

Providing formative feedback to students via emails and feedback strategies based on student metacognition

Chang Zhu
Vrije Universiteit Brussel

ABSTRACT

This research focuses on studying students' preferences of formative feedback strategies and the effects of teachers' formative feedback on student learning. Electronic feedback has the advantage of providing timely and individualised feedback. Participants in this study were third-year undergraduate students ($n=109$) studying Business Management at a university in Beijing, China. In order to measure students' metacognition and their preferred feedback strategies, a questionnaire was administered to participants. In addition, teacher feedback via emails and communications between the teacher and the students were collected for analysis. The results show that students with high and low metacognition reported a different level of preferences for feedback strategies. The results show that teachers' formative feedback was appreciated by students, and promoted student learning.

INTRODUCTION

Assessment is a central element in the overall quality of teaching and learning in higher education. Formative assessment aims to enhance learning through providing appropriate feedback. Formative feedback is defined as information communicated to the learner that is intended to modify the learner's thinking or behaviour for the purpose of improving learning. Formative feedback is usually presented as information to a learner in response to some action on the learner's part. There are various types of formative feedback, e.g. verification of response accuracy, explanation of the correct answer, hints, worked examples (Kulhavy and Stock, 1989). Verification is defined as the simple judgment of whether an answer is correct, and elaboration is the informational aspect of the message that provides relevant cues to guide the learner toward a correct answer. Researchers point out that effective feedback should include elements of both verification and elaboration (e.g., Bangert-Drowns et al., 1991; Mason and Bruning, 2001). Feedback is generally regarded as a significant factor in motivating learning and improving knowledge and skill acquisition (Epstein et al., 2002; Moreno, 2004; Narciss & Huth, 2004). Effective formative assessment helps the student to see the gap between their current understanding of course components and the goals of the course so that they can take the appropriate action to achieve these goals (Ramaprasad, 1983; Sadler, 1989). Previous research on formative assessment points to the importance of feedback to students as part of the learning process (Ramsden, 2003). Black and Wiliam (1998) suggested that innovations designed to strengthen the frequent feedback that students receive about their learning yield substantial learning gains. Other

researchers have also argued that formative feedback is more likely to facilitate effective, well-motivated student learning (Yorke, 2003). Formative feedback can be provided to students through a variety of ways. Among all those methods, electronic feedback methods are increasingly used by teachers since they have the potential to enhance feedback production, delivery and communication (Race, 2001). Previous studies have suggested that student achievement level is relevant when teachers consider feedback strategies (Yorke, 2003). One recommendation is to provide immediate feedback for students with low achievement levels, while delayed feedback is suggested for students with high achievement levels, especially for complex tasks (Mason and Bruning, 2001). Among the factors related to student learning, metacognition is a very important one as it makes the learner aware of his/her cognition and triggers control processes that serve the pursued goal of the self-regulation process (Efklides, 2008). Despite the indisputable importance of feedback and the strong and consistent research outcomes on its effectiveness in the educational process and the promotion of learning, evidence in the literature suggests that often the formative feedback does not reach the students in the desired ways, either being not collected or not read by the students (Bailey, 2009; Winter and Dye, 2004). Other researchers have argued that feedback needs to be personalised and tailored to individual students' strengths and weaknesses (Race, 2006; Irons, 2008).

THEORETICAL BACKGROUND

Metacognition

Metacognition refers to higher order thinking which involves active control over the cognitive processes engaged in learning (Borkowski, Carr, and Pressley, 1987; Sternberg, 1984). It includes a person's knowledge about his or her own cognition and the control he or she has over it (Flavell, 1976; Koriat, 2007). Metacognitive regulation strategies include predicting, planning, monitoring and evaluation of one's own learning (Brown, 1987). Research evidence demonstrates that student metacognition is associated with their academic performance (Laing and Kamhi, 2002). However, previous studies have also suggested that student metacognition and cognitive skills are not always consistent (Kifer, 2002). Empirical studies have identified high metacognition and low achieving students and vice versa (Marsh and Hau, 2004; Shen and Pedulla, 2000). Individual differences exist in metacognition (Kruger and Dunning, 1999). Metacognition is important in learning and is a strong predictor of academic success (Dunning, Johnson, Ehrlinger, and Kruger, 2003). Students of different metacognition capabilities may have different expectations of teacher guidance and feedback (Kruger and Dunning, 1999).

Formative feedback

Formative assessment consists of two parts: the assessment of performance (formally or informally) and the provision of feedback. Monitoring student progress can be a difficult task for teachers. An important way to monitor and provide guidance for student learning process is the use of feedback. Formative feedback can improve teaching and learning and stimulate student thinking (Bransford, Brown and Cocking, 2000, 128). Feedback is

an essential component in all learning contexts and serves a variety of purposes including evaluation of students' achievements, development of students' competences and understanding, and elevation of students' motivation and confidence (Hyland, 2000). Previous studies show that formative assessment techniques can improve teaching and learning (Race, 2006). Formative feedback can be provided in response to students' work on essays, assignments, projects, and etc. In order to be effective, formative feedback needs to be timely, motivational, personal, manageable and relevant (Irons, 2008; Juwah et al, 2004). Formative feedback has the advantage of providing students with opportunities to know if they understand the learning material correctly and to correct any mistakes (Shute, 2008). The feedback strategies can include the contents of feedback and how it is communicated to students. Formative feedback needs to be provided appropriately. Moreover, teachers need to use positive or negative feedback in a proper way. For example, educational practices have shown that low achievers may need more detailed and constructive feedback. Some studies found that the quality of teachers' feedback varied considerably and some were too vague to be of any practical value (Higgins, Hartley and Skelton, 2002). Formative feedback strategies based on students' characteristics are very important since the strategies selected may encourage or discourage students in the feedback process.

Electronic feedback

Formative feedback can be communicated to students in a number of different ways, both traditional and electronic (Irons, 2008). Traditional methods include handwritten comments, face-to-face individual feedback, group feedback in the classroom and print-outs of word-processed feedback forms, etc. Electronic feedback methods include email feedback, feedback in e-learning systems or online feedback systems (Hatziapostolou and Paraskakis, 2010). Electronic feedback methods are increasingly used by teachers since they enhance feedback production, delivery and communication (Race, 2006). Previous research has frequently reported that formative feedback is not effective, and does not lead to further action or improvement (Glover and Brown, 2006). Among the identified reasons, the lack of timely feedback is one of the most cited issues. Providing feedback via emails can have the advantages of being timely, motivational, individual and manageable. With the frequent use of ICT in education, more and more students submit their written assignments to teachers via email. Emails can also allow teachers to send individualized feedback to each student in a timely manner. In addition, Yu and Yu (2002) found empirical evidence supporting the usefulness of e-mail as a promising aid to promote student cognitive growth.

Student metacognition and tailored feedback

Researchers have argued that feedback needs to be personalised and tailored to individual students' strengths and weaknesses (Race, 2006; Irons, 2008). Previous studies suggest that an important part of providing feedback to students is matching the type of feedback to a student's learning style. The use of appropriate feedback is important (Carless, 2006). Specific individualised feedback can promote student understanding and quickly correct student individual misconceptions (McMillan, 2001). Researchers have argued that formative assessment should be provided in a proper way, as it can play an important role

in student motivation. However, very limited research has been conducted on how feedback can be tailored to individual students. Furthermore, few studies have paid attention to the level of student metacognition and adaptive formative feedback strategies based on student metacognition levels.

Sternberg (1998) argued the importance of metacognition advocating that it is important for teachers to take students' metacognitive functioning into account to foster student academic success. In the assessment process, teachers need to understand students' individual characteristics such as their motivation beliefs and metacognition (Harlen, 2006). Each student has unique strengths and weaknesses. As a result, in order to be effective and enable students to improve their competences, formative feedback needs to be personalised and tailored to fit each student's strengths and weaknesses. Furthermore, teacher skills and efforts are needed in order to give detailed, tailored and personalized feedback to students. Formative feedback may have positive or negative effect on student motivation and self-esteem. It affects students' personal feelings which, in turn, affect their engagement in the learning process (Juwah et al, 2004). For students with lower metacognitive abilities, formative feedback should explain in more detail information about their knowledge gaps, specific errors, misconceptions, and ways to improve. However, for students with higher metacognitive abilities, different strategies can be used as these students are more capable of reflecting, regulating and evaluating their learning. Previous research has suggested that student achievement levels and prior knowledge need to be considered when providing feedback strategies to students (Waldrop et al, 1986). Mason and Bruning (2001) suggest that there may be differences in the extent to which lower and higher ability students effectively utilize various types of feedback. Low achieving students may need more positive, detailed and elaborative feedback and clear guidance in order not to be discouraged (Yorke, 2003). For high achieving students, positive feedback is also important, however, detailed or elaborative feedback may be relatively less necessary than for low achieving students, as high achieving students may have a higher confidence in his/her answer (Mory, 1994). Although there was no direct assessment of student metacognition, the research of Mason and Bruning (2001) pointed out that high achieving students may have the necessary metacognitive skills to identify errors and actively seek the correct information. Other studies have also found different student learning gains in response to different types of feedback (Morrison et al., 1995; Pridemore and Klein, 1995). However, empirical studies examining student preferences for feedback strategies are very limited, especially in relation to student metacognitive abilities.

RESEARCH QUESTIONS

The research questions were two-fold: (a) Do students of different metacognition level prefer different type of formative feedback strategies? (b) What are the effects of teachers' formative feedback strategies on student learning?

METHOD

Participants and measures

Participants in this study included one teacher and 109 third-year undergraduate students studying business management at a Chinese university in Beijing. The language of instruction was Chinese. The research was conducted during the 2009-2010 academic year. Among the students, 64 of them were female and 45 were male, with an age range from 19 to 25 years old. A three part survey was administered to the students:

(1) Student metacognition using a 24-item Chinese version of Metacognition Questionnaire for University Students (Kang, 2005): it includes four scales: metacognitive planning, monitoring, regulating and evaluating; and students were asked to report their metacognition level with a 1-5 Likert scale.

(2) Questions about students' preferred teacher feedback strategies and their teacher's actual feedback strategies. Four types of feedback strategies were differentiated: (A) formative feedback without positive or negative comments, in which the teacher gives some basic feedback about the work of students but without details of what was good or not good; (B) formative feedback with positive or negative comments, in which the teacher gives feedback about the work of students by reflecting what was good or not so good; (C) formative feedback with constructive and elaborative comments, in which the teacher gives feedback about the work of students and provide suggestions as to the ways the students can improve their work and do better; (D) no formative feedback, only with a score or ranking. Students were asked to choose preferably only one answer from A, B, C or D, but they could choose more than one answer when applicable.

(3) Questions about student perceptions of the effect of teacher's formative feedback on their learning motivation and achievement were asked. The teacher's formative assessment of student assignment was also used.

In addition to the survey, the teacher participant provided the email communications that were used for formative feedback to students for this course. Part of the email communication scripts between the teachers and students involved in the study were analysed. The scripts were translated from Chinese into English by a bilingual expert and then checked by another bilingual expert and a native speaker of English.

The research objective was explained at the beginning of the survey and informed consent was obtained from all the participants. Agreement was also obtained from the teacher and the students to use the email communications only for the purpose of this research. The anonymity of the respondents was assured.

RESULTS

Student metacognition

The reliability of the Metacognition Questionnaire for University Students was confirmed to be satisfactory for the four scales with Cronbach's α from .79 to .87 with an overall Cronbach's α of .93.

Students with a score equal to or higher than the mean were recoded as having a High metacognition level; and students with a score lower than the mean were recoded with a Low metacognition level. Students were clustered into two groups according to their metacognition level, and their metacognition score and the clustered number of each group of students is presented in Table 1. The results show that about 60% of the students reported a high metacognition level and about 40% of them with lower metacognition level.

	Mean	SD	Number of students
Metacognitive planning	3.55	.62	
Metacognitive monitoring	3.50	.61	
Metacognitive regulating	3.31	.60	
Metacognitive evaluating	3.18	.55	
High metacognition (HM)			65
Low metacognition (LM)			44

Table 1: Student metacognition score and level.

Student preferences of feedback strategies and reported actual teacher feedback strategies

The results show that a majority of students preferred teachers to use feedback with constructive and elaborative comments. Secondly, about one third of the students also preferred the teacher to use feedback with positive or negative comments. Only a very small proportion of students preferred the teacher to use feedback without positive or negative comments, or without formative feedback. Compared to students with High Metacognition abilities, a larger proportion of students with Low Metacognition (68.8%) preferred the teacher to use feedback with constructive and elaborative comments ($p < .05$). Among the Low Metacognition students, 29.8% of them preferred to receive feedback with positive or negative comments; only 1.6% of them preferred feedback without positive or negative comments and 68.8% preferred feedback with constructive and elaborative comments. Among the High Metacognition students, 57.5% of them preferred feedback with constructive and elaborative comments; 28.5% of them preferred feedback with positive or negative comments, and 9.3% of them preferred feedback without positive or negative comments. Although only a small number of students preferred feedback without positive or negative comments, the results show clearly that students with High Metacognition had a higher preference for this strategy compared to students with Low Metacognition ($p < .05$). In addition, a score without formative feedback was one of the least favoured feedback strategies as perceived by students.

With regard to student reported actual teacher feedback strategies, 56.3% students with Low Metacognition and 45% students with High Metacognition reported that the teacher used feedback with constructive and elaborative comments for their work/assignment, and more than 30% of students with Low or High Metacognition reported the teacher used feedback with positive or negative comments for their work. Students' preferences

of feedback strategies and the reported actual teacher feedback are reported in Table 2. Compared to students with Low Metacognition, more students with High Metacognition reported that the teachers used feedback without positive or negative comments to their assignments. The results indicate that the reported actual teacher feedback strategies matched with the students' preferred feedback strategies quite well. For example, more feedback with constructive and elaborative comments was given to students with lower metacognition; more students with higher metacognition received feedback without positive or negative comments than students with lower metacognition. In general, feedback with constructive comments or feedback with positive or negative comments were appreciated more often and more frequently used by the teacher. However, students reported a higher percentage of teachers' use of a score without formative feedback than their reported preferences for this strategy.

Feedback strategy	Students' preferred teacher feedback strategies		Students' reported actual teacher feedback strategies	
	Students with HM	Students with LM	Students with HM	Students with LM
A. Feedback without positive or negative comments	9.3%	1.6%	6.2%	3.3%
B. Feedback with positive or negative comments	28.5%	29.8%	31.8%	34.4%
C. Feedback with constructive and elaborative comments	57.5%	68.8%	45%	56.3%
D. Without formative feedback, only with a score or ranking	4.7%	3.3%	17%	11.5%

Table 2: Student preferences of teacher feedback strategies and reported actual teacher feedback strategies

Per cell: % of students who selected feedback strategy A, B, C, or D.

Effects of formative feedback on student learning

During the learning process, the teacher provided formative feedback to students with specific comments on the achievement of the students, the good points, the weaknesses and how to improve their work/assignment via email communications. We found that 75% of the students with High Metacognition and 65% of the students with Low Metacognition appreciated the feedback very much. About 50% of the students reported

that the teacher's feedback had improved the quality of their assignment. In addition, 50% of students with High Metacognition and 64% of students with Low Metacognition reported that through teacher's feedback on their work, their interest in this course had been increased. Moreover, 23% of the students reported that their academic achievement for this course had been improved through the teacher's feedback on their work/assignment. Based on the teacher's formative assessment of students' assignment, a majority (60%) of the students had greatly improved their learning performance.

	Students with HM	Students with LM
Improved quality of student assignment	45.8%	44.6%
Increased interests in this course	50%	64%
Improvement of academic achievement for this course	22.9%	23%
Appreciation of teacher's feedback	75%	65%

Table 3. The effects of teacher's formative feedback on student learning

Feedback to students via emails

A further level of analysis was undertaken using email communications between the teacher and the students to understand the feedback strategies. For this course, students sent their assignment to the teacher by email. They could also ask the teacher questions via email. The teacher also sent her feedback to students by email. Below are some examples of feedback that the teacher has sent to students regarding a case study assignment.

(Teacher to Student A) *You have improved your work based on my last comments, but you need to read more relevant references and materials. Below are some of the references that you can read and use in your report.....*

In this feedback, the teacher is objective about the student work, but also pointed out what still needed to be done and how the student could move forward in his/her learning.

(Teacher to student B) *Your case study report has already improved compared to last time, especially the part about the additional explanation about the pricing strategy for hotel reservation. In addition, the part about the information on Contract Law is very useful. Good work.*

In this feedback, the teacher pointed out what was good about the student's work and used complimentary words.

(Teacher to Student C) *Regarding your case study report, I have the following comments and suggestions: 1) You plan to prepare a separate pricing strategy for the hotel business and for the restaurant, this is ok; 2) As to the pricing strategy, my*

suggestion is that you can either make a detailed pricing, or you can also make a price category based on different levels of services; 3) I suggest that you analyze in more details about the market segmentation based on customer groups, numbers and target profits, etc. 4) It is ok to have special offers for specific target groups such as birthday parties, but you can also consider other special offers based on the location of the hotel, etc.

In this feedback, the teacher gave objective feedback about the work of the student, at the same time, she also provided suggestions about the ways the student could improve his/her work.

(Teacher to Student D) Your assignment is very well-done. It is very comprehensive and with a lot of constructive ideas, e.g. the suggestions on optimizing the hardware and infrastructure management and upgrading the soft power of the company such as the corporate culture. Thanks for your diligent work. I appreciated your work!

In this feedback, the teacher pointed out the good points of the student work, and also used positive and motivational words to encourage the student.

(Teacher to Student E) Your revision of case report has greatly improved. Your suggestions are feasible and innovative, for example, the suggestion on installing water-saving toilet is a good one. As a next step, please try to work out a more detailed pricing strategy and marketing strategy. I am very happy that you've worked very hard. I am proud of your work!

In this feedback, the teacher gave positive, motivational and constructive comments about the student's work. Suggestions on how to move forward were given.

In general, while reading the communication between the teacher and the students, it demonstrated that the teacher gave timely and constructive feedback to the students. Suggestions on how to improve their work were also provided. Both the students and the teacher were very closely involved in the learning process for this course. Through email communication, the students and the teacher could maintain their interaction with each other.

CONCLUSION AND DISCUSSION

In conclusion, the results show that (1) students with Low Metacognition would prefer more feedback with constructive and elaborative comments compared to students with High Metacognition; (2) feedback without positive or negative comments and a score without feedback were less preferred by students and less frequently used by the teacher; (3) in general, teacher's actual feedback strategies matched with student preferred feedback strategies according to their metacognition level; (4) students appreciated and benefitted from the formative feedback from the teacher; (5) there was an increase in

students' interest in the course and improvement of academic work as a result of teacher's formative feedback.

The findings of this study indicate that providing the right kind of feedback to students can make a significant difference to their achievement. On the one hand, student characteristics such as metacognition level need to be considered in the adoption of different feedback strategies; on the other hand, teacher feedback needs to be responsive to specific aspects of student work. There needs to be a strong link between the teacher comments and the nature and requirements of the student's assignment. This kind of feedback is helpful for reinforcing learning and enhancing student motivation. Second, the feedback must be timely, as delay in providing students feedback diminishes its value for learning (e.g. Bangert-Drowns, Kulik, Kulik, and Morgan, 1991). Feedback via email communications was considered a very convenient and timely means for the teacher and students in this study. The results of this study are in line with previous findings that feedback is one of the most significant activities a teacher can engage in to improve student achievement (Hattie, 1992). Feedback is best when it is corrective in nature. The current study finds that most students prefer constructive and elaborative comments from teachers. Feedback can be an important part of the learning process when students know how to correct or improve their work from the explicit and constructive feedback of teachers (Tao and Boulware, 2002). Motivational words also played a very important role in teacher feedback. If students know the teacher wishes to see them succeed, and appreciates their work, they are more engaged in the learning process and are more motivated to improve their learning (Leh, 2001). Email as a source of more intensive student interaction can lead to deeper, more active, and more engaged learning (Debard and Guidara, 2000).

The results show that both low and high metacognition students appreciated positive and constructive feedback, while elaborative feedback may be more preferential for low metacognition students. Students with higher metacognitive abilities may benefit more from feedback providing general information and allowing them to re-evaluate their own answers, as they more often possess necessary metacognitive skills to identify errors and actively seek the correct information.

Previous research on formative feedback in higher educational settings is not sufficient, especially using electronic feedback (Glover and Brown, 2006). This research indicates that a large majority of university students prefer to have positive and constructive feedback from teachers. This suggests the importance of formative feedback for students' learning. In addition, as university students need to study a lot or work on assignments on their own, feedback is important to keep them motivated and ensure communication and interaction between students and teachers.

Electronic feedback has its advantages and disadvantages. It is clear that email correspondence in the educational environment provides many relative advantages such as speed of delivery, improved and more immediate communication, freedom from the constraints of location and time, potential for increased interaction, and decreased social isolation. In addition, compared to classroom group feedback, the advantage of email

feedback is that the teacher can give personalised feedback to students. This is especially useful in the higher education settings. In primary or secondary schools, teachers usually meet the students several times a week, and some teachers even everyday. In those circumstances, face-to-face feedback seems to be the most practical and efficient. However, in higher education settings, most teachers only meet the students once a week, and some teachers even less often than once a week. In these circumstances, a closer contact with students through modern technology such as email or online forum is very useful. Furthermore, the ubiquitous nature of email makes it an easy and convenient tool for providing feedback to students. Its unique characteristics and capabilities are worthy of further study and consideration. Electronic feedback also has its disadvantages. As e-mail feedback is asynchronous, teachers do not know immediately what the reactions of students are; nor can they detect whether the students understand the feedback correctly. Compared to face-to-face oral feedback, email feedback seems to be more challenging. First of all, it is written communication. Both students and teachers need to be more careful about spelling and grammar to maintain a sense of professionalism. Secondly, as it is a written record, one may be held accountable for the things put in writing. Therefore, teachers and students need to be more considerate and cautious when using email to send feedback and responses. Thirdly, using electronic written feedback may increase teachers' workload as they need to spend more time on sending the feedback and attending to students' responses (Brown et al, 2004). Fourthly, special efforts are needed to help the social interaction when using email communications in order to limit misunderstandings and miscommunications, as much of the nuance of face-to-face communication is lost in email (Leh, 2001; Woods and Keeler, 2001). In addition, some students may have limited access to networked computers and may be somewhat rushed when they receive feedback from the teacher.

Although previous research has paid a lot of attention to formative assessment, less research has been conducted on using electronic feedback. This research makes an important contribution in studying provision of formative feedback via electronic means and the effectiveness of it. Furthermore, very few studies have attempted to study feedback strategies based on student metacognition abilities. This research makes a great contribution as to how to personalise formative feedback based on student characteristics. Previous research has pointed out student achievement levels and prior knowledge need to be considered when adaptive feedback strategies are to be designed (Boud and Falchikov, 2006). The results of this study can provide some insights with regard to adaptive feedback strategies based on student metacognitive abilities. In addition, previous research has reported that often formative feedback is not effective, and does not lead to further action or improvement; one of the reasons is that feedback is not timely (Glover and Brown, 2006). This study demonstrates that using email as a feedback tool can be efficient and effective to motivate and engage the students in further improvement. Although email can be a wonderful tool for delivering feedback to students, it is very challenging for teachers. Teachers need to be able to figure out how best to take advantage of the pedagogical functions of the communication medium, especially how to increase interaction between instructors and students (Carswell et al., 2000). Using asynchronous communication such as emails requires a shift in communication norms, a sensitivity and attunement to e-communication etiquette and conventions, as well

appropriate communication expectations. It also requires a certain level of technical expertise. Without a firm commitment and a concerted effort from educators, the potential of technology cannot be realized (Leh, 2001).

This study has its limitations. Only one teacher and students from one course were involved in this study. Therefore, the findings may only reflect the views of teachers and students from limited perspectives. Other teachers or students may have different strategies and different preferences. In this study, students were grouped into two categories (high or low) based on their mean scores of metacognition. This may have resulted in students with minor differences in metacognition being grouped as high or low. This limits the findings about the range of variances with regard to student metacognition and their preferences of feedback strategies. This approach may on the one hand be helpful to provide adapted feedback strategies for the students; but on the other hand, may provide a too simplistic differentiation of students. Therefore, future studies should consider a more comprehensive approach, for example by grouping them into more categories or by looking at the extremes, and examining what kind of preferences they may have. In addition, student academic achievement was based on student self-report and teacher's formative assessment of assignment. In future studies, strict experimental design may be applied to test the effects of formative feedback on student achievement. Furthermore, feedback to other types of tasks can be included. Therefore, more studies are needed in this domain with more participants and considering other teacher and student variables. Nevertheless, this study does give evidence that timely, informative, constructive, and tailed feedback can produce positive results in student learning and academic performance. Moreover, feedback, when used in a proper and effective manner, can be one of the most powerful influences on learning, and is worthy of further attention in research and education.

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Correspondence

Prof. dr. Chang Zhu

Department of Educational Sciences

Faculty of Psychology and Educational Sciences

Vrije Universiteit Brussel

Pleinlaan 2, 1050 Brussels

Tel: +32 2 629 2630

Fax: +32 2 269 2623

Email: chang.zhu@vub.ac.be