Teachers' written formative feedback on students' critical thinking: A case study

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ABSTRACT

This study explores innovative ways for promoting and assessing the effectiveness of teachers' written formative feedback in the context of undergraduate studies. The investigation entails close collaboration with one Biology teacher in the context of teaching 'evolution'. One of the particular challenges was to encourage 88 first-year biology undergraduates to produce critical analyses of a selected press release related to the topic of evolution (i.e., the advent of genetic diseases). The research approach is based on a critical social paradigm, assuming principles of action-research. All written documents produced by participants and semi-structured interviews (at the end of the semester) were used as part of the content analysis of data. Results show that the teacher's written comments increased opportunities for students to search for further information, negotiate and take decisions within their group, auto- and hetero-reflect before sending their critical analyses to the teacher.

INTRODUCTION

Constructive alignment is one of the most influential ideas in teaching and learning in higher education. The basic premise is that learning activities and assessment tasks should be aligned with the intended learning outcomes for the course (Biggs, 1993; Biggs & Tang, 2011). One of the challenges for higher education is promoting more student-centred approaches, where students actively construct meaning from what they learn (Pedrosa-de-Jesus, da Silva Lopes, Moreira, & Watts, 2012; Ruiz-Primo, Briggs, Iverson, Talbot, & Shepard, 2011). In actuality, promoting students' higher order competences is difficult where learning tasks have previously been designed as being relatively passive (Chapman, 2001). The study we discuss here explores innovative ways for promoting written formative feedback in the context of undergraduate studies and for assessing the effectiveness of these feedback mechanisms. Our investigation entails close collaboration with one teacher of biology at the University of Aveiro, Portugal,

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in the context of teaching 'evolution' over one semester. One particular challenge in this course was to encourage 88 first-year biology undergraduates to produce critical analyses of selected press cuttings related to the topic of evolution (i.e., the advent of genetic diseases). Opportunities for generating learning tasks and assignments to encourage students' higher-order competences in an introductory biology course like this, such as questioning competences and critical thinking, were previously infrequent and rarely taken. In the past this particular course, put a strong emphasis on memorisation of scientific concepts and was assessed through examinations (Pedrosa-de-Jesus et al., 2012).

Critical thinking has emerged as an essential outcome of university learning (Dwyer, Hogan, & Stewart, 2014; Pedrosa-de-Jesus, Moreira, Lopes & Watts, 2014). Ennis (1987) presented one of the most well-known definitions for critical thinking, distinguishing between abilities, attitudes and so-called 'dispositions'. Abilities refer to the cognitive dimensions, while dispositions relate to more affective aspects. These abilities are organised into five areas: elementary clarification, basic support, inference, elaborated clarification, and strategies and tactics. In addition, in the Delphi Project Report critical thinking is said to be 'the process of purposeful, self-regulatory judgment' (Facione, 1990, p. 2). That report formalised a list of core cognitive skills for critical thinking: 1) Interpretation (Categorisation, Decoding Significance, Clarifying Meaning); 2) Analysis (Examining Ideas, Identifying Arguments, Analysing Arguments); 3) Evaluation (Assessing Claims and Arguments); 4) Inference (Querying Evidence, Conjecturing Alternative, Drawing Conclusions); 5) Explanation (Stating Results, Justifying Procedures, Presenting Arguments); 6) Self-Regulation (Self-examination, Self-correction). Critical thinking like this requires students to be engaged actively in the process of conceptualising, applying, analysing, synthesizing, evaluating, and communicating information (Richard & Elder, 2007; Vieira & Tenreiro-Vieira, 2016). Evidence of higher-order competences is usually related to the context of the learning environment and to an effective teaching presence that encourages participation and triggers immersive dialogue and discussion (Garrison & Cleveland-Innes, 2005).

In our case, we were specifically interested in developing critical analysis competency to mobilise students' critical thinking abilities, broadly using Ennis' (1987) taxonomy: (i) to judge the credibility of a source, for example, through the selection of a press cutting; (ii) to identify where clarification was needed during the process of understanding the aims and the scope of the research; (iii) to determine inferential abilities during the evaluation of evidence, research outputs, and the scientific article's recommendations; (iv) to identify the strategic and tactical abilities, described by Ennis (1987) as 'deciding on an action' and 'interacting with others'.

Formative feedback in higher education has positive effects when it facilitates the development of students' reflection and self-assessment in learning (Quinton & Smallbone, 2010). However, the increasing pressures of workload on university teachers make the design of formative feedback strategies more difficult to implement in higher education. The main aim of this study has been to design teaching strategies for appropriate written formative feedback on this analytic task to foster innovation within the constraints of an established undergraduate biology programme, despite the well-known difficulties of doing so. Our work entails close interdisciplinary collaboration between two educational researchers and one Biology teacher from the Department

of Biology of the University of Aveiro. This is just one component of a long-standing project (since 2008) focused on promoting academic development and growth in higher education specifically, in our case, in Portugal. Our work has provided a strong understanding of the dynamics of student-generated questioning, inquiry-based learning and associated academic practices (Pedrosa-de-Jesus et al., 2012; Pedrosa-de-Jesus, Guerra, & Watts, 2016).

One of the assignments in the semester on evolution challenged both teacher and students: the 88 first-year students were encouraged to produce a critical scientific analysis of the press cutting. Needless to say, this required both an understanding of the science involved, and a capacity to see where the press cutting had either 'managed' or 'mismanaged' the news item.

In this paper we: (1) describe the teacher's written formative feedback during the assignment process; (2) evaluate and discuss the quality of teacher's feedback towards the development of students' critical analysis; (3) analyse the teacher's perceptions of what constitutes good feedback in this context.

THEORETICAL BACKGROUND

Feedback: Possibilities and Constraints

Feedback is considered to be one of the most influential factors in the improvement of learner achievement. There is now a strong degree of consensus as to what constitutes effective feedback practice, particularly where assessment is considered as an integral aspect of teaching (Evans, 2012). For instance, Hattie and Timperley (2007, p.102) consider that feedback typically occurs "… after instruction that seeks to provide knowledge and skills or to develop particular attitudes", and Nicol, Thomson and Breslin (2014) think that feedback has positive effects when it facilitates the development of students' reflection and self-assessment in learning. Providing clear requirements for participation, and ensuring approaches to assessment and feedback are congruent with intended learning outcomes, are both important design goals (Orsmond & Merry, 2011).

Figure 1 presents the outline derived from a study by Tunstall and Gipps (1996). Feedback may be evaluative (that is, judgemental) or descriptive (task-related). This results in four types of feedback (A, B, C and D) across a continuum, representing evaluative-descriptive approaches to assessment. Thus, evaluative feedback types are: A1: Rewarding; A2: Punishing; B1: Approving; and B2: Disapproving. Descriptive feedback types are: C1: Specifying attainment; C2: Specifying improvement; D1: Constructing achievement; and D2: Constructing the way forward (Tunstall & Gipps, 1996).
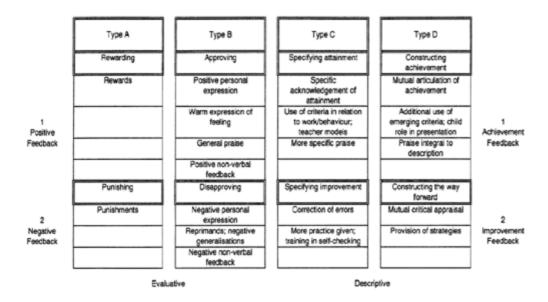
Figure 1. Teacher Feedback Typology: A Summary (Tunstall & Gipps 1996, p. 392)

We describe our adaptation of this model later. Within the original model, Evaluative feedback includes the teacher's criticism about the assignment (both positive and/or negative), while Descriptive/Constructive feedback presents teacher' questions for reflection, aspects that could be improved and suggestions that can lead to the improvement of the critical analysis. Within evaluative types of feedback, judgements are made according to explicit or implicit norms. Within descriptive types, feedback more clearly relates to students' actual competence. Therefore, Type C feedback shows a mastery-oriented approach to formative assessment and focuses on the idea of work as product, while type D feedback emphasises process aspects of work, with the teacher playing the role of facilitator, rather than evaluator (Willian, 2011, p. 7).

The way a student interprets written feedback comments will also affect what impact the assessment has on learning: praise is not always interpreted in a positive light, just as criticism is not always interpreted in a negative light (Kingston, 2009). And feedback can engender strong emotions (Värlander, 2008). Too often, feedback focuses on failings rather than achievements and can sap students' confidence levels. Positive feedback brings fewer problems, it is the feedback on unsuccessful work that causes most difficulty to staff and students alike (Peelo, 2002). Going further, Askew (2000) describes co-constructive feedback as a type of feedback with the following characteristics: dialogic, democratic, bi-directional, of sharing responsibilities, reflective, situated, metacognitive, formative, problem solving, enhancing learning. This very close to the 'generative academic feedback' model we favour, where teacher- or peer-feedback generates learning that both applies to the immediate task, and also transcends it (Peelo, 2002). This broader, greater goal of feedback picks up from Tunstall and Gipps's type D feedback, and lies in generating an ethic of excellence (Berger, 2003), of staff and students striving to attain 'critical being' (Barnett, 1997).

In this sense, besides the relevance of the teacher's role in providing oral and/or written feedback, it is vitally important that students engage and use feedback. In an important sense, no one can be 'forced' to accept help and so the 'quantum' of feedback needs to be of the right dimensions, at the right level, in the right tone and at the right time to be helpful. Feedback, therefore, should be apt and effective for both teachers and students if both are to prosper in their academic communities. Feedback strategies can stimulate students' motivation to learn in an academic context (Ivanic, Clark, & Rimmershaw, 2000). In fact, when receiving formative feedback on their work, students can deal with their difficulties and improve the next element of their assessed work (Black & Wiliam, 1998; Hattie & Jaeger, 1998; Race, 2005).

Race (2005) has already presented several aspects often referred to as 'feed-forward': details of what would have been necessary to achieve better marks or grades, expressed in ways where students can seek to improve their future assignments or answers; direct suggestions for students to try out in their next piece of work, to overcome problems or weaknesses arising in their last assignment; suggestions about sources to explore, illustrating chosen aspects of what they themselves are being encouraged to do in their own future work.

However, an increasing pressure of workload of university teachers makes the design of formative feedback strategies more difficult to implement in the context of higher education (Black & Wiliam, 1998; Yorke, 2003). University teachers find it difficult to spend sufficient time responding to students and their particular problems; the assessor's time and resources are usually constrained (Race 2005). They stated that producing formative feedback on students' assignments demands considerable effort and may not lead to learning improvements (Crisp, 2007). Externally imposed time constraints due to the reduction in course duration may interfere with the 'feedback loop' (Sadler, 1998) or 'loop of reflection' that is formative assessment (Knight & Yorke, 2003). The danger of a focus on written feedback is that students will often misinterpret the comments as facts to be adhered to, rather than queries to be addressed, and so a key element of the feedback process is lost as the feedback loop is never complete (Gibbs & Simpson, 2004). One possible solution to these problems is to expose students to the whole databank of comments from which their own specific comments derive (Nicol, 2010). Feedback strategies could change in style, purpose, meaning and processes as they move from evaluation to description.

Students often report that they do not understand written feedback comments and/or that the comments they receive do not meet their needs and/or do not help to clarify areas that they do not understand (Nicol, 2010). They also declare that the best way to enhance written feedback would be to support this with one-to-one meetings with the teacher. Adapting individual comments to the students' needs, especially when student numbers are large and personal contact is limited, is a particular constraint that university teachers face in designing feedback strategies (Nicol, 2010). Many teachers find it less satisfactory putting feedback into a written format than when giving feedback in face-to-face contexts (Race, 2005). Tuck (2012) makes the point that the 'lived experience' of academic teachers as they engage in feedback has received relatively little attention compared to student perspectives. Her participants sometimes managed to reconcile conflicts between the need for dialogue with students, and the institutions pressures that inhibit such personalised approaches, to 'carve out' small spaces for dialogue with students.

Although all agree that it is essential to optimise feedback if we want to improve the quality of learning, this concise review shows several contextual constraints. Our study, as referred earlier, attempts to present some concrete suggestions of formative feedback, evaluating the consequences, in particular on students' critical thinking.

Innovative Formative Feedback and Assessment Strategies

As noted above, our study took place in the teaching context of 'evolution' (2nd semester of 2012/2013) at the University of Aveiro. The curricular unit was organised in 2-hour per week lectures, lab sessions (2 hours per week) and theoretical-practical sessions (1 hour per week). The learning tasks and the assessment rules were established from the beginning: 85 percent for the final written exam and 15 percent for the critical analysis group work. Table 1 shows the curricular unit lectures timeline together with the students' assignment task (critical analysis).

Table 1: Curricular Unit Lecture Time-line

Context/ date		Assignment/Teacher's feedback
Face-to-face sessions	20 February 2013	Lecture/Debate
	27 February 2013	Lecture/Debate
	6 March 2013	Lecture/Debate
	13 March 2013	Lecture/Debate
	20 March 2013	Lecture/Debate
	3 April 2013	Lecture/Debate
	7 April 2013	Group work final composition and selection of the press note for analysis
	10 April 2010	Lecture/Debate
Autonomous work	21 April 2013	First teacher's written formative feedback (about 1st task – April 7th)
	5 May 2013	Students' handing of the first version of critical analysis
	19 May 2013	Final teacher's written formative feedback of critical analysis (2nd task- May 5th)
	22 May 2013	Final written exam
	10 June 2013	Handing over the final version of the critical analysis together with students' group written feed-forward

During one week's lectures, the teacher organised several debates around the theme of evolution, the aim being to confront students with controversial ideas about the concept, along with attempting a collaborative definition of this scientific concept. The students' discussions were under the teacher's guidance/ supervision, and had scientific literature support (such as book chapters and papers) available on Moodle and Diigo (web 2.0 tool). As noted, our study was focused on the analysis of the feedback produced along one of the assignments, that is, the written critical analysis, scientifically supported, of a selected press release.

As suggested by the teacher, the 88 undergraduates organised themselves in 21 groups (of 2 to 4 students). During their autonomous work, each group selected an article from newspapers, books or Internet blogs. A supporting learning tool called 'Guidelines' was designed, aimed at supporting the process of critical analysis of evolution. This learning tool was organised like a scientific article, where groups had to write an abstract, an introduction, and specify the materials and methods, present results and discussion, draw conclusions and a list of references. The document also had a brief explanation and some guiding questions in each of the sections and formatting requirements. A word limit of 1000 words was stipulated, approximately 4 pages.

The group work was supported mainly by the teacher's written feedback, by e-mail, and an evaluation grid developed in Excel form. Written comments included questions for reflection, suggestions for improvement (i.e. further reading) and also critical observations. Students had to submit the final assignment having taken account of the teacher's written feedback. All students had also self-assessed their performance in the course of their group work using online questionnaires (individual and group assessment). They had to score either their own performance or each colleague, about the process of group work of each critical analysis.

METHOD

The study was organised in two phases: first, to design and implement strategies for formative feedback and assessment aimed at encouraging students' critical thinking within a curricular unit; second, to collect actors' opinions about those processes in order to evaluate their perceived efficacy. The research approach was based on a critical social paradigm, assuming principles of action-research (Cohen, Manion, & Morrison, 2013). In this study action research implied that the two educational researchers collaborated with the Biology teachers in identifying research problems, their causes, and possible forms of intervention. Our collaboration has followed a co-researchers model (Macaro & Mutton, 2002), which allows each participant to benefit from the enterprise. Consequently, the researchers had the opportunity to undertake research in natural teaching-learning settings. The teacher in this instance was part of a wider study (Pedrosa-de-Jesus, Guerra & Watts, 2016) and volunteered to open his teaching to observation and discussion. He was using the curricular unit 'Evolution' to analyse and evaluate new approaches to teaching and learning in a supported way. Data were collected through naturalistic 'low-participant classroom observation' during informal contacts with the teacher (before or after classes). All written documents were used for analysis, particularly the teacher's written feedback. Semi-structured interviews were undertaken (at the end of the semester) with the teacher. We used content analysis

(Bardin, 1977; Neuendorf, 2016), together with the adapted Tunstall and Gipps (1996) feedback typology (see Figure 1). Table 2 provides the description of each type of feedback.

We assumed that specifying attainment and improvement (Type C) shows a mastery-oriented approach to formative assessment and focuses on the idea of work as product, while Constructing achievement and the way forward (type D feedback) emphasises process aspects of work, with the teacher playing the role of facilitator, rather than evaluator.

Table 2: Quality Feedback for Critical Analysis (Adapted from Tunstall & Gipps, 1996)

First feedback	Category	Indicators	Description
A. Evaluative feedback	A.1 Positive feedback	A.1.1 Approving	To approve students' work or engagement
	A.2 Negative feedback	A.2.1 Disapproving	To disapprove of student's work or behaviour
B. Descriptive/ constructive feedback	B.1 Achievement feedback	B.1.1 Specifying attainment	To identify and label aspects of successful attainment
		B.1.2 Specifying mistakes/failures	To identify mistakes/ failures in work performance
		B.1.3 Constructing achievement	To specify how something that is being learned can be corrected.
	B.2 Improved feedback	B.2.1 Specifying improvement	To shift the emphasis more to the student's own role in learning, where teacher is as 'facilitator' rather than 'provider' or 'judge' of feedback.
		B.2.2 Constructing the way forward	To give student greater responsibility to make choices for themselves, instead of telling student what to do to improve.

In order to ensure the quality and reliability of the validation process, the clarity and efficiency of the categorization framework was discussed with an international educational researcher, who was also a team member of this study. This researcher was invited to validate the categorisation of few selected examples. Then, a face-to-face session was undertaken in order to discuss the major difficulties in interpreting the categories and applying the coding system. Some suggestions were taken in consideration and the external researcher considered the instrument as appropriate and innovative for the data analysis.

RESULT & DISCUSSION

Teacher's Written Formative Feedback and Assessment

Table 3 gives an example of the teacher's written feedback with Group 1 at different moments of the critical analysis process (initial, intermediate and final). Concerning the Evaluative feedback dimension (A) written feedback was mainly focused at the beginning of the assignment (press note selection and group work organisation - April 6th). Descriptive feedback (B) was used during the intermediate and final phase of the critical analysis process. This single example also shows that teacher's written feedback was more focused on identifying and amending mistakes, giving clues to improve the group work.

Table 3: Examples of Teacher' Written Feedback to Critical Analysis of Group 1

First feedback		Intermediate feedback		5 May	Final feedback	
3 April	**6 April**	**19 April**	**21 April**		**19 May**	**2 June**
Group Definition of group composition and selection of the press notes for analysis	**1st teacher written feedback: (A.1.1); (B.1.1)**	1st Group feed forward	**2nd teacher written feedback: (B.1.1)**	Group Delivery of the first version of critical analysis	**3rd teacher written feedback: (B.1.1); (B.1.2)**	Group Delivery of the final version of critical analysis 2nd Group feed forward

The same sort of analysis was used for the whole of the teacher's feedback to the remaining groups (21 groups in total). Table 4 shows the result of the total feedback occurrences in each category, giving an idea of the frequency and the 'quality' of teacher's written formative feedback. To enhance consistency, all feedback categorisation was carried out during a one-week period by a single researcher.

Table 4: 'Quality' of Teacher's Written Feedback during Group-work

Categories of Teacher's written feedback	Moments of Teacher-Group Interaction		
	First	Intermediate	Final
A. Evaluative feedback			
A.1 Positive feedback			
A.1.1 Approving	20 groups	1 group	0
A.2 Negative feedback			
A.2.1 Disapproving	8 groups	0	0
B. Descriptive feedback			
B.1 Achievement feedback			
B.1.1 Specifying attainment	3 groups	1 group	18 groups
B.1.2 Specifying failure	2 groups	1 group	21 groups
B.1.3 Constructing achievement	18 groups	6 groups	21 groups
B.2 Improved feedback			
B.2.1 Specifying improvement	1 group	0	0
B.2.2 Constructing the way forward	0	0	0
Total	**52**	**9**	**60**

Table 4 shows that, at the first moment of interaction, the teacher wrote 58 'feedback statements': 20 positive (approving), 8 negative (disapproving), 23 achievement (Specifying attainment, Specifying failure, Constructing achievement) and 1 improved feedback (specifying). By contrast, at the final moment of interaction, he wrote 60 statements, all of them descriptive feedback. That is, a more constructive and positive form of achievement feedback. During the group-work process (intermediate moment), the teacher wrote 8 feedback statements, most of them in a positive mode. The following examples illustrate some of this feedback written interactions during the first moment:

A.1.1- "O.K. your theme is already registered. Good choice." [Positive feedback - approving - Group 10].

In 33 % of the situations (7 groups), "teacher's negative feedback" was related to group composition. For instance, some groups did not sign in and send the compulsory 'code of conduct' outlining students' responsibility and ethical commitment within the work:

A.1.2 - "Concerning the group composition we are having a problem: one of you did not send the Code of Conduct as established on the assessment rules." [Negative feedback - disapproving-   Group 13].

Just one group received negative feedback concerning the selection of the press note. However, the teacher, in a constructive manner, specified the problem stressing that the content of the press note did not fit the topic of 'biological evolution'. Additionally, he also questioned the credibility of the source of information. Above that, he emphasised the students' important role on their autonomous learning. In fact, according to Ennis, (1987), the 'bases for a decision' implies the development of students' critical thinking abilities, such as 'Judge the credibility of a source'. The following excerpts show examples of what we have been discussing above:

A.1.2 -: "It seems to me that your choice of text could give you considerable headaches to elaborate a critical analysis". [Negative feedback - disapproving - Group 3].

B.1.2 - "The press note you have chosen, in my opinion, it is a little on the side of evolution". [Achievement feedback - Specifying failure - Group 3].

B.2.1 - "You should have already thought about your choice, knowing how you are going to discuss the 'news', therefore how to write the critical analysis. So I'm not saying that you should find another text… However, I think the theme is not going to help you… But I believe that you are going to demonstrate that I'm wrong." [Improved feedback - Specifying improvement - Group 3].

The teacher identified aspects of successful attainment from three groups. For instance, Group 7 selected a press note with strong potential for group discussion. Much of the scientific information presented in the text showed the main controversial aspects of evolution theories:

B.1.1- "Concerning the theme, it seems to me that it has a lot of potential for discussion. It is a big challenge because most of the information presented has already been changed/ developed/ replaced…but, for this reason, it will be a challenge for the group." – [Achievement feedback - Specifying attainment - Group 7].

Eighteen groups (86 %) were advised to search for the scientific article that gave rise to the press notes, for instance, write to the authors:

B.1.3 - "My suggestion is that you should find the original scientific article that give rise to the press note. One suggestion is to write to the authors…" [Achievement feedback - Constructing achievement - Group 11].

During the intermediate teacher-group interaction moment, six groups requested further written feedback. For instance, as a consequence of the written feedback, Group 3 decided to select another 'press note' for their critical analysis. This could be seen as a positive consequence of the first teacher-group interaction, explained above. For this case, the teacher approved their new choice:

A.1.1 – "It seems to me that you made a good choice". [Positive feedback - approving - Group 3].

Although they had a supporting learning tool (Guidelines for a critical analysis of a topic of evolution) as noted earlier, Group 5 had a need for additional clarification, such as how to make an abstract:

B.1.3 - "The abstract should reflect your critical analysis. Your critical analysis should follow the structure of a scientific article. In this case, the abstract also synthesize the entire article. What I want, when I am reading your abstract, is to have a general idea of what you did in the critical analysis." [Achievement feedback - Constructing achievement - Group 5].

After delivering the first version of the work, the teacher sent his final written feedback to individual groups. Broadly speaking, this last teacher's formative written feedback revealed a prevalence of the following within categories: "B.1.1 - Specifying attainment" (18 groups); "B.1.2 - Specifying failure" (21 groups); and "B.1.3 - Constructing achievement" (21 groups).

The next example illustrates a positive feedback concerning the adequacy of the critical analysis:

B.1.1 - "In general, the "Abstract", the "Introduction" and "Results and Discussion" are well done. Congratulations." [Achievement feedback - Specifying attainment - Group 12].

However, all groups showed some sort of difficulties to write their critical analysis according to the teacher required Guidelines. So, the teacher identified mistakes/failures of some kind in groups' work performance:

B.1.2 – "In my opinion, the main problems detected in your critical analysis are related with the "Introduction" (it did not fully frames the theme), the connection between the "Material and Methods" and with "Results and Discussion" (R &D)". [Achievement feedback - Specifying failure - Group 3].

The teacher had to be very specific on how to improve and even change/ correct the final critical analysis for the 21 groups:

B.1.3 – "The abstract should be rewritten because it does not describe the scientific study. When I am reading the abstract I must understand what is (are) the problem(s) (s) addressed (s), what was being done to address these issues and what are the main conclusions. This abstract does not do that." [Achievement feedback - Constructing achievement - Group 1].

The overall results show the low frequency of 'improved feedback' envisaging future assignments, such as 'B.2.1 - Specifying improvement' and 'B.2.2 - Constructing the way forward'. This means that, not enough suggestions were provided as to how to improve future assignments in order to promote the development of students higher order competences, such as, questioning and collaborative work.

As referred earlier, it was defined from the beginning that the written critical analysis group work should have 15% of the final marks. Table 5 shows the assessment results of all groups (21), involving 88 students. Students from the same group have the same assessment grade.

Table 5: Assessment Results of the Critical Analysis

Critical analysis [0-3]	n° of Groups	n° of students	% of students
1,9	1	4	5%
2,1	4	15	17%
2,2	1	5	6%
2,3	1	3	3%
2,4	1	5	6%
2,5	1	5	6%
2,6	4	19	22%
2,7	5	20	23%
2,8	1	5	6%
3,0	2	7	8%
Total	21	88	100%

These results show the great involvement of all students despite this being the first time of using this kind of assessment learning task. The global marks were very positive indeed and had, in turn, a positive impact in their final grade on the discipline. Approximately 65% of the students (56) had a minimum of 2.5 values, with two groups having the maximum grade (3 values). The remaining groups (8) were scored between 1.9 and 2.4 values, where only one group had the lowest score (1.9).

The Teacher's Opinions

The teacher's perceptions were collected through a semi-structured interview at the end of the semester. The content analysis allowed identification of important text units, and these were clustered to identify general and unique categories (Cohen, Manion, & Morrison, 2013).

Regarding the innovations introduced in the teaching and learning practices, the teacher confirmed the fact that it has been the first time he has implemented written group's formative feedback by using a critical analysis development process:

- Compared to previous years, this year... in quantitative terms ... I have maintained three values (15%) for the critical analysis. However, some 'nuances' were introduced, particularly the kind of feedback I have sent to groups. In some of

the situations, I made suggestions for changing, in other cases, I even wrote that they should amend or re structure specific sections of the critical analysis. So, I gave some feedback, playing the role of a referee for this critical analysis. And, so, this part did not exist in previous years.

However, he also stated that sending formative feedback to 21 groups involved a huge effort, not only from the point of view of the time spent, but also in the identification of mistakes, and the design of the questions and suggestions for improvement:

- This feedback exercise involved a lot of work to the teacher. Because.... the feedback was given as follows: I made an overall assessment... therefore, I had an Excel sheet for each group where a general review of the critical analysis was registered and then I reviewed, in detail, the entire critical analysis. Each document handed in has x text lines and each of my comments were reported to line y or z. Those comments really, in my perspective, were made in order to improve the groups' critical analysis, sometimes aiming at a better 'speech articulation', a better prose. Other times, I simply asked for a better scientific support of their statements. Frequently, I also advised them to add references supporting what they were saying in the critical analysis and, therefore, this gives me some work".

On what concerns the efficacy of this task, the teacher considered that it allowed him to develop various students' competences, such as the selection and evaluation of scientific information, and the group work collaboration:

- Well, I think that this activity promoted students' critical reflection. On the other hand, it also promoted the collaborative group work, since, as you know, the groups could go up to five elements. And therefore only for that it was worth it.

Furthermore, he considered that the self-assessment process could be integrated in the students' summative assessment, making it of mandatory character:

- The self-assessment is also very important. Some students were extremely objectives when doing their own critical analysis. Some even said: that peer/ colleague only saw the text at the end. Anyway, here we have some critics and I think that this experience was extremely important for students at this stage. However, the fact of knowing how to work in group, accepting the others opinion ... and that is not always easy. To develop/write text documents, to search ... I think it was worth   for all of this.

Also, the teacher stressed how important it is to involve groups during the critical analysis feedback process. He considered that it helped to develop several students' competences, such as argumentation:

- In the end, it was not necessary for students' agreement with my suggestions and opinions, they could disagree with me. However, it was required that they prove/justify their opinion and some groups were looking for extra bibliography in order to argue against what I was saying about their critical analysis.

When asked about new developments for the following academic year, teachers stated that it will be important to continue implementing this kind of learning activity, providing the same sort of guidelines and suggesting scientific bibliography aiming at promoting students critical thinking. Regarding the teacher's role during this process, he considered the importance of   acting as a non-participant observer during the group work to collect additional information about their learning process (i.e. using distance web tools):

- If I had the opportunity to be a non-participant observer, when groups were developing their critical analysis, I think it would be extremely interesting for me in order to understand the dynamics of some groups. Obviously, they probably would not feel comfortable with the teacher looking at their work and listening to them   I have the idea that most of the work was developed during the evening interacting through distance web tools, email, etc... I also think ... that the group did it because they had no opportunities to meet. However, I consider that it is also important to know how to use all these new web tools.

When questioned about the influence of this type of teaching and learning strategy on his academic practice, he stated that it was very useful since it helped him to better align teaching with learning outcomes, therefore changing the way he taught "Evolution ":

- As a teacher, these strategies are extremely pleasant since I'm going to the lectures always taking something new. I'm not going just to transmit knowledge for students to memorise and then they go to the exam ... no ... this is a deliberate strategy having a specific purpose, where   all the intermediate steps are planned in order to maximise the final result [the students learning outcomes]. Therefore, this is what I most value in these strategies being develop during this curricular unit as a result of   this collaboration.

CONCLUSION

The overall results show the very considerable involvement of the teacher and all the students. Although the teacher stressed, during the interview, his enormous effort in carrying out written feedback for 21 groups, over a 10-week period, he also faced this strategy as a personal challenge and recognised several benefits for students. As Tuck (2012) indicates, attempts to create greater opportunities for such work, by offering greater support and recognition at institutional level, must take account of teachers' need for a sense of personal investment in student writing in their disciplinary contexts. It must also be acknowledged that some students seem to want virtually continuous feedback (Scott, 2014), with the expectation on the part of students that they should be able to gauge their progress throughout the course – not least because they tend to be 'digital natives' of the net generation (Prensky, 2001).

The students' overall quantitative marks were very positive indeed and, as noted, had a positive impact in their final grade in the discipline. Data show that teacher's written comments increased opportunities for students to search for further information, to negotiate and take decisions within their group, to auto- and hetero-reflect before sending their critical analysis to the teacher. This is a very positive set of results in the development of critical analysis and thinking, the teacher commenting on his perceptions of a strong growth in students' competencies. That said, there was an implicit assumption that students know how to use teacher feedback for future work. The teacher's priority, however, seemed to be aimed at the immediate final product, therefore valuing Achievement feedback (B.1). In this sense, the teachers may have to make students aware of this direct objective explicitly, so that they understand this as the first aim of the learning task.

Group work also created conditions for the development of higher-order competences, such as critical thinking, collaboration and argumentation. Students' most common difficulties here were related to group organisation issues such as different schedules, compatibilities and commitment were identified. This is not unexpected, given that any group work can cause organisational complexities and there will almost always be differences in student motivation and engagement.

The main findings of this study allow us to present some suggestions and recommendations for teachers interested in implementing concrete feedback strategies in higher education, particularly to promote teacher' written formative feedback in the context of undergraduate studies and assessing their effectiveness. The main suggestions are as follows, to: i) decide the type of formative feedback that accords best with the nature of the learning task being designed, and the appropriate moments in the process to give feedback; ii) discuss with students the purpose of written feedback in order to reach a common assessment understanding, and (iv) value students' peer and self-assessment, as part of the whole learning process. Table 4 could provide suggestion as to how to clarify different modes of feedback in order to develop students' higher order competences such us critical thinking. There was much time and effort invested by all participants (teacher and students) so there was an obligation to attain this goal.

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