The Attributions of Students' Confidence Judgments and Related Feedback Preferences

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Much research has demonstrated that low performers tend to be prone to overconfidence, while high performers are disposed to underconfidence. Still, students' attributions for their confidence judgements and how their judgements relate to academic attitudes, such as feedback preferences, remains undetermined. Undergraduate students in eight introductory psychology classes made confidence judgements for their psychology midterm exam, then reported their attributions for the estimate. One week later, students received their exam score back, assessed how their actual performance compared to their expectations, and ranked their feedback preferences. Consistent with past work, low performers were overconfident and high performers were slightly underconfident. Overconfident students made significantly more internal and external attributions than underconfident students. The most influential attributions for both groups were the perceived difficulty and relevancy of exam questions. Additionally, a significant negative relationship between confidence judgement bias and feedback preferences suggests that as students become underconfident their preference for fewer feedback increases. These results indicate that overconfident learners are more motivated to provide explanations for their confidence judgements, possibly due to cognitive dissonance between their expected ability and actual ability. Contrary to expectations, overconfidence did not have a relationship with maladaptive feedback preferences. Future work would benefit from using alternative methodologies, such as using open-ended questions or a think-aloud protocol.

Keywords: Confidence judgement, attributions, estimation, performance, feedback preferences, university students

"The demand for certainty is one which is natural to man but is nevertheless an intellectual vice." – Bertrand Russell, Unpopular Essays (1950)

Nearly a century later, Bertrand Russell's words ring as true as when they were first scribed. Since Russel first wrote this line in his Unpopular Essays (1950), there has been much evidence gathered to determine the prevalence and causes of the intellectual vice he was describing; that is, overconfidence. Much work has shown that students are prone to overconfidence. As students mature into self-regulated learners throughout their university education, they are faced with many situations where they must appraise the certainty with which they know something. Whether studying for or writing a test, students are constantly making appraisals of what they do or do not know. Indeed, the occurrence of self-appraisals extends beyond the aforementioned examples to nearly all learning processes. Students' appraisals of what they know play a causal role in their study behaviours (Metcalfe, 2009). For example, a student studying for a test needs to accurately monitor their knowledge to successfully navigate the material that they are learning. If they are overconfident about what they have learned, they may terminate their study prematurely. Conversely, if they are underconfident, they may misallocate their study time, spending redundant time on already learned material. High accuracy when appraising one's knowledge has been linked to greater academic achievement (Bol, Hacker, O'Shea, & Allen, 2005). In short, learners' confidence judgments play an important role in effective learning. It is important to explain the factors that influence these confidence judgments and to further our understanding of how confidence judgements fit into the learning experience.

Learners can often exhibit a poor understanding of their actual knowledge and ability (Dunning, Heath, & Suls, 2004; Ehrlinger, Johnson, Banner, Dunning, & Kruger, 2008; Hacker & Bol, 2019). A consistently observed phenomenon is that, as a function of actual performance, the poorest performers show the greatest overconfidence while the best performers are slightly underconfident, a la the Dunning-Kruger effect (1999). The causes of this effect, and overconfidence in general, have been postulated to include factors such as metacognitive ability, motivational factors, and cognitive errors/heuristics (Anderson, Brion, Moore, & Kennedy, 2012; Dunning et al., 2004; Ehrlinger et al., 2008; Ehrlinger & Dunning, 2003). However, perhaps as equally important as these drivers of biased estimates is how students understand their estimates.

The attributional style of students may be an important, yet insufficiently investigated, influence on their estimations of performance. To remedy the lack of evidence, this study investigated the connection between students' postdiction estimates of exam performance, their actual performance, and their attributions in support of their predictions. Additionally, this study inquired about the potential relationship between students' estimate bias and their feedback preferences, furthering existing inquiry on the connection between students' estimates and their ensuing academic behaviours. The relations between these variables can provide a greater understanding of the means to overcoming the consequences associated with inaccurate self-appraisals of performance.

Background

To understand self-appraisals, learners' estimations of performance are compared to their actual performance. This comparison produces two measures: accuracy and bias (Gutierrez & Price, 2017). Accuracy reflects how well the learner has judged their performance compared to their objective performance. Bias indicates the direction of errors present in the learner's accuracy. A positive bias score indicates overconfidence, as their estimate is greater than their performance, while a negative bias score reflects underconfidence, as their estimate is lower than their performance.

Students' academic performance is one of the greatest predictors of their confidence judgements (Dunning et al., 2004; Hacker, Bol, Bahbahani, 2008, Kruger & Dunning, 1999). Despite the large relationship between performance and estimates of performance, an examination of the distribution of these data points reveals that high performing students often exhibit slight

underconfidence while low performing students exhibit a large amount of overconfidence. This effect has been replicated across several domains and with different measures; commonly known as the Dunning-Kruger Effect (Ehrlinger et al., 2008).

Attributional Style

As proposed by Bol and Hacker (2012), learners' attributional style can factor into the formation of one's estimates, thus influencing overconfidence and underconfidence. Zimmerman's (2008) model of self-regulated learning provides a useful conceptual framework for understanding the role and formation of confidence judgements in learning. This model of self-regulation proposes that learners use a personal feedback loop comprising social, environmental, and personal information about one's performance to guide successive efforts towards learning. The personal feedback loop involves three stages: forethought, performance, and self-reflection. While learners make attributions at each stage of the feedback loop, the current study is interested in the attributions that learners make during the self-reflection stage when they engage in self-judgement and consider reasons for their judgements. Self-judgements include the process of setting a standard of performance and judging whether one meets that standard. Based on that judgement, learners make attributions for the causes of their performance, and with confidence judgements, their estimated performance. However, it is not the case that these two mental events are linear. There may be a reciprocal relationship instead, where learners' judgements about their performance are affected by their attributions, and vice versa. For example, lower-achieving students may use their attributions as a defensive mechanism to preserve feelings of self-worth and academic identity, thus leading to overconfident appraisals of their performance (Hacker et al., 2008).

Work from several studies has illuminated some connections that attributions have with judgements of performance. Bol, Hacker, O'Shea, and Allen (2005) completed one particularly illustrative study. The researchers measured the attributional styles of university students' prediction and postdiction estimates for a final exam. Their results showed that students' attributional styles were associated with their actual performance and estimation accuracy on the final exam. Task-centered attributions were predictive for overconfident predictions, and student-centered testing attributions were linked to underconfident predictions. Hence, students' judgements of performance are indeed linked to personal and environmental attributions, such as study behaviour or testing conditions.

Similar studies have confirmed and expanded upon the relationships that attributions have with students' confidence judgements. Attributional style appears to differ as a function of achievement level. Hacker and colleagues (2008) found that high performers' attributional style was not predictive for their exam predictions and postdictions, however, low performers' attributional style significantly predicted their pre-and-postdicted estimates. Thus, for low performing students, their judgements of performance may be alterable by their beliefs about their performance. An examination of open-ended attributions revealed that some high performers wrote that their underestimates stemmed from a lack of confidence in their performance. Hence, high performers' underestimates may be linked to insecurities regarding their academic ability. Performance level appears to moderate students' explanations for their appraisals of performance.

While there are tendencies for certain attributional styles to emerge between low and high performers, when students are asked to express freely the factors they believe influence their estimates, they often give a mixture of both task and environmental factors (Dinsmore & Parker, 2013). Students' responses to an open-ended question inquiring about what influenced their confidence judgements for a reading comprehension test described a mix of attributions, including prior knowledge, characteristics of the text, and guessing. Interestingly, the participants with the most biased estimates provided multiple attributions more often than their less biased counterparts.

In sum, these studies describe the

factors to which learners attribute their confidence judgements. Overconfident and more biased learners are increasingly more likely to make external attributions and to say that multiple factors influenced their confidence judgements. Conversely, the usually less biased and slightly underconfident learners make attributions directed towards themselves, citing their preparation or lack of confidence as responsible for their conservative confidence judgements.

Feedback

Students' confidence judgements and reasons for their judgements do not occur in a vacuum. An equally important part of understanding the basis of confidence judgements is determining how these appraisals relate to other academic behaviours. For example, when students are overconfident in a poor performance and make external attributions, it can lead to learned helplessness, a state where they accept their inability to improve (Hacker & Bol, 2019). While there are many ways learned helplessness could manifest as maladaptive academic attitudes, this study is interested in learners' feedback preferences, as maladaptive feedback preferences may take the form of disinterest or lack of engagement with feedback.

A seminal meta-analysis and review highlighted engagement and receptivity as one of the most important variables when considering what makes feedback effective (Hattie, 2015; Hattie & Timperley, 2007). Quality feedback identifies the gaps in one's knowledge and provides strategies or information to help the learner fill in the knowledge gap. Though, without engagement, even the most perfectly tailored feedback may fall on deaf ears and blind eyes. Given the defensive role that overconfidence has been purported to have, we might expect that overconfident learners would be unwilling to engage with feedback that identifies their shortcomings. On the other hand, underconfident learners may feel empowered by their better than expected performance, thus being encouraged to further their learning through engagement with feedback.

Within the domain of emotional intelligence (EI), overconfident students are significantly less willing to report interest in improving their EI ability when compared to those who are underconfident (Sheldon, Dunning, & Ames, 2014). The overconfident participants were more likely to question the accuracy or the relevancy of the EI test used in their study. Thus, the overconfident business students appeared to exhibit learned helplessness, as they expressed a maladaptive approach to disconfirming feedback. While this report is not the first to have established that negative feedback provokes negative reactions to the feedback (see Brett & Atwater, 2001), Sheldon and colleagues claim to be the first to provide a motivational account for overconfident students' reluctance to engage with the feedback. However, it remains to be seen whether confidence judgements play a role in students' academic feedback preferences.

Based upon the aforementioned research, three hypotheses were formed. Work by Dunning and Kruger (1999), and subsequent studies (Dunning et al, 2004; Ehrlinger & Dunning, 2003; Ehrlinger et al, 2008) replicating their findings, suggests that in this study an unskilled and unaware effect should be present in quartile comparisons between students' estimates of performance and actual performance. The lowest quartile of performers should exhibit the greatest overestimation, while the highest quartile of performers should slightly underestimate.

The second goal of this study is to examine students' attributions for their estimates of performance. I predict that students who overestimate will attribute external attributions as most relevant to their estimate, whereas those who underestimate will attribute internal attributions as most pertinent. In addition, student's estimation bias should be related to their feedback preferences. Specifically, I expect that the more overconfident learners are, the more they will prefer not to receive feedback beyond their exam score.

Methods

Participants

Students from eight Psychology 101 sections at the University of the Fraser Valley

were provided with the opportunity to take part in this study in exchange for participation credit in their class. Of those offered the chance, 215 psychology undergraduate students volunteered for this research. The University of the Fraser Valley's Human Research Ethics Board approved this study.

Materials

Performance

Performance was operationalized as students' midterm percentage mark. Students were split into quartiles based on their actual exam performance. This split reflects the method used to determine the presence of a Dunning-Kruger effect (Ehrlinger et al., 2008; Kruger & Dunning, 1999). Eight psychology 101 sections wrote their midterm, which examined the topics covered in the first four weeks of class. Five sections were taught by Instructor A and three sections were taught by Instructor B. Sections taught by the same instructor received identical exams, while exams differed between instructors. The exam material tested was equivalent between sections. The number of questions on the exam differed between instructors. An independent groups t-test demonstrated that student exam scores did not differ significantly between lecturers.

Questionnaire One

The first questionnaire measured difficulty, estimated performance, and estimate attributions.

Difficulty. Students assessed exam difficulty by rating the exam from 1 (very difficult) to 5 (very easy).

Estimated Performance. Students offered a postdiction estimate for their exam performance by answering the following question: "How well do you think you did on the test? Please estimate the percentage you expect to receive: _____% out of 100." Participants' estimated scores were subtracted from their actual scores to create a bias score. Positive bias scores indicate overestimates, and negative scores indicate underestimates.

Estimate Attributions. Participants expressed which attributions they believed influenced their estimates by rating their agreement with seven Likert-type items (e.g., "The test covered the things we covered in class") ranging from -2 (strongly disagree) to 2 (strongly agree). Items were either internal (three items; e.g. "The studying I did was relevant to the exam content") or external (four items; e.g. The test content covered the content in the textbook readings) attributions. External attributions focused on influences outside the student's control. External attributions included test difficulty, test question relevancy, lecture helpfulness, and textbook helpfulness. Internal attributions were factors within the student's control, including the time spent studying, relevancy of studied materials, and the student's academic expectations (i.e., how they have performed on previous tests). Positive scores showed that the attribution applied to their estimate, and negative scores indicated that the attribution was irrelevant.

Questionnaire Two

The second questionnaire measured students' expectations and feedback preferences.

Expectations. Once they received their exam mark, students were asked to rate how their mark compared to their expected exam score, from 1 (far exceeds expectations) to 3 (meets expectations) to 5 (far below expectations).

Feedback Preferences. Students were asked to give their preferences for feedback by ranking four feedback options from 1 (least preferred) to 4 (most preferred). The feedback options were only receiving their exam score, going over the exam as a class or by themselves, or meeting with the instructor to review the exam.

Procedure

One week before their midterm exam and this study, students were informed about the nature of the research. Upon arriving for their midterm exam students were provided with a research booklet containing the difficulty question, confidence judgement estimation, and estimation attribution questionnaire. Students then wrote their

midterm exams. Once they finished, students opened the research booklet, signed the informed consent, and completed Questionnaire One.

One week after writing their midterm exam, students attended their scheduled psychology class. At the start of the class, they received their midterm exam scores and a second research booklet, asking for their ratings of expectations and feedback preferences. Students examined their exam score and then completed Questionnaire Two.

Results

Hypothesis 1: The Unskilled and Unaware Effect

To verify the normalcy of the current sample and replicate previous findings, students' exam scores were compared to their estimated exam score; first by examining the relationship in general, then by performance quartile. Overall, participants overestimated their exam performance. Students estimated their exam percentage to be 69.73%, while the actual mean exam percentage was 63.31%, an overestimate of 6.49%.

To determine whether there was an unskilled and unaware effect, I followed the practice described by Kruger and Dunning (1999) and split participants into quartiles based on exam performance (see Figure 1). Consistent with Kruger and Dunning, those in the bottom quartile (n=53) showed the greatest overestimation, as their expected percentage was 61.89% while their actual percentage was 43.58%, an overestimation of 18.23%. The top quartile (n=54) slightly underestimated their percentage as 78.02% when their actual percentage was 82.44%, an underestimate of -4.42%.

The students who overestimated their exam score (n=109) rated expectations as not being met (M=3.86, SD=.80), whereas those who underestimated their score (n=58) rated their expectations as being closely met, with an lean towards exceeding expectations (M=2.83, SD = 1.01). A Spearman's Rho correlation analysis between estimation bias and expectation described a large relationship ($r_s(171) = .60$, $p < .05$).

Hypothesis 2: Estimation Attributions and Estimation Bias

The relationship between students' estimation attributions and their estimation bias was examined by investigating the present associations and by comparing the attributional styles between underconfident and overconfident students. The differences between students who overestimated and those who underestimated were examined using an independent-groups t-test (see Table 1 and Figure 2). No assumptions were violated for the t-test. Results demonstrated

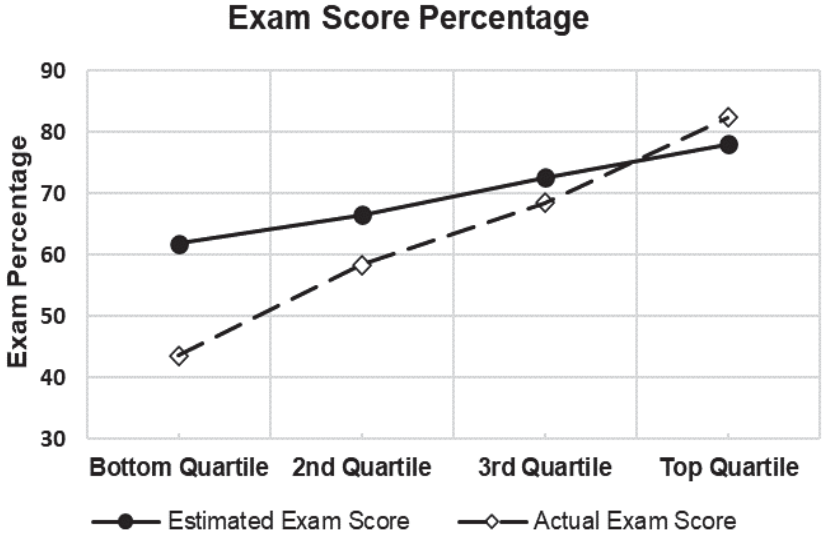

Figure 1. Graph Representing the Unskilled and Unaware Effect. Students' estimated and actual percentage on a psychology exam, as a function of their actual psychology exam performance quartile.

	Overestimate		Underestimate		*t*(195)	95% CI		Effect Size (Cohen's d)
	M	*SD*	*M*	*SD*		Lower	Upper	
Internal	1.85	2.21	.80	2.61	2.89*	.33	1.76	.43
External	4.11	2.70	2.6	2.96	3.51*	.66	2.36	.53

Table 1. T-test Results for the Relevancy of Attributions Between Overestimators and Underestimators. *CI=Confidence Interval of the Difference.*
**p<.05*

that students who overestimated (n = 136) made significantly more internal and external attributions than those who underestimated (n = 60). The finding that those who overestimated made more external attributions was consistent with the prediction; however, these students surprisingly also made more internal attributions. Furthermore, underestimators were less likely to rate both internal and external attributions as relevant to their score.

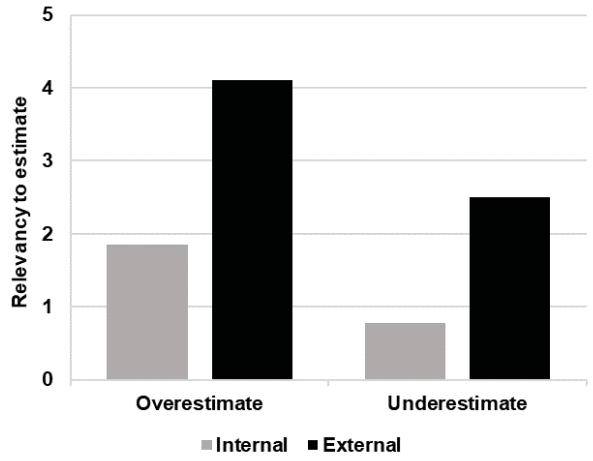

Figure 2. The Relevancy of Attributions to Students' Estimations. Students' internal and external attributions for their exam estimate as a function of their estimation bias. Underestimators. CI=Confidence Interval of the Difference *p<.05

An observation of the most frequent attributions showed that both groups made the same top three attributions but in distinct orders. Those who overestimated attributed the relevancy of the lecture material to the test (M = 1.25), then equally relevant was the relevancy of the textbook to the test (M = 1.01) and the judged appropriateness of the test difficulty (M = 1.00). Students who underestimated most strongly attributed the relevancy of the textbook (M = .88), then the relevancy of lectures (M = .82), and then appropriate test difficulty (M = .50). Intriguingly, both groups' most ardent attributions were external.

Bivariate Pearson's correlations revealed that students' bias scores exhibited small associations with both external and internal attributional styles (respectively, $r(205) = .20$, $p < .05$ and $r(205) = .16$, $p < .05$). Thus, as students' bias moved toward overestimation, their internal and external attributional style scores increased, indicating increased relevancy of the attributions to their estimate.

Feedback Preferences and Estimation Bias

Finally, a one-way ANOVA examined the relationship between students' estimation bias and their preferences for four types of feedback for their exam performance. An observation of the mean of students' feedback preferences revealed that their preferences did not differ as a function of estimation bias (see Figure 3). The top-ranked feedback options were, first, reviewing the exam answers as a class (M = 3.06, SD = .92) and second, reviewing the exam answers privately (M = 2.94, SD = .94). These two options reflect the exam feedback practices of most classrooms, revealing that students prefer the status quo feedback practices.

Interestingly, a Spearman's Rho correlation analysis determined that there was a significant negative relationship between estimation bias and preferring to only receive one's exam score as feedback, rs(174) = -.17,

$p < .05$. This finding runs contrary to the hypothesized outcome; it suggests that as students' bias trends towards overconfidence, their preference for minimal feedback decreases.

A Spearman's Rho correlation analysis demonstrated that students' expectations were moderately negatively associated with their preference to only receive their exam score as feedback, $r_s(182) = -.31$, $p < .05$. This finding implies that as students' expectations reflected increased disappointment (i.e., exam score not meeting expectations) their preference to only receive their exam score decreased.

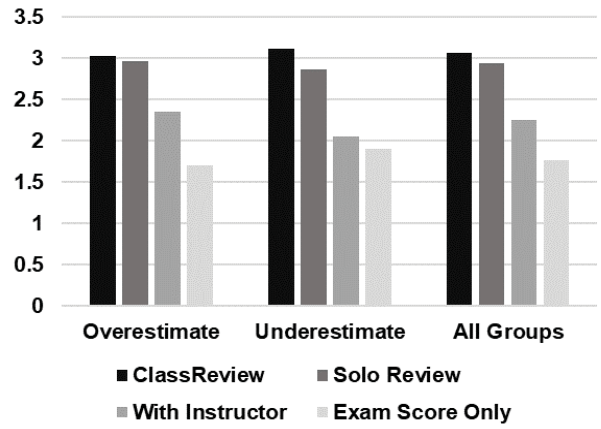

Figure 3. Students' Ranked Feedback Preferences

Discussion

It is a well-established phenomenon that students' estimates of performance only partially align with their actual performance (Dunning et al., 2004). Usually observed, is that the poorer an individual's performance, the more biased their estimates are (Kruger & Dunning, 1999; Ehrlinger et al., 2008; Hacker et al., 2008). These biased estimates create both indirect and direct costs on performance. Performance suffers directly as students make worse decisions on their exams, while biased estimates leading to poorer study choices can impair their future performances (Bjork et al., 2013).

The current research set out to answer the following questions: to what do students attribute their estimations, and do these internal and/or external attributions exhibit any trends? Further, what is the relationship between students' estimation bias and their future study attitudes, such as their preferences towards feedback?

To begin answering these questions, this research replicated the Unskilled and Unaware Effect (Ehrlinger et al., 2008; Kruger & Dunning, 1999). Low performers had the least amount of insight into their actual performance, as they greatly overestimated their actual performance by multiple letter grades. Their overestimation often reflected the belief that they had passed their exam when in reality they had failed. On the other hand, high performers slightly underestimated their actual performance.

Students' estimation biases appear to have factored into the expectations they created for their actual exam performance, especially for those who overestimated. The large relationship observed between estimation bias and expectation scores means that the appraisal students made after their exam directly relates to how they interpret their actual performance. If a student overestimates their performance, they're more likely to experience disappointment when they learn of their exam scores. In contrast, those who underestimate are better aligned in their expectations.

Beyond replicating the Unskilled and Unaware effect, I looked into what attributions students make for their estimates. Specifically, I assessed whether internal and external attributions were different between those who over- or underestimated. Results from the attribution questionnaire showed that students who overestimated made significantly more internal and external attributions than those who underestimated. This finding opposed the hypothesis that those who underestimated would make more internal attributions. Still, this finding validates previous work. Students who made biased estimates and then asked to make open-ended attributions for their estimates were more likely to attribute multiple causes for their confidence judgement than their more accurate peers (Dinsmore & Parker, 2013). These findings support the idea that low performers' attributional style plays a role in the formation of overconfidence as a defense mechanism (Hacker & Bol, 2019; Hacker et al., 2008). Overestimation, especially in sizeable amounts, relates to an increase in the

number of attributions students make, such that overestimated poor performance creates more of a need for explanation than an underestimated good performance.

One explanation for this effect may be that the students who overestimate while making numerous attributions are experiencing cognitive dissonance. Their expectations about their current abilities and knowledge do not align with reality, thus creating a dissonant discrepancy. This dissonance may drive their additional explanations. Indeed, overconfidence is at least partially driven by an enduring motivation to view the self as an accurate perceiver (Blanton, Pelham, DeHart, & Carvallo, 2001; Ehrlinger & Dunning, 2003). For example, students made estimates for 13 quizzes over the course of a semester. Instead of improving the accuracy of their estimates over the weeks, the students desired final grade was a better predictor of their estimates than previous performances (Serra & DeMarree, 2016). Thus, the motivation to be obstinate about one's academic identity appears to be strong. The current study supports these findings, as when participants were confronted with evidence to suggest that they do not measure up to their academic self-beliefs, their performance feedback spurred on numerous explanations to ease the discomfort of inaccuracy.

The fact that students who underestimated made fewer attributions is interesting. If contrasted with overconfident learners' use of attributions as a protective mechanism, it may be that the underconfident learners do not feel pressured to bolster their academic identity with a plethora of attributions. Their performance tends to be higher, and surpasses their estimations; thus, there is no need to 'explain away' a good performance. In sum, it appears that evidence suggests that attributional style may play a larger role for overconfident learners rather than the underconfident (Hacker et al., 2008).

Intriguingly, the most highly cited attributions were the same between those who over- or underestimated. Both groups judged the appropriateness of the test difficulty and how well the test questions reflected what was taught in the class and textbook as most influential in their estimate. Yet, overconfident learners' thought these attributions were more important to their estimation than underconfident learners. These facts lend themselves to an alternative interpretation of the fact that underconfident learners made fewer attributions than the overconfident learners. It may be that the current attributional items did not sufficiently capture the actual attributions for underconfident students. According to answers responding to open-ended questions, at least some high performing underconfident students believe that making conservative estimates is influenced by insecurity in their academic identity (Hacker et al., 2008). Thus, overconfident and underconfident students may use attributions in different ways for the same end goal: to protect their academic identity. The evidence for the underconfident side of the argument still needs more support beyond the anecdotal evidence cited.

An increase in the number of attributions could have a two-fold impact on the future efforts and performance of a student who overestimated their score. One, if the student made many internal attributions, they may feel in control of their ability to improve, leading to more effort and potentially better performance. Still, an increase in the number of external attributions may contribute to self-handicapping, as they may not believe they can control future outcomes.

The link between confidence judgements and feedback preferences produced surprising results. I expected that low performing overconfident students would prefer minimal feedback. However, the opposite was true. The less overconfident students' confidence judgements became, the more they preferred to only receive their exam score as feedback. Students who were disappointed in their exam scores, having been overconfident in their performance, were more receptive to meeting with their instructor to go over their exam. These findings contrast results suggesting that overconfident business students were less likely to report interest in improving their emotional intelligence after disappointing feedback (Sheldon et al., 2014). The different outcomes may be due to different methodologies; however, it could also be the case that the

importance of the domain skill to the respective sample was different. Sheldon and colleagues' (2014) participants were graduate-level business students, aware of the importance of emotional intelligence to their future career prospects as business managers. If these business students felt that they were lacking in emotional intelligence, it may have posed a great threat to their business acumen identity. Whereas a disappointing grade in a first-year psychology exam may pose little threat to the academic identity of the current studies' undergraduate students. Additionally, business students have been found to be more overconfident than those who are studying the sciences or humanities (Schulz & Thoni, 2016). Hence the divergent results between the business and psychology students may be accounted for by innate characteristics of the respective samples.

The results from the current study are more optimistic than Sheldon and colleagues (2014) indicate. Instead of suggesting that overconfident performances are linked to learned helplessness, the opposite appears to be supported. When students are confronted with a grade that does not meet their expectations, they may be prompted to engage with feedback by meeting with their instructor. Although, overall, the students preferred the feedback choices of going over the exam questions as a class or going over the exam answer key by themselves. Both options closely reflect the current common practice in their university classes. As such, it appears that students find the current feedback practices preferable. This may be because class review feedback provides sufficient anonymity for the overconfident and disappointed students, who desire feedback but might feel embarrassment or shame about sitting down one-on-one with an professor. While underconfident, yet pleasantly surprised students may not feel the need for further explanation.

Limitations and Future Directions

The internal validity of this study is limited by the choice to study participants in a classroom setting. Multiple variables are beyond the current studies' measures and control. For example, the amount of student interaction between classroom sessions may have influenced the expectations of students. Students often gather after a test to compare answers. As such, other test takers may provide participants with corrective insight into their actual performance, which was not accounted for when they completed their questionnaire. However, the lack of internal validity is offset by high external validity. As this research took place in the classroom, it is reasonable to suspect that the measured attitudes indicate the real-life experiences of university students. Yet, the external validity came at a cost, as due to efforts to limit the size of the questionnaire to prevent further disruption of the exam environment, demographics information was not collected. Future should prioritize collecting this information since demographics such as gender, age, and intended major could factor into confidence judgements.

Other limitations may direct fruitful future work. As is common with much of the research in psychology, the participants of this study were first-year psychology students. Future work would benefit from studying other groups, such as students further along in their studies and/or in other academic fields. It might be expected that more experienced university students would have more adaptive responses to their performance, i.e. preferring greater feedback and focusing their appraisals on controllable internal factors.

Drawing on past work investigating students' estimation attributions, this investigation provided students with a list of potential attributions for their estimates (Bol et al., 2005; Hacker et al., 2008). The scope and variability of students' attributions was limited by using a questionnaire. It would be useful to use open-ended measures, such as a think-aloud protocol or self-generated answers, to examine the organic tendencies of students' attributions. As noted in past work, open-ended responses would probably be an assortment of internal and external attributions (Dinsmore & Parker, 2013).

To further establish the role that students' estimation attributions play, future work may want to determine how these attributions link to actual behaviour. Researchers may consider converging a behavioural measure with students' attributions to determine whether attributions

reflect actual causes of performance. For example, one might try converging a measure of study time with students' attributions regarding the impact that studying had on their performance.

Conclusion

To become effective learners, students must be able to make accurate confidence judgements about what they do and do not know. These results support claims that the lowest quartile of performers have difficulty assessing their knowledge, as demonstrated by vast overconfidence. These overconfident learners attribute their estimations to a combination of external and internal forces. Indeed, the frequency of their attributions may act to protect their academic identity. Dissimilarly, top performers are slightly underconfident. Those who underestimated their performance made fewer attributions for their estimates than those who overestimated. Although, the most frequently cited attributions did not differ between over-or-underconfident students. The top feedback preferences between students did not differ. Still, there appeared to be a trend for those who underestimated, to prefer minimal feedback. As such, the idea that overconfidence produces learned helplessness was not supported.

Given these results, underconfident learners may want to be mindful that they do not let their surpassed expectations interfere with their desire to seek high-quality feedback. On the other hand, overconfident learners may be encouraged to learn that their biased estimates do not interfere with their feedback preferences. However, I would recommend that students still attempt to increase the accuracy of their confidence judgements, given the benefits that increased clarity can have for other actions, such as study behaviours (Bjork, Dunlosky, & Kornell, 2013).

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