Teacher Development: A Patchwork-Text Approach to Enhancing Critical Reflection in Veterinary and Para-Veterinary Educators

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ABSTRACT

Reflection is an essential component of teacher-development programs, and reliable, valid methods to teach, assess, and evaluate reflection are critical. However, it is important that appropriate methods are created for and evaluated across multiple disciplinary backgrounds, as the participants' backgrounds are a major factor in the development of critical reflection. The patchwork-text approach is a narrative process that is predominantly focused on the personal development of the individual. The current study used the patchwork-text approach for the development of reflection in participants with a science background who had not used a reflective approach for personal development before. Twenty summative essays and 103 formative essays from 21 participants who underwent a 1-year higher-education teacher-development program were analyzed to assess whether the quality and quantity of reflective writing was enhanced through a regular, iterative process of reflective writing with feedback. The analysis of the essays involved the use of a predefined set of criteria for identifying the different reflective levels from 1 to 4 and the calculation of a reflective score to evaluate the overall development. The results show a clear improvement of higher-level critical thinking as the participants progressed through their course. Higher levels of reflection were achieved particularly where a unit focused on a familiar area for the participant as opposed to one in which the participant had less experience. The analysis provides evidence that the patchwork text is a useful method for development and evaluation of reflection in participants with a veterinary/animal-science base.

Key words: assessment of reflection, critical reflection, higher education, patchwork text, post-graduate certificate in veterinary education

INTRODUCTION

Recognition that all teachers should be trained for this important role has led to formal post-graduate certificates for teacher training in higher education (HE) becoming standard in many universities around the world.[1,2] This has resulted in a steady increase in theoretical knowledge related to such programs,[3] with well-defined criteria intended to support those designing post-graduate certificate courses.[4] One of the key concepts that have been identified as essential in Australia, New Zealand, and the UK is the development of the reflective practitioner, based on Schön (1983).[3] The reflective practitioner is grounded on the notion that professionals need to learn to frame and reframe complex and ambiguous problems during practical situations (reflection-in-action) or after an activity (reflection-on-action); both forms result in reasoned judgments and ways to act.[5] During the teacher-development process, the use of reflection-on-action is encouraged to analyze one's own concerns and to help inform practice through the integration of personal experience.[6] This suggests that exploring one's own experiences within the context of new knowledge and theories can lead to new understandings and continuous improvement.[7,8] The concepts offered by Hatton and Smith[6] are particularly relevant to HE teacher development as they refer to the extent to which reflection is related to action, the time frame within which reflection occurs, problem centeredness, and contextual beliefs and values. Reflection is also considered essential to the development of undergraduate students, such as those training to be health care professionals,[9] as lifelong learners. Therefore, developing reflective practice in veterinary and para-veterinary teachers benefits their practice directly and gives them a broader understanding regarding how to develop these skills in their students.

Developing reflective practitioners is not an easy task. Many struggle to identify the difference between *thinking* and *purposeful reflection*.[10] Academic reflection is not a random thought process but, as defined by Dewey, an

"active, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends."[11(p.6)] Participants from science-based disciplines find reflection particularly difficult,[3] considering the process of reflection to be subjective and concluding that it is an inappropriate method through which to contest knowledge. For some participants, their disciplinary training has led them to expect evidence-based, right-or-wrong answers to the problems they encounter in teaching and learning.

There are numerous methods that aim to cultivate reflective activity in practitioners, including personal diaries and portfolios.[12] Another approach that is emerging is the patchwork-text approach[13,14] as a popular form of learning and assessment for developing integrated, deep understanding and critical self-analysis.[15] This narrative, developmental approach is based on students writing "patches" (short essays) at regular intervals and the tutors giving individual feedback. At the end, the students write a final summative piece that is "stitched together"[14(p.112)] like a patchwork quilt from several individual patches. The Postgraduate Certificate in Veterinary Education (PGCertVetEd) developed at the Royal Veterinary College (RVC), UK, uses a variant on the patchwork-text formative and summative approach that has been adapted to scientists. This approach should contribute to an incremental improvement of reflection due to the benefits of ongoing formative feedback tailored to learner needs.[14] The patchwork-text approach has been used to develop teachers' reflective activity in multiple disciplines, including science,[16] and is considered to be an application of assessment *for* learning as opposed to assessment *of* learning.[17,18] The approach is perceived as valuable; however, currently there is no consensus on how to evaluate the different levels of reflection using the patchwork-text approach.

Various approaches have been suggested to categorize different levels of reflection. The hierarchical classification developed as three types of reflection from technical (level 1) through to practical (level 2) and critical (level 3)[19] and was later expanded to the widely used four levels of classification.[6] These four levels of classification[6] are particularly useful in assessing reflective writing as the categories of descriptive writing (level 1), descriptive reflection (level 2), dialogic reflection (level 3), and critical reflection (level 4) conform easily to a grading rubric. The differences between reflection on process and reflection on content are key in the scale developed by Kember,[20] which also recognizes transformation in perspective as the highest level of reflection. This paper adopts the Hatton and Smith[6] criteria because it is framed within the context of teacher development and therefore is the most relevant to the current project.

The main goals of this project were to investigate whether the patchwork-text approach can be used to (a) develop reflection in the participants of an HE teacher-development program (PGCertVetEd in the RVC) who have not used a reflective approach for personal development before and (b) explore whether reflection could be graded using the patchwork text as an assessment approach for teacher development in veterinary, para-veterinary, and animal-science educators.

METHODS

Participants

The study population consisted of 21 participants, all of them practitioners in veterinary education: nurses, clinicians, lecturers/professors, and staff in academic management. All participants had undertaken the PGCertVetEd in the RVC. Prior to commencing the research, the RVC was granted ethical approval, following which consent was obtained from all the participants who did the Principals and Practices in Veterinary Education (PPVE) module in 2010–2011 to use their patchwork texts (reflective writing) for the purposes of research.

Patchwork-Text Data Set

The PPVE, the first module in the PGCertVetEd, consists of five units delivered consecutively over 5 months. Participants submitted a monthly patch at the end of each of the five units in the module, equating to a total of five formative written patches over the course of the module. With the exception of the final patch where they had a free choice of theme, they chose a title for each patch from a list of two or three titles. The patches submitted were 800–1,000 words long, and each participant received formative, personalized feedback from their course tutor within 2 weeks of the submission date. At the end of the module, the participants were required to write an integrated reflective essay consisting of 2,500 words, which was evaluated by a summative assessment.

The data set consisted of a total of 103 formative patches (800–1,000 words each) and 20 summative integrated essays (2,500 words each). The data set was made anonymous and assigned random numbers to eliminate bias. The main researcher (HM) was therefore unaware of the authors of the patches, the order in which the patches had been written, and the stage in the course at which they were written. The second researcher's (KM's) role was to determine the consistency of criteria application and inter-rater reliability and also, through discussion, to increase the criteria's suitability for being used to make judgments.

Data Analysis

The two independent researchers in the study analyzed the final data set from the 21 participants. The approach chosen for analysis of the data set involved the use of a predefined set of criteria (instructional rubric modified from Hatton and Smith[6]) for identifying the different reflective levels. The criteria identified four levels of reflective writing designated as descriptive writing (level 1), descriptive reflection (level 2), dialogic reflection (level 3), and critical reflection (level 4), based on Hatton and Smith.[6]

To test empirically the predefined set of criteria and determine inter-rater agreement, a pilot sample of 10 patches was marked independently and assigned different levels of reflection by the main and secondary researchers.

Box I: Modified criteria (words in italics have been added) for grading reflection (based on Hatton and Smith[6])

Level and criteria

Level 1: descriptive writing
- Not reflective
- *Pure* description of *facts, theory, or* events that occurred/report of literature
- No attempt to provide reasons/justification for events
- *No analysis or opinion*

Level 2: descriptive reflection
- Reflective: not only a description but some attempt to provide reason or justification for events or actions but in a "reportive" or descriptive way
- *Use of evaluative terms to indicate an opinion is being given (e.g., "the most important," "the best," "significant"), but little analysis of how and why they have formed a stated opinion*
- May be recognition of multiple perspectives in the literature, *but with no attempt to analyze the underlying concept; in particular, if one view is chosen, no attempt is made to identify this "superior approach" by rational argument*

Level 3: dialogic reflection
- Demonstrates a "stepping back" from the events/actions leading to a different level of mulling about the experience, discourse with self, and exploration of the experience, events, and actions using possible alternatives for explaining and hypothesizing
- *Multiple perspectives (either from own experience or the literature) are represented, but typically these assume a rather narrow view of the situation itself*
- *Attempts are made to justify an action by referring to personal belief or to an identified authority; may use personal opinion and prejudices rather than an evidence-based approach to problem solving*

Level 4: critical reflection
- *Demonstrates an internal dialogue that arises as a result of evidence gained from personal experiences, is contextualized and informed by theory, and links uniquely to the student's world*
- *An issue is viewed in several different ways (from multiple perspectives), the evidence is analyzed critically, and either a choice/ judgment is made between actions, or what has been discovered is integrated into a better understanding of the issue*
- *Shows an awareness of personal assumptions and makes a rational and informed evaluation of the consequences of his/her actions*
- *Attempts to identify a superior approach from a range of possibilities and give well-defended theoretical and/or practical reasons for his/her choice (i.e., makes a judgment)*
- *Discusses implications for personal development (i.e., a better understanding of the problem) and/or future action*
- *Recognizes the need for new questions to be asked, leading to better understanding*

Through careful reading and re-reading of the patches, sentences and paragraphs were analyzed for their reflective qualities and were given scores from 1 to 4. On checking the patches for agreement, the following challenges were recognized:

- Despite the use of a predefined set of criteria, the researchers did not consistently assign the same levels to the patches; therefore, inter-rater agreement was only moderate.
- Borderline blurring resulted from difficulty in distinguishing between what constituted level-3 and level-4 forms of reflection.
- Difficulties were encountered in deciding what constituted a unit of reflection, with many students appearing to begin their paragraphs with descriptive writing (level 1) and to provide context followed by descriptive reflection (level 2) before moving on to the higher levels.

It was agreed that further modifications to the criteria were required to increase their appropriateness for judg-

ing reflection on teaching and learning by the group of participants. Through an iterative process of development, the issues around the unit of reflection were resolved, and the criteria were refined and elaborated to better define the four levels of reflection (shown in Box 1) and to address these initial difficulties. A paragraph was used as a unit of reflection in this analysis.

Through a cyclical process of analysis and verification between the main and the secondary researcher, complete agreement on the adapted criteria was reached. When all of the data set (103 formative patches and 20 summative integrated essays) had been analyzed, a reflective score was calculated for each patch and integrated essay. The rationale for calculating a reflective score was to give an overall score for each patch and integrated essay for comparison purposes. To calculate the reflective score, the word counts for each level recorded was first multiplied by the reflective level 1, 2, 3, or 4 and added together to get a weighted word count. The average reflective score per word was then calculated by dividing the weighted word counts by the total

Table 1: The changes to the mean reflective scores of the participants at each hand-in point

Theme	Patch no.	Hand-in point	Number of patches submitted	Average score for theme mean $+/-$ SE
Student learning	SL-1	1	18	
	SL-2	1	3	2.68 $+/-$ 0.11*
Teaching methods	TM-1	2	9	
	TM-2	2	13	
	TM-3	2	2	2.38 $+/-$ 0.14*
Integrated curriculum	IC-1	3	6	
	IC-2	3	13	1.88 $+/-$ 0.09†
Assessment and feedback	AF-1	4	3	
	AF-2	4	18	2.32 $+/-$ 0.08‡
Free choice of theme	FC-1	5	9	
	FC-2	5	9	2.86 $+/-$ 0.15*
Integrated summative essay	Int Sum	6	20	3.21 $+/-$ 0.11§

* Is not significantly different from all others
† Is significantly different from all others: $p < .01$
‡ Is significantly different from all others: $p < .05$
§ Is significantly different from all others except free choice: $p < .001$

number of words in the essay. The proportion of words at levels 3 and 4 was also recorded.

Numerical data and scores were tabulated and graphed to explore trends and differences related to participants, specific patch numbers, and patch submission order (hand-in point) leading up to the final summative integrated essay. Data on the average reflective scores and the proportion of words at levels 3 and 4 were statistically analyzed for differences between patch themes, hand-in points, and the integrated summary using the non-parametric Friedman test in SPSS.a Differences between the groups were also compared using SPSS software.

RESULTS

Two of the formative patches were not coded and one of the summative integrated essays was not used as the student deferred the assessment element of the module. Therefore, the final analysis consisted of 103 out of 105 formative patches (of 800–1,000 words) and 20 out of 21 summative essays (of 2,500 words).

Summative Essays

The mean scores for all participants at each formative hand-in point, together with the mean score for the summative integrated essay, is shown in Table 1. The scores indicate the development that took place over the course of the module. The summative integrated essays received the highest scores and were significantly different ($p < .001$) from all other patches except free choice. The formative patches handed in at point 3 (integrated curriculum) scored the lowest and were significantly lower than all the other patches ($p < .01$). The patches on assessment and feedback also had lower scores and were

significantly different from other patches ($p < .05$). Individuals performed better on patches that related to student learning and teaching methods and when they had free choice of the theme for the patch than patches related to assessment and feedback and integrated curriculum. The proportion of reflection at levels 3 and 4 showed a similar trend (Figure 1). The highest proportion was re-coded in the summative integrated essays, which were different from all other patches ($p < .001$) except free choice.

The progress through the formative patches of the five individuals who received the highest reflective scores in the summative integrated essay (the top quartile) was compared with the progress of the five individuals who received the lowest scores in the final essay (the bottom quartile) by comparing the mean reflective score for their first two patches (hand-in points 1 and 2) with the mean reflective score for the last two patches (hand-in points 4 and 5). Four out of the five top-scoring participants in the summative integrated essay showed an improvement in their reflective writing between the early and the later essays. In contrast, four out of the five low-scoring participants gained lower reflective scores in their last two pieces compared to their first two (Table 2). Examples of reflective writing from one trainee teacher (Participant 18) who showed the most improvement are given in Box 2.

DISCUSSION

The analysis showed that dialogic and critical reflection (levels 3 and 4) varied over time and were highest in the final summative integrated essay. Qualitative data revealed that there was a transition from general thinking to reflective thought underpinned by evidence.[11] The results presented and discussed here offer qualitative and
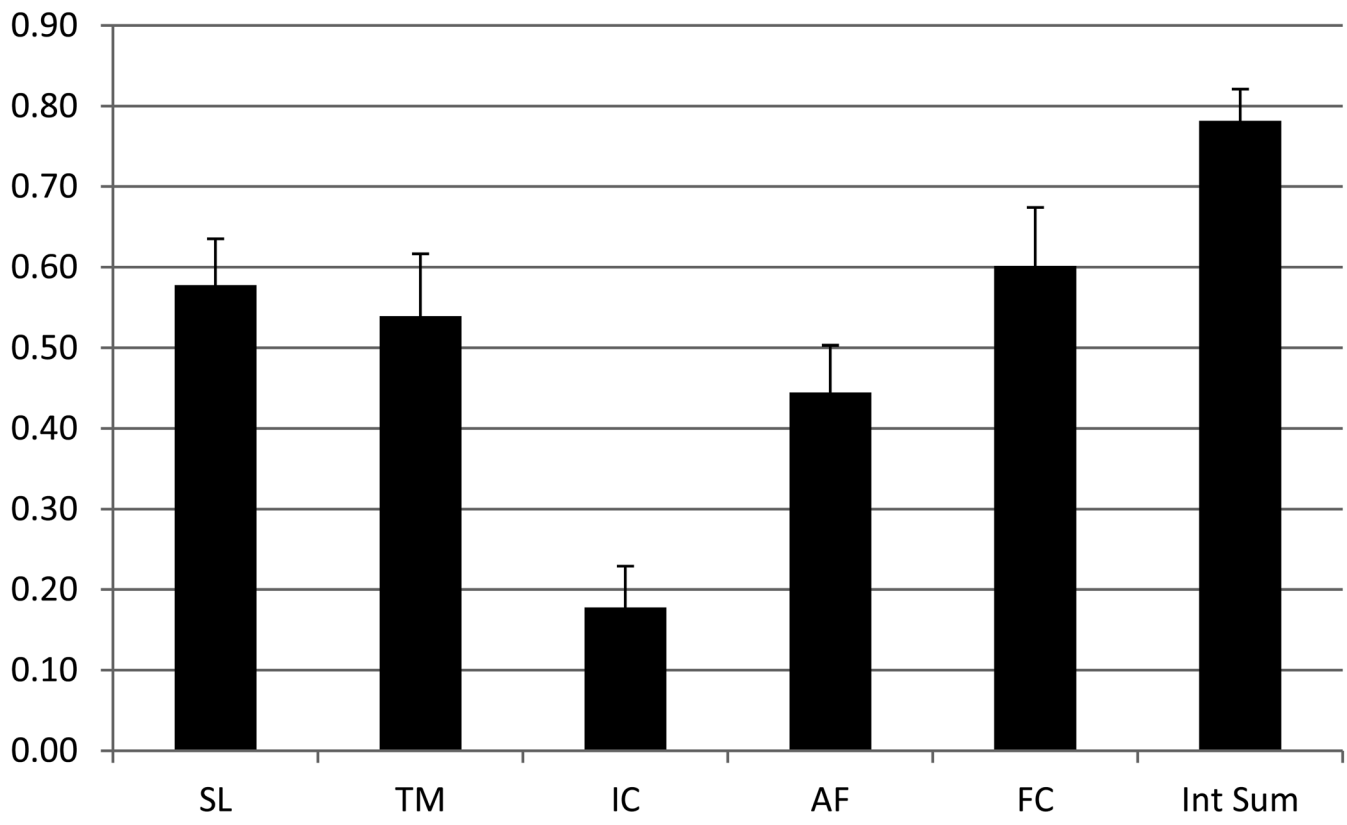
Figure 1: The mean proportion of reflection at levels 3 and 4, expressed as a proportion of total word count at each hand-in point
SL = student learning; TM = teaching methods; IC = integrated curriculum; AF = assessment and feedback; FC = free choice of theme; Int Sum = integrated summative essay

Table 2: Progress through formative patches for the five lowest-scoring and five highest-scoring participants in the summative essay

Participant no.	Integrative essay score	Change between early and late scores*
1	2.79	−0.77
2	2.72	−0.20
4	2.71	−0.47
8	2.14	−0.07
11	2.62	0.28
7	3.9	0.19
12	3.78	0.31
13	3.87	0.10
17	3.67	−0.26
18	3.83	0.43

* Early scores refer to the mean reflective scores for the first two patches, and late scores refer to the mean reflective scores for the last two patches.

quantitative evidence that the patchwork-text approach can be used to develop critical reflection in teacher-development program participants with a science background who have never used a reflective approach for personal development before. While demanding and arduous for both the trainee teacher and the tutor, being immersed in periodic reflective discourse with repeated formative feedback was ultimately effective.

Although some participants permanently changed their attitude to the value of reflection, this was not achieved easily. There was much resistance at the start. This initial reluctance of the participants to engage in reflection and reflective writing often stemmed from the perception that reflection lacks a scientific-evidence base. One participant wrote,

> [C]ultural differences exist between the natural and social sciences in which some natural scientists are uneasy about the social science (Kneebone, 2002, White, 2004). In physical science the burden of proof that condition "x" differs from condition "y" is met by statistical repetition under standard conditions i.e. experiments with an "n of 3." (Participant 2)

At times, participants clearly found the process of reflective writing difficult and resented it. This attitude hinders

Box 2: Extracts from a trainee teacher (Participant 18) who showed progressive improvement between the first two and the last two formative patches

Hand-in point/reflective score (whole essay)

2/2.20

Majority of essay is level 2, descriptive reflection (personal opinion based on experience):

"I guess there is also a danger in using the teaching styles one is most familiar with or that have worked in the past when the teacher was a student him or herself. This phenomenon of choosing a style to teach in according to one's own learning preferences will bring some inherent problems with it. For example if one teaches only in the style that the teacher learns the best with, a student with a different preferred style would potentially be left out and one would only provide benefit to part of the taught group."

5/3.52

Majority of essay is level 4, critical reflection (mulling, linkage to literature ["triangulated reflection"] and proposed action for the future):

"As a student I am highly motivated to deliver high quality assignments since I am keen to improve my knowledge and skills on this topic yet find myself demotivated by the time constraints and the practical reality that I am unlikely able to write a reflective assignment to the best of my capabilities given the external circumstances. These problems I have encountered are further discussed by Wildman and Niles (1987) and Moon (2000), who all identify that for effective and high quality reflection to take place certain conditions need to be met, which include 'support, time and space and a collaborative environment.' I feel the course management ... have certainly aimed to provide the necessary support, and the cancellation of one patch assignment is evidence of this, but still the time is definitely still lacking to provide high quality reflection every single month alongside a (more than) full-time job. If there were a collaborative environment then I guess this time would have been created after consultation between the line managers and the course directors and indeed this might well be arranged in the course next year."

creative growth in health professionals.[21] One student teacher wrote,

> In my first post observational patch, I wrote about the role of peer assessment, but was asked to re-write to align more closely to the experience of the observation. Unfortunately I reacted badly to this, and wrote a second essay. After talking with various people I realized I had fallen into the trap of unproductive dialogic reflection wherein my reasoning and choice of literature, was predicated on a negative reaction to re-writing the essay. (Participant 2)

These responses are not uncommon as developing teachers are introduced to new concepts and language.[3] For many participants with a science background, this is their first academic introduction to the discipline of education. Initially, the trainees struggled to understand what constitutes educational evidence and persistently requested quantitative evidence. At this stage it was necessary to provide both cognitive and emotional support[22] to move the trainee beyond descriptive reflection (levels 1 and 2). Giving monthly feedback on short reflective essays led to a growing understanding between the tutor and the participant. One-to-one feedback can be used to draw out reflections from the student,[23] and this provided continuity of development for our participants. Feedback on the process of reflective writing rather than the content that is the subject of reflection was more effective in achieving higher levels of reflection.[24] Although this aspect of the nature of feedback given to our participants

was not analyzed in this study, it is likely that the feedback was focused on the reflective process because some of the tutors involved in providing feedback were not subject experts in veterinary-related topics. This intense tutor feedback and the strategy of using extracts from the trainees' essays to demonstrate how deeper reflection can be achieved, by triangulation with external evidence, gradually led to successful transitions. One participant wrote,

> In pedagogy the goal is to improve teaching, which is a normative process which recognizes that teaching occurs in a non-standardizable environment and cannot be right or wrong but more or less effective. Teaching situations are experiences with many variables, consequently the methods of analysis in the tool kits of physical and natural scientists are different (Woolpert, 1993). In social science salutary lessons must be learnt from interpreting experience-data with an "n of 1" (McMahon, 2006). This analysis we perform daily, but do not question its validity—you do not need to put your hand in the fire three times to predict it will burn you! Ultimately we expect our students to be open-minded; therefore we should be as well. (Participant 3)

The cyclical nature of the patchwork-text approach can be aligned with Lewin's experiential learning cycle.[25] That some participants recognized the spiral structure was seen in the linkages that they made between the experiences they described in sequential patches. Munby

et al.[26] argue that many teacher-development programs are concerned with knowledge development rather than integration of knowledge with practice through critical reflection. Deliberate practice is important in the acquisition of expert performance.[27] This aspect of teaching practice was encouraged via tutor feedback and had an impact on participant reflections, as shown in the following participant comment:

> … the role modelling is less practical but from the teaching observation feedback it would appear that I have missed opportunities for role modelling as an effective teaching strategy. I have thought that student's interaction with farmers has been variable and there is poor communication by some students while on [a] farm. I have been guilty [of] focusing students on the "hard" parts of the visit such as body condition scoring, mobility scoring and similar tasks and placing less emphasis on the "softer" skills such as questioning the farmer. Over the next few weeks I intend in my teaching … to try and focus on these aspects and reflect on the response by students. (Participant 16)

For some, the process was a discovery of self-analysis and self-assessment[28] through reflection rather than by setting oneself against benchmarks or criteria[7]:

> The most important take home message for me from this experience was not just a collection of specific practical comments that were relayed to me, but mostly the general message that their perception of my teaching was slightly different from my own perception of myself as a teacher. This made me realise that I am indeed biased in my perception of best teaching styles and methods. My observers' comments pointed toward aspects that I actually undervalued as assets of my own teaching style and a few aspects of my teaching that I could improve upon. And the mere fact that they were able to point these aspects out to me. (Participant 18)

The fact that the patches were formative and not graded may have led to deeper reflection, as assessed reflective work can lead to less personal critical reflections.[29] However, this led to many instances where participants' requests for a mark for formative patches had to be declined by the tutors. It is difficult to prove whether giving or not giving a mark to formative patches will enhance critical reflection without a controlled study in which one group of students is given a mark in addition to feedback and another group is given feedback only.

Although there was an overall increase in critical reflection (levels 3 and 4) over the course of the module, this increase was not consistent across the patches. The patches on integrated curriculum and assessment and feedback were the subject of less critical reflection and more descriptive reflection. Teachers acknowledge that it is easier to reflect on teaching methods and learning than on lesson structure and management.[30] Several participants struggled to understand the curriculum or how their teaching is related to the overall curriculum. One participant wrote,

> One of the sessions of this module discussed the importance of curriculum design. This session made me realise that I have been fairly unaware of the position of my particular lectures within the greater curriculum and this is something I want to address. Knowing the position of the elements I teach within this curriculum will likely help me understand the prior knowledge of my students and the level of understanding I need to try to get my students moving towards. (Participant 18)

Assessment is another challenging area, although teachers are willing to adopt new approaches to assessment after a Postgraduate Certificate training course.[31] However, reflecting on these issues may be restricted to more superficial, descriptive levels, as it appears that it is the capacity to link direct experience and memories to theoretical knowledge that leads to true critical reflection. The application of theoretical concepts to less familiar contexts is seen as too distant from practice by novice teachers.[3] The current analysis has given some indicators that the topic could be a relevant factor in developing and practicing critical reflection. The data in the current study are not sufficient to prove the level of contribution of different factors, and a larger study is ongoing.

In addition, the possibility of students adopting performance goals rather than developing mastery,[32] due to the large number of patches that had to be created in a relatively short period, cannot be ruled out. The timetabling of the module and patch submissions meant that the patches on integrated curriculum (early December) and assessment and feedback (early January) had deadlines that might have allowed less time for patch preparation.

There are several limitations that need to be acknowledged in relation to this study. The categorization of reflection was a challenging task. The criteria, based on Hatton and Smith,[6] did not result in a scale that could be used to differentiate between reflection on processes and reflection on content. Some argue that it is necessary to differentiate between the two to understand the transformative process.[20,33] Although both models can be used to assess reflection of the participants, the reliability of such assessments should take into account the consistency across multiple assessors and the style and nature of feedback given to participants for formative development. The reliability can be improved by ensuring a higher degree of clarity in the criteria for assessment.[20] The expansion and modification of Hatton and Smith's[6] criteria in the current study was an attempt to ensure further clarity for assessors.

Another issue is the extent to which individual writers embrace the "reflective game," so that technical aspects of their writing, rather than superior reflective ability, account for the higher scores.[6] In developing the reflective score, it was necessary to divide the body of the essay into smaller, manageable units to provide a detailed analysis of reflective content. Assessment of the essay as a whole would not give sufficient granularity and would end up being vague and subjective. However, it was difficult to decide what length of "unit" was appropriate. Clearly, a single sentence would be too short to allow

reflection to develop. Several sentences are required to describe reflective ideas about an issue. The paragraph seemed to be the most suitable length of segment for marking purposes: variable in length and flexible in structure, yet sufficient to allow the full reflection on a topic to be described.

On the whole, this segmentation worked, but it relies on the paragraph being used correctly, which was not always the case. Some participants did not use any paragraphs (and very little punctuation), some started new lines at random, and others used subtitles and note form. Care had to be taken to ensure that this technical variation did not result in one reflection being graded as level 4 when a similar reflection, presented in a fragmented way, resulted in a mixture of 1s, 2s, 3s, and 4s. The highest levels of reflection are particularly affected by this, as it takes longer to achieve the required analysis and synthesis of multiple perspectives, personal assumptions, experiences, and implications for future behavior. Therefore, some flexibility in the use of segments was required.

CONCLUSION

> Any initial prejudices resulting from my training as a scientist has been recognized by increased understanding of the differences that exist between biology and pedagogy. Typically understanding that the goal of biology is to prove a hypothesis statistically in as controlled a fashion as possible, whilst that of pedagogy seeks to improve teaching on a continual basis in an environment which contains many variables, thus the tools used by the two disciplines are very different, but equally valid. (Participant 2)

Reflection is an essential component of teacher-development programs. Reliable and valid methods to teach, assess, and evaluate reflection are critical. It is equally important that evidence is generated and evaluated from multiple disciplinary backgrounds, as the institutional culture and participants' backgrounds are major factors in the acceptance of and engagement with programs[2] and the development of deeper critical reflection. The current study provides some valuable evidence that the quality of reflective writing can be enhanced through a regular, iterative process of reflective writing, which is supported by formative tutor feedback, particularly when the theme deals with a familiar area for the participants (learning, teaching methods, or a free choice of topic) as opposed to one in which they have less experience. Not all participants showed similar development, so this finding needs to be further explored. However, this study provides evidence that the patchwork text is a useful formative/summative assessment method for the development of reflective ability in participants in an HE teacher-development program in veterinary education. The participants showed different levels of reflection as graded by the Hatton and Smith[6] criteria. Through a formative process, the reflection was gradually enhanced from a predominantly descriptive and dialogic type of reflection to more critical reflection. Therefore, an arduous process of transformation in thinking and writing, supported by a tutor, is necessary to transform a teacher in the sciences into a reflective practitioner. It can also be concluded that reflection can be graded and developed through the use of the patchwork text as an assessment approach for teacher development in veterinary and para-veterinary educators.

NOTE

a   IBM SPSS Statistics. Version 22. Chicago, IL: IBM.

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