How well do microanalytic measures of academic self-regulation predict teacher ratings of student self-regulated learning in science?

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Abstract

The purpose of the current investigation was to establish the validity of microanalytic measures used to assess students' self-regulation of an academic science task, not only in terms immediate achievement, but also in terms of a well-established *person* measure of self-regulated learning. Person measures are designed to capture enduring characteristics of learners that are evident over time. The Rating Student Self-Regulated Learning, A Teacher Scale (RSSRL) is a scale for measuring the self-regulatory behavior of students *after* teachers have observed students' self-regulatory behavior for a period of time. Fifty-one high school students were chosen based on their 10^{th} grade scores in science. Regression analyses suggest that the microanalytic methodology is a valid measure of students' self-regulation when studying and learning about tornados according to a previously well-established measure of self-regulation. In addition to predictive power, microanalytic event measures have the additional advantage of providing a detailed account of students' forethought, performance, and self-reflection phase subprocesses.

Statement of the Problem

Research on self-regulated learning has been conducted for more than twenty years. In a recent overview of the field, Zimmerman (2008) discussed the conceptual and empirical advantages of *event* measures that assess self-regulatory processes and beliefs during actual performance. For example, these measures can reveal causal relations among underlying processes and beliefs. A variety of event methods have been used to measure students' self-regulation of learning as it occurs, including trace logs of SRL processes in computer-assisted environments, think-aloud protocols, structured diaries, and classroom observation measures.

Zimmerman and his colleagues (Cleary & Zimmerman, 2001; Kitsantas & Zimmerman, 2002) have developed another event methodology for assessing self-regulatory processes termed a microanalysis. Like other event measures, it provides a dynamic, online measure of learning. This approach involves asking very specific questions about self-regulatory processes at key points, *before*, *during*, and *after* learning has taken place (Zimmerman, 2008). Students' microanalytic scores have shown high levels of reliability and predictive validity in prior research on athletic tasks (Kitsantas & Zimmerman, 2002), but it has not been validated on academic tasks to date.

The purpose of the current investigation was to establish the validity of microanalytic measures used to assess students' self-regulation of an academic science task, not only in terms immediate achievement, but also in terms of a well established *person* measure of self-regulated learning. Person measures are designed to capture enduring characteristics of learners that are evident over time. The Rating Student Self-Regulated Learning. A Teacher Scale (RSSRL) is a scale for measuring the self-regulatory behavior of students *after* teachers have observed students' self-regulatory behavior for a period of time.

Method

Sample. Fifty-one high school students were chosen based on their 10th grade scores in science. To ensure that the sample be wide ranging in ability, seventeen students were selected from each of three categories: honors or advanced placement level science students, average science students; and at-risk science students.

Procedure. Students were individually presented with a tornados passage to read and study. Upon completion of studying, students were given a test consisting of two parts: the Tornado Knowledge Test (TKT) and the Conceptual Model Test (CMT). The CMT differed from the short answer TKT in that students were required to use a higher level of learning by having to abstract from the written passage, a drawing of the three phases of tornado development. The CMT was a measure of transfer because students had to transform a verbal description of the phases of tornado development into a pictorial account.

The microanalysis consisted of nineteen short answer/scaled questions assessing each process in Zimmerman's three phases of academic self-regulation as outlined in Table 1 below. Several of the processes had multiple questions.

Table 1: *Phases and self-regulation processes* (Zimmerman, 2002).

Forethought Phase	Performance/Volitional Control Phase	Self-Reflection Phase
1) Task Analysis * Goal Setting * Strategic Planning 2) Self-motivation beliefs * Self-efficacy *Outcome Expectations *Intrinsic interest/value *Goal Orientation	1) Self-Control * Task Strategies 2) Self-observation * Metacognitive monitoring	1) Self-judgment * Self-evaluation * Causal Attribution 2) Self-reaction * Self-satisfaction/affect * Adaptive-defensive

The RSSRL was given to each student's10th grade science teacher, or in cases where this teacher was no longer at the school, an alternative 10th grade teacher. This questionnaire has high

levels of reliability and predictive validity (Zimmerman & Martinez-Pons, 1988). The scale assesses teacher's observations of a student's self-regulation in class and provides a clear picture as to whether the teacher views the student as having engaged in academic self-regulation.

Results

Cronbach's alpha test was conducted on the TKT; the alpha was found to be .71. A principal component factor analysis indicated one main factor which accounted for 37% of the variance. The CMT, included in the factor analysis, loaded the highest on the main factor (.82), indicating it was a valid measure of tornado knowledge. Cronbach's alpha was also conducted on the microanalytic measures and the alpha was found to be 65.

Cronbach's alpha on the RSSRL was found to be .91. The RSSRL correlated significantly with achievement on both: TKT and CMT . These correlations are presented in Table 2 below.

Table 2: Correlations of teacher self-regulated learning scale with both measures of tornado learning

		Tornado Knowledge Test	Conceptual Model Test
Teacher Self-Regulated Learning Scale	*r* =	.511**	.450**
	p < (2-tailed)	.000	.001
	N	51	51

**. Correlation is significant at the 0.01 level (2-tailed).

Regression was calculated to determine if the microanalytic measures would predict the RSSRL. Two questions in the microanalysis were open-ended questions and categorized based on four possible responses, such as different types of attributions. These responses were transformed into a metric scale based on the presence or absence of a response, which produced twenty-five microanalytic measures. The analysis revealed that the microanalytic measures explained a significant proportion of variance in the RSSRL, $R^2 = .67$, $F(24) = 2.13$, $p < .03$.

Regression was then used to predict the TKT and it predicted significant acquisition of information about this topic, $R^2 = .77$, $F(24) = 3.47$, $p < .01$.

Discussion

Regression findings suggest that a microanalytic methodology is a valid measure of students' self-regulation when studying and learning about tornados according to a well established person measure of self-regulation. This is based on teachers' ratings of students' self-regulation in class ($r = .67$). Regression findings on the microanalytic event measures were even better predictors of students' tornado knowledge than the RSSRL person measure in this study ($r = .77$ versus $r = .51$). This difference in predictive power represents increase in variance by more than double (59% versus 26%).

In addition to their predictive power, microanalytic event measures of self-regulation have the additional advantage of providing a detailed account of students' forethought, performance, and self-reflection phase subprocesses. These subprocesses have important diagnostic educational implications because of known linkages to other self-regulatory processes and beliefs. What is needed next is intervention research designed to teach specific self-regulatory microanalyatic processes to at-risk students. This is the ultimate benefit of an event based measure of self-regulated learning.

References

Zimmerman, B.J. (2008**).** Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, *45*(1) 166-183.