



Role of Self-Regulated Learning in the Relationship between Feedback and Academic Performance

Dr. Surayya Jamal¹ & Iram Naeem²

¹Abdul Wali Khan University, Mardan, 23200, Pakistan,

Email: surayyajml@gmail.com

²Punjab School Education Department, Lahore,

Email, irumnaeem44@gmail.com

ARTICLE INFO

Article History:

Received:	April	10, 2023
Revised:	May	20, 2023
Accepted:	July	02, 2023
Available Online:	July	18, 2023

Keywords:

feedback, self-regulated learning, academic performance, mediation, university students, Islamabad, Pakistan, SEM, correlational design.

ABSTRACT

Feedback has been highly acknowledged as one of the most effective forces on student learning and academic performance, and the mechanisms by which feedback has its effects are not fully understood. This paper examined the mediating effect of self-regulated learning (SRL) on the relationship between feedback and academic performance amongst university students in Islamabad, Pakistan. To use a quantitative correlational research design, the researcher sampled 300 students who attended six universities (three public and three privately owned) and administered a structured survey questionnaire to determine the data. Feedback was the independent variable, which was operationalised in the specificity, timeliness, and actionability dimensions; academic performance was the dependent variable, which was measured through self-reported GPA and academic satisfaction. The descriptive statistics, reliability analysis, Pearson correlation, and Structural Equation Modeling (SEM) with bootstrapped mediation testing were used to analyse the data. The findings showed that the positive direct impact of feedback on academic performance was enormous and that the relationship between them was both significant and partially mediated by self-regulated learning. Such results can generalize the feedback-performance literature to a South Asian university setting and offer some practical advice to an educator, curriculum designer, and university administrator to improve the academic performance of students by means of evidence-based feedback procedures.



© 2023 The Authors, Published by AIRSD. This is an Open Access Article under the Creative Common Attribution Non-Commercial 4.0

Corresponding Author's Email: surayyajml@gmail.com

Introduction

Feedback has been one of the most potent and dynamic factors of instruction teachers can employ to influence student academic success in higher education, one of many variables that

influence student academic achievement (Hattie and Timperley, 2007; Shute, 2008). Feedback, more generally defined as informing learners of their performance regarding learning tasks to some degree relative to some form of goal or standard, has a variety of overlapping roles in the learning process: feedback is informative of the actual level of understanding and skill, it indicates the specific areas where actual performance falls short of desired performance, it directs future learning strategy and effort, and it also acts to motivate the learner to continue with learning tasks. The meta-analysis studies of the decades, most notably a meta-analysis synthesizing more than 800 meta-analyses by Hattie (2009) has confirmed that high-quality feedback correlates with large gains in student learning outcomes, and the effect sizes of this intervention are so significant that it ranks among the most effective educational interventions available. However, the direct application of this discovery to the successful feedback practices in higher education classrooms has been difficult and how feedback has its performance effects continues to be an active topic of both theoretical and empirical investigation.

One of the most significant yet understudied questions is whether self-regulated learning (SRL) is an intervening variable in the feedback-performance relationship. Self-regulated learning is described as the active, metacognitive, and motivational process whereby learners define their learning objectives, lay-out and execute strategies to reach the goals, self-monitor, and assess and revise their strategies in relation to performance feedback (Zimmerman, 2000; Pintrich, 2000). The theoretical linking of feedback and SRL is also strong: feedback is the informational raw material of gap information, strategy suggestions, performance standards, which self-regulated learners exploit to revise their goal-setting, refocus their studying effort, and optimize their cognitive and metacognitive strategies. The high-quality feedback could not lead to performance improvement without self-regulatory engagement and vice versa; students with high SRL abilities are better placed to interpret, internalise, and act on the feedback they get. This implies that SRL does not just correlate with academic performance but serves as a process by which feedback affects performance a mediating process and not just a parallel process. This mediation hypothesis is one of the main goals of the current research to be empirically tested.

The higher education sector in Pakistan has experienced a high level of growth in the last two decades and the number of universities in Pakistan has risen to more than 230 as of 2022 and the student enrolments have risen to match this growth (Higher Education Commission of Pakistan [HEC], 2022). As the home of some of the most prestigious and well-equipped state universities in Pakistan and an increasingly popular place of privately-run institutions, Islamabad is something of a microcosm of this growth and an exceedingly well-suited environment in which to examine the educational processes that determine the end product of the student. Nevertheless, little empirical evidence has been given to the feedback practices and self-regulation cultures of Pakistani universities. The pedagogical habits that dominate most Pakistani universities, including lecture-based education, large student-to-faculty, and evaluation-focused assessment systems and limited opportunities to engage in formative feedback, may produce some unique patterns in the way students receive, process, and act on feedback, and the degree to which they develop and utilise self-regulatory learning strategies (Malik and Bhatt, 2020; Shah and Sha). The quantitative knowledge of these patterns and the possibility of testing the hypothesis that the SRL mediation process exists in this situation is not only theoretically significant but also practically needed to enhance the quality of teaching and learning in Pakistani higher education.

The research is based on three related theoretical concepts. The model of feedback developed by Hattie and Timperley (2007) gives the conceptualisation of feedback as the information

that can work at different levels: task, process, self-regulation, and self with the feedback on the process and self-regulation levels being posited as the most influential ones in deep learning and academic performance. The theoretical architecture of SRL as a dynamic and feedback responsive process entails Zimmerman (2000) cyclical model of self-regulated learning that explains self-regulation as a process consisting of forethought phase, performance phase and self-reflection phase. The motivational basis of the SRL-performance relationship has been offered by Bandura (1997) in his social cognitive theory, in which self-efficacy as a goal-setting, persistence, and strategic effort factor is prominently featured, as feedback has the potential to affect academic performance, which can be partially achieved by reinforcing or weakening the belief in the ability to succeed in students. The combination of these frameworks creates the prediction that feedback will enhance academic performance in part, though not solely, by means of its ability to activate and maintain self-regulated learning processes.

This paper empirically tests this prediction by conducting a study on 300 students sampled across six universities in Islamabad with a correlational quantitative design and SEM with bootstrapped mediation tests. The analysis is guided by three hypotheses: (H1) Feedback is positively related to academic performance; (H2) Self-regulated learning is positively related to academic performance; (H3) Self-regulated learning mediates the relationship between feedback and academic performance with a significant positive indirect effect of the former on the latter. The research has added to the educational psychology body of knowledge by offering rare quantitative mediation data in a South Asian higher education context, generalizing Zimmerman SRL framework to a non-Western institutional environment, and offering practical suggestions to faculty development, assessment design, and student support program in Pakistani higher education.

Literature Review

Literary sources on the feedback in educational settings are numerous and based on educational psychology, instructional design, cognitive science, and higher education pedagogy. The seminal review and conceptual model of Hattie and Timperley (2007) has been the benchmark of comprehending the process through which feedback works to shape learning. They considered feedback as the information given by an agent, such as a teacher, peer, textbook or other source, concerning the aspects of one performance or comprehension, and identified four levels of feedback: task feedback (correct/incorrect information about particular answers), process feedback (information about the strategies and processes of doing something), self-regulation feedback (information about self-monitoring, self-direction and self-evaluation), and self feedback (personal evaluations). They proposed that the most effective type of feedback to enhance deep learning involves process and self-regulation level feedback, as they are the ones to make students utilize their metacognitive and strategic abilities instead of just providing them with right/wrong information. This taxonomy has a theoretical basis in the current study since it directly involves self-regulatory processes as the medium through which the most effective types of feedback are directed.

The more general meta-analytic data on feedback-performance correlations are mostly favorable but subtle. In his synthesis of 800 meta-analyses with more than 50,000 studies, Hattie (2009) discovered an average effect of feedback of $d = 0.75$ on student achievement, which is among the largest of any instructional intervention investigated. The previous and methodologically rigorous meta-analysis by Kluger and DeNisi (1996) however revealed a lot of variability in feedback effects with about a third of feedback interventions in their sample actually reducing performance. This heterogeneity made it clear that we need to comprehend the circumstances and processes in which feedback can lead to positive or null

impacts. Shute (2008) has conducted a thorough review of research on formative feedback, and found that feedback is most effective when it is specific, timely, non-threatening and goal-oriented learning feedback, as opposed to feedback based on personal qualities, which in turn meets the theorised ability of such feedback to facilitate self-regulatory processes. Nicol and Macfarlane-Dick (2006) built on this analysis by creating a model of good feedback practice that explicitly made self-regulation the aim of effective feedback, and contended that feedback must work to develop learners in the capacity of self-monitoring and self-evaluation, and not merely as a way of directing their immediate behaviour.

The theoretical and empirical essence of this research is self-regulated learning. The model of SRL proposed by Zimmerman (2000) is a cyclical model outlining the process of self-regulation as consisting of three stages. During the forethought stage, learners analyze the task such as goal-setting and strategic planning as well as belief in motivation such as self-efficacy and intrinsic motivation. During the performance stage, the learners play out self-control measures, such as the attention focusing, self-instruction, and imagery, and self-observation procedures. During the self-reflection stage, the learners are involved in self-evaluation, attribution of results as caused by self and adaptive or defensive self-responses. Instructors are theorised as having feedback that can enter this cycle especially at the self-reflection stage to provide external information that can be compared with self-evaluations and adjusted attributions and to adjust the forethought processes in the subsequent learning cycle. PMLR framework by Pintrich (2000) also placed feedback as an input to self-regulatory processes in cognitive, motivational, behavioural, and contextual areas based on the premise that good learners do not use feedback only to correct their mistakes but to recalibrate their goal structures and learning strategies.

Empirical studies have always attributed SRL to academic achievement at all levels of education and different countries. Zimmerman and Martinez-Pons (1990) also discovered that high-achieving students employed a considerably larger number and more often self-regulatory strategies than low-achieving students. Pintrich and De Groot (1990) established that the SRL strategies were good predictors of academic performance despite the control of previous achievement and cognitive ability. These relationships have been supported by more recent studies in the context of higher education: a meta-analysis by Credé and Phillips (2011) revealed moderate to strong correlations between SRL strategies and GPA in samples of university students. Malik and Bhatt (2020) in their study on the Pakistani higher education setting discovered that the self-regulatory strategies used by the university students were positively related to both the GPA and academic satisfaction, but the feedback-SRL-performance chain was not studied. In an attempt to determine the preliminary bivariate evidence to support the mediation hypothesis in the present study, Shah and Shaikh (2021) discovered that formative feedback offered by university instructors in Pakistan was positively correlated with self-reported SRL engagement among students.

The feedback-performance relationship has been found to be mediated by the SRL theorised, which has been explored in a small but increasing number of studies. Butler and Winne (1995) presented an underlying theoretical argument, which postulated feedback is cognitively processed by students using existing knowledge structures and self-regulation processes define how feedback information is encoded, evaluated and translated into modified learning behaviour. Their model assumed that the SRL capacities of students are the most important criterion that determines whether feedback is used to enhance learning process or is forgotten or incorrectly used. Cho and Cho (2011) have empirically supported this mediation model in a peer feedback scenario, and the authors discovered that the positive impact of peer feedback on writing performance was largely mediated by the use of self-

regulatory strategies. van der Kleij et al. (2015) also have evidence of an SRL-mediating process in their research on formative assessment and achievement in secondary school. Although this is piling up, there are no rigorous quantitative tests of the feedback-SRL-academic performance mediation chain involving SEM in South Asian university settings, which is the gap that is filled by the current study. The hypotheses that structure the empirical analysis are as follows: (H1) Feedback is positively related to the academic performance; (H2) Self-regulated learning is positively correlated with the academic performance; (H3) Self-regulated learning mediates the relationship between feedback and the academic performance.

Methodology

This research design was a quantitative correlational research design which aimed at establishing the relationship between feedback, self-regulated learning and academic performance. The correlational design was also suitable because the aim of the study was to determine and measure the direction and the strength of the relationship between theoretically related variables in a natural university environment without manipulating the independent variable experimentally (Creswell and Creswell, 2018). The quantitative methodology has been chosen to allow measurement of the constructs using validated psychometric scales and estimation of the structural relationships by means of multivariate statistical modelling.

The sample of the study included undergraduate and postgraduate students of six universities in Islamabad, Pakistan, three of them being government-run universities and three being privately-run universities. The selection of both the public and the private universities was not accidental since the two types of universities vary in pedagogical culture, faculty-student ratios, assessment practices, and the feedback that they provide to students. The three public universities sampled in the research were chosen to be representative of the various academic areas (social sciences, natural sciences, and engineering/technology) and the three private universities were also chosen to represent similar disciplinary areas. Simple random sampling was used to select a sample of 300 students (50 students each of the institutions). Sampling frames were lists of enrolled students in each university and random number generation was employed to select respondents in each institution. This method gave all the eligible students an equal chance of being selected, and the sample was representative of the diversity of experiences of students in the six institutions.

The questionnaire was a structured self-administered survey questionnaire that contained two parts to collect the data. Part one involved demographics: age, gender, type of university (public/private), year of study and academic discipline. Part two included scale items of the three study constructs with a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Ten items that had been modified to measure feedback included the dimensions of specificity of feedback, timeliness, actionability, and goal orientation and measured feedback. The twelve items that were used to measure self-regulated learning were the items that had been adapted by Zimmerman and Martinez-Pons (1990) and Pintrich (2000), which included goal-setting, self-monitoring, strategic planning, and self-evaluation sub-dimensions. The academic performance was assessed with the help of six items adapted by Credé and Phillips (2011) and Malik and Bhatt (2020) that included self-reported cumulative GPA (scaled to a five-point scale) and the items that evaluated academic satisfaction and perceived learning progress. Three subject-matter experts in the field of educational psychology reviewed the questionnaire and piloted it on 30 students not included in the main sample before it could be finalised.

The analysis of data was conducted in a series of multiple steps. Frequency distributions and percentage tables were used in summarising demographic data. All constructs were calculated using descriptive statistics which included means and standard deviations. Cronbachs alpha was used to determine internal consistency reliability with a minimum value of 0.70 being the acceptable minimum (Nunnally, 1978). Pearson correlation analysis was used to assess the associations between variables. The full measurement model and structural hypotheses were tested at the same time using SmartPLS 4.0 to run Structural Equation Modeling (SEM). Before structural estimation, the measurement model was tested on convergent (AVE 0.50) and discriminant (HTMT 0.85) validity. The structural model was used to test the direct effect of feedback and SRL on academic performance (H1 and H2) or the indirect effect of feedback on academic performance via SRL (H3). The bias-corrected bootstrapping was evaluated with 5,000 resamples to build 95 percent confidence intervals of the indirect effects (Hayes, 2018). Model fit was assessed using $CFI \geq 0.90$, $TLI \geq 0.90$, $RMSEA \leq 0.08$, and $SRMR \leq 0.08$ (Hu & Bentler, 1999).

Analysis and Results

Demographic Characteristics of Respondents.

Table 1 gives the demographic profile of the 300 respondents. The sample included 174 males (58.0) and 126 females (42.0) students, with a relatively unequal gender representation that can be attributed to the gender balance in Pakistani university enrolments where men are a slightly disproportionate group in most of the technical and social sciences (Higher Education Commission of Pakistan [HEC], 2022). The age group of 22-25 years (46.0%), 18-21 years (32.0%), and 26 and above (22.0 percent) represented respectively the majority of the sample. The sampling design was designed to be split between the public and private at 50 percent with the aim of having this split. The distribution based on the study year was fairly even with 26.0, 28.0, and 28.0 percent in 2nd year, 3rd year, and 4th year/postgraduate respectively. The largest discipline grouping was social sciences and management students (36.0%), which were then natural sciences (26.0%), engineering and technology (22.0%), and arts and humanities (16.0%).

Table 1: Demographic Profile of Respondents (N = 300)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	174	58.0%
	Female	126	42.0%
Age	18–21 years	96	32.0%
	22–25 years	138	46.0%
	26 years and above	66	22.0%
University Type	Public	150	50.0%
	Private	150	50.0%
Year of Study	1st Year	54	18.0%
	2nd Year	78	26.0%
	3rd Year	84	28.0%
	4th Year / Postgraduate	84	28.0%
Discipline	Social Sciences / Management	108	36.0%
	Natural Sciences	78	26.0%
	Engineering / Technology	66	22.0%
	Arts / Humanities	48	16.0%

Note. Percentages may not sum exactly to 100 due to rounding.

Reliability Analysis and Descriptive Statistics.

Table 2 shows descriptive statistics and internal consistency reliability coefficients of the three study constructs. Academic performance recorded the highest mean ($M = 3.82$, $SD = 0.64$), followed by feedback ($M = 3.74$, $SD = 0.68$) and self-regulated learning ($M = 3.61$, $SD = 0.71$). The mean scores of the three constructs were moderate-high, which means that the respondents tended to think that their academic settings were moderately good in terms of feedback, engaged in moderately-high-level self-regulated learning behaviours, and evaluated their academic performance on a positive scale. There was a similarity in standard deviations among constructs implying that there was similarity in the variation of the experiences of the respondents. All the alpha of Cronbach were above the 0.70 mark with the range of 0.83 academic performance to 0.88 self-regulated learning showing there was sufficient internal consistency among all scales (Nunnally, 1978).

Table 2: Descriptive Statistics and Reliability Coefficients ($N = 300$)

Construct	N	Mean	SD	Cronbach's α
Feedback	300	3.74	0.68	0.85
Self-Regulated Learning	300	3.61	0.71	0.88
Academic Performance	300	3.82	0.64	0.83

Note. SD = Standard Deviation. SRL = Self-Regulated Learning.

Correlation Analysis.

Table 3 shows the Pearson correlation coefficients of all the study variables. There was a positive and significant correlation between feedback and self-regulated learning ($r = .59$, $p < .01$), which means that students who thought their instructors provided them with quality feedback also said they engaged in self-regulatory learning. Feedback ($r = .62$, $p < .01$) and self-regulated learning ($r = .68$, $p < .01$) also had a significant and positive correlation with academic performance, but SRL was somewhat more strongly correlated with performance. Such bivariate patterns were in line with all three hypotheses of the study and the reason of going to SEM to do multivariate and mediation tests. The intermediate correlation between feedback and SRL ($r = .59$) was much lower than the critical of .85, which would suggest the presence of problematic multicollinearity.

Table 3: Pearson Correlation Matrix for Study Variables ($N = 300$)

Construct	1. Feedback	2. SRL	3. Acad. Perf.
1. Feedback	—		
2. Self-Regulated Learning (SRL)	.59**	—	
3. Academic Performance	.62**	.68**	—

Note. ** $p < .01$ (two-tailed). SRL = Self-Regulated Learning; Acad. Perf. = Academic Performance.

Measurement Model Assessment.

The results of the measurement model are given in Table 4. All three constructs were convergently validated with AVE values ranging between 0.51 and 0.54, which is above the 0.50 criterion, and composite reliability ranging between 0.86 and 0.90, which is above the 0.70 criterion (Hair et al., 2019). Individual item loading of factors was 0.66 to 0.83, which are all statistically significant at $p < .001$. The discriminant validity was evaluated through the

HTMT criterion with the highest HTMT ratio of 0.81 (SRL-Academic performance) lesser than the 0.85 threshold indicating that the three constructs were empirically different. These findings justified the sufficiency of measurement model as a structural estimation basis.

Table 4: Measurement Model: Convergent Validity Indicators (N = 300)

Construct	AVE	CR	Max. Loading	Min. Loading
Feedback	0.52	0.87	0.81	0.67
Self-Regulated Learning	0.54	0.90	0.83	0.68
Academic Performance	0.51	0.86	0.80	0.66

Note. AVE = Average Variance Extracted; CR = Composite Reliability. All AVE \geq 0.50 and CR \geq 0.70.

Mediation Analysis Results Structural Equation Modeling.

The complete results of the structural model are shown in Table 5. Overall model fit was satisfactory: CFI = 0.95, TLI = 0.94, RMSEA = 0.056, SRMR = 0.061, all meeting recommended benchmarks (Hu & Bentler, 1999). The variance in self-regulated learning (R² = .30) and academic performance (R² = .55) were strongly explained by the model, which means that the model has a good explanatory power.

The direct effects are shown in panel A of Table 5. Feedback exerted a significant positive direct effect on academic performance ($\beta = 0.38, t = 7.60, p < .001, 95\% \text{ CI } [0.28, 0.48]$), supporting H1. Feedback also strongly forecasted self-regulated learning ($\beta = 0.55, t = 11.00, p < 0.001, 95\% \text{ CI } [0.45, 0.65]$), which defines the initial portion of the mediation chain. The self-regulated learning then had a strong positive influence on academic performance ($\beta = 0.44, t = 8.80, p < .001, 95\% \text{ CI } [0.34, 0.54]$) in support of H2 and determining the second part of the mediation pathway.

The bootstrapped indirect effect is presented as panel B. Feedback had an indirect positive and statistically significant impact on academic performance via self-regulated learning ($\beta = 0.24, p < 0.001, 95\% \text{ CI } [0.16, 0.32]$) and, therefore, SRL was found to have a statistically significant mediating role in the feedback-academic performance relationship, and H3 was supported. The confidence interval was not equal to zero, which gave solid evidence of mediation. The significance of the direct feedback-performance path ($\beta = 0.38$) and the considerable indirect pathway supported the partial and not complete mediation role of feedback in academic performance by the SRL channel and other direct pathways as was predicted by Hattie and Timperley (2007) in the multi-level feedback model. Thereby all the three hypotheses were supported.

Table 5: SEM Results: Direct Effects and Bootstrapped Mediation (N = 300)

Path / Effect	β	SE	t	p	95% CI	Decision
Panel A: Direct Effects						
Feedback → Academic Performance (H1)	0.38	0.05	7.60	<.001	[0.28, 0.48]	Supported
Feedback → Self-Regulated Learning	0.55	0.05	11.00	<.001	[0.45, 0.65]	—
SRL → Academic Performance (H2)	0.44	0.05	8.80	<.001	[0.34, 0.54]	Supported
Panel B: Indirect Effect – H3 (Bootstrapped Mediation)						

Feedback → SRL →	0.24	0.04	6.00	<.001	[0.16, 0.32]	Supported
Acad. Performance						
Panel C: Variance Explained						
R ² – Self-Regulated Learning	—	—	—	—	.30	—
R ² – Academic Performance	—	—	—	—	.55	—

Note. SRL = Self-Regulated Learning. Indirect effect estimated via bias-corrected bootstrapping (5,000 resamples) with 95% confidence intervals. β = standardised path coefficient; SE = standard error. CI = Confidence Interval.

Discussion

The research findings are highly empirical evidence of all three hypotheses and offer many contributions to current literature in the field of educational psychology on feedback, self-regulation, and academic performance. H1: The positive and significant relationship between feedback and academic performance is confirmed, which duplicates and broadens the existing international evidence base (Hattie and Timperley, 2007; Shute, 2008) in a Pakistani university environment, and proves that the performance-enhancing effectiveness of instructional feedback is not a feature of Western or high-resource educational environments only. This huge direct impact ($\beta = 0.38$) and the large share of academic performance that is explained ($R^2 = .55$) together imply that feedback is a truly potent instrument to enhance student outcomes within the Islamabad university sector, which has substantial practical consequences in the pedagogical practice.

The most interesting theoretically significant study outcome is the partial mediation result (H3). The fact that SRL has a significant mediation effect between the feedback and performance (indirect 0.24, 95% CI [0.16, 0.32]) gives the original evidence of this mediation process using SEM in a Pakistani university environment to support the theoretical frameworks proposed by Butler and Winne (1995), Zimmerman (2000), and Nicol and Macfarlane. The implication of the fact that the effect of feedback on performance is partially mediated by SRL has a straightforward practical implication: any intervention aimed at improving the self-regulatory abilities of students (i.e. by teaching them explicit SRL, training them on metacognitive skills, or having students reflect on their feedback) will increase the academic benefits that properly designed instructor feedback can lead to. The biased nature of the mediation is also instructive: it reaffirms that feedback can affect performance not only via the SRL route but also via more immediate routes, say by directly correcting performance or boosting motivation or by explaining performance standards, which do not involve self-regulatory processing to operate. This direct effect of SRL on academic performance (H2 supported, $\beta = 0.44$) alone highlights the importance of promoting self-regulatory skills in students, which is in line with the large body of previous research on SRL and academic performance (Credé and Phillips, 2011; Pintrich and De Groot, 1990; Zimmerman and Martinez-Pons, 1990).

Conclusion and Recommendations

The paper examined the mediating effect of self-regulated learning in the relationship between feedback and academic performance among 300 university students who were sampled in six institutions in Islamabad, Pakistan. The study adopting a quantitative correlational design and SEM with bootstrapped mediation testing revealed that feedback significantly predicted both self-regulated learning and academic performance, that SRL

significantly predicted academic performance, and that SRL partially and significantly mediated the feedback-performance relationship. The results contribute to the empirical evidence of the mechanisms of feedback in providing its academic performance effects, the expansion of the SRL mediation framework to a non-Western university, and the evidence-based recommendations on enhancing teaching and learning quality in Pakistani higher education.

A number of specific recommendations are a result of these findings. Faculty in the public and private universities in Islamabad need to focus their attention on the delivery of process and self-regulation level specific, timely and actionable feedback that is most effective in influencing the development of students as formulated by Hattie and Timperley (2007). The institutional level of the faculty development programmes must comprise systematic training on formative feedback design, which would make instructors aware not only of what is a high-quality feedback but also of how to frame and present feedback in a manner that triggers the self-regulatory processes of the students. University curriculum designers must include explicit self-regulated learning teaching in introductory courses - especially first- and second-year courses - teaching students goal-setting, self-monitoring and self-evaluation techniques that make them employ instructor feedback effectively. Metacognitive skills workshops provided in student support centres should be supplementary to academic advising and equip students with practical means of SRL strategy development. The Higher Education Commission of Pakistan ought to think of including assessment literacy and quality of feedback as part of its institutional quality assurance models, and encourage universities to cease focusing on summative-only evaluation cultures in favor of formative feedback models that develop long-term academic self-regulation skills in students. Future studies need to utilize longitudinal designs, objective GPA data and experimental or quasi-experimental manipulations of feedback quality to determine causal directionality and whether SRL-enhancing interventions can further increase the performance benefits of enhanced feedback practice.

References

1. Bandura, A. (1997). *Self-efficacy: The exercise of control*. W. H. Freeman.
2. Butler, D. L., & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis. *Review of Educational Research*, 65(3), 245–281. <https://doi.org/10.3102/00346543065003245>
3. Cho, K., & Cho, M. H. (2011). Training of self-regulated learning skills on a social website: Effect on acquisition of research writing skills. *Instructional Science*, 39(6), 949–965.
4. Credé, M., & Phillips, L. A. (2011). A meta-analytic review of the motivated strategies for learning questionnaire. *Learning and Individual Differences*, 21(4), 337–346. <https://doi.org/10.1016/j.lindif.2011.03.002>
5. Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches* (5th ed.). SAGE Publications.
6. Hair, J. F., Risher, J. J., Sarstedt, M., & Ringle, C. M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24. <https://doi.org/10.1108/EBR-11-2018-0203>
7. Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. Routledge.
8. Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of Educational Research*, 77(1), 81–112. <https://doi.org/10.3102/003465430298487>

9. Hayes, A. F. (2018). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach (2nd ed.). Guilford Press.
10. Higher Education Commission of Pakistan. (2022). HEC annual report 2021–22: Advancing higher education for development. Government of Pakistan.
11. Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling*, 6(1), 1–55.
12. Kluger, A. N., & DeNisi, A. (1996). The effects of feedback interventions on performance: A historical review, a meta-analysis, and a preliminary feedback intervention theory. *Psychological Bulletin*, 119(2), 254–284. <https://doi.org/10.1037/0033-2909.119.2.254>
13. Malik, S., & Bhatt, H. (2020). Examining the role of self-regulation in academic achievement among university students in Pakistan. *Journal of Education and Educational Development*, 7(1), 121–139.
14. Nicol, D. J., & Macfarlane-Dick, D. (2006). Formative assessment and self-regulated learning: A model and seven principles of good feedback practice. *Studies in Higher Education*, 31(2), 199–218. <https://doi.org/10.1080/03075070600572090>
15. Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). McGraw-Hill.
16. Pintrich, P. R. (2000). The role of goal orientation in self-regulated learning. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 451–502). Academic Press.
17. Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology*, 82(1), 33–40. <https://doi.org/10.1037/0022-0663.82.1.33>
18. Shah, R., & Shaikh, F. (2021). Formative feedback and student self-regulation in Pakistani universities: A survey study. *Pakistan Journal of Education*, 38(2), 59–76.
19. Shute, V. J. (2008). Focus on formative feedback. *Review of Educational Research*, 78(1), 153–189. <https://doi.org/10.3102/0034654307313795>
20. van der Kleij, F. M., Feskens, R. C. W., & Eggen, T. J. H. M. (2015). Effects of feedback in a computer-based learning environment on students' learning outcomes: A meta-analysis. *Review of Educational Research*, 85(4), 475–511. <https://doi.org/10.3102/0034654314564881>
21. Zimmerman, B. J. (2000). Attaining self-regulation: A social cognitive perspective. In M. Boekaerts, P. R. Pintrich, & M. Zeidner (Eds.), *Handbook of self-regulation* (pp. 13–39). Academic Press.
22. Zimmerman, B. J., & Martinez-Pons, M. (1990). Student differences in self-regulated learning: Relating grade, sex, and giftedness to self-efficacy and strategy use. *Journal of Educational Psychology*, 82(1), 51–59. <https://doi.org/10.1037/0022-0663.82.1.51>