Chen, W. et al. (Eds.) (2017). Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education

Exploring the Nature of Teacher's Ongoing Feedback to Pupil using iPad

Weiyun CHEN[a,b], Yaofeng XUE[a,b] & Xiaoqing GU[a,b*]
[a]*Department of Education Information Technology, Faculty of Education, East China Normal University, Shanghai, China*
[b]*Shanghai Engineering Research Center of Digital Educational Equipment, East China Normal University, Shanghai, China*
*xqgu@ses.ecnu.edu.cn

Abstract: Ongoing feedback from teacher to pupil during the instruction and interaction play an important role for pupil's learning. In a mobile computer supported teaching environment, the assessment and feedback are often designed to be in a concise and simplified manner for ease of use and data recording. In this paper, we aim to understand the nature of the ongoing feedback in this setting. By employing principal component analysis on a three-semester period dataset, we found the ongoing feedback of the teachers to the pupils can be decomposed into assessment oriented component and encouragement oriented component. The teachers tended to use more assessment oriented feedback than encouragement oriented as they went through from semester 1 to semester 3.

Keywords: iPad; ongoing feedback; classroom behavior management system

1. Introduction

Ongoing feedback from teacher to pupil during the instruction and interaction, in the process of formative assessment, is a prime requirement for pupil's learning progress. Through the timely feedback, teacher convey their judgment on pupil's current state or performance that is intended lead to improved performance and also extend their care and attention to pupils. From these feedback, the pupils are motivated to accommodate themselves to adjust to the formative assessment system and to fit well in it, especially for young children (Brophy, 2013; Evans, 1996). The orientations of teacher's assessment are presented in the ongoing feedback and thus powerfully influence the pupil's motivation, learning achievements.

Despite its generally recognized power, there is considerable variability on effectiveness of feedback, which implies that some types of feedback are more effective than others (Kluger & DeNisi, 1996). Existing empirical analysis and theoretical framework mainly focus on traditional oral assessment and feedback from three aspects: 1) what should be primary key features of effective feedback, e.g. Hattie and Timperley (2007) and Tunstall and Gipps (1996); 2) what make feedback effective or ineffective in real educational setting, e.g. Nelson and Schunn (2009) and Lu and Law (2012); 3) how to give effective feedback to pupils, e.g. Brookhart (2008) and Johnston (2004). However, little attention has been given to teacher's ongoing feedback in mobile computer supported teaching environment. To keep them easy to use for the teachers, these computer-based tools are often designed to be as concise as possible and the teachers are required to accommodate their teaching to the environment (CHEN & GU, 2016). Exploration the nature of feedback in these technology enhanced teaching environment would provide us a new start point for further improvement (Lee, 2009).

The main purpose of this paper is to explore the main factors the drive the teachers' ongoing feedback in a primary classroom via an iPad-based classroom behavior management system (CBMS). The paper is organized as follows. We first review related literature and develop our hypothesis in following section 2 and 3. We then describe our data in section 4. Following that, we test our research hypothesis in section 5. Finally, the paper concludes with practical implication of our results.

2. Literature Review

Feedback is critical for learning any new skills because it provides the pupils or teachers about his or her performance information that is intended to lead to improved performance (Chan, Konrad, Gonzalez, Peters, & Ressa, 2014). Although giving feedback is a generally accepted practice in educational settings, the nature of the feedback and the context in which it is given matter a great deal to its effectiveness (Brookhart, 2008; Mory, 2004) and little consensus exist about what constitutes qualitatively good feedback (Kluger & DeNisi, 1996; Nicol & Macfarlane‐Dick, 2006). To understand the nature of effective feedback, Hattie and Timperley (2007) reviewed the evidence related to the focus of feedback and categorized feedback into four operation levels. They concluded that feedback at the process and self-regulation level seemed to be most powerful to enhance pupil learning, followed by feedback at the task level. Feedback at the self-level, defined as personal feedback and unrelated to specific of the task, seems least effective to enhance learning, but is too often used in classroom situations (Hattie & Timperley, 2007). These four levels resemble the learning activities that were distinguished by Vermunt and Verloop (1999); namely cognitive, affective, and meta-cognitive learning activities (Van den Bergh, Ros, & Beijaard, 2013). Since the affective factor is always part of the interpersonal communication between teacher and pupil (Meyer & Turner, 2002), Bergh, Ros and Beijaard considered the affective feedback be embedded in the nature of feedback, instead of as a separate focus of feedback (Van den Bergh, et al., 2013). From a broader view, Nelson and Schunn (2009) differentiated feedback into cognitive and affective categories. Cognitive feedback targets the content of the work and involves summarizing, specifying and explaining aspects of the work. Affective feedback targets the quality of work and use affective language to bestow praise and criticism.

When the context of feedback was confined in primary school, Tunstall and Gipps (1996) developed a typology of teacher feedback based on observations. They also emphasized that we should see these types on a continuum rather than completely separate categories (Hargreaves, 2005). For example, the socialization oriented feedback underpinned other types of feedback and other types feedback contained their own social codes (Tunstall & Gipps, 1996). They also pointed out the social norms which underlie evaluative feedback were highly important and the range of issues coming into play were complex if we aimed to analyze specific feedback. Since feedback is a social activity, we can understand it only by taking account of the social, cultural, economic, and political contexts in which it operates (Gipps, 1999). Other researchers have concentrated on teasing out what makes feedback effective or ineffective (Lu & Law, 2012; Nelson & Schunn, 2009) and describing the characteristics of effective feedback (Johnston, 2004; Van den Bergh, et al., 2013).

3. Hypothesis and Method

Following previous discussion by Nelson and Schunn (2009), the feedback can be broadly differentiated into two categories: namely cognitive and affective. Based on this, we can first propose that the feedback of the teachers by iPad-based CBMS can be roughly divided into two components. The first component is assessment oriented which evaluate whether the pupil's learning or behavior aspect in the explicit or implicit norms. The second is encouragement oriented which focus on using positive affirmation to encourage pupil's effort. Besides Nelson and Schunn (2009), these types of orientation in traditional oral assessment and feedback are discussed in previous literature, e.g. Tunstall and Gipps (1996), Hattie and Timperley (2007) in different names. Based on these discussions, we propose our first hypothesis as following:

> ***H***1: Teachers' rating of the pupils by iPad-based CBMS can be represented in two common factors.

Since the assessment dimension often intends to reflect the actual pupil status and previous master level and habit of behavior tend to positively correlated subsequent learning outcome and behavior, we can propose a hypothesis that subsequent scores on the first principal component are positively correlated with the previous scores. Meanwhile, since the encourage dimension is often used to encourage pupils and its transformation into actual pupils' good outcomes depends on more

uncontrollable conditions (Hattie & Timperley, 2007), the correlation between the scores on this dimension is not consistently significant. Therefore, we propose the second hypothesis as following:

H2: Subsequent scores on the assessment dimension are positively correlated.

Since the indicators employed in our iPad-based CBMS were often very concise, the exact meaning of a specific rating data may contains mixed cognitive and affective oriented aspects (Van den Bergh, et al., 2013; Vermunt & Verloop, 1999) or in a evaluative-descriptive continuum (Tunstall & Gipps, 1996). To distill these mixed components, principal component analysis can be employed (Johnson & Wichern, 2007).

4. Data

The data were collected from four primary school classes in East China range from September, 2013 to January 2015, across three semesters. In this period, four different Chinese teachers used an iPad-based CBMS to rate the pupils' classroom behavior and learning performance on several predetermined concise indicators. The rating data served as an ongoing feedback to the pupils and was recorded in the backend data management module. Figure 1 depicts a screen of the CBMS app, in which each avatar image indicates each pupil. When a teacher interacts with a specific pupil, he or she can access and rate this pupil's performance on the predetermined behavior indicators by clicking the pupil's avatar. If the pupil performs well on the indicator(s) of the current context, then the teacher can rate her or him positively. To reduce the workload additionally introduced by the iPad-based CBMS for the teachers, the behavior indicators were selected as concise as possible.

Figure 1. User interface of the CBMS app on iPad.

Table 1: Classroom behavior assessment indicators in three semesters.

Semester	Indicators & Abbreviation
Semester #1	(1) Listen to teachers attentively (LTA1); (2) Speak clearly (SC1); (3) Response to teacher's question actively (RTA1); (4) Recognize and read new Chinese characters correctly (RCC1); (5) Copy Chinese characters correctly (CCC1); (6) Participate the game actively (PGA1).
Semester #2	(1) Listen to teachers attentively (LTA2); (2) Spelling Chinese characters correctly (SCC2); (3) Comprehensive expression (CE2); (4) Read the sentences correctly (RSC2); (5) Copy the Chinese characters standardly (CCS2).
Semester #3	(1) Listen to teachers attentively (LTA3); (2) Read the sentences correctly (RSC3); (3) Compose complete sentences (CCS3); (4) Writing Chinese characters correctly and properly (WCP3).

Four Chinese teachers in four first grade classes (with a total of 124 pupils) participated in the study between September, 2013 and January 2015. The enrollment in these four classes was 34, 28, 34 and 29 respectively. The predetermined learning and behavior indicators for individual semesters are listed in Table 1. In total, 27,227 pupils' performance data points were collected during the three-semester study period. Each data point represents a pupil's performance on one particular indicator in one day.

5. Analysis and Results

Principal components analysis (PCA) was conducted on the rating data to test ***H***1 (Note that the common factors are equal to principal components if we employ PCA-based approach to infer factors, see Johnson and Wichern, 2007). Results are shown in table 2. It was found 8 out of the 9 percentage of total rating variances explained by the two principal components are over 80%. Note that the teachers were not familiar with the new tools in the first semester and the randomness in their rating behaviors was more than the other two subsequent semesters. The results indicate that two components are sufficient to represent the variances in the original indicator-rating data. Hypothesis ***H***1 is supported by results in table 2.

Table 2: Proportion of explained rating variance by the first two components in three semesters.

	Explained variance by the first two components			
	Class 1	**Class 2**	**Class 3**	**Class 4**
First Semester	69.57%	81.41%	87.47%	81.55%
Second Semester	91.77%	91.98%	97.13%	91.78%
Third Semester	95.28%	95.95%	96.20%	94.85%

To test ***H***2, the correlations between scores on the previous two principal components and subsequent components across three semesters are analyzed by linear regression. The R-square (R^2), estimated coefficient (coef), standard error (se) and p-value are reported. We used abbreviation "SX_COMY" to stand for " Component Y in Semester X ". The results are shown in figure 2. From figure 2, we can see that the assessment component in the first semester is positively correlated with the assessment component in the second semester and this positive correlation hold the same between the second and the third semester. Note that the R^2 between the first semester and the second semester are generally smaller than the R^2 between the second and the third. This means more assessment and feedback on the learning and behavior dimension are included in the feedback. This can also be verified from two other points. First, the teachers added more academic related indicators in their ongoing assessment and feedback, as in table 1. Second, for the four classes, the proportions of the component "assessment" in the two components generally increased from the first semester to the third semester, as shown in figure 3.

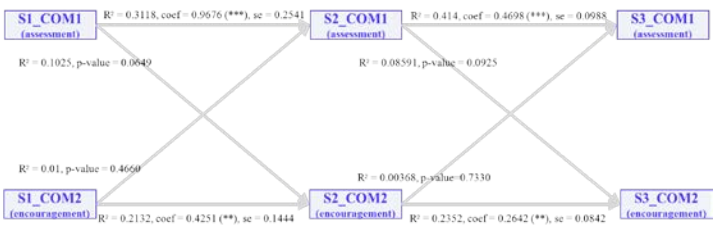

Figure 2(a). Correlation of the two components in class 1.

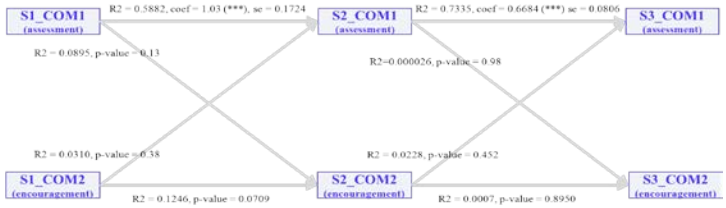

Figure 2(b). Correlation of the two components in class 2.

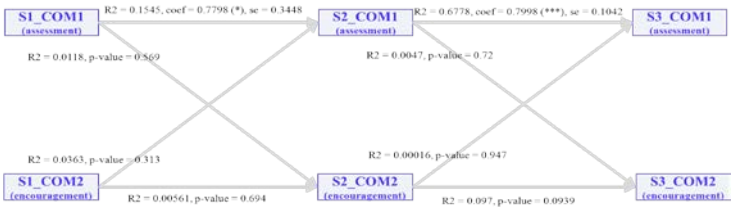

Figure 2(c). Correlation of the two components in class 3.

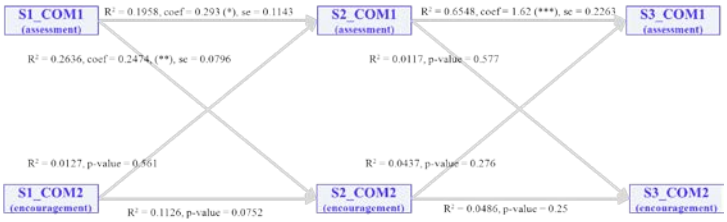

Figure 2(d). Correlation of the two components in class 4.

Figure 2. Correlation between the previous and subsequent two components computed by linear regression

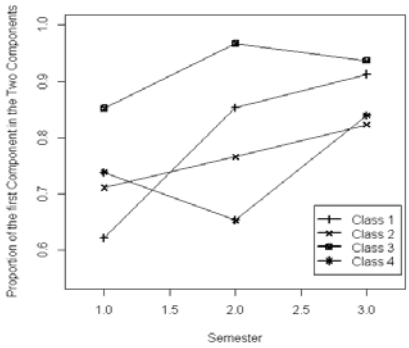

Figure 3. Proportions of the component "assessment" across the three semesters.

6. Discussion and Conclusion

By the study of a three semester feedback data collected by an iPad-based CBMS, we found we can interpret the ongoing feedback of the teachers from two independent viewpoints, namely assessment orientation and encouragement orientation. The assessment oriented component mainly evaluated the pupils' learning or behavior aspect, while the encouragement oriented component focused on positive affirmation to encourage pupil's effort. These two factors can be mixed in actual teacher ratings on specific behavior indicator. Based on this viewpoint, we also found the teachers tended to encourage the pupils' by using their feedback from the beginning. When the teacher got along with the pupils for longer time, the teachers tended to use more assessment oriented feedback to evaluate pupils' actual learning behavior or performance.

Our study shed light on how to explain the collected feedback data in a teacher rating manner using iPad-based behavior management system. Our finding has several implications for teachers and educational researchers interested in designing and implementing concise electronic feedback for pupils. First, teachers can use the extracted component from their historical feedback data to reflect their assessment on the pupil. It is often not accurate for the teachers to reflect their teaching activities solely based on their raw recorded feedback data. The decomposed data would provide the teacher a relatively objective base to reflect their teaching activities. Second, the two confirmed components help the educational researchers to explore the validity of the cognitive assessment component and the affective encouragement component. Since the original feedback data are often quite complex caused by teachers' personal pedagogical experiences, principal components of the original feedback data provide us a more straight way to validate the effectiveness of the feedback by their actual meaning. In future study, we suggest to investigate how the two components affect pupils and under what conditions or circumstances.

Acknowledgements

This work was supported by the Key Project of Science & Technology Commission of Shanghai Municipality of China (Grant No.: 17DZ2281800).

References

Brookhart, S. M. (2008). *How to give effective feedback to your students*: ASCD.

Brophy, J. E. (2013). *Motivating students to learn*: Routledge.

Chan, P. E., Konrad, M., Gonzalez, V., Peters, M. T., & Ressa, V. A. (2014). The critical role of feedback in formative instructional practices. *Intervention in School and Clinic, 50*(2), 96-104.

CHEN, W., & GU, X. (2016). To Click or Not to Click: Effectiveness of Classroom Behavior Rating on Achievement Using iPad. In the 2016 *American Educational Research Association Annual Meeting* (AERA 2016), Washington D.C., U.S.A..

Evans, T. (1996). Encouragement: The Key to Reforming Classrooms. *Educational Leadership, 54*(1), 81-85.

Gipps, C. (1999). SocioCultural Aspects of Assessment. *Review of Research in Education, 17*(5), 1188-1222.

Hargreaves, E. (2005). Assessment for learning? Thinking outside the (black) box. *Cambridge Journal of Education, 35*(2), 213-224.

Hattie, J., & Timperley, H. (2007). The power of feedback. *Review of educational research, 77*(1), 81-112.

Johnson, R. A., & Wichern, D. W. (2007). Applied multivariate statistical analysis: Pearson Prentice Hall:.

Johnston, P. H. (2004). *Choice words: How our language affects children's learning*: Stenhouse Publishers.

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.

Lee, I. (2009). Ten mismatches between teachers' beliefs and written feedback practice. *ELT journal, 63*(1), 13-22.

Lu, J., & Law, N. (2012). Online peer assessment: effects of cognitive and affective feedback. *Instructional science, 40*(2), 257-275.

Meyer, D. K., & Turner, J. C. (2002). Discovering emotion in classroom motivation research. *Educational psychologist, 37*(2), 107-114.

Mory, E. H. (2004). Feedback research revisited. *Handbook of research on educational communications and technology, 2*, 745-783.

Nelson, M. M., & Schunn, C. D. (2009). The nature of feedback: how different types of peer feedback affect writing performance. *Instructional science, 37*(4), 375-401.

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.

Tunstall, P., & Gipps, C. (1996). Teacher Feedback to Young Children in Formative Assessment: a typology. *British Educational Research Journal, 22*(4), 389-404.

Van den Bergh, L., Ros, A., & Beijaard, D. (2013). Teacher feedback during active learning: Current practices in primary schools. *British Journal of Educational Psychology, 83*(2), 341-362.

Vermunt, J. D., & Verloop, N. (1999). Congruence and friction between learning and teaching. *Learning and instruction, 9*(3), 257-280.