Role of the Mentor's Comments in the Performance of Mathematics Teachers

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We study the relationship between mentors' and mathematics teachers' performance in an education program. To this end, we characterize the relationship between the changes made in the written productions of three groups of teachers and the characteristics of their mentors' comments that could motivate those changes—type of comment, content, and knowledge type. The analysis of these relationships was performed with the help of contingency tables and logistic regressions. We found that, for the whole group of teachers, the changes made by them depend on the type of knowledge and on the content to which the comments refer.

Keywords: Mathematics teacher education; Mentors; Teachers' learning

Papel de los comentarios del tutor en el desempeño de profesores de matemáticas en formación

Estudiamos la relación entre el desempeño de grupos de profesores de matemáticas y la actuación de sus tutores en un programa de formación. Para ello, caracterizamos la relación entre los cambios realizados en sus producciones por tres grupos de profesores y las características de los comentarios de sus tutores que pudieron motivar esos cambios —tipo de comentario, contenido y tipo de conocimiento—. Analizamos estas relaciones con base en tablas de contingencia y regresiones logísticas. Encontramos que, para el grupo global, el tipo de cambio depende del tipo de conocimiento y del contenido al que se alude en el comentario.

Términos clave: Aprendizaje de profesores; Formación de profesores de matemáticas; Tutores

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This study forms part of a broader project underway whose goal is to describe and characterize the relationships between the mentor's performance and teachers' learning in a mathematics education program organized around the model of didactic analysis (Gómez, 2007). In this program, the teachers were organized into groups to perform a series of activities in which a mentor accompanied them. The program represents a natural context in which to study the mentor-teacher group relationship. In an initial study, we characterized the performance of the mentors and developed profiles of this performance (Arias, 2011; Arias & Gómez, 2012). Developing studies about the mentor's role in teachers' learning is justified both from the research literature itself and from the topic's importance for practice.

Experts distinguish different roles and functions for mentors. Among these, they stress the mentors' role in guiding the construction of new knowledge and practices (e.g., Borko, 2004), consider the mentor as a source of support for others who are finding their way in the profession (Jaworski & Watson, 1994), and understand that the mentors can play different roles—such as model, supervisor, assistant, guide, support, facilitator, observer, evaluator, critical friend—to foster the teachers' professional development (e.g., Huang & Chin, 2003).

There is a line of research concerned with establishing what characteristics of the mentors' or teacher's comments can promote learning or reactions in their mentees or students (e.g., Bruno & Santos, 2010; Fernández & Furnborough, 2014; Ferris, 1997; Goldstein, 2004; Silver & Lee, 2007; Whitelock, Watt, Raw, & Moreale, 2003). Fernández and Furnborough (2014) and Whitelock, et al. (2003) studied the reactions of the mentees to the comments of their mentors. The contexts of these studies were training programs in virtual learning environments. Although they involve other agents, there is research that studies how the different types of teacher commentaries promote student learning (e.g., Bruno & Santos, 2010). Other studies focus on the students reactions to comments from their teachers (Ferris, 1997; Goldstein, 2004; Silver & Lee, 2007). Most of these studies are related to the area of language education and cover different educational levels: elementary education (Silver & Lee, 2007), secondary school (Bruno & Santos, 2010) and higher education (Fernández & Furnborough, 2014; Ferris, 1997; Goldstein, 2004; Whitelock et al., 2003). Although these studies are focused on other areas of knowledge and different educational levels, their results agree on finding that there are particular types of mentors' or teachers' comments that guide their mentees or students to make significant changes in their written productions. This is the case of the study by Whitelock et al. (2003) who analyzed the mentor's comments when the students were preparing their written productions. The study concludes that the comments should be less direct and should include questions to stimulate the students to reflect on their responses and improve in subsequent tasks. Ferris (1997) characterized the kinds of change (positive changes, ambiguous changes, and no changes) that the students made in their written productions (in the area of language education) connected to the characteristics of the teacher' comments. We highlight one result from this study: The comments in which the teacher made suggestions produced a significant number of cases in which the students did not make changes. Further, the study showed that the specific comments on the content of the work were associated significantly with improvement in the students' written productions. Ferris concluded that a significant proportion of the comments seemed to lead the students to substantive revision and that some specific kinds of comments and ways of commenting seemed to be more useful than others. The results of the studies cited suggest the research conjecture that the mentees' (students') performance depends on the type of comment they receive from their mentors (teachers). Our

study will develop this conjecture in greater depth for the case of groups of mathematics teachers who participated in an education program, whose work is supported by mentors. Our study focuses on the mentor-mentee relationship. It focuses on the mentees' reactions to their mentors' comments. We do not pretend to establish a direct relation between the performance of the groups of mathematics teachers and their learning.

In the area of mathematics education, the number of research studies that tackle the role of mentor in teacher education has been growing (e.g., Nilssen 2003, 2010; Yoon, 2012). Among the implications for educational practice, we can mention the design and development of programs in which mathematics teachers are expected to be educated with the support of mentors and the grounding of the design and implementation of plans for educating mentors. There are research projects that have studied the relationships among trainees, educators and peers. For example, the Project MANOR focuses on the development of a professional group of high school mathematics teacher-leaders and teacher educators in service (Even & Tirosh, 2002). On the other hand, in the PIC project PIC, researchers have studied the interactions between a novice teacher and a master teacher, and their impact on the teacher's reflection processes, knowledge, conceptions and practices (Muñoz-Catalán, Carrillo & Climent, 2010).

We focus our attention on characterizing the relationships between the mentors' and their groups of mentees performances. We formulate the following research questions: What types of change occur in the work of the groups after reflecting on the mentors' comments? On what do these types of change depend? What role does the characteristics of the mentors' comments play?

In what follows, we summarize aspects of the context of our research, describe the conceptual framework, explain the research goal, present the method that we followed to characterize the relationships between the characteristics of the mentors' comments and the types of change that the groups performed in their productions, and explain and interpret the results. Finally, we make some conclusions.

Context

The study was performed in the context of a postgraduate education program for secondary-school mathematics teachers who were working in middle-school secondary education (from 11-16 years of age)—Master's in Didactic Analysis (MAD). The main purpose of this Master's program is to provide opportunities for the teachers to complement and deepen the didactic knowledge needed for planning, putting into practice, and evaluating didactic units in mathematics (Gómez et al., 2010; Gómez & González, 2013).

This program is developed in hybrid learning mode. Teachers who participate in the program are located geographically in the same place, but the educators and mentors are in geographically different locations. The program is structured using the model of didactic analysis (Gómez, 2007). The teachers are organized into groups. Each group performs a cycle of didactic analysis on the topic of school mathematics with which they work throughout the program. The didactic analysis develops around four analyses that compose a cycle: subject matter, cognitive, instruction, and performance. The content analysis stresses the relationship among concepts, highlights its multiple representations, and distinguishes the connections between the elements of the conceptual structure and between those elements and the phenomena from which they emerge. This information is used in the cognitive analysis, in

which the teacher describes his hypothesis about how students construct their knowledge when they face the learning activities that are proposed to them. The cognitive analysis involves the identification of the skills, reasoning, and strategies necessary to solve the tasks, of the mistakes students can make when they are solving them, and of the difficulties and obstacles they might face. The information from the content and cognitive analysis allows the teacher to carry out the instruction analysis: the identification and description of the tasks that can be used in the design of the teaching and learning activities that will compose the instruction in class. These tasks should mobilize students' knowledge in order to generate cognitive conflicts and promote the construction of meaning using the materials and resources available. In the performance analysis the teacher observes, describes, and analyses students' performance in order to produce better descriptions of their current knowledge and review the planning in order to start a new cycle (for a description of the didactic analysis model see Gómez, 2007; Gómez & González, 2013). When each of the analyses is performed, the curriculum organizers are put into play (Rico, 1997). The program is composed of 8 consecutive modules. The educators present and introduce the content of each module in a week of face-to-face education at the start of each module and present the activities to be performed throughout the module. Each module is composed of 4 activities, and each group has a mentor who accompanies and orients the group in each of the 32 activities that make up the program. Each activity lasts 2 weeks. Figure 1 presents an outline of the structure of an activity.

Figure 1. Structure of an activity

In the first week, each group develops a draft of its work and sends the draft to its mentor by email. The mentor reviews his group's draft, makes written comments on the draft to orient the group, and sends these comments by email. Each group is expected to review its mentor's comments and reflect, discuss, and improve its work based on these comments. In the course of the second week, the groups produce a final document, which they present and discuss at the end of that week. On the other hand, educators introduce the content and purposes of the module, give support to mentors, solve teachers' general questions and assess the work of the teachers' groups. We will now present the conceptual elements that ground the study.

Conceptual Framework

In this section, we describe the three questions that ground this study conceptually: learning the curriculum organizers, descriptors of the mentor's performance based on his comments, and the kinds of changes in the work produced by the groups of teachers.

Learning the Curriculum Organizers

A curriculum organizer is a concept that (a) forms part of the disciplinary knowledge of mathematics education and (b) permits analysis of a mathematics topic in order to produce information on the topic that is useful for the design, implementation, and evaluation of didactic units (Rico, 1997). Conceptual structure, representation systems, phenomenology, learning expectations, limitations, and hypotheses are examples of curriculum organizers. For example, when the teachers perform the analysis of representation systems for their topic, they establish which systems of representation are the most significant for the topic and establish the relationships between these representation systems. In the programs based on the model of didactic analysis, the goal is for the teachers to develop three kinds of knowledge about the curriculum organizers. González and Gómez (e.g., Gómez & González, 2008a, 2008b) call these kinds of knowledge theoretical knowledge, technical knowledge, and practical knowledge, respectively. González and Gómez characterize these three kinds of knowledge as follows.

Theoretical knowledge. Refers to the disciplinary knowledge related to the curriculum organizers that educators in this program have chosen as an option among the options available in the literature.

Technical knowledge. Refers to the set of techniques that the educators consider useful for producing information on the topic with the curriculum organizer.

Practical knowledge. Refers to the set of techniques that the educators consider necessary in order to use the information that arises from the technical knowledge of the curriculum organizer in the analyses with other curriculum organizers or in the design of the didactic unit.

In the program studied here, educators take into account the above knowledge classification when they design the module. Mentors know the model and resort to it when they make their comments. We expect the mentors to promote the development of the three kinds of knowledge in their groups of mentees.

Descriptors of the Mentor's Performance

The descriptors of the mentor's performance that we presented in the introduction of this document are general and emphasize the mentor's role in educating the teachers. The figure of the mentor as guide and source of support for the mentees stands out. We characterize the mentor's performance based on four descriptors of his comments—type of comment, type of knowledge, content, and type of requirement. Firstly, in previous research, we characterized the mentors' performance according to the type of comment that they make when they correct in writing the productions of their groups and we established profiles of mentors based on a structure of categories, subcategories, and codes (Arias & Gómez, 2012). The first level of this structure is composed of the categories Verifies, Suggests, Clarifies, Complements, Doubts, and Values. For example, we classified the comment, "I do not see the symmetrical

elements reflected in the whole numbers or the property of symmetry that can be seen in the set of whole numbers" in two categories: Clarifies and Verifies. The group of mentees to which the mentor made this comment worked with the topic of integers and was analyzing the mathematical subject matter in order to produce the conceptual structure of their theme. In this comment, the mentor made a clarification about the focus of the information and stated that his group did not consider a conceptual element in the analysis of its topic.

We also characterize the mentors' comments by type of knowledge—theoretical, technical, and practical—and by the didactic content to which they allude (the curriculum organizer to which they refer). For example, in the previous comment, the mentor makes clarifications related to the technical knowledge about the focus of the information on the topic on which his group was working. This mentor comment is related to the organizer Conceptual structure. The last descriptor that we considered was of the type of requirement that the mentor made: He/she could require or not require a change in the initial production (draft) of the group of mentees. In the comment given as an example, the mentor expressed the need for his group to make changes in its production.

Types of Change

When a group performs an activity assigned in the education program, their textual production (the draft) can contain information that is valid and invalid with respect to the requirements for the activity. For example, we can recognize in the list of representation systems that some are correct (the information is valid) but others are not (the information is invalid).

In comparing the draft to the final document, it is possible to establish the changes that the group made from the increase or decrease in the valid and invalid information from the draft to the final document. In this way, we can classify the changes made by the group into four types: (a) positive, (b) negative, (c) ambiguous, and (d) no change. We have described this characterization in detail in Arias and Gómez (2013). For example, if on observing the final document, we find that the valid information remains the same and the invalid information decreases, we consider that there has been a positive change from the draft to the final document. In the section on method, we describe the situations linked to each type of change.

Research Goal and Conjectures

The goal of the study is to describe and characterize the relationships between the changes that the groups of teachers performed in preparing their written productions and the characteristics of the comments from their mentors.

We formulate the following conjectures.

- The groups of teachers make changes in their productions when their mentor requires it.
- The types of change made by the groups depend on the type of comments from the mentors.
- The types of change made by the groups depend on the type of knowledge and the content to which mentors allude in their comments.

METHOD

This study is exploratory and mixed. We describe the relationships between the mentors' performance—in terms of their comments on the drafts—and of the groups—in terms of the types of change that they made in their productions. We use the technique of content analysis with units of written information. In the following, we describe the study subjects, information sources, and coding process, present an example of the coding, and explain the procedures for analyzing the information.

Information Sources

Our research subjects were three groups of teachers and their mentors. Two of the groups belonged to the first cohort of the program (Group 1 and Group 2) and the third to the second cohort (Group 3). The three groups were composed of four teachers. The information sources were the documents produced by the groups and the mentors' comments. We decided to analyze the documents from two modules of the program—subject matter analysis and cognitive analysis. We reviewed 16 documents per group (eight drafts with comments from mentor and eight final documents).

Coding

In an initial stage, we organized the information source by group and activity. In a database, we recorded each comment along with the portion of the text from the draft and the corresponding portion of the text from the final document. We obtained 734 information items—portion of the draft text, comments from the mentor, and portion of the text from the final document. In a second stage, we codified the type of requirement, type of comment, content, and type of knowledge, relative to the mentor's comment. The variable type of requirement enabled us to select the observations under study (those for which the mentor required change). To establish the type of change, we compared the parts of the text from the draft and the final document and recorded the changes in the valid and invalid information contained in them. For example, the positive changes are those for which we confirmed that there was an increase in the valid information or a decrease in the invalid information. We coded the information as "no change" when the information did not change. Table 1 describes the variables and their possible values. For example, the variable type of requirement can take two values: requires change and does not require change.

Table 1
Description of Variables and their Possible Values

Variable	Description	Value
Type of requirement from the mentor	In his comments, the mentor proposes the need to make changes in the productions.	Requires change Does not require change
Type of comment	The mentors' comments are coded according to the system of categories and codes.	Clarifies Verifies Complements Doubts

Table 1
Description of Variables and their Possible Values

Variable	Description	Value
		Values
		Suggests
Content	Curriculum organizer to which the mentor refers in his comment. The two final values refer to relationships between the organizers of the subject matter analysis or cognitive analysis.	Conceptual structure
		Representation systems
		Phenomenology
		Learning expectations
		Learning limitations
		Learning hypotheses
		Relation to subject matter analysis
		Relation to cognitive analysis
Type of knowledge	Type of knowledge about the curriculum organizers to which the comment refers.	Theoretical
		Technical
		Practical
Type of change	Group's performance according to the differences observed in the final document.	Positive change
		Negative change
		Ambiguous change
		No change

Example of Coding

In the last activity of the module on subject matter analysis, the groups of teachers were to identify and select a focus for their topic in a reasoned way. Group 2 identified its topic focus as "Graphing method to solve systems of linear equations with two variables." It did not specify the reasons for choosing this content focus. On this portion of the draft, the mentor made the following comment: "I do not know your reasons for choosing this focus, but you could state them explicitly in the final version." In this case, the mentor required a change and suggested that the group state its reasons for choosing this focus explicitly. In its final document, the group incorporated 3 reasons for this choice of topic focus: (a) linear equation—affine function connection, (b) little importance is given to this method in the classroom, privileging algebraic methods, and (c) permits relating more representation systems than the cases of combination—comparison. We coded this comment as follows: the type is Suggests, refers to the curriculum organizer conceptual structure, and refers to the theoretical knowledge of this curriculum organizer. On the other hand, the group made a positive change in its production.

Analysis of Information

From the information coded, we constructed tables of data for each group of teachers and for the three groups as a whole. We determined the percentages of observations by type of requirement and type of change to characterize the performance of the mentors and their groups of mentees based on these descriptors. We chose the observations in which the mentors expressed the need for change (coded as requiring change). We constructed a data matrix from these observations. The matrix cells contain either 0 or 1 (Figure 2).

Nº	Group			TC	Type of comment					Content								Type of knowledge		
	G1	G2	G3		C	V	S	D	Cm	CS	RS	P	LE	LL	LH	RSM	RCA	KTHEO	KTEC	KP
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n	0	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1
.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Group 3 positive change Verifies Conceptual structure Practical

Figure 2. Structure of the data matrix

Figure 2 shows the structure of the data matrix. For example, observation *n* corresponded to Group 3, the change that the group made in its production was positive, the comment from the mentor was of the type Verifies, and it refers to content related to the organizer conceptual structure and to practical knowledge. We decided to develop contingency table procedures and a binary logistic regression to establish the relationships between the variables that characterize the mentors' comments and the variable type of change. We defined the variable type of change as dependent variable with a value 1 if the change is positive and 0 if no change is made (no change). We consider the characteristics of the comments as independent variables: type of comment, content, and type of knowledge.

Contingency Tables

We analyzed the contingency tables to study whether there is a relationship between the variables that characterize the comments written by the mentors and the variables that characterize the change in the teachers' written productions. Contingency tables are especially significant when we have nominal or qualitative variables, since we assume that one depends on the other (independent and/or explanatory variable). The interest in analyzing the contingency tables lies in summarizing the information contained in the table to measure the association between the two variables that form the table. We performed the procedure for each of the groups and for all of the groups as a whole (12 cases in total). We chose the Pearson Chi-square statistic to determine whether or not there is a relationship between the variables studied. We chose $\alpha = 0.05$. If the significance level (SL) from the Chi-square test is very small, lower than α, we conclude that we can reject the hypothesis that the variables studied are not related.

Binary Logistic Regression

With the analysis of the contingency tables, we can confirm relationships between the mentor's comments and changes in the groups' productions, but we cannot establish which categories of the mentor's comments have greater influence on the groups' changes. To

determine this, we performed a binary logistic regression analysis, since our data imply a dichotomous ordinal dependent variable—type of change—and three categorical independent variables—type of comment, content, and type of knowledge (Burns, Burns and Burns, 2008). In the previous section, we specified the values that these variables can take. We performed the binary logistic regression procedure for each of the groups and for all of the groups as a whole. We decided to analyze in detail the cases in which the Chi-square statistics generated with the contingency tables produced a value of SL < 0.05. We generated various logistic regression models. Each model was determined by the value of the independent variable used as a reference.

We decided to analyze the SL-values using an omnibus test, Nagelkerke's R^2, and the overall percentage predicted. By analyzing these statistics, we determined whether the independent variables contribute significantly to predicting the kind of change. In each case and for each model, we also analyzed the values of SL, the coefficient value (B), and the odds ratio (EXP(B)) obtained. These values give us information about which values of the independent variable are better predictors of a specific type of change. We focused on positive change.

RESULTS

In this section, we present the most relevant results of the study. We have organized the section into three parts: (a) requirements and types of change, (b) contingency tables, and (c) binary logistic regressions.

Requirements and Types of Change

In Table 2 we present the results of the types of requirements that mentors made distinguished by groups and for all of the groups as a whole.

Table 2
Percentage of Observations by Types of Mentor Requirement

Type	Group 1	Group 2	Group 3	All groups
Requires change	92.7	61.4	91.8	85.7
Does not require change	7.3	38.6	8.2	14.3

One can see that the mentors showed a predominance of requirements for change in the productions of the groups of mentees (85.7 %). We decided to explore the types of change that the groups performed when their mentors required change (Table 3). The percentages were calculated based on the total observations that require change for each group and globally for all of the groups.

Table 3
Percentage of Observations for Required Change and Types of Change

Type of change	Group 1	Group 2	Group 3	All groups
Positive change	72.9	76.4	64	70
No change	25.6	23.6	32.9	28.1
Other	1.5	0	3.1	1.9

In the data in Table 3, we see that the groups made primarily positive changes in their productions. The significant percentage of cases in which the groups did not make the changes required by the mentors is also worth noting. We confirmed very few negative and ambiguous changes (1.9%) and thus decided to analyze the contingency tables and binary logistic regression with the 569 observations of positive change and no change.

Contingency Table

As indicated in the previous section, we performed the contingency table procedure for each group of teachers and for all of the groups as a whole. We analyzed a total of 12 cases. As an example, we present the contingency table for Group 3 for the variables type of change and type of comment (Table 4). The table has two parts. In the section on the left side of the table, we show the frequencies observed and the corresponding percentages calculated based on the totals of each value of the independent variable. The right-hand section contains the results of the Chi-square test for the variables analyzed in each case.

Table 4
Contingency Table for Group 3 for Variables of Type of Change and Type of Comment

Characteristic of comment	Type of change			Chi-square test		
	Positive change	No change	Total	X^2	DF	SL
Type of comment				4.502	4	0.342
Clarifies	32 (68.1%)	15 (31.9%)	47			
Verifies	26 (54.2%)	22 (45.8%)	48			
Complements	11 (78.6%)	3 (21.4%)	14			
Doubts	12 (66.7%)	6 (33.3%)	18			
Suggests	63 (69.2%)	28 (30.8%)	91			
Total	144	74	218			

Note. DF = degree of freedom; SL = significance level.

We see that most of the comments from the mentor were of the type Suggests, whereas the comments on Doubts and Complements were less frequent. The group produced a similar proportion of positive changes for all the different types of comments. We also observe a significant number of situations in which the group did not make the changes required, and for these, the tutor's comments were of the type Suggests.

From the data shown in the right-hand section of Table 4, we confirm that there is no relationship between the variables type of change and type of comment, since the SL-value

(SL = 0.342) is higher than 0.05. We can also confirm that the value of χ^2 obtained (χ^2 = 4.502) is less than the value of χ^2 given in the Chi-square distribution with 4 degrees of freedom and a confidence level of 0.05.

Table 5 contains the SL-values for the Chi-square test that are produced by analyzing the contingency tables for the 12 cases analyzed.

Table 5
SL-values for the Chi-square Test

Group	TC – TCm	TC – C	TC – TK
All	0.118	0.000	0.002
G1	0.000	0.234	0.000
G2	0.145	0.094	0.396
G3	0.342	0.000	0.997

Note. TC = type of change; TCm = type of comment;
C= content; TK = type of knowledge.

We confirm that there are 5 cases in which p is lower than 0.05, which allows us to claim that there is a relationship between the variables studied. These cases are the following.

- Group G1 with the variables type of change and type of comment, and with the variables type of change and type of knowledge.
- Group G3 with the variables type of change and content.
- For all groups as a whole with the variables type of change and content, and with the variables type of change and type of knowledge.

Binary Logistic Regression

In Table 6, we present a summary of the results of the analysis performed on the data with the binary logistic regression procedure. We organized the results for four different data sets: one for each group of teachers and one that combines all of the data from the three groups. For each set of data, we present the results of the relationships between the dependent variables and those independent variables for which SL < 0.05. These are the cases in which we cannot reject the hypothesis that there is no relationship between the dependent variable and that independent variable. For example, this hypothesis cannot be rejected in the data set for Group 1, for the case of the variable type of knowledge (Chi-square = 22.05 and SL = 0.000). In this case, we obtain a prediction percentage of 76.3%, and Nagelkerke's R^2 takes a value of 0.118, results indicating that there is a weak relationship. We take theoretical knowledge as the reference value. With this reference value, we generate the model that gives the highest probability of positive change. The comments in which the mentor refers to technical or practical knowledge contribute significantly to the prediction (SL = 0.000 for technical, SL = 0.049 for practical). The values EXP(B) and B indicate that comments that refer to technical knowledge increase by 6.832 times the probability that the change will be positive (B = 1.922 is positive); comments that allude to practical knowledge increase the likelihood by 2.773 times that change will be positive (B = 1.020 is positive).

Table 6
Summary of the Binary Logistic Regression Analysis

Variable	Omnibus tests X^2	DF	SL	Nagelkerke's R^2	PP	B	Wald	SL	EXP(B)
					Group 1				
Type of change and type of knowledge	22.05	2	0.000	0.118	76.3				
Practical						1.020	3.888	0.049	2.773
Technical						1.922	18.855	0.000	6.832
Type of change and type of comment	20.57	4	0.000	0.111	74				
Clarifies						1.051	9.046	0.003	2.86
Verifies						1.618	13.411	0.000	5.043
					Group 3				
Type of change and Content	36.23	7	0.000	0.212	70.2				
Learning expectations						1.372	7.488	0.006	3.942
Learning limitations						3.321	9.306	0.002	27.692
					All groups				
Types of change and Content	32.20	7	0.000	0.079	71.4				
Learning expectations						1.061	12.646	0.000	2.889
Phenomenology						0.737	4.798	0.028	2.089
Learning limitations						1.412	12.477	0.000	4.105
Type of change and type of knowledge	11.88	2	0.003	0.03	71.4				
Technical						0.992	10.323	0.001	2.695

Note. DF = degree of freedom; SL = significance level; PP = percentage predicted; B = coefficient value; EXP(B) = odds ratio.

The data from Table 6 show that, in addition to the relationship between the type of change and type of knowledge mentioned above for the data set from Group 1, this group shows a weak relationship (Chi-square = 20.57, SL = 0.000, Nagelkerke's R^2 = 0.111) between the dependent variable and the type of comment, with a prediction percentage of 74%. We take

the type of comment Suggests as the reference value. With this value, we generate the model that gives the highest probability of positive change. The comments of the type Verifies and Clarifies are the values of the independent variable that contribute significantly to predicting a positive type of change (SL = 0.000 for Validate and SL = 0.003 for Clarify). The values EXP(B) and B indicate that the fact that a comment is of the type Clarifies increases by 2.86 times the likelihood that the change will be positive (B = 1.051 is positive). And if a comment is of the type Verifies, this increases by 5.043 times the possibility that the change will be positive (B = 1.618 is positive).

We will now summarize the rest of the results without referring explicitly to the statistics that appear in the table.

In Group 3 we see a weak relationship between the dependent variable and the content, in which the learning expectations and the learning limitations contribute significantly to the prediction (we use representation systems as a reference value).

Seeing all groups as a whole, we confirm a weak relationship between the dependent variable and the type of knowledge, as the comments that refer to technical knowledge are those that contribute significantly to the prediction (we use the type of theoretical knowledge as a reference value). We also observe a weak relationship between the dependent variable and the content, such that the comments related to the curriculum organizers learning expectations, learning limitations, and phenomenology contribute significantly to the prediction (we use representation systems as a reference value).

Discussion

In this study, we proposed describing and characterizing the relationships between the changes that the groups of teachers made in their written productions and the characteristics of their mentors' comments. We formulated three research conjectures. First, we asserted that the groups tend to make changes in their productions when their tutors require it; second, we conjectured that the types of change that the groups made in their productions depend on the type of comments from the mentor; and, third, we supposed that those types of change also depend on the type of knowledge and the content to which mentors allude in their comments. As to the first conjecture, we confirmed that the groups tended to modify their productions when their tutors required it. This claim does not mean that the modifications performed on the productions were all correct or met the mentors' and educators expectations. This result agrees with that of Ferris (1997), who confirms that a significant proportion of the comments seem to lead to changes in the productions.

The results obtained do not permit us to confirm the second and third conjectures. The types of change that the groups performed do not depend exclusively on the type of comments from their mentors (teachers). Although there are experts who believe that mentees' (students') performance can depend on the type of comments from the mentors, and there are empirical studies that provide evidence for this conclusion (e.g., Bruno & Santos, 2010; Fernández & Furnborough, 2014; Ferris, 1997; Silver & Lee, 2007; Whitelock et al., 2003), this conjecture is not clearly observed in our study. The relationship of the mentees' performance in terms of positive changes in their productions to the type of comment from the tutor appears in only one of the cases studied, and as a weak relationship (Group 1). Regarding the third conjecture, we found that there is a weak relationship between the types

of changes that groups perform in their productions and the types of knowledge and the content to which mentors allude in their comments.

Ferris (1997) considered as a limitation of her study having analyzed only the comments of one teacher and his group of students. In our case, we studied three mentors and found that the relationships between the dependent variable (type of change) and the characteristics of the comments differ depending on the mentor. Thus, our study makes an empirical contribution to this study topic. We will now analyze these differences.

In the case of Group 1, we confirm that, when the comment from the group's tutor was of the type Clarifies or Verifies and referred to technical knowledge of the curriculum organizers, the group made primarily positive changes in its productions. In this case, the changes depend on the type of comment and type of knowledge. On the other hand, we confirm that Group 3 performed more positive changes when the comments of their tutor referred to the curriculum organizers learning expectations and learning limitations. In this case, the changes depend on the content. For Group 2, we were not able to confirm which characteristics of the mentor's comments determined the occurrence of a particular type of change. When we studied the groups as a whole, we confirmed that the types of change depend on two characteristics of the comments: type of knowledge and content.

The results of this study do not permit us to affirm that the mentees' performance depends on the type of comment from their mentor, as occurs in some of the studies we have mentioned. In contrast to some of these studies, we considered two additional variables related to the content to which the comment alludes: the curriculum organizer to which it refers and the type of knowledge put into play. Introducing these variables enabled us to establish that, for some mentors and groups, the types of change are related to these variables and are not related to the type of comment from the mentor. These relationships of dependence are weak, however. The results suggest that there must be additional factors that influence the group's performance and the type of change it makes.

We conjecture that the group's performance in tackling a change required by the mentor and performing it properly also depends on the group's understanding of the comment and decision to tackle the issue. It is very possible that the groups' performance in response to a comment from the mentor is linked to a problem of communication. We believe that the groups of teachers do not always interpret their mentors' comments with the same meaning that the mentor intends and that situations arise in which the groups recognize that they did not understand their mentor's comment. This conjecture opens a line of research that we intend to explore in the future.

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