New Trends and Issues Proceedings on Humanities and Social Sciences

Volume 6, Issue 1 (2019) 386-395

www.prosoc.eu

How does using feedback empower student metacognition and learning?

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Suggested Citation:
Thuy, T. T. & Thuy, D. T. T. (2019). How does using feedback empower student metacognition and learning? *New Trends and Issues Proceedings on Humanities and Social Sciences*. [Online]. *6*(1), pp 386–395. Available from: www.prosoc.eu

Selection and peer review under responsibility of Prof. Dr. Jesus Garcia Laborda, University of Alcala, Spain.

Abstract

Encouraging students to foster the learning styles and supporting them to strive with the challenges in education are responsibilities of teachers, especially in higher education where students are expected to master their current and lifelong learning. The study, therefore, investigates the impact of teacher feedback on student meta-cognition and explores the link between student achievements and their cognitive skills through a research done on 440 Vietnamese students from 40 universities and colleges in Vietnam. The findings show that only monitoring strongly affect the students' academic achievement, meanwhile teacher feedback has no direct impact on the students' results.

Keywords: Self-regulated learning (SRL), meta-cognition, teacher feedback, life-long learning, Vietnamese students.

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1. Introduction

Education has been shifted from traditional teaching (transmitting knowledge from teachers to students) to problem-based learning and project-based learning in which students have to actively participate in accessing to various kinds of information and internalising it into their own knowledge (Esteve, 2000; Kennedy, 1998). In this case, teachers no longer are providers of knowledge to students but become learning activity organisers and facilitators (Van Driel, Douwe Beijaard & Verloop, 2001) guiding and giving feedback to students so that students could notice ways to eliminate the gap between the actual learning and the desired goal (Esteve, 2000; Van Driel et al., 2001). To respond to the rapid change in science and technology like what we witness in the second decade of 21st century, self-regulated learning (SRL), 'a powerful new learning theory' (Boekaerts, 1996, p. 100) shows a vital capacity that each learner needs to construct for himself/herself to study independently or to position in the world with various challenges while as teachers,

> 'The challenge we face is how to make the learning in schools more authentic, more useful, and more contextualised for students so that they are equipped to solve problems that they confront in and beyond school' (Winograd, 2003, p. 1).

Moreover, the challenges that both teachers and students have to face, exist in the way that how teachers could use their feedback to help students empower their SRL capacity and how students could benefit the teacher feedback to move forwards in the process of mastering cognitive skills. On the other hand, Pintrich and Zusho (2002) define SRL as a process in which learners set goals for their learning, regulate their learning activities and assess the effectiveness of their work. The writers here just discuss how students' SRL in terms of meta-cognition, including three elements, namely, planning, monitoring and reflecting the learning activities, empowers students ability to master their present study as well as help them surpass obstacles in life-long learning.

The present study aims to address the two following questions:

1. How do the students employ SRL to enhance their academic achievements?
2. How does teacher feedback influence on students' academic achievements?

2. Literature review

2.1. Self-regulated learning and metacognition

Many studies had been implemented to uncover the nature of student learning and what could be done to help students become active learners; however, more investigations about student control and their self-mastery needed to be done. SRL initially appearing in 1980s (Butler & Winne, 1995; Winne, 1996; Winne & Hadwin, 1998), focused on learners' autonomy and responsibilities for their own goal-directed learning (Paris & Paris, 2001; Winograd, 2003) which refers to the cognitive, metacognitive, behavioural, motivational and emotional/affective aspects of learning (Panadero, 2017; Sperling, Howard, Miller & Murphy, 2002). SRL is seen to affect learners comprehensively not only in terms of cognition, regulation of cognition but also of behaviour and emotions; hence, it has become one of the most leading research in the area of educational psychology (Panadero, 2017).

In the light of the model raised by Winne and Hadwin (1998), Greene and Azevedo's (2007) in their review of more recent SRL studies have indicated the tasks of students in SRL.

Table 1. Tasks of students in SRL [adapted in Greene and Azevedo's (2007)]

1	Identifying the task	A Conditions (of learner and context)
2	Planning a response	B Operations to transform input and own data
3	Enacting a strategy	C Standards: criteria for self-appraisal
4	Adapting: reviewing perhaps re-cycling	D Evaluation

The Figure 1 shows different tasks that a self-regulated leaner exercise when they try to study on their own. SRL, therefore, brings in powerful skills (Butler & Winne, 1995) which affects learners the most comprehensively in cognitive, behavioural and emotional aspects, in which metacognition (MC) refers to cognition and regulation of cognitive strategies (Pintrich, Wolters & Baxter, 2000; Schraw & Moshman, 1995), meanwhile Veenman, Van Hout-Wolters and Afflerbach (2006, p. 4) defined MC in terms of many factors, such as 'metacognitive beliefs, metacognitive awareness, metacognitive experiences, metacognitive knowledge, feeling of knowing, judgment of learning, theory of mind, metamemory, metacognitive skills, executive skills, higher order skills, metacomponents, comprehension monitoring, learning strategies, heuristic strategies and self-regulation'. In their research, Veenman et al. (2006) has specifically conceptualised the metacognitive process which involves all possible steps occuring in mental process that initiate and direct learning. In this case, students act as the central agent of the learning process, which means they actively activate their schemata, employ learning strategies to internalise new knowledge and construct new skills in various learning situations; hence, SRL encompasses three factors 'their use of SRL strategies, their responsiveness to self-oriented feedback about learning effectiveness, and their interdependent motivational processes' (Zimmerman & Zimmerman, 2016, p. 6).

Specifically, SRL strategies have been classified as 'self-evaluation, organisation and transformation, goal setting and planning, information seeking, record keeping, self-monitoring, environmental structuring, giving self-consequences, rehearsing and memorising, seeking social assistance (peers, teacher or other adults) and reviewing (notes, books or tests)' (Zimmerman & Zimmerman, 2016, p. 7). On the other hand, SRL, a process of self-observation, self-judgement and self-reactions (Zimmerman, 2014) is compared as a goal-directed activity like other human behaviours. The strategies are the guidelines that learners need to adopt to control and adjust their learning process in a variety of learning contexts in order to obtain the desired learning goals. In short, SRL has become a vital requirement for any learner in generating capacity for their future occupation and lifelong learning (Self-regulated learning in higher education: identifying key component processes, 2011).

2.2. The theory of formative assessment with feedback in the centre and its relationship with SRL

The theory of formative assessment (TFA) appeared around the time of post structuralism as its philosophical basis (Clark, 2011), in which formative assessment is conceptualised as a multi-layer trunk with feedback in the central position illustrating the key function of feedback in supporting students to boost their learning in terms of MC and self-efficacy (SE).

Figure 1. The TFA (Clark, 2011)

The Figure 2 (Clark, 2011) shows the TFA as the big outer ring serving two purposes of assessment, which is assessment for learning (AfL) and assessment as learning (AaL). Interestingly, the outer ring as the TFA embraces SRL inside which encompasses SE and MC, namely, monitoring (M), planning (P) and reflection (R) on the left, while appearance of SE indicates ambition (A), persistence (P) and efforts (E) on the right. The Figure 2 implies that formative assessment with the focus of feedback affects SRL cognitively and emotionally.

Assessment feedback has not been defined systematically; however (Evans, 2013, p. 71), considers it as 'an umbrella concept' that covers various kinds of definitions consisting all 'feedback exchanges' that learners got, taken or received from many sources, such as peers, parents, teachers or any person around them. To support students learn better, formative assessment need to be given through the feedback after students perform a task. Formative assessment with the most notable focus on feedback which means 'the provision of information about performance' (Yorke, 2014) given to students has been regarded to advance their learning as Eraut (2006) points out:

> When students enter higher education... the type of feedback they then receive, intentionally or unintentionally, will play an important part in shaping their learning futures. Hence we need to know much more about how their learning, indeed their very sense of professional identity, is shaped by the nature of the feedback they receive. We need more feedback on feedback (p. 118).

Eraut (2006) has emphasised profound impact of feedback on students' future progress; however, certain impact of teacher feedback on student MC has been underexplored.

According to Winne and Butler (1994, p. 5740), feedback is delineated as, 'informative with which a learner can confirm, add to, and overwrite, tune, or restructure information in memory, whether that information is domain knowledge, meta-cognitive knowledge, beliefs about self and tasks or cognitive tactics and strategies'. Due to the feedback, learners know what they need to adjust in their study. More importantly, Butler and Winne (1995) have confirmed the link between feedback and SRL when stating that feedback brings in the essence of performance outcomes. Boekearts and Corno, furthermore, in their discussion of top–down SR draw on the model of Winne and Hadwin (1998) stating that it:

…specified the recursively applied forms of metacognitive monitoring and feedback that change information over time (thus influencing goals) as self-regulated learners engage in an assignment (p. 203).

On the other hand, Nicol and MacFarlane-Dick (2006) argue that teacher feedback is a potential source to strengthen the power of SRL in the way that drive students to become self-regulated learners who are active in problem solving processes (Clark, 2014). Moreover, formative feedback is confirmed as 'an iterative and dialogic process that promote reflective thinking and self-regulatory strategies among the students' (Gikandi et al., 2011, p. 15).

MC has been classified into categories, including knowledge of cognition and regulation of cognition (Veenman et al., 2006). In the same direction, Butler and Winne (1995) have confirmed the link between feedback and SRL when stating that feedback brings in the essence of performance outcomes and feedback greatly affect students' all aspects of learning when emphasising 'for all self-regulated activities, feedback is an inherent catalyst' (Butler & Winne, 1995, p. 246).

When considering multilateral impacts between teachers and learners and between learners themselves, William and Thompson (2007) analyses the five strategies of formative assessment based on the interrelationship of three dimensions, namely, teachers, students and learners shown in Figure 2.

	Where the learner is going	Where the learner is right now	How to get there
Teacher	1. Clarifying learning intentions and criteria for success.	2. Engineering effective classroom discussions and other learning tasks that elicit evidence of student understanding	3. Providing feedback that move learners forward
Peer	Understanding and sharing learning intentions and criteria for success.	4. Activating students as instructional resources for one another	
Learner	Understanding learning intentions and criteria for success.	5. Activating students as the owners of their own learning	

Figure 2. Aspects of formative assessment (William & Thompson, 2007)

Figure 3 shows the interrelationship or the tri-dimensional direction between the three subjects in education process, including teachers, learners and peers; moreover, it reveals five strategies of formative assessment reflecting different types of learning, such as collaborative learning (Slavin et al., 2003) and SRL (Pintrich, 1990) which shows the active role of learners as people taking responsibilities for their learning. The formative assessment from the three sources of feedback helps learners not only notice learning intentions and success criteria but also spot discrepancy between their actual learning state and their desired goal so that they know what they need to adjust and what they need to do to get the desired learning goals. To strengthen the view, Nicol and MacFarlane-Dick (2006) argue that teacher feedback is a potential source to strengthen the power of SRL in the way that drive students to become self-regulated learners who are active in problem solving processes (Clark, 2014). Moreover, formative feedback is confirmed as 'an iterative and dialogic process that promote reflective thinking and self-regulatory strategies among the students' (Gikandi et al., 2011, p. 15).

3. Research method

A sample of 440 Vietnamese university students (96 males and 344 females) in 40 universities voluntarily participated in the study, which would be demographically described in Table 2 as follows. The survey participants majored in many disciplines of social science and natural science covering five studying levels from freshman to super senior, in which freshmen participated in the survey the majority, followed by juniors, sophomores, seniors, while the smallest number of respondents (3.2%) belongs to super seniors.

Table 2. Demographical features of the survey respondents

Category	Group	*N*	Percentage (%)
Gender	Male	96	21.8
	Female	344	78.2
Classification	Freshman	160	36.4
	Sophomore	87	19.8
	Junior	124	28.2
	Senior	55	12.5
	Super Senior	14	3.2
Major	Social Science	141	32.0
	Natural Science	177	40.2
	Foreign language	122	27.7
Self-study hours	Under 3 hours	160	36.4
	From 3 hours to under 6 hours	88	20.0
	From 6 hours to under 9 hours	90	20.5
	More than 9 hours	102	23.3
Student achievement	Poor	14	3.2
	Average	124	28.2
	Good	223	50.7
	Very good	69	15.7
	Excellent	10	2.3

The students had different ways to spend time studying on their own outside classroom. The majority of them (36.4%) spent the least self-study hours (less than 3 hours), meanwhile the rest of respondents had approximately equal self-study time. Interestingly, the number of students with the longest self-study time (more than 9 hours a week) nearly accounts for one fourths of the total four time groups ranking the second biggest group who focused extensively on their learning outside classroom. The Table 2 also reveals the students' academic achievements, of which good students making the majority took half of the total, whereas the minorities belonged to the poor and excellent categories and the students of average education level ranked the second group. The students were invited to voluntarily answer a questionnaire, including 23 items on students' planning, monitoring and reflection activities.

4. Research findings

4.1. Student metacognition and teacher feedback

The mean of the three MC items (planning, monitoring and reflecting) and the three aspects of feedback fluctuate quite stably from 2.40 to 3.00, which show that most survey respondents agree with the asking items. Among the three metacognitive elements, reflecting or evaluation is the most preferred step of the students in their cognitive process with the biggest mean (M = 2.97, SD = 0.42), while monitoring is the least gratifying step among the respondents and amazingly, all the student agreed with the frequency of the positive teacher feedback they had received.

Table 3. Mean of dimension of MC and feedback

	N	Mean	Standard deviation
MC			
Planning	440	2.74	0.45
Monitoring	440	2.40	0.49
Reflecting	440	2.97	0.42
Feedback			
Feedback Quality	440	2.83	0.44
Negative Feedback Frequency	440	2.46	0.67
Positive feedback Frequency	440	3.00	0.59

4.2. The model of teacher feedback impact on student metacognition and achievement

The model clearly reveals the impact of MC on study achievement and the impact of teacher feedback on student MC.

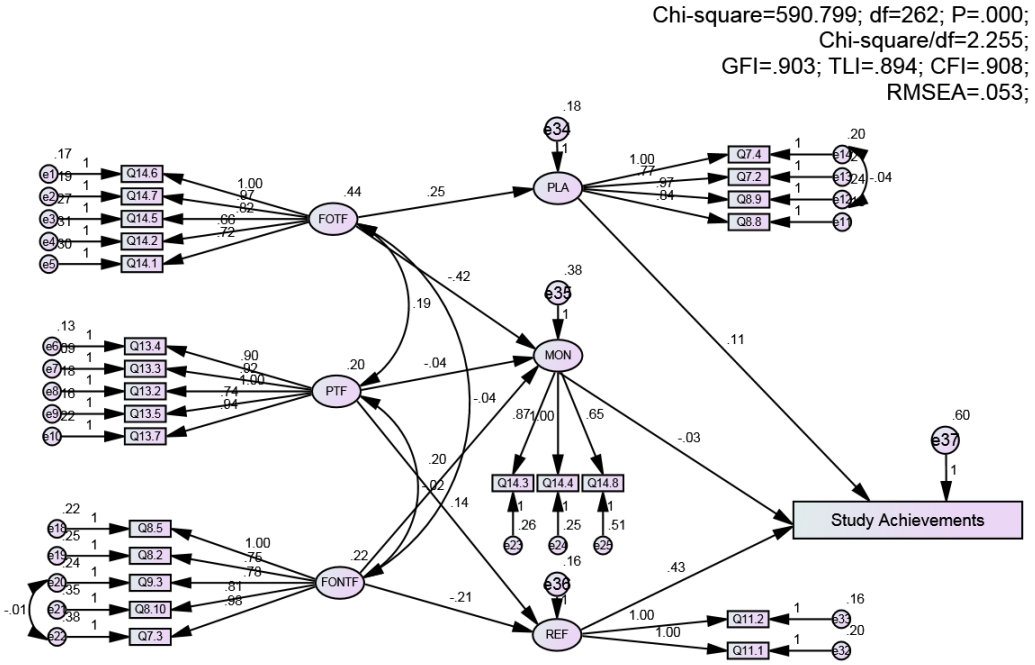

Figure 3. The model of teacher feedback on student MC and achievement

The model has the model fit summary as being shown in Table 4 below. The model with CMIN/DF = 2.255 (<3) and goodness of fit (GFI) = 0.903 (>0.9) indicates that the model is of good quality.

For the purpose of measurement validation, CFA was firstly adopted. In Table 4, we showcase the results of our multiple fit indices, including chi-square, degree of freedom, GFI, adjusted goodness of fit (AGFI), normed fit index, root mean square error of approximation and Comparative fit index (CFI). As indicated in Table 4, all multiple fit indices obtained from our estimation are satisfied.

Table 4. Results of multiple fit indices

Index	Result	Acceptable level
Chi-square	395.281	-
Degree of freedom	235	-
Chi-square/Degree of freedom	1.682	<5
GFI	0.932	>0.9
AGFI	0.913	>0.8
TLI	0.946	>0.9
RMSEA	0.039	<0.08
CFI	0.954	>0.9

The model shows negative correlations between frequency of positive feedback (1) and frequency of negative feedback (5) as well as the negative correlation between frequency of negative feedback and positive feedback (2). Positive feedback and frequency of positive and negative feedback do not in turns affect all three steps of metacognitive skills, conversely, each type affects planning, monitoring and reflecting in its own way with approximately equal force (0.22–0.33) except for the influence of frequency of negative feedback on planning which is the weakest. The model also reveals student MC in which planning (3), monitoring (6) and reflection/evaluation (9) are negatively interrelated, which indicates that the students flexibly adopted the three cognitive skills instead of rigidly following them in order. It also mean that the students did not evaluate the three skills planning, monitoring and reflection equally important, however they might randomly take any of the cognitive skills whenever they might think it was essential to them. Furthermore, only monitoring has positive impact on student academic achievement, meanwhile the other two cognitive skills have no influence on this achievement though the three skills are correlated. This implies that the students did not pay much attention to thoughtful planning and reflection or evaluation on their performance; in other words, their planning and evaluation/reflection on performance were not strong enough to boost any change in study results. It can be understood that the students need to enhance their ways of planning and reflection on performance so that adopting the two steps could result in positive changes in academic results.

The negative feedback and positive feedback have such negative correlation since they are contrastive by nature. On the other hand, the model shows the interrelation between the three metacognitive skills; however, they do not affect one another in the positive way from the first planning skill to the other skills in the cognitive process namely monitoring and reflection. The direction of impact here is negatively converted from the back step (reflection) to the initial monitoring and planning steps in the cognitive stage, which means that the students in the survey did not follow the steps in the cognitive process, they might randomly use any cognitive step which has been in the same line in the research done by Winne and Hadwin (1998, p. 281–282). Specifically, positive feedback from teacher help the students determine their clear learning objectives while their clear goals affect student self and peer assessment. Moreover, the more negative feedback the teachers give the students, the more difficulties the students have to deal with since they have little understanding about the teachers' requirements.

It has been found in some surveys that students find feedback the least satisfying factor compared to other elements in their courses (Nicol, Thomson & Breslin, 2014), so the attention in changing the quality of feedback and the form of feedback should be the focus of our next research.

5. Discussion and conclusion

SRL acts as a source of powerful skills to empower students the capacity to achieve desired academic goals (Paris & Paris, 2001; Winograd, 2003) and Butler and Winne (1995) evaluates SRL as a pivot upon student achievement; however in this research, we do not see strong influence of planning and reflection on the students' academic achievement. The students in the research, hence need to

focus more on their ways of planning and reflection and the teachers also have to spend more time discussing with their students the learning intentions and criteria of success so that they would become better at planning, monitoring and reflecting their learning practice.

Moreover, teacher feedback investigated in the study does not directly affect the students' achievement and feedback has been found to be the least gratifying element (Nicol et al., 2014), while feedback is an essential requirement for students despite their minimum influence on student performance (Kluger & Adler, 1993; Kluger & DeNisi, 1996). The teachers are expected to enhance the quality of feedback and the frequency of positive feedback in order that the learners could benefit from teacher feedback to eliminate the discrepancy between their target learning goal and their actual state of study.

In our study, the students' monitoring has been proved to be a good indicator that makes a strong positive impact (0.38) on student learning, which needs to be maintained and praised among the students. The findings in the research have urged us to investigate the reasons to explain the very weak or zero link between the students' planning, reflecting and students' academic results as well as study thoroughly kinds of proper feedback that the students expect to get from their teachers.

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