Management of Errors in Classrooms: Student Mistakes and Teachers[1]

Assistant Prof. Dr. Seyithan Demirdag
Faculty of EducationalSciences
Bulent Ecevit University
Turkey

Abstract

Teachers employ different strategies to deal with errors occur in the classrooms. Research about this topic is a few and provides mixed results. However, some studies conducted on this topic contribute to the understanding of the interplay between teachers' everyday instructional routines surrounding mistakes about errors. The purpose of this quantitative study was to investigate the perceptions of classroom teachers about their errors and how such perceptions differed from one another among elementary school teachers, middle school teachers, and high school teachers. The perceptions of classroom teachers were investigated by the Error Orientation Questionnaire (EOQ).Teachers' error management behaviors were analyzed. The findings of the study suggested that there was no significant difference among teachers' perceptions on all factors of the EOQ including error competence, learning from errors, error risk taking, error strain, error anticipation, covering up errors, error communication, thinking about errors.

Keywords: Management of errors, classroom management, teacher perceptions

Introduction

People have different perceptions about their errors at work places. Errors may be seen as important issues by an organization.They may cause stress, performance issues, and negative climate. The way how a person deals with an error depends on the attitudes of the community and organization. Some attempt to prevent errors at all costs and some attempt to learn from errors. If people seek to learn from errors, they need to understand their own perceptions towards errors (Rybowiak, Garst, Frese, &Batinic, 1999).Making errors and learning from the mistakes are the natural elements of learning process for everyone including classroom teachers.

Errors are the occasions, which include planned mental or physical activities that fail to succeed for its intended outcome (Reason, 1990). Human error may cause a system to perform less satisfactory than usual times (Rasmussen, 1986). Human errors tend to take limited numbers of forms in various situations. Some forms of the errors may be seen in problem solving, decision making, speech, and judgment (Rasmussen, 1982). It is difficult to provide an exact representation of a framework for human error. Predicting the accuracy of an error occurring in a certain task depends on the factors such as the general nature of the person, the nature of the task, and the mechanisms that governs performance (Reason, 1990).In addition to predicting the accuracy of an error, teachers must consider evaluating the error in a context in order to locate signaling factors that have an association with environmental characteristics and people's cognitive abilities (Rizzo, Parlangeli, Marchigiani, & Bagnara, 1996).

According to Rybowiak et al. (1999), the orientation of errors includes several concepts: handling errors and recovery, communication with colleagues, learning from errors, risk taking, and anticipation of errors. When teachers examine all these concepts' associations together, they may enhance an effective error orientation approach. Rybowiak et al. (1999) suggest that coping with an error includes different approaches: staying calm in the face of errors, covering up an error asopposed to communicating about it, dealing with an error, and learning from an error. The findings from previous studies have indicated that error culture exists in different working environments. Most organizations manage the errors in two categories: punishment and empathy. People should share their attitudes, behaviors, norms, and perceptions towards errors in order to learn and benefit from their errors (Rybowiak et al., 1999).

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It is important to understand that errors made by classroom teachers may have a substantial effect on student learning (Roeser, Midgley, & Urdan, 1996). Teachers' attitudes towards errors are likely to influence how students develop conceptions on how to learn from their own mistakes (Steuer & Dresel, 2011).

Research shows that teachers' misconceptions towards their errors are likely to increase students' failures as students may develop a maladaptive pattern on dealing with their mistakes (Dweck, 1986). Such patterns create negative effect on students as they may start to avoid academically challenging courses (Goetz, Pekrun, Hall, & Haag, 2006). In addition, students may develop negative feelings about subjects related to the school and learning. Whereas empirical research has mainly focused on the macro level of how different organizations similarly manage errors, less is known about how teachers and schools manage errors in different countries (Clarke, Emanuelsson, Jablonka, &Mok, 2006). It may be concluded that learning from errors depends on the perceptions of teachers and the culture of the schools (Givvin, Hiebert, Jacobs, Hollingsworth, & Gallimore, 2005; Le Tendre, Baker, Akiba, Goesling & Wiseman, 2001). Research indicates that teachers' perceptions towards errors may influence their teaching practices and student learning (Ames, 1992). Some studies suggest that teachers' mastery about errors affect students' perceptions on errors (Cobb, Stephan, McClain, &Gravemeijer, 2001; Depaepe, DeCorte, & Verschaffel, 2006). Consequently, it is assumed that everyday error related practices of teachers may have an impact on the error culture of the classroomand the attitudes of students towards mistakes (Cobb et al., 2001). Attitudes of teachers towards errors may create a positive or negative classroom climate depending how they conceive their mistakes (Meyer, Seidel, & Prenzel, 2006). Students may learn from their mistakes when they are encouraged by teachers about how to discuss about their misconceptions on mistakes that they have made (Heimbeck, Frese, Sonnentag, & Keith, 2003). It has been seen that the existence ofpositive error climate depends on a classroom with clear standards and trustful learning environment (Goldin, Epstein, &Schorr, 2007; Spychiger, Kuster, & Oser, 2006). If teachers employ positive perceptions towards mistakes, students will take more initiatives to participate in learning tasks as they would know that they will not be ridiculed due to their mistakes (Edmondson, 1999; Tulis & Riemenschneider, 2008). In contrast, if students are being ridiculed, punished, and ignored due to their errors, they will tend to cover up their mistakes and avoid taking risks in learning activities (Rybowiak et al., 1999).

Learning is an active process that allows people to learn in both procedural and conceptual ways. Therefore, classroom settings should encourage teachers to explore and discuss their errors (Hiebert & Carpenter, 1992; Reusser, 2000). Although constructivist approaches support adaptive ways of dealing with errors and learning from mistakes, little is known about the attitudes of classroom teachers on dealing with their errors.As a result, classroom teachers need to learn from their errors and be sensitive to students' errors so that they may be able to develop a positive learning environment that encourages all students to engage in learning activities. Teachers' positive attitudes towards their errors may eventually create a classroom environment, which is constituted by the quality of learning experiences within error situations. Although it is known that teachers' errors may have a negative effect on student learning, research is lacking about the perceptions of teachers on their errors. Therefore, the goal of this study was to investigate the perceptions of classroom teachers about their own errors. In line with this aim, the following research questions were investigated:

1. What are the perceptions of classroom teachers about their own errors?
2. How do the perceptions of elementary school teachers, middle school teachers, and high school teachers differ from one another about their errors?

Table 1: Percentages of Teachers Participating in the Study

Group	Frequency	Percent	Cumulative Percent
Elementary School Teacher	32	32.7	32.7
Middle School Teacher	36	36.7	69.4
High School Teacher	30	30.6	100.0
Total	98	100.0	

Methodology

Setting

This quantitative study was conducted at four elementary schools, four middle schools, and four high schools in the Midwestern United States. There were about 700 teachers teaching at these schools.

Teachers' teaching experiences varied from 1 year to 29 years. The schools had a diverse student population including Hispanic students at 78%, African - American students at 12%, Caucasian students 6%, and the other students at 4%. The schools were located at economically disadvantaged areas. Therefore, most of the students (83%) received free or reduced lunch.

Table 2: Percentages of Genders Participating in the Study

Group	Frequency	Percent	Cumulative Percent
Female	52	53.1	53.1
Male	46	46.9	100.0
Total	98	100.0	

Sample

The study included a non-equivalent and a non-random sample from several elementary schools, middle schools, and high schools. The number of participants included 32 elementary school teachers, 36 middle school teachers, and 30 high school teachers with varying years of teaching experience (see Table 1). A questionnaire consisted of 37 items was given to the study participants to be answered within 45 minutes. The sample included 52 female and 46 male participants (Table 2) in the study.

The Instrument

This study included a questionnaire called the Error Orientation Questionnaire (EOQ). The questionnaire was developed by Rybowiak et al. (1999). The instrument included 37 items and eight factors: Error competence (four items), Learning from errors (four items), Error risk taking (four items), Error strain (six items), Error anticipation (five items), Covering up errors (six items), Error communication (four items), and Thinking about errors (five items). The Likert scale instrument had five possible answers (1 = Not at all, 2 = A bit, 3 = Neither a bit, nor a lot, 4 = A lot, and 5 = Totally). Before the study was conducted, the instrument's reliability was calculated by pilot testing to assess the coefficient alpha (Cronbach, 1951). After pilot testing the instrument with 38 teachers, the instrument was found to be reliable, as the coefficient alpha was 0.62. This value is considered to be acceptable.

Data Analysis

For the data collection, a questionnaire was used for all participants during the 2013-2014 academic school years. The participants were allowed about 45 minutes to answer all questions on the questionnaire. The participants answered 37 questions on the instrument. After the data were collected, they were imported into SPSS 20.0 for further analysis. The data were analyzed on the basis of the arithmetic mean, standard deviation, and one-way Anova.

Results

Teachers have different perceptions about how to deal with their errors occurring in the classrooms. The results are presented according to teachers' mean scores on the items of the instrument. In addition, the perceptions of elementary school teachers, middle school teachers, and high school teachers about their errors occurring in the classrooms were compared based on eight factors: Factor 1: error competence, Factor 2: learning from errors, Factor 3: error risk taking, Factor 4: error strain, Factor 5: error anticipation, Factor 6: covering up errors, Factor 7: error communication, and Factor 8: thinking about errors.

Table 3: Test of Homogeneity of Variances

Dependent Variables	Levene Statistic	df1	df2	Sig.
Eror competence	.32	2	95	.72
Learning from errors	1.92	2	95	.15
Error risk taking	2.42	2	95	.09
Error strain	1.41	2	95	.24
Error anticipation	.60	2	95	.54
Covering up errors	1.54	2	95	.21
Error communication	.07	2	95	.92
Thinking about errors	.99	2	95	.37
Overall	1.21	2	95	.30

TheLevene's test wasconductedto assess the homogeneity in variances. The test is necessary to examine whether the variables in the study are normally distributed. When examining the normality of distributions, the significant value of p should be bigger than .05. After running the Levene's test, the significant values for all factors indicated normality as the significant values were bigger than .05 (see Table 3).These results showed that the variances did not vary too much among one another.

Table 4: Summary of Ranges, Means, and Standard Deviations on Items of EOQ

Dependent Variables	Items	N	Min-Max	Mean	SD
Error competence	Item 1	98	2.00-5.00	3.95	.77
	Item 2	98	1.00-5.00	3.26	.90
	Item 3	98	2.00-5.00	3.58	.86
	Item 4	98	1.00-5.00	2.62	.98
Learning from errors	Item 5	98	1.00-5.00	3.66	.86
	Item 6	98	1.00-4.00	1.98	.76
	Item 7	98	1.00-4.00	1.98	.81
	Item 8	98	1.00-5.00	1.75	1.11
Error risk taking	Item 9	98	1.00-5.00	3.87	.99
	Item 10	98	1.00-5.00	3.77	1.05
	Item 11	98	1.00-5.00	2.97	1.16
	Item 12	98	1.00-5.00	3.14	.96
Error strain	Item 13	98	1.00-5.00	2.79	.99
	Item 14	98	1.00-5.00	3.45	1.01
	Item 15	98	1.00-5.00	2.90	1.12
	Item 16	98	1.00-5.00	3.87	.89
	Item 17	98	1.00-5.00	3.65	.96
Error anticipation	Item 18	98	1.00-5.00	2.69	.93
	Item 19	98	2.00-5.00	3.82	.91
	Item 20	98	1.00-5.00	2.02	.90
	Item 21	98	1.00-5.00	3.38	1.03
	Item 22	98	1.00-5.00	2.71	.97
Covering up errors	Item 23	98	1.00-5.00	3.62	1.03
	Item 24	98	1.00-5.00	2.00	.99
	Item 25	98	1.00-5.00	1.96	.97
	Item 26	98	1.00-5.00	1.85	.97
	Item 27	98	1.00-5.00	3.60	.94
	Item 28	98	1.00-5.00	3.74	1.04
Error communication	Item 29	98	1.00-5.00	2.88	1.20
	Item 30	98	1.00-5.00	3.11	1.07
	Item 31	98	1.00-5.00	2.71	.98
	Item 32	98	1.00-5.00	3.11	1.11
Thinking about errors	Item 33	98	1.00-5.00	2.81	1.06
	Item 34	98	1.00-5.00	3.63	1.07
	Item 35	98	1.00-5.00	3.53	1.01
	Item 36	98	1.00-5.00	2.72	1.14
	Item 37	98	1.00-5.00	3.46	1.12

Note. EOQ = Error Orientation Questionnaire.

The mean values on the factors – error competence, learning from errors, error risk taking, error strain, error anticipation, covering up errors, error communication, and thinking about errors– of EOQ instrument showed that most subscales had different mean scores (see Table 4). Teachers had the highest mean score on item 1 of error competence(M = 3.95, SD = .77) and the lowest mean score on item 8 of learning from errors(M = 1.75, SD = 1.11).

80

Teachers had considerably high mean scores on item 9 of error risk taking(M = 3.87, SD = .99), item 16 of error strain(M = 3.87, SD = .89), item 19 of error anticipation(M = 3.82, SD = .91), item 28 of covering up errors(M = 3.74, SD = 1.04), and item 34 of thinking about errors(M = 3.63, SD = 1.07). On the other hand, teachers scored considerably low scores on item 6 of learning from errors (M = 1.98, SD = .76), item 7 of learning from errors (M = 1.98, SD = .81), item 25 of covering up errors (M = 1.96, SD = .97), and item 26 of covering up errors (M = 1.85, SD = .97).

Table 5: Summary of Ranges, Means, and Standard Deviations on Dispositions of EOQ

Dependent Variables	Elementary School Teachers			Middle School Teachers			High School Teachers		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Error competence	32	3.46	.51	36	3.23	.47	30	3.38	.61
Learning from errors	32	2.44	.57	36	2.28	.37	30	2.32	.53
Error risk taking	32	3.46	.78	36	3.40	.65	30	3.46	.53
Error strain	32	3.42	.57	36	3.36	.53	30	3.22	.44
Error anticipation	32	2.93	.45	36	2.85	.38	30	3.02	.43
Covering up errors	32	2.88	.61	36	2.74	.41	30	2.75	.39
Error communication	32	2.85	.60	36	2.98	.53	30	3.03	.58
Thinking about errors	32	3.06	.64	36	3.23	.53	30	3.41	.65
Overall	32	3.06	.31	36	3.01	.21	30	3.06	.23

Note. EOQ = Error Orientation Questionnaire.

The mean scores among teachers were analyzed and the results showed that elementary school teachers, middle school teachers, and high school teachers had different mean scores on each factor of EOQ (see Table 5). Elementary school teachers had higher mean scores on error competence(M = 3.46, SD = .51), learning from errors(M = 2.44, SD = .57), error strain(M = 3.42, SD = .57), and covering up errors(M = 2.88, SD = .61) than middle school teachers, and high school teachers. On the other hand, high school teachers had higher mean scores on error risk taking(M = 3.46, SD = .53), error anticipation(M = 3.02, SD = .43), error communication(M = 3.03, SD = .58), and thinking about errors(M = 3.41, SD = .65) than elementary school teachers, and middle school teachers

Table 6: One-way Anova Test Results between Groups

Dependent Variables	Sum of Squares	df	Mean Square	F	Sig.
Error competence	.94	2	.47	1.63	.20
Learning from errors	.46	2	.23	.93	.39
Error risk taking	.06	2	.03	.07	.92
Error strain	.67	2	.34	1.23	.29
Error anticipation	.47	2	.23	1.31	.27
Covering up errors	.41	2	.20	.88	.41
Error communication	.56	2	.28	.85	.42
Thinking about errors	1.90	2	.95	2.54	.08
Overall	.06	2	.03	.50	.60

Data analysis from Anova tests showed that there were not any significant differences on mean scores among teachers on all factors of the EOQ.Teachers had non-significant mean scores on error competence, with conditions $F(2, 95) = 1.63$, $p = .20$, $\eta2 = .47$, on learning from errors, with conditions $F(2, 95) = .93$, $p = .39$, $\eta2 = .23$, on error risk taking,with conditions $F(2, 95) = .07$, $p = .92$, $\eta2 = .03$, on error strain, with conditions $F(2, 95) = 1.23$, $p = .29$, $\eta2 = .34$,on error anticipation, with conditions $F(2, 95) = 1.31$, $p = .27$, $\eta2 = .23$, on covering up errors, with conditions $F(2, 95) = .88$, $p = .41$, $\eta2 = .20$, on error communication, with conditions $F(2, 95) = .85$, $p = .42$, $\eta2 = .28$, and on thinking about errors, with conditions $F(2, 95) = 2.54$, $p = .08$, $\eta2 = .95$.

Discussion

This study investigated the perceptions of classroom teachers about their errors and how such perceptions differed from one another among elementary school teachers, middle school teachers, and high school teachers. Analyzing the perceptions of classroom teachers about their errors, the findings showed that there was no significant difference among teachers' perceptions on all factors of the EOQ including error competence, learning from errors, error risk taking, error strain, error anticipation, covering up errors, error communication, thinking about errors. Although classroom teachers had different perceptions about their own errors, none of these perceptions were meaningful. This result indicates that schools may have similar error management cultures.In their study, Clarke et al. (2006) suggested that workers of different organizations have commonalities in managing errors. In similar studies, Givvin et al. (2005) and Le Tendre et al. (2001) found that the ways how teachers deal with errors depend on the perceptions of the teachers and schools' culture.Rasmussen (1986) found that how people perceive their mistakes depends on the general nature of people and how they evaluate their errors.

When the perceptions of elementary school teachers, middle school teachers, and high school teachers were compared on the basis of error competence, learning from errors, error risk taking, error strain, error anticipation, covering up errors, error communication, thinking about errors, the results showed that there were no significant differences among these grade level teachers. Although the difference on perceptions of different grade level teachers was not meaningful, the perceptions of elementary school teachers and high school teachers were more positive than middle school teachers. Previous research has indicated that teachers may have different perceptions towards errors made in the classroom, and that such perceptions could affect student learning (Ames, 1992). In parallel studies, Cobb et al. (2001) and Depaepe et al. (2006) found that how teachers perceive errors may eventually influence students' understanding of errors, which may be positive or negative. Having positive attitudes towards errors in the classroom are crucial because teachers affect students in many ways including their behaviors and misconceptions towards errors (Heimbeck et al., 2003). In addition, teachers, who have established clear standards and positive classroom settings tend to be more successful in encouraging students in meaningful learning tasks as students know that even if they make any mistakes in such learning environments, they would not be ridiculed by anyone in the classroom (Goldin et al., 2007; Heimbeck et al., 2003; Spychiger et al., 2006).

The study included several limitations. First, the time constraints did not allow the researcher to collect data from more schools. Such constraints limited the generalizability of the study results. Second, the study took place mainly in economically disadvantaged locations of the school district. Conducting research in diverse locations of the school district would provide a more comparable and clearer picture of the outcomes. Efforts for the future study should build on the perceptions of teachers from different school settings across the state. In addition, future research should build on these findings by replicating data-informed results for educational leaders at different school settings.

The findings from the study showed that although the perceptions of classroom teachers were somewhat different from one another, the results were not meaningful. Previous studies have suggested that learning is an active process. Therefore, classroom teachers should be encouraged to explore and discuss their mistakes. Learning from the errors would eventually help teachers to be more sensitive to students' mistakes so that students would understand the fact that making mistakes is a part of learning and includes no punishment by others. It is evident that trustful and positive learning settings have positive impacts on student learning. As a result, leaders in education should take strong measures to help increase classroom teachers' understanding of errors. In addition, they must provide professional development and seminars for teachers so that they would know that making errors is part of the learning process and that such errors may create opportunities for a democratic and positive learning environment.

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