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Student Engagement with Feedback and Attainment: the Role of Academic Self-Efficacy

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Abstract

Academic self-efficacy, the belief that one can achieve desired academic goals plays an important role in learning. This study aimed to determine the extent to which academic self-efficacy mediates relationships between students' perceptions of feedback and their academic attainment. An opportunity sample of 232 students (123 female) in their first year of higher education reported their academic self-efficacy and evaluated their assessment experience, including the perceived quantity and quality of feedback and the extent to which this feedback elicited an active response. Positive associations were observed between academic attainment and students' confidence that they could achieve their desired grades and adopt appropriate study behaviours. A negative association was identified between attainment and confidence to talk about their studies. Attainment was not related to the perceived quantity or quality of feedback, but did bear a significant association with the reported use to which feedback was put. Positive associations were generally identified between academic self-efficacy and perceptions of feedback. Path models revealed that inter-relationships were best represented by a model wherein academic self-efficacy mediated links between students' perceptions of feedback and academic attainment. The findings highlight the need to incorporate characteristics of the individual into an understanding of student engagement with feedback.

Feedback has the potential to impact profoundly on student learning (Hattie & Timperley, 2007) and in the last decade major advances have been made in developing our understanding of feedback processes and identifying best practices for its delivery and uptake (Boud & Molloy, 2013). Nevertheless, evidence of feedback's beneficial effect on future attainment is at best variable (Hattie & Timperley, 2007; Kluger & DeNisi, 1996) with a range of factors proposed to affect the strength of its impact such as a modular curriculum (Jonsson, 2013) and large variation in assessment requirements (Carless et al., 2011). Dissatisfaction with feedback processes are expressed consistently by both students and tutors (Higgins, Hartley & Skelton, 2001; Mulliner & Tucker, 2017), accompanied by glaring differences in how tutors and students view feedback (Dawson et al., 2019; Mulliner & Tucker, 2017). Evans (2013) refers to this as the 'feedback gap' and Nash & Winstone (2017) have argued eloquently for learners and educators to acknowledge their shared responsibility to address these issues. Thus it is beholden upon tutors to ensure that students recognise when feedback is being provided, understand the concepts raised and have available to them strategies to act upon the feedback. Students for their part must be prepared to engage with feedback and be motivated to invest time and effort in applying the feedback in future study behaviours.

Henderson, Ryan and Phillips (2019) propose that an understanding of feedback needs to incorporate issues of feedback policy, culture and practices, alongside awareness of the attributes of the individual. Similarly, Lipnevich, Berg, and Smith (2016) highlighted likely interactions between factors such as the context in which feedback is provided, and the character of the learner and their cognitive and affective responses. Encapsulating this 'in the round' perspective of the efficacy of feedback, Winstone et al., (2017a) emphasised the communicative features of feedback, highlighting important characteristics of both the receiver and sender, the feedback message and the learning context. For example, some receivers may not fully appreciate the function of feedback or their role in it (Hattie & Timperley, 2007). Students may respond less favourably to feedback delivered by a less credible (Eva et al., 2012) or less trustworthy source (Carless, 2006). The feedback message itself may be expressed in language not accessible to some learners (Higgins, Hartley & Skelton, 2001) or the sender and receiver may not share a similar interpretation of the language used (Bailey & Garner, 2010). An understanding of the learner and the way their individual characteristics impact their interactions with feedback will be a crucial component in closing the 'feedback gap'. Winstone et al., (2017a) have referred to a learner's 'proactive

recipience’, ‘a state or activity of engaging actively with feedback processes’ (p.17) to capture both the attitudes and behaviours required to optimise the potential of feedback to enhance future learning. Learners’ engagement with feedback was presented within a taxonomy of four recipience processes; Self-appraisal, Assessment literacy, Goal-setting and self-regulation and Engagement and motivation. The extent to which an individual reflects upon their feedback and self-appraises their traits and abilities as being flexible and hence potentially positively instrumental in altering their learning is likely to enhance their proactive recipience of feedback (Forsythe & Johnson, 2017). Assessment literacy represents students’ understanding of the criteria against which performance is evaluated and its expression within feedback, enabling accurate judgments of the gap between current and desired performance (Carless & Boud, 2018). Explicitly articulating desired performance goals and evaluating progress towards these may also enhance proactive engagement with feedback (Hattie & Timperley, 2007). Learners are also more likely to engage effectively with their feedback if they are motivated and committed to embrace change and development in their learning (Handley Price & Millar, 2011).

This burgeoning research field has highlighted many factors likely to influence the effective uptake of feedback, although the exact manner of their impact is not yet well-understood (Winstone et al., 2017a). Profitable avenues to be explored include evaluating interventions targeted at specific recipience processes (Winstone et al., 2017a) and investigating factors within an individual that may hinder the effective uptake of feedback (Nash & Winstone, 2017). Such theoretically-based interventions would confer the additional benefits of testing and extending our understanding of feedback processes.

The current study attends to one such psychoeducational aspect to consider an individual’s academic self-efficacy as an inhibitor or facilitator of effective engagement with feedback. Meta-analyses have confirmed academic self-efficacy as an important predictor of academic performance (e.g. Richardson, Abraham & Bond, 2012). The role of self-efficacy in education is often explored as a domain-specific construct, for example assessing relationships between perceived mastery and attainment in a particular academic subject (Putwain, Woods & Symes, 2010). However, perceived efficacy can be extended beyond competence beliefs restricted to a specific academic subject, to self-efficacy and confidence in more generic study-related skills and behaviours especially those which may underpin self-regulated learning (Schunk, 2005). Such broader academic self-efficacy also bears close

associations with academic performance (Putwain, Sander & Larkin, 2013; Nicolson et al., 2013).

A critical factor in feedback effectiveness is the extent to which feedback impels the receiver to actions that impact positively upon future learning. Simply being aware that feedback has a feedforward function is not sufficient to influence future learning. The individual must also believe that they have the capability to implement the advice to beneficial effect (Winstone et al., 2017b). High academic self-efficacy is likely to be accompanied by a sense of control and optimism. It may thereby perhaps enable negative comments to be viewed as challenges rather than threats resulting in students with high academic self-efficacy being better placed to take advantage of the learning opportunities indicated in feedback (Putwain, Sander & Larkin, 2013). For reasons of both perceived competence to apply the advice effectively and offering a defence against any criticised challenges of feedback, those with high academic self-efficacy may therefore be expected to engage more effectively with their feedback, altering their behaviour to improve attainment and advance towards their desired learning goals.

Much of the research exploring the role of student characteristics in engagement with feedback has harnessed qualitative data from students' self-reports (e.g. Eva et al., 2012). Although providing an evocative picture of students' experiences, the extent to which evidence from small samples of students who volunteer to discuss their feedback experiences is representative of students more generally, should be considered (Jonsson, 2013). One recent exception employed quantitative survey data from a relatively large sample to contrast multiple models of relationships between students' conceptions of feedback, their self-regulated learning and academic self-efficacy and their academic attainment (Brown, Peterson, & Yao, 2016). Using structural equation modelling, they identified that a model in which students' conceptions of feedback predicted self-regulated learning, academic self-efficacy and academic performance was a better fit to the data than models in which self-regulated learning, academic self-efficacy and attainment predicted students' conceptions of feedback. On this basis, although it was acknowledged that the cross-sectional data could not confirm causality, they concluded that students' conceptions of feedback were the 'plausible sources of influence' (p.611) on self-regulated learning, academic self-efficacy and academic attainment. Academic self-efficacy partially mediated the relationship between feedback and attainment, perhaps reflecting that students who do not believe themselves competent to

interpret and apply feedback may be less likely to reflect on its implications for learning and use it to guide future study behaviours.

Various aspects of students' conceptions of feedback were identified in the aforementioned study and their relationships with both academic self-efficacy and attainment could be discriminated. The preferred model included positive associations between the extent to which students agreed that they attended to and made use of their feedback and self-regulated learning and academic self-efficacy. In contrast, relationships between student appraisals of the nature or quality of tutor feedback and self-regulated learning and academic self-efficacy were not represented in the model. In addition, whereas the extent to which students reported actively using feedback bore a positive association, students' appraisal of the nature of their feedback bore a negative association with attainment.

This study raises intriguing questions regarding the extent to which learners' perceptions of the quality of their feedback and the manner of their engagement with it can be discriminated, and particularly whether they have differential relationships with academic self-efficacy. It also highlights the potential for academic self-efficacy to facilitate or inhibit the effective uptake of feedback and hence operate as a possible barrier to proactive recipience (Nash & Winstone, 2017). However, as the authors acknowledged there is a need to replicate and extend their findings. The current study takes up this challenge in relation to a number of issues. Different indices of learners' perceptions of feedback and academic self-efficacy are employed. Importantly, it examines academic self-efficacy beyond reference to perceived competence in a specific subject, extending it to a consideration of self-efficacy of more generic study-related behaviours and skills which might be expected to align with behaviours around feedback. We draw on the findings and theorising of Brown et al., (2016) wherein academic self-efficacy mediated the association between active use of feedback and attainment suggesting a role for students' perceived academic competence in their effective engagement with feedback. We therefore hypothesise that students' academic self-efficacy for study-related skills and behaviour will mediate the relationship between their reported active engagement with feedback, but not the perception of its quality and attainment.

Method

Participants

An opportunity sample of 232 students (123 female) attending a higher education institution in the North West of England participated in the project at the beginning of their second year of study. Participants were recruited from ten different degree programmes delivered by three Faculties.

Materials

Participants completed two questionnaires. Academic self-efficacy was operationalised using the Academic Behavioural Confidence (ABC) scale (Sander & Sanders, 2009) which assesses an individual's confidence that they are able to engage in effective study behaviours. For each item participants respond to a question stem ('How confident are you that you will be able to ...') on a five-point scale (where 1 = 'not at all confident', 5 = 'very confident'). Items are then grouped and summed to represent four subscales of study behaviours and totalled to provide an overall ABC score. The four subscales are as follows. *Grades* (6 items) represents the individual's confidence that they will attain their desired grades. *Verbalising* (4 items) reflects the individual's confidence to verbally discuss course material with peers/tutors. *Studying* (4 items) measures confidence in one's self-efficacy for independent study. *Attendance* (3 items) evaluates confidence that they will be able to attend scheduled teaching activities. Higher scores reflect greater confidence in efficacious study skills and behaviours.

The Assessment Experience Questionnaire (AEQ v3.3) (Gibbs & Dunbar-Goddet, 2012) was developed from a review of assessment conditions which promote student learning (Gibbs & Simpson, 2004) and assesses students' experiences, including their learning responses to assessment and feedback practices. The original version of the scale was administered, although a reduced subset of subscales were adopted in the analyses (e.g. *Appropriate Assessment*, *Coverage of Syllabus*, *Deep and Surface Approaches to Learning* and *Clear Goals and Standards* omitted) informed by a recent reappraisal of the tool's psychometric properties (Batten, Jessop & Birch, 2018). For all reported items, participants are presented with a series of statements and asked to indicate the most appropriate response on a five point scale (1 = 'strongly agree' and 5 = 'strongly disagree'). Four subscale scores relating to *Quantity of Effort*, *Learning from Exams*, *Quantity and Quality of Feedback*, and *Use of Feedback* were derived. *Quantity of Effort* (QoE, 2 items) measures the extent to which the assessment environment led to an appropriate, evenly spread expending of effort. *Quantity and Quality of Feedback* (QQF, 3 items) examines whether feedback received was

sufficient and timely. This subscale can be contrasted with the scale evaluating *Use of Feedback* (UoF, 3 items) which assesses the extent to which the learning environment elicited an active response to feedback received. *Learning from Exams* (LfE, 3 items) represents students' reflection on how the nature of the assessment affected their study behaviours.

Academic attainment, comprising the overall percentage level mark for all courses taken in the first year of study, validated by the university registry, was also recorded for each participant.

Procedure

Students were introduced to the aims of the study, the expectations of participants and any ethical considerations in a participant information sheet included with the questionnaire. Hard copies of the questionnaires were distributed in taught sessions, enabling those who wished to participate to do so. Signed consent forms confirmed willingness to complete the questionnaires and agreement to obtain the overall attainment mark for the first year of study.

Model fit standards

A range of indices, derived from analyses conducted in AMOS v.22, were applied to evaluate the fit of the measurement and path models. To examine the measurement models of the ABC and AEQ tools, confirmatory factor analyses applying the maximum likelihood estimation procedure were conducted. The absolute fit measure of χ^2 alongside the confirmatory fit index (CFI) were consulted to evaluate the sufficiency of the models. In relation to the path models, evaluation of a range of indices were required to appraise model fit; absolute, comparative and parsimony fit indices (Hooper, Coughlan & Mullen, 2008). The absolute fit indices applied here are chi-square (χ^2) and chi-square degrees of freedom (χ^2/df) where $\chi^2/df < 2$ represents a good model fit. The absolute fit index root mean square error of approximation (RMSEA) was also evaluated, where $RMSEA < 0.08$ demonstrates a good model fit. For comparative fit indices, the Comparative Fit Index (CFI) where $CFI > 0.95$ represents a good model fit and the Tucker-Lewis Index (TLI) where > 0.90 is considered to reflect a good fit were applied. To compare within the nested models, z-standardized difference chi-square tests were used with $p < 0.05$ suggesting that the model is statistically better than the comparison model, therefore indicating a better model fit (Kline, 2015). For parsimony model fit, Akaike Information Criteria (AIC) is considered effective in comparing between nested and non-nested models (Hooper, Coughlan & Mullen, 2008).

Ethics

Fully informed consent was obtained from each participant regarding both the completion of the questionnaires and agreement for their attainment data to be obtained. Written information made clear that participation was not related to teaching or assessment on their course and that they could retrospectively withdraw their data by contacting the research assistant employed on the project. Ethical approval for the study was conferred by the institution's Research Ethics Committee. The British Psychological Society ethical guidelines for studies with human participants were abided by throughout.

Results

Preliminary analyses established the sufficiency of the measurement models of the questionnaires and their subscales. Initial confirmatory factor analysis was conducted to evaluate the factor loadings of the items within the proposed subscales of ABC and AEQ. For ABC this concluded that all three items for the *Attendance* subscale failed to load consistently onto a single factor, a subscale that has proved problematic in previous studies (Putwain et al., 2013). In addition, a single item on each of the subscales of *Studying* and *Grades* failed to load on the same factors as the other subscale items. These items were removed resulting in an ABC scale comprising 12 items loading onto three subscales; *Studying, Grades and Verbalising*. For the AEQ, confirmatory factor analysis imposing a five-factor structure revealed that the four items relating to *CoS* did not load consistently onto a single factor. These were removed from the scale resulting in a scale of 11 items representing four subscales; *Quantity of Effort, Learning from Exams, Quantity and Quality of Feedback, and Use of Feedback*.

The reliability of the questionnaires was evaluated against the acceptability limit of Cronbach's α at or above .7 (Table 1). The ABC overall scale and its subscales of *Grades* and *Verbalising* were found to be reliable. The ABC subscale of *Studying* fell just below the desired value. The overall AEQ scale also fell below the acceptable level. This was most likely because of weaker reliability for the *QQF* and especially the *QoE* subscales, although both *LfE* and *UoF* should be considered reliable scales. The implications of these estimates for the conclusions which can be drawn are addressed in the discussion.

To further clarify the structure of the two scales, confirmatory factor analyses were conducted. In relation to the ABC scale the absolute fit index was $\chi^2 = 74.49, p < .05$, however, the CFI for the model was .968 and the RMSEA was .047 both indicating a good

model fit. In relation to the AEQ scale the absolute fit index was $\chi^2 = 46.74$, $p > .05$, the CFI for the model was .981 and the RMSEA was .034, indicating a good model fit to the data.

Descriptive statistics, including distribution indices and reliability coefficients for the measures are reported in Table 1. Distributions of each variable were adjudged to be suitable for parametric analyses.

Insert Table 1 about here

Correlational analyses (Table 2) explored the relationships between academic attainment, academic behavioural confidence and students' perceptions of their assessment experience.

Insert Table 2 about here

For both the ABC and the AEQ scales, the subscales consistently bore significant associations with the overall score. In addition, the ABC subscales were themselves significantly interrelated. However, although all the AEQ subscales were significantly related to the overall score, the only significant interrelationships between subscales involved *UoF*, which was significantly, positively associated with all other subscales. The ABC scale therefore appears to capture a kernel of confidence in a range of study-related behaviours whereas the AEQ scale represents a more diverse array of assessment experiences. Thus, associations with the individual subscales rather than the total scores are afforded greater credence in the following analyses.

Academic attainment was significantly, positively associated with overall AEQ, although this appeared predominantly to reflect its association with the subscale of reported *UoF*. Notably, the association between attainment and *QQF* was not significant. Attainment was also not significantly associated with ABC total score. Further inspection though

revealed significant, positive associations with the subscales of *Grades* and *Studying*, offset by a significant, negative association with *Verbalising*. Students' attainment therefore appears more closely related to confidence in the ability to achieve desired grades and to adopt efficacious study skills than to discuss material with peers or tutors. Academic behavioural confidence bore weak, but nevertheless significant, positive associations with both *QQF* and *UoF*, although these relationships tended to be stronger between both *Grades* and *Studying* and *UoF* than *QQF*.

Path analysis was employed to clarify the relationships between aspects of academic behavioural confidence, learning from exams, reported active use of feedback, appraisal of the quantity and quality of feedback and academic attainment. The poor reliability of *QoE* underpinned its exclusion from the model. The first set of models (see Table 3 and Figure 1) specified the ABC subscales of confidence in *Grades*, *Studying* and *Verbalising* as mediators of the relationships between students' perceptions of feedback and attainment. The second set of models (see Table 4 and Figure 2) evaluated whether the data more accurately reflected students' perceptions of feedback mediating relationships between ABC and attainment. Models specifying direct relationships were also examined.

Insert Figure 1 about here

Insert Table 3 about here

Following evaluation of the relevant indices, Figure 1 represents the preferred, fully mediated Model 1. In this model, ABC mediates the relationships between students' perception of feedback and their academic attainment. Note the models did not include a path between either *UoF* or *LfE* and *Verbalising* since they were not significantly correlated. Model 1 indicated a good model fit with all standardised estimates significant ($p < 0.05$). This model was preferred to alternative, nested models that included combinations of direct links between *LfE*, *UoF*, *QQF* and attainment (See Models 1a, to 1g in Table 3). These alternative

models were evaluated against the fully mediated Model 1 using z-standardized difference chi-square tests. Although inspection of the p (zdiff) data in Table 3 reveals that none of the alternative models were significantly different to Model 1, this original model being more parsimonious (having greater degrees of freedom) should be preferred. This position is supported by the AIC since Model 1 has a lower AIC value than the alternative models indicating a better model fit (Kline, 2015). Our preferred Model 1 was observed to explain a moderate 19% of the total variance in academic attainment.

Insert Figure 2 about here

Insert Table 4 about here

Figure 2 represents the preferred model of alternatives for Model 2 where perceptions of feedback mediate relationships between ABC and academic attainment. Crucially, this preferred model retains a direct link between *Studying* and academic achievement and notably the paths between both *UoF* and *QQF* and attainment were not significant. The fully mediated Model 2, wherein students' perceptions of feedback mediate relationships between ABC and academic attainment did not demonstrate good model fit. Models that included direct links between confidence in *Studying* and *Grades* and academic attainment were evaluated against the fully mediated model (see models 2a, 2b & 2c in Table 4). According to the model fit indices, Model 2a which included a direct path between *Studying* and academic attainment was observed to have a better model fit than Model 2. The AIC and z-difference chi squared values also indicated the superiority of each of the alternative, nested models above Model 2. Thus, Model 2a should be preferred amongst these models, although it did not meet all the assumptions of a good model fit suggesting an inappropriate model of the data. This model was able to explain 11% of the variance in academic attainment.

A final comparison between the two best-specified Models 1 & 2 was made on the basis of the AIC. AIC was substantially lower for Model 1 (66.131) than Model 2a (78.917),

and indeed differences >10 have been proposed to be a strong indicator of the smaller model being better fitting (Burnham & Anderson, 2004). Thus we conclude that an array of indicators argue that the data are better captured by a model in which relationships between students' perceptions of feedback and their academic attainment are mediated by aspects of academic confidence.

Discussion

In accordance with our hypothesis, path analyses revealed that the data were better represented by a model in which associations between students' perceptions of feedback and their educational attainment were mediated by academic self-efficacy. This concurs with the findings of Brown and colleagues (2016), and enhances our understanding of these relationships in a number of important ways.

Brown and colleagues (2016) assessed academic self-efficacy using only a five-item unidimensional scale, focused on the students' major academic subject. The current study adopted a measure of academic self-efficacy that enabled the differentiation of specific aspects of confidence for more general study-related skills and behaviours and thus evaluation of their particular associations with attainment. Three of these aspects, confidence to attain the desired grades, to adopt efficacious study habits and to discuss academic material were observed to be measured reliably. Assessment of the confidence to attend taught sessions, perhaps more strongly influenced by external factors not directly associated with a student's motivation to study (Nicholson et al., 2013), was found to be less secure. Crucially, these more specific aspects of academic confidence demonstrated differential associations with attainment. Whereas consistent with conclusions from recent large-scale meta-analyses of associations between self-efficacy and attainment (e.g. Richardson, Abraham & Bond, 2012) confidence in one's ability to attain the desired grades and to adopt appropriate study behaviours were positively associated with academic performance, the relationship with confidence to talk about studies was negative. This pattern replicates evidence of weaker associations between attainment and verbalising confidence found in previous research using this scale (Putwain, Sander & Larkin, 2013). Confidence in the ability to talk about studies also bore less consistent relationships with ratings of assessment experience than did confidence to attain desired grades and to adopt beneficial study behaviours. Perhaps as has been suggested previously (Nicholson et al., 2013) confidence in verbalising may be influenced by factors such as social anxiety about talking in public (Strahan, 2003), or by

other personality traits associated with attainment (Richardson, Abraham & Bond, 2012). These findings highlight the importance of acknowledging the multidimensional nature of academic confidence when exploring its role in educational experience and attainment.

The present findings are also able to elucidate those aspects of the assessment environment that are associated with academic self-efficacy and attainment. Consistent with previous research (Gibbs & Simpson, 2004), attainment was significantly, positively associated with students' appraisal of their assessment environment. These relationships pertained especially to the perceived ability to learn from exams and the use of feedback, although markedly, not to the quantity of effort expended on studies or appraisal of the quantity and the quality of feedback. That students' evaluations of the characteristics and content of feedback can be distinguished from their agentic use of that feedback has been noted previously (Dawson et al., 2019). The distinction between perceptions of the feedback itself and active application to future learning in terms of their associations with attainment identified here, resonates with the findings of Brown and colleagues (2016 see also Lizzio & Wilson, 2008), who showed that attainment was positively associated with the extent to which students agreed that they made use of feedback but negatively associated with appraisal of the feedback comments themselves.

The distinction between generalised appraisal of feedback and its application to learning is evidenced in the present study by their weak interrelations and differential correlations with both attainment and confidence. Use of feedback, rather than perceptions of its quantity or quality, was related to confidence to attain the desired grades and adopt effective study skills. Notably these relationships were independent of academic performance. This divergence further illustrates that the salient metric of efficacious feedback is its impact on future learning; effective feedback is information used not merely information provided (Adams & Wilson, 2017) and affirms the importance of completing the dialogic feedback cycle (Ajjawi & Boud, 2017). Further research is required though to understand how appraisal of the quality of feedback relates to the ability to exploit this advice for academic improvement. Whilst it is acknowledged that the perceived quality of feedback may be a less easily captured variable (we would note its relative unreliability in the present data), effort should be directed towards exploring such aspects of students' engagement with feedback and their relationships with wider educational variables.

We would concur with Henderson, Ryan and Phillips (2019) that an understanding of feedback requires a perspective encompassing aspects of feedback policy, culture and practices and also attributes of the individual. The current findings suggest that one individual attribute likely to influence whether feedback is applied effectively to future learning is academic self-efficacy. The preferred model was one in which academic self-efficacy operated as a mediator of the association between perceptions of feedback and academic attainment. This model was favoured over alternative models that included direct pathways between perceptions of feedback and attainment and those in which perceptions of feedback mediated relationships between academic self-efficacy and attainment. Whilst this account is in accordance with Brown and colleagues' (2016) interpretation of a linear, unidirectional path from feedback to academic self-efficacy and attainment, it diverges from their preferred model which retained direct paths from some aspects of students' perceptions of feedback to attainment. Their data reflected a partially mediated model rather than the fully mediated model identified here. The application of different assessment scales, which partition feedback perceptions along somewhat different lines, likely influences the structure of the models. Nevertheless, both studies attest to the importance of acknowledging the complexity of students' conceptions of feedback and moreover, the potential of academic self-efficacy to impact the way in which feedback is perceived and utilised.

A number of factors may explain the importance of academic self-efficacy and self-efficacy in students' engagement with feedback. These may reflect its associations with 'approach' and 'avoidance' goals (Putwain & Symes, 2012), with self-regulated learning (Brown, Peterson, & Yao, 2016) and with framing situations as threat or challenge (Symes & Putwain, 2016). High self-efficacy may be accompanied by feelings of positivity, competence and hence possibility; low self-efficacy by negativity, incompetence and hopelessness. The former is more likely to be associated with embracing educational challenges, including constructive feedback, as opportunities to learn. Such personal concept beliefs have been shown to influence academic performance (Putwain, Sander & Larkin, 2013) even when prior attainment is controlled, and is commensurate with the patterns in the current data. When students receive feedback, the degree to which they take an agentic approach that elicits appropriate study behaviours likely to enhance performance, may depend on the individual's perceived efficacy to act upon this information to effect improved learning and performance. Winstone et al., (2017a) propose that higher academic self-efficacy may make it more likely that learners will spend longer reflecting on their feedback, confident that their efforts will

bring them closer to their educational goals. Our current conceptualisation is of academic self-efficacy acting as a prism through which feedback is viewed, similar to the way in which Eva et al. (2012) proposed interpretation of feedback through filters of learner motivations and expectations. Research has highlighted how negatively phrased feedback may be particularly problematic for students with low confidence (Poulos & Mahoney, 2008), whereas high self-esteem may offer protection against criticism (Young, 2000). Ways to empower all students to embrace and engage with feedback, in the light of these factors, should be explored. The current data would advocate efforts to increase recipients' academic self-efficacy in interpreting and applying the technical aspects of feedback and encourage practitioners to accommodate this psychoeducational aspect of recipients into their feedback processes.

It is important to note limitations to the study and the conclusions that can be drawn. Although our model comparisons favour an interpretation in which academic self-efficacy mediates the relationships between perceptions of feedback and academic attainment, caution must be advised in drawing such conclusions from cross-sectional data. More compelling support for this position awaits data from experimental or longitudinal studies. The extent to which academic attainment bears reciprocal relations with both academic self-efficacy and perceptions of feedback would appear to be a particularly important aspect to evaluate in this regard. Attention should also be drawn to the weak reliability of some of the subscales used, particularly *Studying*, in the scale of academic behavioural confidence and *Quantity and Quality of Feedback* in the assessment experience scale. Although there is evidence of acceptable reliability for *Studying* in previous research (Nicholson et al., 2013; Putwain, Sander & Larkin, 2013) there is less evidence for *Quantity and Quality of Feedback* (Batten Jessop & Birch, 2018; Gibbs & Dunbar-Goddet, 2012). Nevertheless, the importance of differentiating the concepts of students' perceptions of feedback and academic self-efficacy for understanding the relationship between feedback and effective impact on learning would make the further development of these scales of some import (see Batten, Jessop & Birch, 2018).

Few studies have examined responses to feedback directly (Jonsson, 2013), utilising indirect reports of students' use of feedback or evidence of its impact for example through successive drafts. Future research might explore the issue of students' response to feedback more directly, for instance by examining verbal protocols recorded when accessing feedback or learner analytics from on-line interactions with feedback. It may be particularly fruitful to

explore the extent to which differences in the emotional response to feedback, identified in some cohorts of students, for example those whose marks fall below their expectations (Ryan & Henderson, 2018), are related to academic self-efficacy. Yorke and Knight (2004) have argued that the 'self-theories' of students in terms of their beliefs, attitudes and emotions relating to their studies, and their impact on learning are generally underappreciated in higher education. They postulate how misalignment of tutor and student perceptions of the malleability of learner capabilities may interfere with the efficacy of feedback. The present study has highlighted the importance of one such aspect, academic self-efficacy, and exploring its role in the efficacy of feedback remains an important research endeavour.

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Table 1.

Descriptive statistics for Academic Behavioural Confidence (ABC) and Assessment Experience Questionnaire (AEQ) scales and academic attainment

	Mean	SD	Skewness	Kurtosis	α
Academic Attainment	59.60	8.45	-.21	-.54	
Academic Behavioural Confidence					
Total ABC Score (12 item version)	41.35	6.62	-.05	.17	.81
Studying	13.81	2.71	-.35	.44	.62
Grades	21.68	3.45	-.26	.74	.79
Verbalising	12.13	3.76	.14	-.66	.76
Assessment Experience Questionnaire					
Total AEQ Score (11 item version)	51.35	6.64	.35	.46	.62
Quantity of effort	7.46	1.34	-.79	1.84	.50
Quantity and Quality of Feedback	10.57	2.42	-.33	-.40	.60
Use of Feedback	11.11	2.30	-.47	.43	.78
Learning from Exams	8.98	2.74	-.04	-.30	.76

Table 2.

Relationships between academic attainment, ABC and AEQ scores (n = 232).

	1	2	3	4	5	6	7	8	9	10
1. Academic Attainment										
2. ABC (3 factor) total	.093									
3. ABC Grades	.227***	.726***								
4. ABC Studying	.289***	.669***	.523***							
5. ABC Verbalising	-.177**	.777***	.294***	.238***						
6. AEQ (4 factor) Total	.178**	.352***	.380***	.458***	.150*					
7. AEQ Quantity of Effort	.125	.113	.106	.289***	-.051	.503***				
8. AEQ Learning from Exams	.132*	.132*	.297***	.188**	.008	.652***	.113			
9. AEQ Quantity and Quality of Feedback	-.001	.240***	.160*	.211***	.236***	.584***	.087	.103		
10. AEQ Use of Feedback	.191**	.355***	.312***	.464***	.126	.673***	.377***	.171**	.152*	

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3.

Model fit indices for models with direct links between perceptions of feedback and academic attainment, or where academic behavioural confidence mediates the relationships

Model Specification	Model Fit indices					Difference tests			
	χ^2	df	χ^2/df	CFI	TLI	RMSEA	AIC	χ^2zdiff	p(zdiff)
1. Relationship fully mediated by ABC	10.131	7	1.447	.985	.954	.046	66.131		
1a. Direct link between LfE - AA	9.950	6	1.658	.981	.933	.056	67.950	0.181	0.671
1b. Direct link between LfE + UoF - AA	8.761	5	1.752	.982	.920	.059	68.761	1.37	0.504
1c. Direct link between LfE + UoF + QQF - AA	8.761	4	2.190	.977	.878	.075	70.761	1.37	0.713
1d. Direct link between UoF + QQF - AA	8.900	5	1.780	.981	.920	.061	68.900	1.231	0.540
1e. Direct link between QQF -AA	10.122	6	1.687	.980	.930	.057	68.122	0.009	0.924
1f. Direct link between UoF - AA	8.902	6	1.484	.986	.950	.048	66.902	1.229	0.268
1g. Direct link between QQF + LfE - AA	9.947	5	1.989	.976	.899	.068	69.947	0.184	0.912

Note. ABC, Academic Behavioural Confidence; UoF, use of feedback; QQF, quantity and quality of feedback; AA, academic attainment.

Table 4.

Model fit indices for models with direct links between academic behavioural confidence and academic attainment, or where perceptions of feedback mediates the relationships

Model	Model fit indices					Difference tests			
	χ^2	df	χ^2/df	CFI	TLI	RMSEA	AIC	χ^2_{zdiff}	$p(zdiff)$
2. Relationship fully mediated by perceptions of feedback	36.889	8	4.611	.859	.630	.130	90.889		
2a. Direct link between S - AA	22.917	7	3.274	.922	.767	.103	78.917	13.972	<0.001
2b. Direct links between S + G - AA	22.217	6	3.703	.921	.723	.113	80.217	14.672	<0.001
2c. Direct link between G - AA	31.432	7	4.490	.881	.642	.128	87.432	5.457	0.019

Note. S, Academic behavioural confidence, studying; G, Academic behavioural confidence, grades; AA, academic attainment.

Figure 1. Schematic of model of relationships between perceptions of feedback and academic attainment mediated by academic behavioural confidence.

Note: Intercorrelation values removed for simplicity.

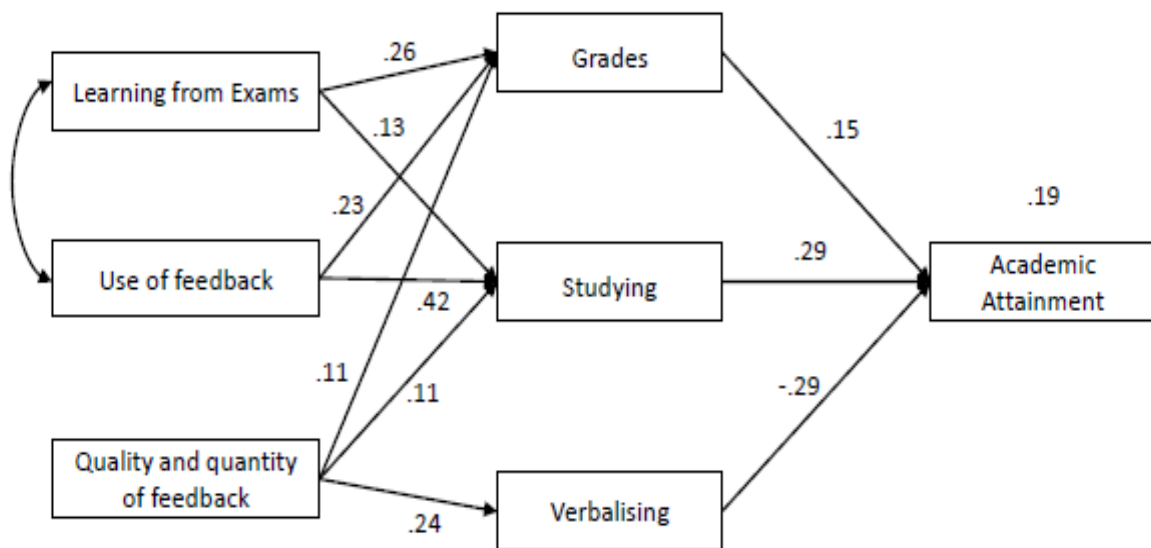


Figure 2. Schematic of model of relationships between academic behavioural confidence and academic attainment mediated by perceptions of feedback.

Note: Intercorrelation values removed for simplicity.

