one can present to staff and to students, saying 'This is the class, this is what the class is about…'. So in approving a class one has done the next step, which, in a sense, we are already doing but in a paper based system. This is a draft class descriptor which is going to an academic committee tomorrow, and we will look at it and we will say 'yes, that sounds like a very sensible class to be running'. You can now apply for a class code, you now put it in the calendar. It now exists! Then they'll take that away, they'll update it and shove it all on the VLE. This can completely automate that process!"*	4	7	3
PPI:2	Curriculum design	Content coded at this node relates to participant experience or issues with the practical aspects of curriculum design or their knowledge of curriculum design theory and/or practice.	*"I find these kinds of questions - Educational Aim - um, and rationale... I just find... I get a little irritated by these sorts of things because I sort of feel because it could be answered in the one go. And then I have to sort of think, 'What are they wanting me to answer here?', as opposed to rationale."*	5	11	4
PPI:2.1	Class rationale	Content coded at this node concerns participant views or uncertainty over providing a rationale for a class (esp. section 3.1 of C-CAP), e.g. general views of its applicability, unsure what information should be provided, unnecessary because they feel it has already been provided elsewhere (i.e. course specification).	*"Provide rationale...blah...blah. A lot of this information will already be there in the programme specification, so it seems, sort of, it is being included for no additional value. Providing evidence for the need for the new class; that's normally something we wouldn't have. We would have a rationale for the class, in terms of scope; but things like employers, etc. would be in the covering note. And now we're onto classes, not courses..."*	9	14	8
PPI:2.2	Course linkage	Data coded at this node pertains to the numerous links that can exist between the classes that comprise a course and any issues therein.	*"My goodness, I have to put in all the courses that this is part of, which is of the order of 10 different courses? Because... It could be optional.... Well, we have 10 different degrees: Maths, Stats and Accounts, Maths, Stats and Management Science, Maths and Physics, Maths and Computer Science... So it looks like I have to put everything in here for each one, which is not so good. I'll just enter one for now; but that's just an observation."*	1	1	1
PPI:2.3	Credit weightings	Data coded at this node evidences wider pedagogical and curriculum design issues with respect to credit weightings and their association with activity hours, including participant uncertainty on the regulations.	*"I mean, there's 20 credits, but how those would be divided up, um, that would require more information, which is something I haven't really considered at this stage."* *"Another thing is private study. There's obviously, um, there must be a template out there that says that if a course is worth 20 credits the student should be spending a certain amount of time in private study. I mean, I would hope they would go off and study privately but, y'know, I don't know why I always have to say that. Y'know, if I say private study "5 hours", that's going to look ridiculous. It would be good to have the mapping of what's expected. I know it's out there but it's not in my head. But then again, I wouldn't be sitting here doing this. I would probably go and find out and then enter it in."*	5	9	4
PPI:2.4	Disparate practice	Content coded at this node denotes participants' perceptions of differing curriculum design practice within the University. This might across faculties or within departments.	*"Several of the questions did not correspond to SBS requirements, while several other questions used language that was appropriate for other faculties or did not include SBS relevant terms. The system needs to be appropriate for all faculties or customisable by relevant Academic Committees."*	3	5	3
PPI:2.5	Inspiring reflection	Content at this node captures participant views on the potential for C-CAP to	*"Learning objectives... assessment. I think... Interesting that one. It is clearly something which is beneficial to understand how the class works, and the students would understand*	3	6	3

Super-node: Process and pedagogical issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
		inspiring reflection in the curriculum design process.	*the linkage between what the class is meant to achieve and the assessment, but it's not something we routinely list. It is an additional and new idea. It would force people to think a bit harder about their assessments and their learning outcomes."* *"I think that's really, really derogatory, to think that, y'know, people sit down and they're not... Because this takes away the thought. The idea, the innovation in the course; the thing that's going to make this course different from a course offered anywhere else is nothing to do with whether I'm able to think about the University's principles of assessments. It's completely convoluted."*			
PPI:2.6	Learning outcomes	Content coded at this node denotes data relating to participant comments about learning outcomes.	*"What's the difference between a learning outcome and a learning objective? Right, okay, we would... four... now we have a very bland learning outcomes statement here on this class; but many others we specify very tightly what we expect the students to demonstrate a knowledge of and an ability to use. And then saying... Limiting it to four is not necessarily valid. Unless, of course, you put learning outcome 1, "Students shall show a basic understanding of dynamics, which will include a knowledge of X, Y Z". But that's then... circumventing... cheating."*	10	32	8
PPI:2.6.1	Aligning learning outcomes	Data coded at this node pertains to participant difficulties in aligning learning outcomes/objectives, e.g. difficulty aligning with assessment, desire to assess all outcomes, etc.	*"For most of our classes, the examination and coursework are essentially going to assess all of these things. So do I have to click four times to put them all in? It would be nice to have them altogether, I think. Because the exam is essentially going to assess the whole course."* *"Instead of just matching learning objectives to assessment you need to map your learning outcomes to your assessment, which is equally as important as objectives. In my opinion they are different things".*	9	11	7
PPI:2.6.2	Cognitive outcomes	Data coded at this node explores the additional need for C-CAP accommodation of - or University wide adoption of - cognitive based outcomes. These are typically transferrable skills which students are likely to acquire or develop in addition to discipline specific learning outcomes.	*"The only piece of information that I'm aware of that this online system hasn't asked me for that I would normally provide, either on a class descriptor or through the class approval process, what's called "key skills linkages", which we often ask - certainly within my own department ask for. So we would ask, what generic skills, key skills are covered by this class. So... verbal skills, academic skills, analytical skills... and... they are the framework of key skills which were produced many, many years ago, which we follow. I don't know whether that's still current or not..."* *"What we do is we have learning objectives and we also have learning outcomes, in terms of subject specific knowledge and skills that the students are developing and the general cognitive and non-subject specific skills. I think you need an additional two sections in there to cover those things."*	4	5	3
PPI:2.6.3	Syllabus	Node denotes content at which syllabus is discussed.	*"In summarising the syllabus, one of the issues that came up when designing the course was that we noted that these items were not all of the same weighting. That there would be more attention given to item two. So simply listing them all as individual bullets tends to obscure that aspect, even in the paper version of the course description."* *"Why is the syllabus disconnected from the learning objectives? I would say that you define the learning objectives and then you put the syllabus in place to support those learning objectives. So I would have thought the natural flow of the document was learning objectives and then syllabus."*	3	3	3
PPI:2.7	Personal ownership	Content coded at this node evidences the need for academic staff to assume personal ownership in the curriculum design process and/or the need for this to be reflected in the C-CAP system.	*"One of things that, again, I can't remember what I put on the form... But I don't think it made specific reference to personal ownership. One of the things that often happens when classes are created is that there's already a member of staff - an academic member of staff - who is designated with building the class and creating the class, and I think that needs to be indicated. Because they then become the point of contact that other people can refer back to for concerns or queries. On a class descriptor form, even on a draft planned class,*	1	1	1

Super-node: Process and pedagogical issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
			you would still have identified the class coordinator, because they will be the person driving it forward."			
PPI:2.8	Principles of Assessment	Content coded here evidences participants' knowledge, experiences and views on the University's Principles of Assessment and Feedback.	*"As if anyone actually knows that the University's principles of assessment feedback actually are. It would be good to have a drop down menu so that you could randomly pick one to twelve, or is it one to four now? That's also not a requirement of the Faculty documentation, so... who knows?"* *"Principles of Assessment and Feedback. There are 12 principles of good assessment... yup. Right, and this, I think, is an area where some examples would be really quite useful. Again, I've seen a very high variation in what different lecturers put in here. Maybe, given the emphasis on feedback that the students are requesting and also in the student survey it seems to be quite important, it maybe better to have the feedback as a separate category here. So it's quite clear that the students can see exactly what the feedback is, what they can expect from the course... More guidance on that area would be useful, and perhaps the feedback as a separate issue."*	4	4	3
PPI:3	University management, policy	Content coded at this node pertains to participant feedback about University policies, procedures or management decisions that affect the curriculum design and approval process and/or teaching.	*"Class evaluation... That's interesting... I'm not quite sure what it means by self-evaluation. Who is the self - student or staff? Staff evaluation might be more appropriate. It's... Um... I wonder whether this is slightly redundant. I would hope the University is moving towards a specific... These should just be standard features of an academic activity which really don't need to be defined. They are there and they are used. All departments have staff-student committees. So all staff-student committees have the opportunity to comment on classes. All classes are required to go through an annual review process, so is it even necessary...? This is not something that features in the current process at all and I wonder whether it is even necessary. Not that class evaluation isn't necessary. Class evaluation is absolutely critically necessary, but it's there. There are University processes which are used and are known about. They don't need to be defined in the approval process."* *"I rather like... The form isn't asking me to confirm availability of a lecture room. Again, we would take that for granted. Why should a computer lab be any different?"* *"It's specific to Science, I suppose. If that wasn't running.... Erm, the devolved nature of the University allows different Faculties to do different things, which is stupid."*	4	5	4
PPI:3.1	Code allocation	Content coded at this node documents participants' understanding of the course/class code allocation process.	*"I'm still a bit worried about a request for a course code. If it really means a degree course code; most people involved in approval will have no idea that means, especially because the University currently runs duplicate systems of course coding. So, 2.1 is very confusing and unclear."*	1	2	1
PPI:3.2	Flexibility	Evidence of the need for academic flexibility in curriculum design and teaching delivery.	*"Deadline week number may vary, again, depending on how the coursework is split up. We don't know precisely how many pieces of coursework there might be. But the expectation is that there would be a minimum of two but probably a maximum of three. That's something that we might decide early on once we saw the number of people attending the course."*	3	3	3
PPI:3.3	Terminology	Content evidencing participant uncertainty, confusion or recognition of terminological problems in the class and/or course design and approval process.	*"What happens if "course" actually means "programme" name or "degree" name, and there are several? We have different terminologies in different faculties, you see. Nothing is standardised. So a class and programme and a course can be interchangeable depending on which faculty you're at."* *"It is a little bit unclear here, when I'm starting this. This is a class specification; really curriculum - or my understanding of curriculum - is the whole course rather than an individual class, so that's a little confusing, I think. And also "class"... Traditionally we'd call this a "module descriptor" form, rather than "class". A problem with definitions, I*	4	5	4

Super-node: Process and pedagogical issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
			guess."			

7. Appendix B: Coding framework: System issues (super-node)

Table 8: Coding framework for the super-node "System issues" only.

Super-node: System issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
SI:1	Assessment activity	Data coded at this node denotes a participant requirement for a greater number of assessment options.	*"Format, delivery and assessment? Okay, so you are able to insert.... Well, I mean, our descriptors have "lectures", "tutorials", "laboratories", "assignments", "self study". One of things you sometimes see in terms of activities is a distinction between private study and directed study, in that - and this is particularly important in terms of some of the accreditation activities; because private study would be time which you spent reading, revising, doing things that you wish to do in order to get you through the class. Directed study would be time spent your own in your own time doing specific tasks, such as writing up a lab report, producing an essay... So some.... Everybody recognises that within the hours of the class you don't... for a 20 credit class you don't teach 200 hours; but when you look at the bits you're not in contact with the student it is very differently divided into directed and private. It's important that one indicates that there is an element of directed study where a specific and intended task is being completed. This is particularly important in things like practical work where a very large amount of the class might be involved in directed study as opposed to private study."*	10	33	9
SI:1.1	Assessment deadline	Data coded at this node evidences a participant view that "assessment deadline" should not be associated with particular assessments, e.g. examinations, courseworks, etc.	*"I'm fairly flexible with some the deadlines, actually. I wouldn't like to be prescriptive about it because I think it would vary a little bit according to the progress you make in terms of the lectures and labs. And that depends on the cohort of students and how quickly they learn. I do adapt it a bit in practice. I don't like these being too prescriptive. So I'd rather not have to have fixed deadlines."* *"Deadline week number may vary, again, depending on how the coursework is split up. We don't know precisely how many pieces of coursework there might be. But the expectation is that there would be a minimum of two but probably a maximum of three. That's something that we might decide early on once we saw the number of people attending the course."*	6	9	6
SI:1.2	Assessment duration	Data coded at this node supports participant concerns over the validity of "assessment duration", as per section 4.1 of the C-CAP system.	*"Coursework, as an assessment... Duration may not make sense there. Some of the coursework might be done in labs, in which case the duration will be the duration of the labs. In other cases it may involve submitting an assignment. So the duration... does that mean the time between the coursework being issued and submitted. It might be several weeks. I'm not clear on how I would answer that."*	5	7	5
SI:1.3	Option values	Data coded at this value provides specific participant suggestions for additional assessment option values (for section 4.1 of C-CAP).	*"So these are very generic categories. So, "individual assignment", "group assignment", "group work", "group presentations"; all these things are all missing."* *"I was looking for a debate or presentation... It's quite narrow in terms of your descriptions of assessment. I would expect to see a break down between a case study and a project are relatively similar, in a business context perhaps. Essay, report, presentation. Other formats we may use are debate, as I say; but we also... If you have an attendance requirement, in terms of they have to come to compulsory tutorials then that needs to be in as an assessment weighting as well because it tends to have marks attached to it.* *This "coursework" is just a bit bland and a bit general for me. It doesn't give enough detail."*	8	10	7
SI:2	C-CAP perceptions	Data coded at this node evidences participants' general perceptions about the C-CAP system, e.g. its usability, its ability to support curriculum design, etc.	*"You see, this bothers me... This always bothers me about these things where you have these pre-set form and you're entering information. I mean it's easy for me to just use a form because when I'm sticking to a pre-set piece of software, y'know, I can't really see very well what I've written. And I hate that. If you can imagine, I did this under great pressure of time, um, and so that last thing I want to do is spend my time trying to figure out what it is I've just written. And then if I accidentally erase it.."*	7	14	7

Super-node: System issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
			"Learning objectives? They often are bulletted. It directly relates to the sort of information one would expect on a class descriptor. Interestingly, if this system performs well it could actually be the generator of a class descriptor. Ahhh, now I understand how this adding works. This is good." *"Generally the system is quite intuitive to use, so it's easy, it's straightforward."*			
SI:2.1	Class evaluation	Data coded at this node discusses class evaluation and related aspects in the C-CAP system.	*"There's no summative assessment in class evaluation. It's all formative. I think that's a... I don't think it's a relevant question, to be honest. What are the choices? "Self-evaluation" is hardly summative. Similarly with "Student feedback"... There is a wee bit of summative in that you give the students a list of one to five; but again, it's feedback that informs your teaching. There is no summative in there. Summative essentially has a final mark associated with it. That's my understanding of summative. There's a mark that counts towards something. Any form of feedback you can take on board or you can ignore. If you ignore it then, okay, you're making a rod for your own back."* *"These should just be standard features of an academic activity which really don't need to be defined. They are there and they are used. All departments have staff-student committees. So all staff-student committees have the opportunity to comment on classes. All classes are required to go through an annual review process, so is it even necessary...? This is not something that features in the current process at all and I wonder whether it is even necessary. Not that class evaluation isn't necessary. Class evaluation is absolutely critically necessary, but it's there. There are University processes which are used and are known about. They don't need to be defined in the approval process."*	7	7	7
SI:2.2	Course codes	Content coded at this node evidences participant concerns about identifying courses in C-CAP, e.g. need for drop down lists, potential for confusion of course codes with UCAS codes, etc.	*"Once you find the class you then enter... It automatically enters the course code because... The reason why I say that is: there are different codes depending on how you interact with the system. For example, BSc Physics is 0027/1 2 3 or 4, depending on which year it is, and that's the code that Registry use, I think, to identify a student with that. Whereas... With the UCAS application process there is a completely different set of codes associated with that. And the Admissions side of the degree has a different code from the actual Registry side of things. So, you can end up remembering too many codes. Maybe a simple drop down menu, or another box saying "This is a new course" would make more sense..."* *"Course code? Um, it's not clear what the course code refers to there at all. If it really means a degree course code, people won't understand that."*	7	7	7
SI:2.3	Dummy codes	Node denoting participant discussion of the perceived need for "dummy codes" to assist in the curriculum approval process.	*"These will often come to approval processes with dummy course codes anyway. Indeed, there is some confusion there in that sometimes you can't get a class code until your course is approved. And sometimes you can. This form here that working from as a draft is giving a dummy code, but others have already got their codes, so it's variable."*	2	2	2
SI:2.4	Form requirements	Participant comments concerning the detail or requirements of the form and the information required to be completed by participants.	*"I want to just say there are four classes that take place this week, this week, that week. You know? It's almost as if there's too much information being asked in this. Some of this information should be given to the students by the department when they are delivering the class, rather than going in... making up the approval form."*	8	13	8
SI:2.5	PoA menu	A node that evidences participants' C-CAP system perceptions or needs for section 4.5 (Principles of Assessment and Feedback).	*"Principles of Assessment and Feedback. There are 12 principles of good assessment... yup. Right, and this, I think, is an area where some examples would be really quite useful. Again, I've seen a very high variation in what different lecturers put in here. Maybe, given the emphasis on feedback that the students are requesting and also in the student survey it seems to be quite important, it maybe better to have the feedback as a separate category here. So it's quite clear that the students can see exactly what the feedback is, what they can expect from the course... More guidance on that area would be useful, and perhaps the feedback as a separate issue."*	2	2	2

Super-node: System issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
SI:2.6	Read only	Participant discussing the role of "read only" versions of the form.	*"How easy is it print this form out in its entirety? I can't work.... I can do this but I don't like. I just prefer writing on documents and it's faster to write than it is to call up a PDF sticky and type that in, or enter a comment."*	1	1	1
SI:2.7	Reading and resources	Data coded at this node evidences user confusion / issues with section 5.2 (Recommended reading and resources).	*"When the say "Availability", is it that something is available in the library? So, for example, because there are various journal, so journal they pick up from the library, some not. Can I just put "Not available"? Or, there are various journal [...] some we just provide for them. Also, an option.... "Available locally"?"* *"This 5.2 is incredibly tedious to do, to be honest. Resource? Does that mean an actual book, or does it mean books in the library? The forms that go to Academic Committee require a reading list, an indicative reading list, and that is different from the additional resources required for the class. So you'd have things like, "We need a room with flexible seating, AV - which is impossible in some cases - or you need white boards or this, that and the other". Books are separate. It's a reading list. This seems to be confusing two things together."*	9	11	9
SI:2.8	System consistency	Nodes denotes participant comments relating to C-CAP system (or lack of) consistency.	*"Now it's telling me, in red, that assessment weighting was sum to 100%. I believe they do. It would be nice if it didn't tell me that if it did. Otherwise I'm assuming there might be something wrong or incorrect. If it's going to add up figures earlier on but not add them up now, it seems inconsistent."*	1	1	1
SI:2.9	System navigation	Data coded at this node evidences participants' experiences with the C-CAP navigation.	*"It's not intuitive that you move along these top bars. That was a guess. I guessed. As you'll notice from the survey, I regard myself as reasonably IT literate. But I don't think it's intuitive that these five boxes are step boxes that you step along. Perhaps just a sentence..."*	3	4	3
SI:2.10	Unnecessary information	Code evidences examples of unnecessary information being provided in class forms, e.g. "not applicable", "none", etc.	*[Evidenced via screen capture video]*	3	3	3
SI:3	Class framework	General issues pertaining to class / module framework issues. Also acts as aggregate node for child nodes.	*"Many of the classes the Physics Department offers, and the Science Department offers, offer an exemption scheme whereby students will take a range of class tests. These will be done throughout the semester and then they will... and then if the student performs to a certain defined level, the student will be awarded the credits. Sorry, the student will not need to sit the January or June examination for that task because the Department has deemed that their performance is satisfactory such that the exam board can award the credits for the class. How can that be reflected under here? I know there's a notes field but, the way I look at it, the notes field relates to the examination and such like."*	10	25	10
SI:3.1	Academic level	Data coded at this node evidences participant issues with the assignation of UG or PG and a preference for "academic level".	*"Okay, level you should specify the academic level, not whether it's undergraduate or postgraduate. It should be level one, two, three, four, five - and then you can determine whether it's postgraduate from, erm, the level descriptor."* *"Credit value... Level... It's either undergraduate or postgraduate. Level, in my terminology, is 1, 2, 3, 4, or 5. MEng or MSc is level 5, for taught modules."*	5	5	5
SI:3.2	Credit values	Content at this node evidences participant issues with the credit values used in section 1.1 of C-CAP.	*"I don't know if I've ever seen it written down, exactly how many hours there should be for 10 credits; but I've heard informally that it should be about 100 hours. And I assume that that includes students doing their assessments... assessment activity. I may be wrong, but that's what I've heard."*	3	3	3
SI:3.2.1	Credit-to-hours mapping	General evidence of system need to assist participants in calculating the number of activity hours associated with the credit system.	*"One thing that we're advised is that for a 10 credit class there should be a total of 100 hours, so it would be useful to get some advice here, I guess, on the screen to make up their total to 100 hours; or, at least, to have some explanation why it's not 100 hours. So in this case I will insert an activity which is "private study", and make that 50 hours - and that gives me 100 hours, which is typical for a 10 credit class, I think."*	6	7	6

Super-node: System issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
			"Perhaps if there's a standardised model in terms of the number credits that you put in? Perhaps there should be a total hours of activity that you've got to get to?"			
SI:3.3	Mode of attendance	Data coded here evidence participant uncertainty relating to definitions of attendance modes, e.g. open, distance, etc.	*"The 'modes of attendance' is an interesting question. Many academics designing classes won't really necessarily be familiar with the distinction between "attending" or "open" class structures. So... I wonder whether that's something that's really relevant at the early stage of class approval."*	4	4	4
SI:3.4	NQ	Content that discusses the issues involved in "NQing" (Not Qualified to sit examination).	*"In that context I think, one of things class descriptors will often talk about - and it's an issue the University needs to consider more - there is a process called "NQ"; you deem a student "non qualified" to sit an assessment on the basis of some activity. Some failure to attend, some failure in another aspect of the course. And if one has an NQ procedure with their class it needs to be indicated; routes out of NQ procedure also need to be indicated. That's a tricky one because, to be quite honest, I don't like the whole concept of NQing anyway, so I'd rather not see it there at all. But I know it is quite heavily used by some classes and some departments."*	2	2	2
SI:3.5	Semester system	Content coded at this node captures participants' views on recording the teaching pattern of classes.	*"One other thing.... It doesn't apply to this particular class which I'm entering now, but some other classes that I have been involved with, is that the MSc - Power Plant Engineering - is taught throughout the year, so it's not tied to the semester system. So having semester one, semester two, wouldn't be applicable for some of the modules which we have on that course."*	2	2	2
SI:3.6	Taught hours	Node content pertains to participants' discussion of how hours for particular types of activity are allocated.	*"Format, delivery and assessment? Okay, so you are able to insert.... Well, I mean, our descriptors have "lectures", "tutorials", "laboratories", "assignments", "self-study". One of things you sometimes see in terms of activities is a distinction between private study and directed study, in that - and this is particularly important in terms of some of the accreditation activities; because private study would be time which you spent reading, revising, doing things that you wish to do in order to get you through the class. Directed study would be time spent your own in your own time doing specific tasks, such as writing up a lab report, producing an essay... So some.... Everybody recognises that within the hours of the class you don't... for a 20 credit class you don't teach 200 hours; but when you look at the bits you're not in contact with the student it is very differently divided into directed and private. It's important that one indicates that there is an element of directed study where a specific and intended task is being completed. This is particularly important in things like practical work where a very large amount of the class might be involved in directed study as opposed to private study."*	7	8	6
SI:4	Learning activity	Content at this node captures general issues pertaining to learning activities and their documentation in curriculum design approval forms.	*"For instance, as part of the class delivery hours we've got 76 hours allocated for assignments. Now that might partly be done in the labs but it may be submission of some kind of report."*	3	3	3
SI:4.1	Learning activity number	Data coded at this node evidences participants' views on the C-CAP requirement to specifiy the number of learning activities required in the class.	*"The number or duration... I don't think this detailed information is necessary. All that is mostly necessary is the number of hours within the class. So typically... A class like this might have, it's a 20 credit class - it's going to have round about a third of that; it might have 60 hours of practical. Again, my experience of most class descriptor processes; they don't bother to drill down to the number of sessions. So, okay, I'm going to say, for example, we might expect there to be round about 15 four hour sessions. Private study would be the rest."*	1	2	1
SI:4.2	Learning activity options	Data coded at this node supports the need for extra options in the drop down menu for "Type of activity" (section 4.1 in C-CAP).	*"Well, I mean, our descriptors have "lectures", "tutorials", "laboratories", "assignments", "self-study". One of things you sometimes see in terms of activities is a distinction between private study and directed study, in that - and this is particularly important in terms of some of the accreditation activities."* *"Now, we had "assignments" as a button on our list here, which is "Field work", "Lecture", "Placement", "Practical"... We had that separate from "Private study". That's just an*	8	10	8

Super-node: System issues						
Node code	**Node**	**Node definition / scope note**	**Example quote(s)**	**Sources**	**References**	**Unique source**
			observation. But we could just combine it. They do a lot of homework and that's how they get their feedback and so on. So we like to say, "Yes - you will be expected to spend time on this", rather than just this nebulous "private study" that, sometimes, I think they completely ignore that. Whereas if it says "You're expected to spend a certain amount of time on the assignments", it focusses them a bit more."			
SI:5	Technical impediment	Data at this - and sub-codes - pertain to specific technical issues or errors preventing meaningful use of the C-CAP system.	*[Facet node]*	0	0	0
SI:5.1	Delete button problems	User difficulties with the C-CAP delete button.	*[Evidenced via screen capture video]*	1	1	1
SI:5.2	Form submission errors	Content coded at this node evidences C-CAP form submission or form saving errors.	*[Evidenced via screen capture video]*	2	6	2
SI:5.3	Inputting class codes	Data coded here evidences participant concerns about entering or remembering class codes, e.g. re-ordering of form fields, requirement for look-up, etc.	*"I can't remember the correct class code. Yeah, yeah. This is just me; but I always think of the class code, not the class name. So the first thing I enter is the class code and not the class name. I always find it really disconcerting when you search the class catalogue and the first field is the class name rather than the class name, because it is more efficient to enter the class code than the class name. But, yeah, that's just me."*	1	1	1
SI:5.4	Insert button problems	Data coded at this node documents participant usability issues with the "insert item" buttons in C-CAP, e.g. insert button not visible to participant, insert button unresponsive, etc.	*"My impression is that I need to click on "Add a learning objective" twice each time, in order to get it to respond. I think that's happened... I'll double check next time. Yeah - that's confirmed."*	4	4	2
SI:5.5	Obscuration of text	Content coded at this node evidences instances in which C-CAP obscures inputted content thereby limiting usability, e.g. failure for text box to expand, important text above or below page fold, etc.	*"The later coursework is designed to assess all the learning objectives, so it was relatively easy; but it would be tedious if you were focussing on just one or two of these things to remember which learning objective is it, and having scroll back up, and then..."* *"Not being able to see learning objectives when using the drop down lists."*	4	4	3

8. Appendix C: Node tree map

A tree map is a representation of coded data, displaying items as nested rectangular boxes. These boxes diagram hierarchical data as nested boxes of varying sizes. The size of the box represents how many of source items are coded by the nodes displayed. The colour of each box also represents the number of coding references.

Figure 8: Node tree map representing nodes from the coding framework.

9. Appendix D: Evaluator log example

Principles in Patterns (PiP): user acceptance evaluation
PROTOCOL ANALYSIS EVALUATION LOG
Significant events for stimulated recall

Time stamp: The time stamp should record the exact time at which the participant experiences a significant event, thus ensuring quick identification for stimulated recall. Example input format for an event at 6 minutes 45 seconds, 00:06:45.

Time stamp	Brief description of significant event	Optional notes on stimulated recall
00:00:42	Department list not up-to-date.	
00:01:11	"Curriculum" an ambiguous term, as is class.	
00:01:56	Should not be UG and PG. Should be level 1, 2, 3, etc.	
00:02:27	"What does "Open" mean?"	
00:02:30	Semester based options not applicable to some Engineering courses.	
00:05:02	Need for class codes, and/or dummy codes to support curriculum designer in course drafting process. C-CAP defficient here?	
00:07:01	Much of the form is to do with "New" modules. Doesn't cater for class amendments.	
00:13:00	Use of "Help". Business case is "way over the top for modules".	
00:14:32	Who would be reviewing this information?	
00:16:38	"Computer labs" should be included in Activity types. "Site visits". "Group work", "team working", "project work". "Crits" - almost like a viva.	
00:19:45	10 credit class should be a total of 100 hours.	
00:21:15	Examples of learning objectives from different disciplines in the Help section of C-CAP to support improved learning objective (Section 4.2), i.e. standardise practice with other academic colleagues, assist curriculum designer in drafting learning objectives that are sufficiently specific and measure performance, state critereon and conditions.	
00:22:55	Section 4.3. More assessment options required, e.g. "Presentation", "Web pages", and "Other".	
00:34:10	Confusion over "Duration" in section 4.3.	
00:24:45	Deadline unclear and inappropriate in some circumstances.	
00:26:00	Assessment deadlines is a dead concept in Engineering. No fixed deadlines. Flexibility required.	
00:26:58	Specificity in assessment design and dates will necessitate continual editing throughout its lifetime in order to reflect practical changes.	
00:28:00	Assessment and hours issue. Reducing time to balance at 100 hours. STIMULATED RECALL.	

00:28:18	Failure of C-CAP to support constructive alignment of assessment with learning objectives.	
00:29:00	Section 4.5. requires feedback examples.	
00:30:23	Section 4.6 is confusing. Terminology of formative and summative confusing and unclear.	
00:33:10	How brief should section 5.1 be?	
00:34:35	Student expected to purchase the recommended reading. Inclusion of MyPlace demonstrates that this section is far too ambiguous in its current form.	

10. Appendix E: C-CAP system interface (evaluation system)

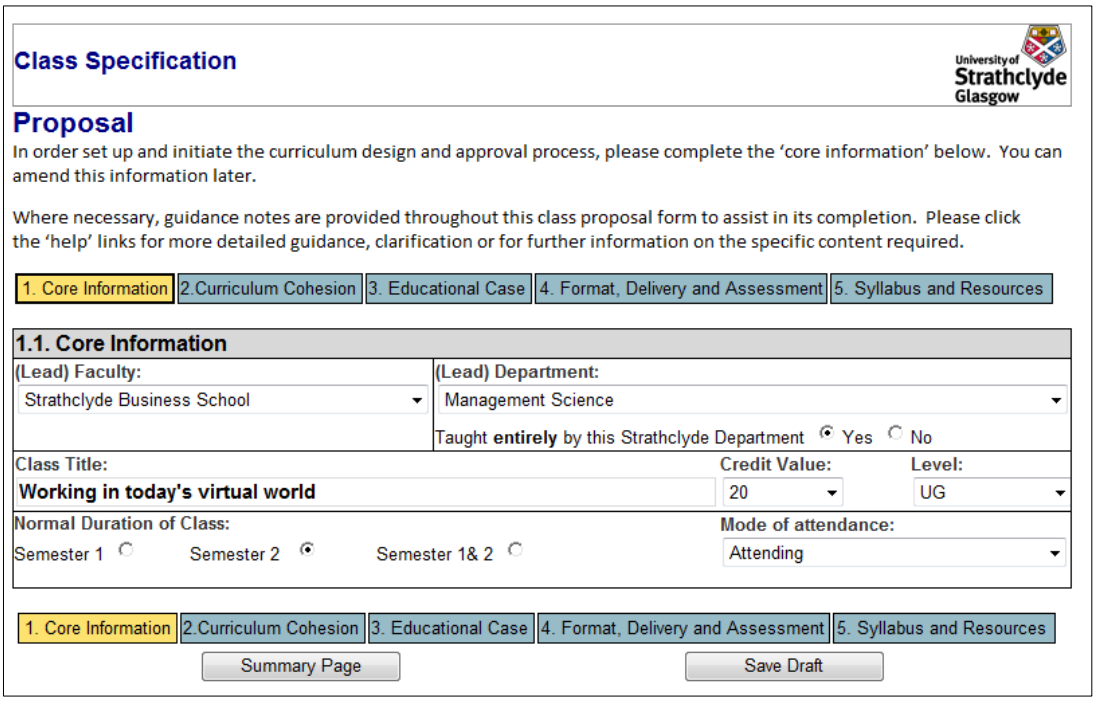

Figure 9: Section 1.1 of C-CAP (Core Information).

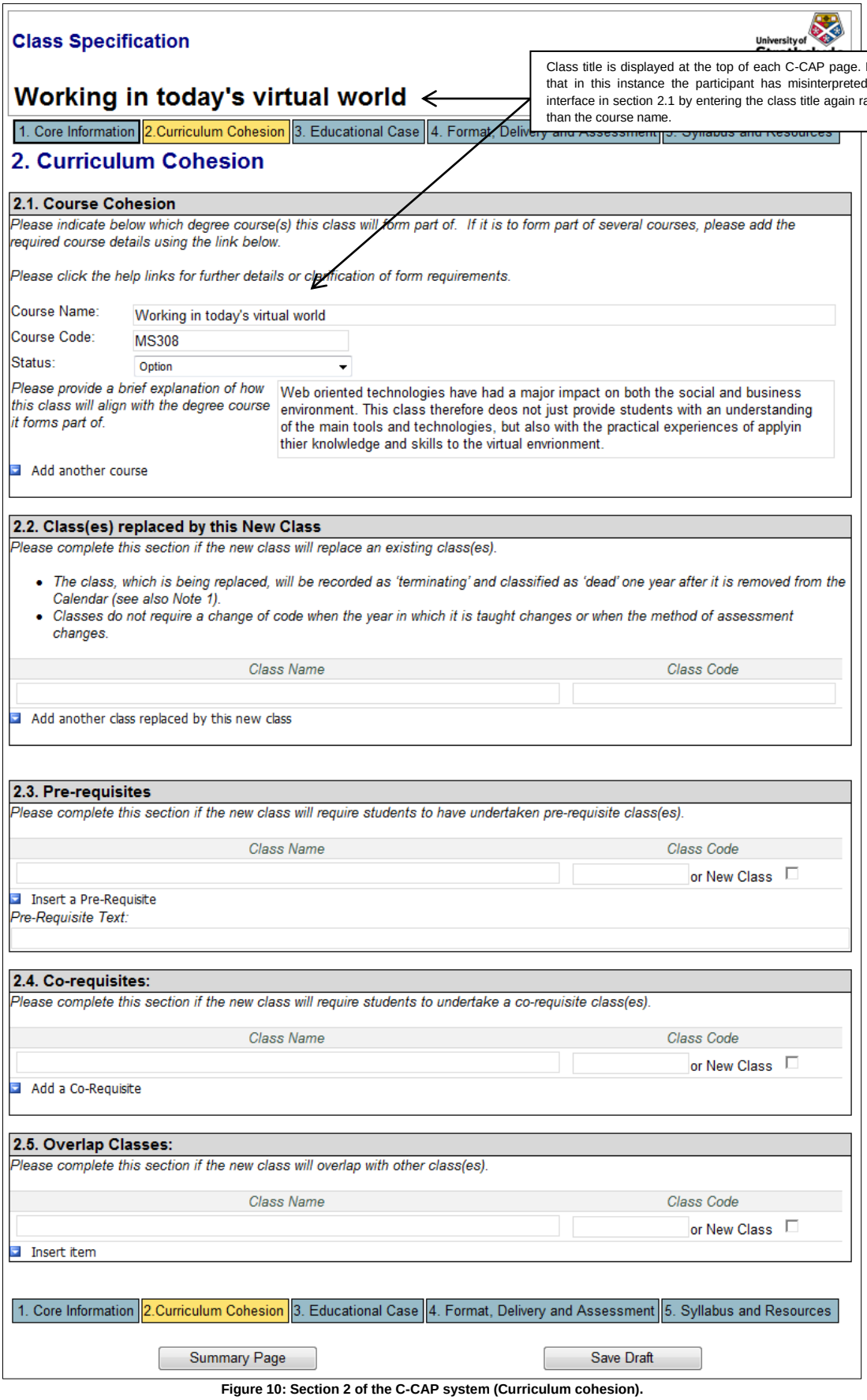

Figure 10: Section 2 of the C-CAP system (Curriculum cohesion).

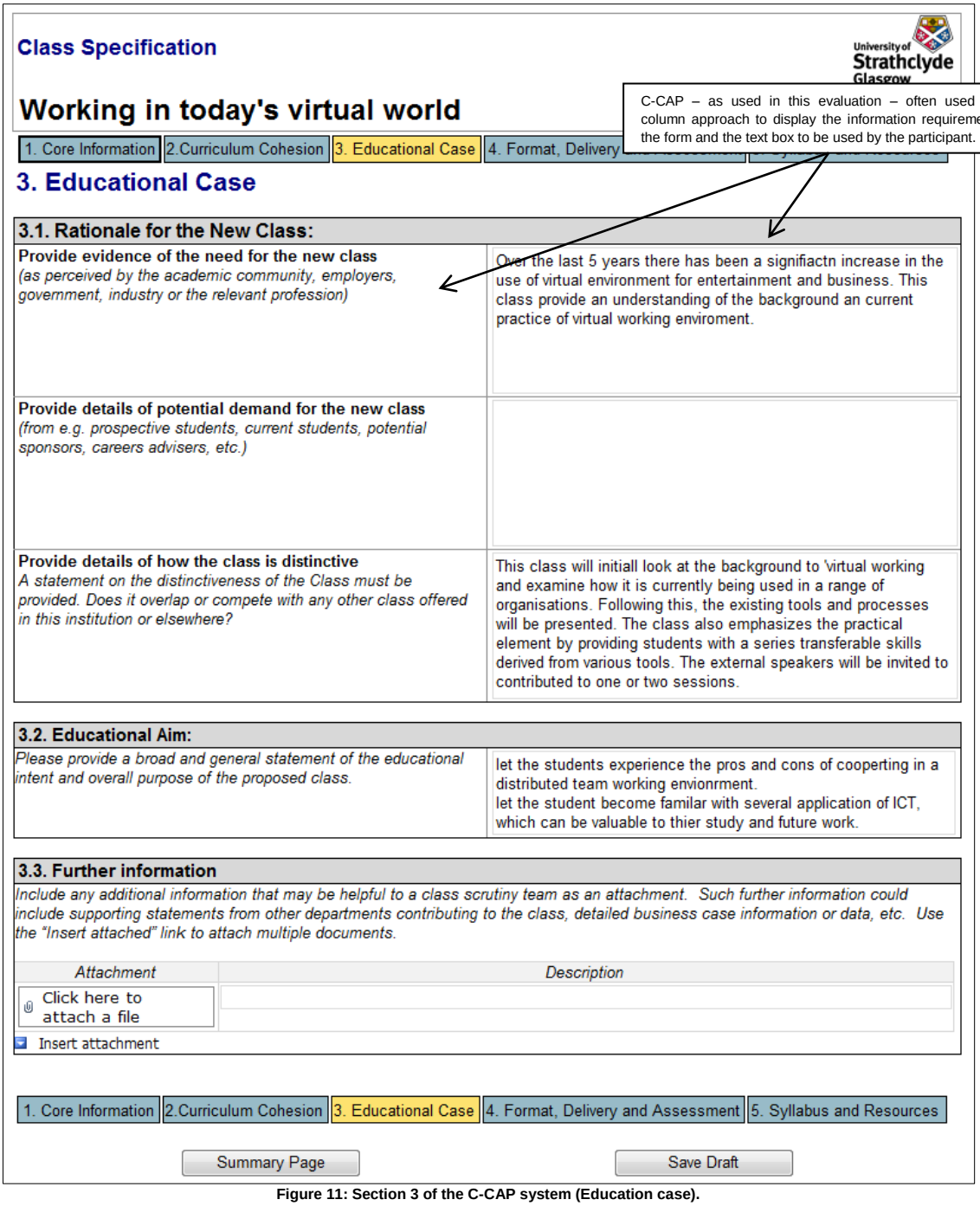

Figure 11: Section 3 of the C-CAP system (Education case).

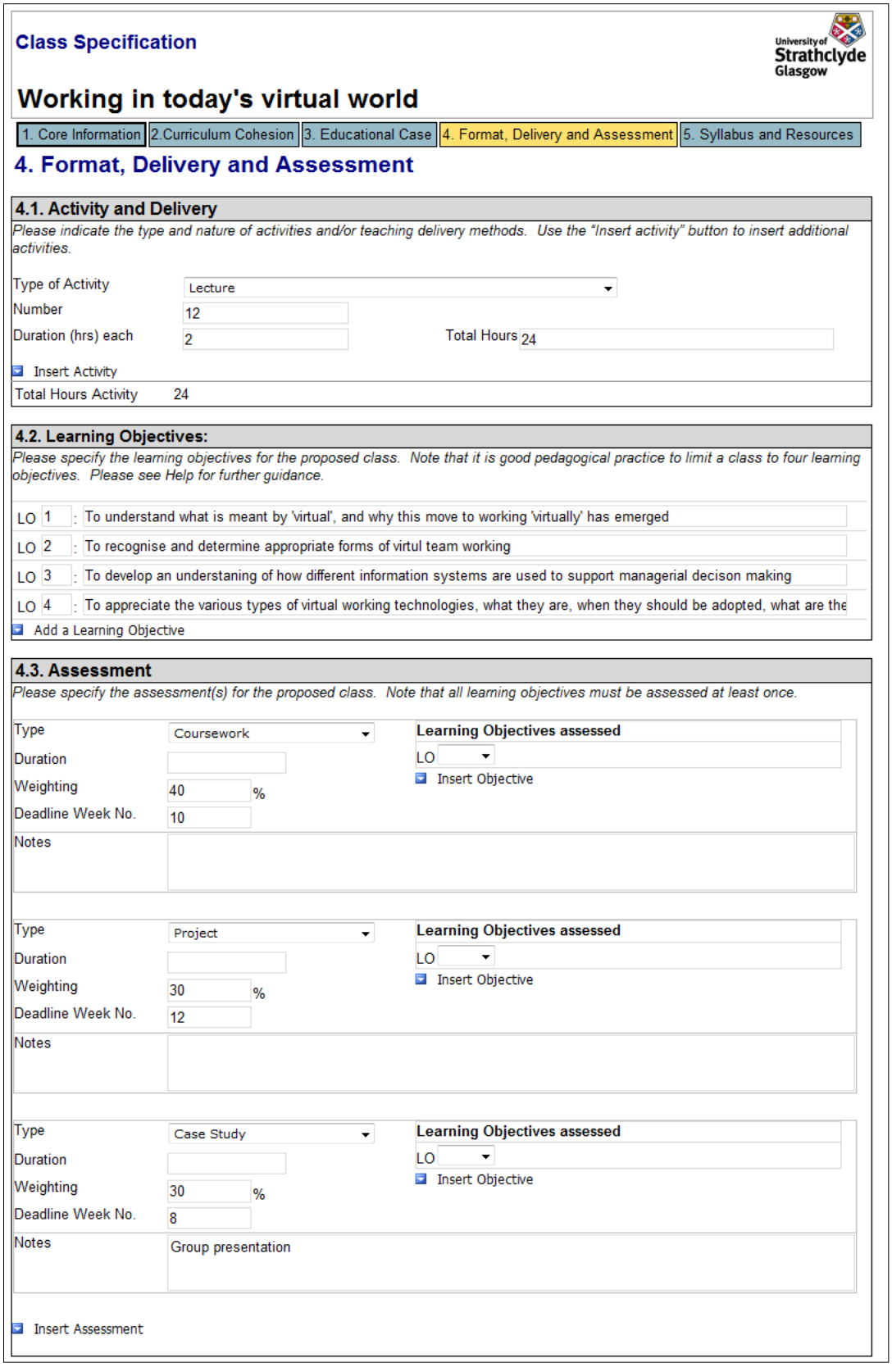

Figure 12: Section 4 of the C-CAP system (Format, delivery and assessment). 1 of 2 screen shots.

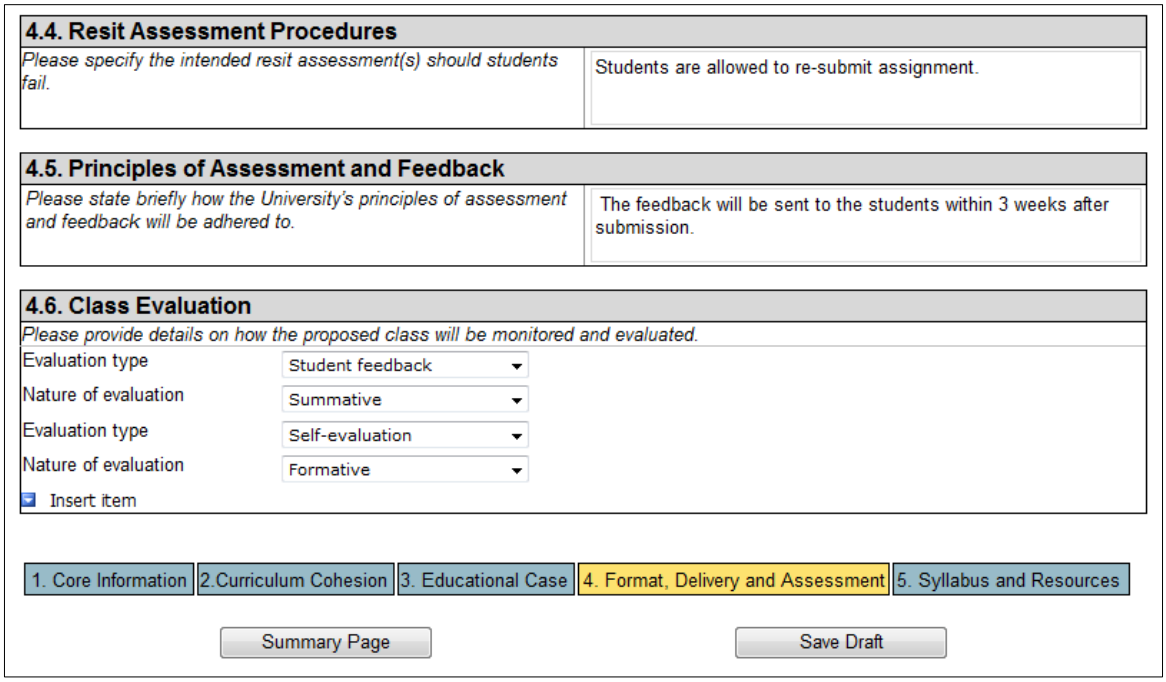

Figure 13: Section 4 of the C-CAP system (continued). 2 of 2 screen shots.

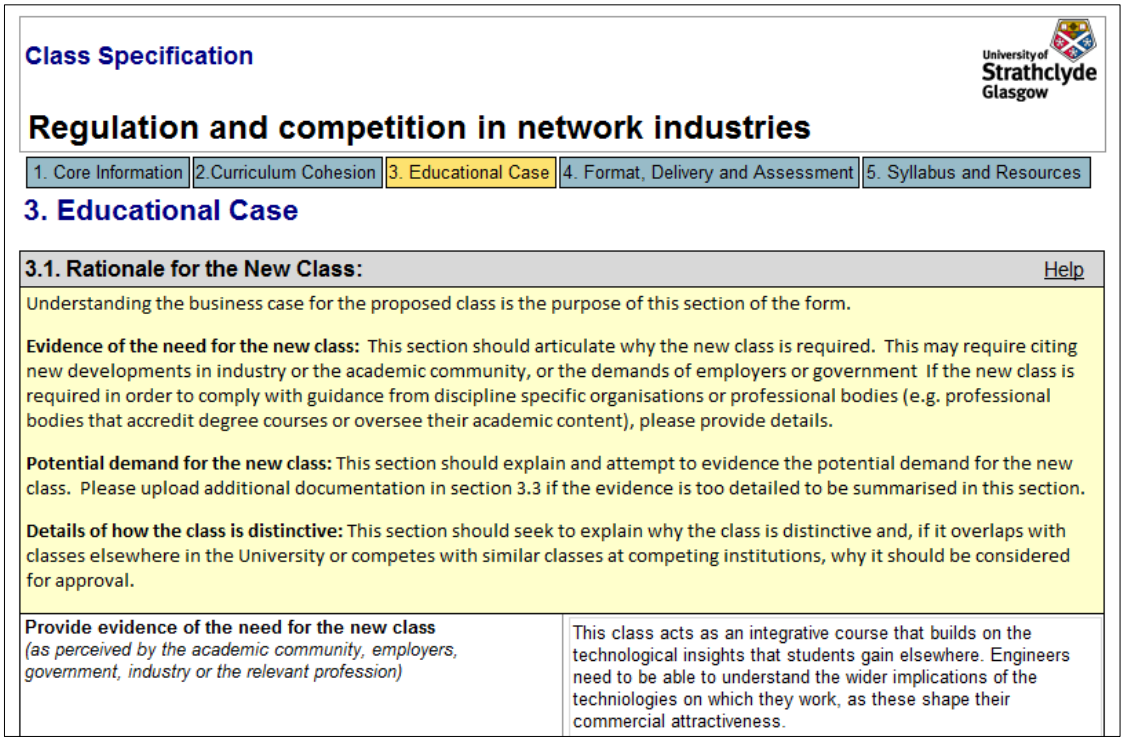

Figure 14: Example of the expandable / collapsible help screens available within C-CAP.

Class Specification

University of Strathclyde Glasgow

Regulation and competition in network industries

1. Core Information | 2.Curriculum Cohesion | 3. Educational Case | 4. Format, Delivery and Assessment | 5. Syllabus and Resources

4. Format, Delivery and Assessment

4.1. Activity and Delivery

Help

Specifying the nature of the principal learning activities and teaching delivery methods is the purpose of this section of the class proposal form.

Type of activity

It is normal for a class to employ a number of learning activities and/or teaching delivery methods and those proposing a new class should attempt to list all necessary activities.

Lecture: A lecture is one of the principal methods of teaching delivery in universities and is useful for delivery significant information to large student cohorts.

Tutorial: Tutorials are generally used to complement lectures and involve active student participation, e.g. student discussion of probing questions, cohort debate of paper presented by student, problem solving activities, etc. Such tutorial activities normally seek to explore lecture content at a deeper level and demand active student participation.

Private study: If students are required to engage in extensive private study for a proposed class, designers should consider whether it should be included in this section.

Practical: A practical session is normally a workshop or lab session in which students engage in practical learning activities, e.g. biochemistry labs, computer programming IT labs, etc.

Field work: Field work includes any formal learning activity that requires students to be off campus in order to study, investigate or explore something outside the classroom. Field work generally uses the environment, whether natural or artificial, as a learning resource. In such contexts students are allowed to experience phenomena in its usual setting and thereby better understand it.

Placement: A placement is a period of extended experiential learning, such as an industrial placement and sandwich year.

Number: This section refers to the number of the specified activity or delivery method required to fulfil the proposed class.

Duration: This section should indicate the length (in hours) of the learning activity or teaching delivery method.

Total hours: The system will automatically calculate the total number of activity / delivery hours required to fulfil the class.

Please indicate the type and nature of activities and/or teaching delivery methods. Use the "Insert activity" button to insert additional activities.

Type of Activity	Lecture		
Number	12		
Duration (hrs) each	2	Total Hours	24
Type of Activity	Tutorial		
Number	4		
Duration (hrs) each	1	Total Hours	4
Type of Activity	Private Study		
Number	1		
Duration (hrs) each	80	Total Hours	80
Type of Activity			
Number	1		
Duration (hrs) each		Total Hours	0

Insert Activity

Total Hours Activity 108

Figure 15: Example of help / guidance detail available in expandable / collapsible help sections in C-CAP.

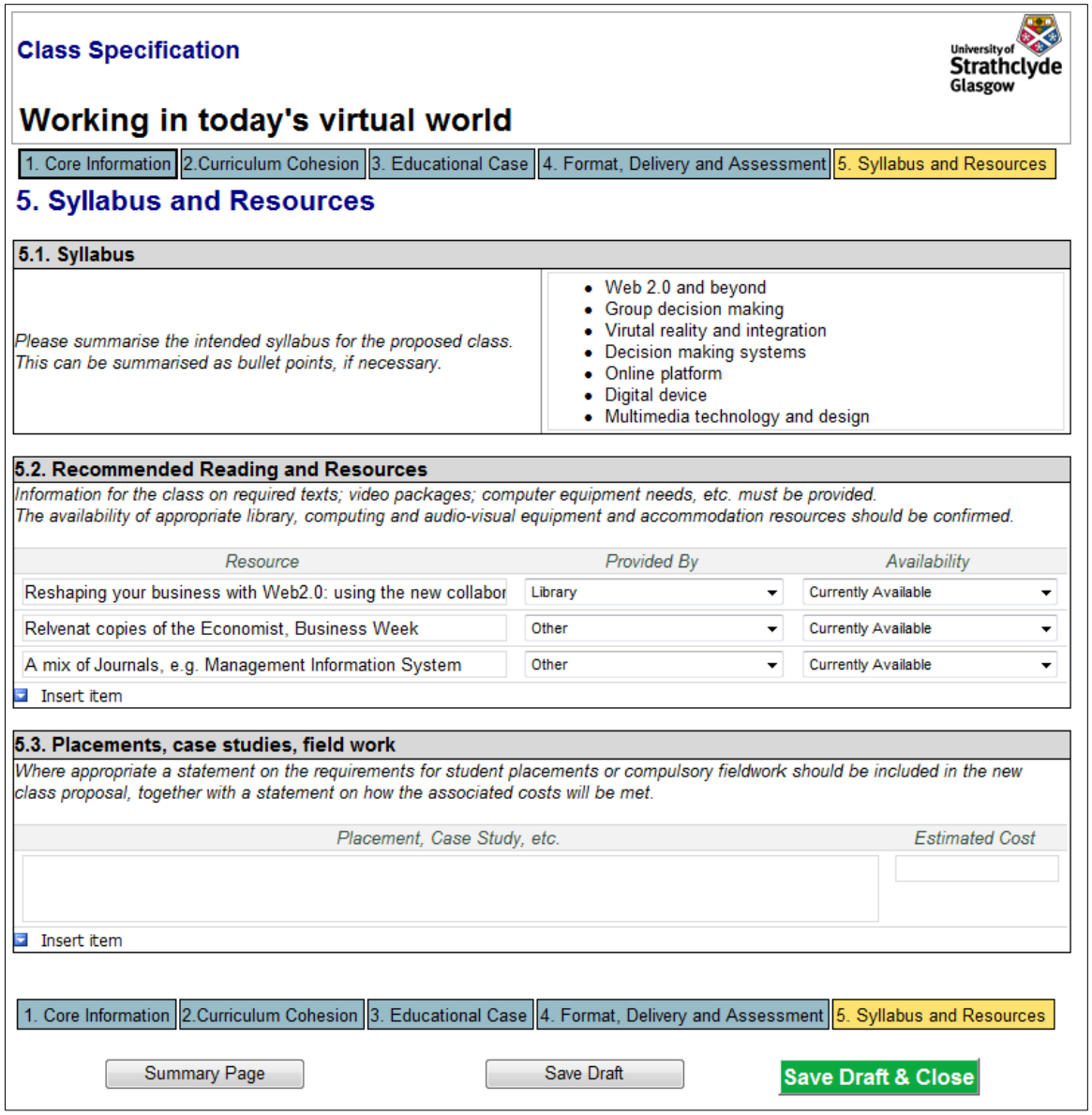

Figure 16: Section 5 of the C-CAP system (Syllabus and resources).

11. Appendix F: Pre-session questionnaire instrument in BOS

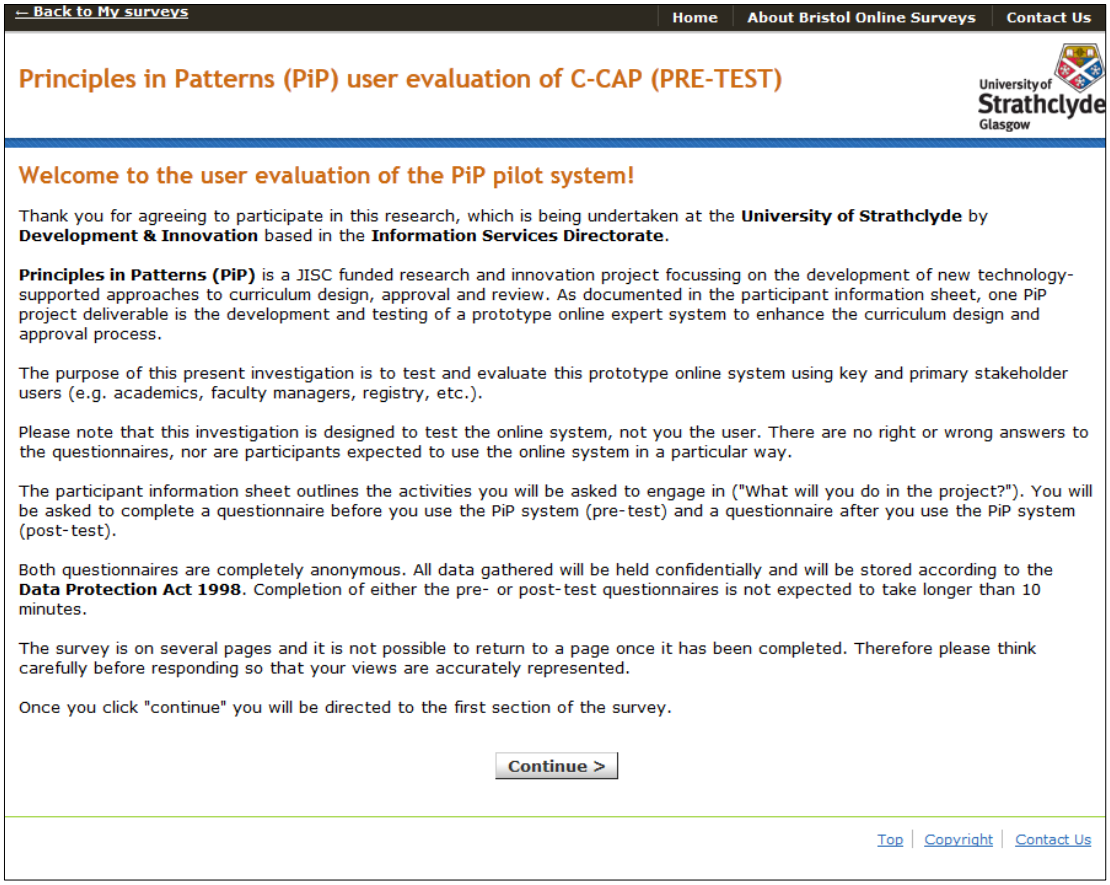

Figure 17: Pre-session questionnaire instrument, page 1.

Principles in Patterns (PiP) user evaluation of C-CAP (PRE-TEST)

University of Strathclyde Glasgow

Pre-test questionnaire

Participant background information

1. To which Faculty do you belong? *(Optional)*

Select an answer

If you selected Other, please specify:

ICT experience and attitudes

2. The following statements relate to aspects of **Information & Computer Technologies** (ICT) literacy.

Please indicate the level of your agreement with the following statements using the scale where **1 = I have very little confidence and 5 = I have a lot of confidence.**

	Please indicate the level of your agreement with the following statements using the scale. 1 = I have very little confidence and 5 = I have a lot of confidence.				
	1	**2**	**3**	**4**	**5**
a. I feel confident working on a personal computer or laptop	○	○	○	○	○
b. I feel confident getting software up and running	○	○	○	○	○
c. I feel confident using the user's guide when help is needed	○	○	○	○	○
d. I feel confident entering and saving data (numbers or words) into a file	○	○	○	○	○
e. I feel confident escaping / exiting from a program or software	○	○	○	○	○
f. I feel confident calling up a data file to view on the monitor screen	○	○	○	○	○
g. I feel confident understanding terms/words relating to computer hardware	○	○	○	○	○
h. I feel confident understanding terms/words relating to computer software	○	○	○	○	○
i. I feel confident handling a CD-R/DVD correctly	○	○	○	○	○
j. I feel confident learning to use a variety of software applications	○	○	○	○	○
k. I feel confident making selections from an on-screen menu	○	○	○	○	○
l. I feel confident copying an individual file	○	○	○	○	○
m. I feel confident adding and deleting information from a data file	○	○	○	○	○
n. I feel confident moving the cursor around the monitor screen	○	○	○	○	○
o. I feel confident using the computer to write a letter or essay	○	○	○	○	○
p. I feel confident seeking help for problems with my computer	○	○	○	○	○
q. I feel confident using the computer to organise information	○	○	○	○	○
r. I feel confident getting rid of files when they are no longer needed	○	○	○	○	○
s. I feel confident organising and managing files	○	○	○	○	○
t. I feel confident troubleshooting computer problems	○	○	○	○	○
u. I feel confident browsing the World Wide Web (WWW)	○	○	○	○	○
v. I feel confident surfing the World Wide Web (WWW)	○	○	○	○	○

Figure 18: Pre-session questionnaire instrument, page 2. Includes CSE instrument [30].

view on the monitor screen					
g. I feel confident understanding terms/words relating to computer hardware	○	○	○	○	○
h. I feel confident understanding terms/words relating to computer software	○	○	○	○	○
i. I feel confident handling a CD-R/DVD correctly	○	○	○	○	○
j. I feel confident learning to use a variety of software applications	○	○	○	○	○
k. I feel confident making selections from an on-screen menu	○	○	○	○	○
l. I feel confident copying an individual file	○	○	○	○	○
m. I feel confident adding and deleting information from a data file	○	○	○	○	○
n. I feel confident moving the cursor around the monitor screen	○	○	○	○	○
o. I feel confident using the computer to write a letter or essay	○	○	○	○	○
p. I feel confident seeking help for problems with my computer	○	○	○	○	○
q. I feel confident using the computer to organise information	○	○	○	○	○
r. I feel confident getting rid of files when they are no longer needed	○	○	○	○	○
s. I feel confident organising and managing files	○	○	○	○	○
t. I feel confident troubleshooting computer problems	○	○	○	○	○
u. I feel confident browsing the World Wide Web (WWW)	○	○	○	○	○
v. I feel confident surfing the World Wide Web (WWW)	○	○	○	○	○
w. I feel confident finding information on the World Wide Web (WWW)	○	○	○	○	○

Computer attitude

3. The following statements relate to your attitudes towards ICT.

Please indicate the level of your agreement with the following statements using the scale.

	Please indicate the level of your agreement with the following statements using the scale.				
	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
a. I like working with computers	○	○	○	○	○
b. I look forward to those aspects of my job that require me to use a computer	○	○	○	○	○
c. Once I start working on my computer I find it hard to stop	○	○	○	○	○
d. Using a computer is frustrating for me	○	○	○	○	○
e. I quickly get bored when working on a computer	○	○	○	○	○

Continue >

Figure 19: Pre-session questionnaire instrument, page 2 continued.

Principles in Patterns (PiP) user evaluation of C-CAP (PRE-TEST)

University of Strathclyde Glasgow

Pre-test questionnaire (cont.)

Curriculum design and approval

4. In your current or previous job role, do/did you have experience of the curriculum design and approval process at the University of Strathclyde?

- ○ Yes
- ○ No
- ○ Don't know

5. If "Yes" to Q.10, please indicate your level of agreement with the following statements using the scale.

	Please indicate your level of agreement with the following statements using the scale below.				
	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
a. The curriculum approval process at the University of Strathclyde is an efficient process	○	○	○	○	○
b. The curriculum approval process at the University of Strathclyde is simple to understand	○	○	○	○	○
c. The curriculum approval process at the University of Strathclyde is a trivial process	○	○	○	○	○
d. The curriculum approval process at the University of Strathclyde is a process that demonstrates a quick turnaround time (i.e. time from submission to final approval)	○	○	○	○	○
e. The curriculum approval process at the University of Strathclyde is an effective process	○	○	○	○	○
f. The curriculum approval process at the University of Strathclyde is a process that is easy to manage	○	○	○	○	○
g. The curriculum approval process at the University of Strathclyde is a process that is well placed to respond to the demands from industry and the employment market	○	○	○	○	○
h. The curriculum approval process at the University of Strathclyde is a process that ensures quality teaching is delivered	○	○	○	○	○
i. The curriculum approval process at the University of Strathclyde is a process requiring too many decisions by other people	○	○	○	○	○
j. The curriculum approval process at the University of Strathclyde is a convoluted process	○	○	○	○	○
k. The curriculum approval process at the University of Strathclyde is onerous and stifles innovation in course/module design	○	○	○	○	○
l. The curriculum approval process at the University of Strathclyde is a process requiring improvements to enhance efficiency	○	○	○	○	○

Figure 20: Pre-session questionnaire instrument, page 4.

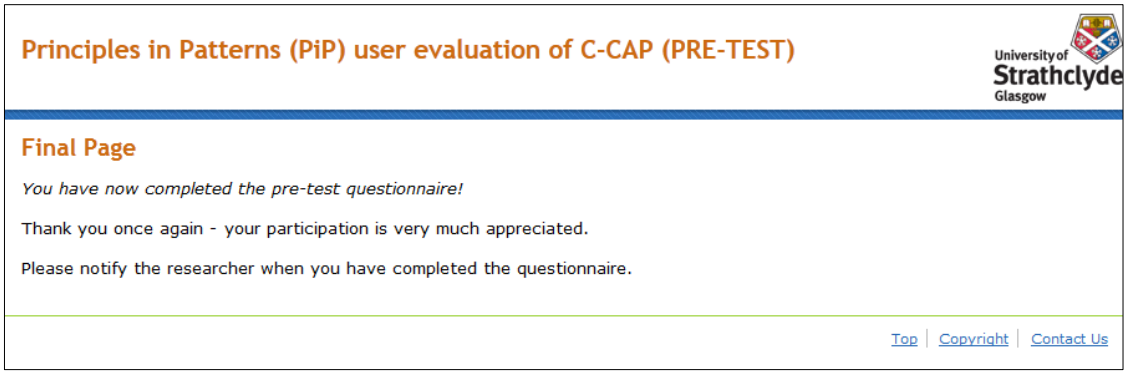

Figure 21: Pre-session questionnaire instrument, page 5.

12. Appendix G: Post-session questionnaire instrument in BOS

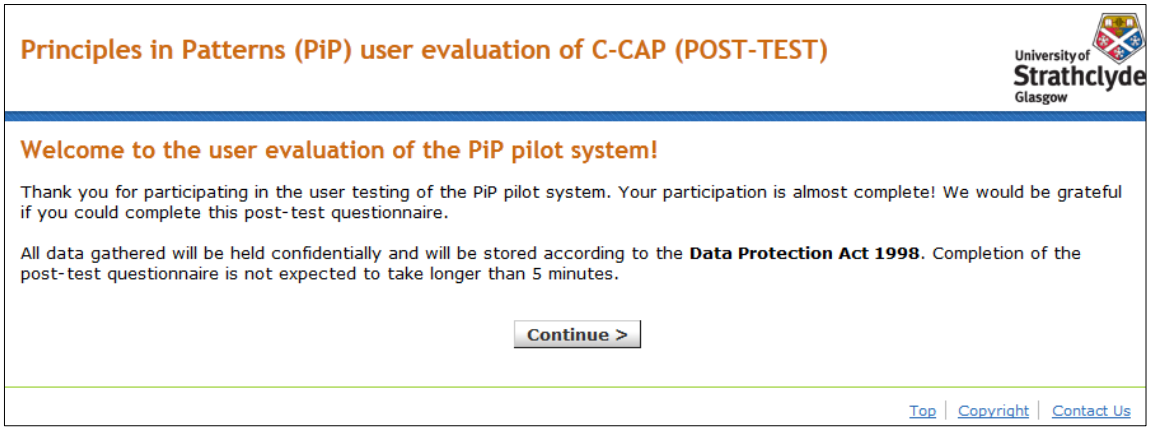

Figure 22: Post-session questionnaire instrument, page 1.

Principles in Patterns (PiP) user evaluation of C-CAP (POST-TEST)

University of Strathclyde Glasgow

Post-test questionnaire

Perceptions of PiP online system

1. Please indicate your level of agreement with the following statements using the scale provided.

	Please indicate your level of agreement with the following statements using the scale provided.				
	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
a. I think that I would like to use this system frequently.	○	○	○	○	○
b. I found the system unnecessarily complex.	○	○	○	○	○
c. I thought the system was easy to use.	○	○	○	○	○
d. I think that I would need the support of a technical person to be able to use this system.	○	○	○	○	○
e. I found the various functions in this system were well integrated.	○	○	○	○	○
f. I thought there was too much inconsistency in this system.	○	○	○	○	○
g. I would imagine that most people would learn to use this system very quickly.	○	○	○	○	○
h. I found the system very awkward to use.	○	○	○	○	○
i. I felt very confident using the system.	○	○	○	○	○
j. I needed to learn a lot of things before I could get going with this system.	○	○	○	○	○

2. **Overall**, I would rate the user-friendliness of this system as:

○ Worst imaginable ○ Awful ○ Poor ○ OK ○ Good ○ Excellent ○ Best imaginable

3. Were there features of the system that you found particularly frustrating or unusable? If so, please provide details. *(Optional)*

4. Please indicate your level of agreement with the following statements using the scale provided.

	Please indicate your level of agreement with the following statements using the scale provided.				
	Strongly disagree	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
a. The PiP system supports the curriculum design and approval process	○	○	○	○	○
b. The PiP system could greatly improve the curriculum design and approval process at the University of Strathclyde	○	○	○	○	○
c. The PiP system could support me in improving the pedagogical quality of curricula I design	○	○	○	○	○
d. The PiP system could support me in making curriculum design more efficient	○	○	○	○	○
e. The PiP system is sympathetic to the needs of my discipline	○	○	○	○	○

Figure 23: Post-session questionnaire instrument (page 2), including SUS and ARS questions [32], [33].

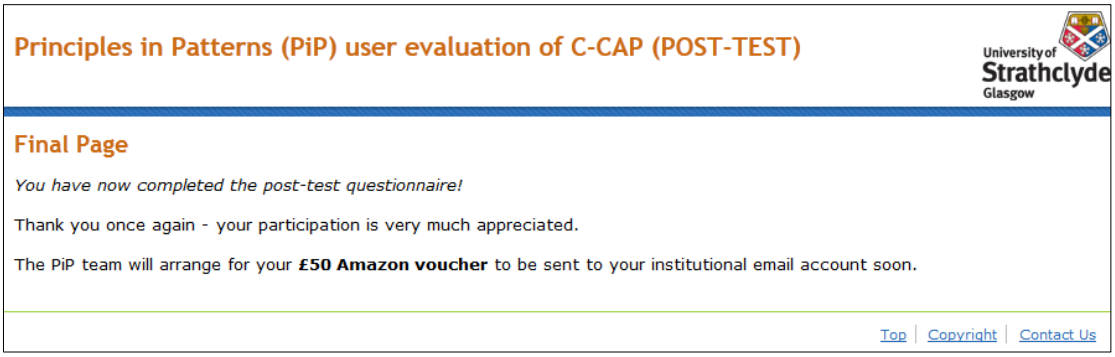

Figure 24: Post-session questionnaire instrument, page 3.

13. Appendix H: Table of heuristic issues derived from protocol analysis

Table 9: Example table of heuristic issues to be resolved in C-CAP, as partially derived from the super-node "System issues" and its sub-nodes.

Issue #	Issue description	Issue severity
1	Credit value should be 10 or 20. (Core information)	2
2	Specify academic level (Core information), not UG or PG	4
3	What's the definition of "Open".	3
4	Use "compulsory" rather than "mandatory".	1
5	A drop down menu for existing course codes.	2
6	Section 2.2 onwards – easier to insert the class code first.	1
7	Auto-populating elements of section 2. (curriculum cohesion)	1
8	Page error preventing form submission.	3
9	Entering "Not applicable" – wide unneeded boxes	4
10	Teaching across different sites – not visible on first screen. Insufficient options?	2
11	Need to generate read only version for printing. Faster to write for drafting, etc.	1
12	Extra options in drop down menu for Activity type (section 4). Some departments set homework and it is a defined task. List to add: computer lab, "Other – please specify", need for notes field / further information field	6
13	Ability to click "all" learning objectives assessed.	5
14	No deadline should be associated with examination.	3
15	Ability to accommodate anomalous assessment situation whereby students get examination exemptions.	1
16	Change class evaluation options; too difficult to understand.	6
17	Unclear how to delete an item.	1
18	Recommended reading and resources needs addressing. Too confused and conflates too many resources. Rooms should be taken for granted? Need for bibliographic elements.	5
19	Class session types (Activity 4.1) – add to list: computer lab, "Other – please specify", etc.	3
20	Idea of assessment duration problematic / type - how long if included?	8
21	Additional assessment types	4
22	Problem understanding difference between class and course in section 2.1	3
23	No deadlines for courseworks – flexibility required.	3
24	Need for dummy course codes – how to amend an existing class, e.g. search by module code?	3
25	Section 3.3 vague – examples required.	1
26	Larger syllabus box?	1
27	Save and submit error (e.g. "Some rules were not applied").	1
28	Departmental name corrections in Core Information required.	1
29	Help – learning outcome examples for disciplines.	1
30	Insert item – purpose of button unclear.	2
31	Module leader details – personal ownership required.	1
32	Core information screen – need for note of compulsory information.	1
33	Insert buttons unresponsive (e.g. Add a learning objective). Requires clicking twice.	2
34	Retention of blank learning objectives during constructive alignment.	1
35	Section 4.3 – adding of assessment weighting and removal of warning.	1
36	Check weightings to be consistent (section 4.3)	1