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# What do STEM+ Students from Two Chilean Universities do with their Teachers' Written Feedback Comments Recorded in their Drafts and how is this Related to their Final Grades?

# ¿Qué hacen los estudiantes de STEM+ de dos universidades chilenas con los comentarios escritos de sus profesores registrados en sus borradores y cómo se relaciona esto con sus calificaciones finales?

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## ABSTRACT

Feedback is crucial for assessing and learning; thus, teachers usually provide written feedback comments (WCF) to students. The purpose of this study is to identify what students do with the written feedback in tasks from the STEM+ discipline area and how it is related to the result of their grades, identifying the type of genre in each discipline. Participants were 5 university teachers and 57 students studying marine biology, phono audiology, and nutrition who performed 671 actions in authentic materials previously given by teachers from an intact class categorized in a corpus analysis. For this reason, this research follows a correlational longitudinal non-experimental approach. To achieve the objectives, the study uses Gardner and Nesi's genre theory (2012) for text classification and a modified version of Faigley and Witte's taxonomy (1981) to compare the decisions made by students concerning feedback comments made by teachers. Thus, the study compares the initial and final versions of each text based on teacher comments and correlates these findings with students' grades. Results of this study indicate a significant correlation between students' adoption of feedback and their grades. Furthermore, the two main life sciences genres from Gardner and Nesi's study (2012) were found in the corpus.

Keywords: feedback, STEM, written comments

## RESUMEN

La retroalimentación es crucial para evaluar y aprender; por tanto, los profesores proporcionan a los estudiantes comentarios escritos de retroalimentación. El propósito de este estudio es identificar qué hacen con ellos los estudiantes en tareas del área de STEM+ y cómo se relaciona con el resultado de sus calificaciones, identificando el tipo de género en cada disciplina. Participaron cinco profesores universitarios y 57 estudiantes de biología marina, fonoaudiología y nutrición, con 671 acciones en materiales auténticos proporcionados por los profesores de una clase intacta, categorizados en un análisis de *corpus*. Esta investigación sigue un enfoque correlacional longitudinal no experimental. Utiliza la teoría de género de Gardner y Nesi (2012) para la clasificación de textos y una versión modificada de la taxonomía de Faigley y Witte (1981) para comparar las decisiones tomadas por los estudiantes con respecto a los comentarios de retroalimentación hechos por los profesores y correlacionar estos hallazgos con las calificaciones de los estudiantes. Los resultados indican una correlación significativa entre la adopción de la retroalimentación por parte de los estudiantes y sus calificaciones. Además, se encontraron los dos géneros principales de ciencias de la vida del estudio de Gardner y Nesi (2012) en el corpus.

Palabras clave: retroalimentación, STEM, comentarios escritos

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## INTRODUCTION

Feedback is a crucial component for monitoring and assessing the progress of students' writing, from initial drafts to final products. From a pedagogical perspective, following Hattie and Timperley's (2007) and Henderson *et al.'s* (2019) definitions, feedback is understood in this paper as a process in which an agent helps another to improve performance. Therefore, in this case, teachers' feedback's main objective is to help students improve their writing products, learn, and obtain better grades. In fact, according to Hattie and Timperley (2007), assessing through feedback should help students see what they understand and misunderstand, how to improve, and how to ask for help. Nevertheless, despite feedback being considered essential for learning and the improvement of overall performance, at times, students might not make use of feedback, or they might partially use it (Brown & Glover, 2006; MacLellan, 2001; Sinclair & Cleland, 2007). Hence, when teachers revise writing products, they can observe that students did not make use of their feedback comments or partially applied changes. This prompts the question of whether and how individuals use feedback. Moreover, it is also important for students to be heard, so that they feel they are active participants, part of the process of learning, and that their opinions are relevant for the learning process.

Additionally, writing is fundamental for learning, improvement, and being part of the scientific community. To assess, WFCs are provided by teachers or assessors. At the university level, WFCs serve as a means of communication between students and teachers. However, a wide variety of challenges affect the study of written feedback comments. Firstly, studies in the field of WFC are performed mainly in English as a second language; hence, little information about Spanish as a mother tongue exists. Secondly, a lack of formal training for teachers to provide effective feedback exists; considering this, a variety of problems related to the way of giving and receiving feedback arise; additionally, students have demands about feedback quality, especially at the university level. By understanding student actions, teachers could identify what type of feedback promotes the development of independent, critical, or dependent writers. More-

over, by knowing genres students can identify the text structure and deal with related problems.

Furthermore, there is a lack of information about the consequences of feedback; teachers do not normally know if the feedback they are providing is effective (MacDonald, 1991), and effectiveness will depend on students' correct use of feedback when re-writing. A gap in information regarding practical studies about changes between the first and final versions of texts exists. In general, few studies about students' decisions have been made, studies are mainly related to students' perception of feedback. Genres are a way to connect feedback comments to the improvement actions of the text, through genres, writers or students can comprehend the structure aimed by teachers or the writing community; hence, write with that purpose. Therefore, teachers provide feedback instinctively; that is to say, in most cases, there is no training to provide feedback, even though we know its importance. For this reason, in a recent study, Tapia-Ladino and Correa (2022) created an academic writing feedback-training program for university professors to be tested over a period of three years, in a case study with two participants. The training program included 10 direct hours each with a set of 12 activities distributed over 4 to 5 sessions. Once the semester activity ended, the academics were interviewed to ask about their experience with the training and experimentation phase. In general, the objective was to study the teachers' perception of the training process and the implementation phase in their respective courses (Tapia-Ladino & Correa, 2022). Finally, the authors concluded that the feedback-training program increased focus on student learning and aimed at enriching the professor's academic writing feedback and delivery, among other conclusions.

Finally, for teachers, adding personalized written feedback comments takes time, commitment is required, and if they do not know the impact of their WFC on students, they might doubt their effectiveness. Therefore, not only do students benefit from feedback, but for teachers, assessment helps them discover the effectiveness of their teaching (Hattie & Timperley, 2007). Hence, considering the gap of information regarding students' real actions about feedback, this study aims to clarify if students apply changes in their texts

based on feedback effectively, comparing the first and final versions of written texts. Specifically, the objective of this study is to identify what STEM+ students from two regional Chilean universities do with the written feedback comments provided by their teachers in drafts in the STEM+ (Science, Technology, Engineering, and Mathematics) discipline area in Spanish as a mother tongue, how this is related to the result of their grades, and to identify the type of genre in each discipline.

Hence, the specific objectives of this study are: to analyze actions carried out by students when correcting their writing products based on teachers' feedback comments in their drafts from STEM+ disciplines from two regional Chilean universities using a modified version of Faigley and Witte's taxonomy's (1981) classification of actions; to analyze the relationship between final grades obtained and actions performed by STEM+ students from two regional Chilean universities when correcting their writing products based on written feedback comments provided by teachers in digitally written drafts from authentic learning contexts; and to identify the discursive genres used in the fields studied.

This research includes the theoretical background section covering academic writing, academic genres based on Gardner and Nesi's theory (2012), feedback, actions, and feedback which acknowledges Faigley and Witte's taxonomy (1981); methodology recount with the design of the study, participants, data collection, procedure, analysis, and validity; results; discussion; conclusion; and lastly references.

## THEORETICAL BACKGROUND

### Academic Writing

To begin with, most of the time in diverse fields, universities assess students through writing; for that, this study will cover this specific definition. Academic writing can be understood as an elaborated meaning-making tool involved in educational contexts, such as investigations in sciences that allow us to formally communicate. Moreover, academic writing in different areas of study is taught and

performed differently. Indeed, due to the multidisciplinary nature of careers, academic writing becomes more difficult to reach a consensus (Navarro, 2019).

For example, Wilson (2019, p. 28) defines writing as "a skill that is learned over time through repeated practice and guided instruction". Nevertheless, to establish a consensus, the academic writing phenomenon has been approached from the discourse genres studies. First of all, Bakhtin (2011) defines discourse genres as relatively stable types of statements that people use in the different scopes of human communication. Secondly, Bakhtin's definition of discourse genres includes social, historical, situational, and mode (orality and writing) variations (Navarro, 2019). Moreover, from Socio-Discursive Interactionism, in which genres are modified according to the aim of the author due to the use of the language, academic writing is defined by the context of the participants, in this case, the science field, specifically STEM+. Thus, the genre depends on the use of the language in context.

## Academic Genres

Following the socio-discursive perspective, Bronckart (2013) declared that texts have different organization modes related to the type of activity and functions in context, known as text genres. Examples are the novel, the interview, the leading article of a newspaper, etc. Moreover, Swales (2004) states that the discursive genre encompasses a class of communicative events, whose members share a set of communicative purposes that are recognized by the expert members of the discursive community to which they belong. This logic shapes the schematic structure of the text and includes and restricts content and style options (Navarro, 2019; Swales, 2004). Therefore, academic writing discourse gives authors a sense of belonging to a meaningful group.

Hence, academic genres are text genres used in educational contexts, mainly at the university level, in different fields of study. For example, the scientific community expects a specific genre from a research paper. Knowing the structure of a specific genre is useful for students and teachers, especially complex genres used in investiga-

tion or knowing a specific field genre structure to understand when reading or writing; nonetheless, Gardner and Nesi (2012) could not find any experimental classification of genres genuinely used in universities, because at that time teachers based on experience, but did not study written texts as a corpus. Hence, to establish all the genres used, they studied about 3000 different types of texts from different fields in England and they classified them into 13 families, grouped according to 5 broad social functions of students' writing; correspondingly, genres are Case Study, Critique, Design Specification, Empathy Writing, Essay, Exercise, Explanation, Literature Survey, Methodology Recount, Narrative Recount, Problem Question, Proposal, and Research Report.

As stated, Gardner and Nesi (2012) studied the communicative purposes of texts to observe what teachers authentically do and what should be taught in each field of study when writing. These 5 social functions arose: 1) Demonstrating knowledge and understanding: Explanations and exercises; 2) Developing independent reasoning evaluation and argumentation: Essays and critiques; 3) Developing research skills: Research reports, Literature surveys, and Methodology recounts; 4) Preparing for Professional Practice: Case study, Design specification, Problem question, Proposal; and 5) Writing for oneself and others: Empathy writing, Narrative recounts.

Specifically on life sciences, the field of this study, three main genres were found in their study: methodology recount (22%), essays (18%), and explanations (16%). Moreover, case study (13%) and critique (12%) were also found to some extent. First of all, the purpose of Methodology Recount is to demonstrate or develop familiarity with disciplinary procedures, methods, and conventions for recording experimental findings. Hence, a methodology recount describes procedures undertaken by the writer and in its structure may include an Introduction, methods, results, and discussion sections. Secondly, in the case of essays, its purpose is to demonstrate or develop the ability to construct a coherent argument and employ critical thinking skills, the structure of the text may include an Introduction, series of arguments, and conclusion. Thirdly, the explanations' purpose is to demonstrate or develop an understanding of

the object of study and the ability to describe and/or account for its significance. Additionally, the structure of an explanation includes a descriptive account and a neutral explanation. from the three genres identified, the first, methodology recounts, aims at developing research skills; moreover, essays and critiques aim at developing independent reasoning evaluation.

Ávila *et al*. (2021) in their study concluded that most of the skills required in higher education are new to every student; hence, genres have to be taught. In this context, academic writing, literacy, or every subject with writing practice should teach how to write with the use of the genres required in their field, because students are going to constantly write that type of genre, and academics and scientists expect that. Moreover, Arancibia, Correa and Tapia-Ladino (2019) studied a corpus of 1061 Genre-Oriented Written Comments and highlighted the importance of feedback, explaining that through feedback teachers communicate the most important aspects to value in the assessment, for example, the language, the content, or the topic. The analysis showed that supervisors expect students' writing to fit a prototypical genre.

## Feedback

In this study, feedback is understood from a pedagogical perspective, following Hattie and Timperley's (2007) and Henderson's *et al*. (2019) definitions. The first two authors define feedback as "information provided by an agent (*e. g*., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding" (Hattie & Timperley, 2007, p. 81); whereas the second authors define feedback as a process in which students make use of information related to performance to promote their learning. Hence, for this study, feedback is understood as a process in which an agent helps another (teachers help students) to improve and learn. In this context, the main objective of teachers' feedback is to help students improve their writing products and, therefore, to learn. From a pedagogical perspective, feedback can have two main purposes, assessment and correction (CF), graded or not. Nevertheless, different authors have doubts about feedback efficacy because students might

not make use of that provided by teachers, or they might partially use feedback (Brown & Glover, 2006; MacLellan, 2001; Sinclair & Cleland, 2007). Moreover, in a literature review study, Jonsson (2012) identified five reasons students may not use feedback: it may not be useful; it may not be sufficiently individualized; it may be too authoritative; students may lack strategies for using feedback; and students may not understand the terminology used. Hence, the challenges of providing high-quality feedback are: it needs to be useful; students prefer specific, detailed, and individualized feedback; authoritative feedback is not productive, for that, teachers should communicate to students that feedback comments are open to dispute. Consequently, it is reasonable to ask whether individuals use feedback or not and how. An important aspect to consider, mentioned by Jonsson (2012), is students' feelings; hence, Neupane (2021, p. 1) states that "giving and receiving feedback involves an emotional aspect, and students need to feel a sense of trust in and care from supervisors to benefit from feedback"; that is to say, the way teachers provide feedback can affect students' motivation. Teachers personalizing feedback comments influence students' self-esteem which produces a sense of trust and motivation (Neupane, 2021).

For that reason, Tapia-Ladino, De La Ho and Sáez-Carrillo's (2020) previous classification of actions based on Faigley and Witte (1981) is used: adopted, not adopted, and suppressed. In this study, we added more classifications: adopted, not adopted, partially adopted, not found, and does not apply. Having covered the actions students can take, a specific clarification of actions has to be made. According to Faigley and Witte's taxonomy (1981), revision changes that students make can be divided into two different categories, surface and meaning changes, each with their characteristics, as shown in Table 1.

## Actions and feedback

Research suggests that a gap exists between feedback given and feedback used by students (Cartney, 2010); for that, investigators study students' actions to look for an answer to "why do students not take

into consideration teachers' suggestions". Moreover, Faigley and Witte's taxonomy (1981) categorized the executions that students could carry out regarding feedback. Afterward, Tapia-Ladino, De La Ho and Sáez-Carrillo's previous study (2020) declared that this classification turned out to be useful for the corpus study, by investigating written comments provided by their guiding professors in three consecutive drafts during the preparation of the degree seminars. These authors found in their analyses that writers adopt almost every suggestion offered by the guiding teacher, corresponding to more than 90% of teachers' comments adopted by students.

■ Table 1. Faigley and Witte's taxonomy

| Category | Subcategory | Specific category |
|---|---|---|
| Surface Changes | 1.1. Formal Changes | Spelling<br>Tense, number, and<br>Modality<br>Abbreviations<br>Punctuation<br>Format |
| | 1.2. Meaning-Preserving Changes | Additions<br>Deletions<br>Substitutions<br>Permutations<br>Distributions<br>Consolidations |
| Meaning Changes | 2.1. Microstructure Changes | |
| | 2.2. Macrostructure Changes | |

Source: own elaboration based on Faigley and Witte, 1981.

On one hand, surface changes do not modify relevant information from the text, they modify the text's structure. On the other hand, meaning or text-base changes modify the information presented in the text and they can be divided into micro or macrostructure changes. Moreover, there are specific categories in which meaning changes and meaning-preserving changes from surface changes can be categorized. Table 2 describes all these categories and specific changes which are actions students can make when modifying the text from feedback given from Faigley and Witte's taxonomy (1981).

■ Table 2. Specific Categories of Faigley and Witte's taxonomy by Ellis

| Category | Meaning |
|---|---|
| Addition | Raise to the surface what can be inferred; expansion; clarification. |
| Deletion | Remove item/s so that the reader must infer what was explicit; remove wordiness. |
| Substitution | Alternative words or phrases with the same meaning. |
| Permutation | Rearrangement of words or phrases that retain original meaning. |
| Distribution | Splitting elements from one text segment into two, e.g. two sentences instead of one. |
| Consolidation | Elements from two text segments are combined into one, e.g. one sentence instead of two. |

Source: own elaboration based on Faigley and Witte, 1981 by Ellis, 2011, p. 92.

There is a gap in information regarding practical studies about changes between the first and final versions of texts. Therefore, this study aims to reduce that gap by providing information about the consequences of students' actions by correlating them with assessment.

In Tapia-Ladino, De La Ho and Sáez-Carrillo's previous study (2020), authors classify feedback actions into adopted, not adopted, and suppressed. Nevertheless, in this study, the classification was modified as adopted, not adopted, partially adopted, not found, and does not apply. The previous study aimed to describe the executions that the students carried out regarding the written comments provided by their guiding professors in three successive drafts during the preparation of the degree seminars. These authors found in their analyses that writers adopt almost every suggestion offered by the guiding teacher, corresponding to more than 90% of teachers' comments adopted by students. Moreover, González-Lillo and Jarpa-Azagra (2023) performed similar research aiming at examining the way feedback is generated and its impact on students' improvement, text, and grade and discovered that participants who made changes (60%) presented better results on the performance than those who did not make them.

## METHODOLOGY

### Design

Firstly, this research corresponds to non-experimental research, all the groups were intact classes. Moreover, the scope of this study is correlational because its main aim is to determine the relationship between the types of executions or actions undertaken by university students in the area of science (STEM+) and the grade obtained in the final work, comparing the type of genre in each discipline. Hence, the variables to be correlated are actions and the grade obtained. Secondly, considering the data collection was done in different periods, the study follows a longitudinal design; indeed, student participants received comments in their drafts and then corrected them, which is also a longitudinal characteristic. Moreover, this study follows a quantitative data analysis method, due to the use of categorization and statistics and the type of variables.

Thus, the specific research questions of this study are:

1. What do students do with written feedback comments provided by teachers in documents from STEM+ disciplines?
2. How do students' actions impact their final results?
3. What are the differences between STEM+ disciplines in genres?

### Participants

The teacher-participants of this study are five university teachers from STEM+ disciplines from regional Chilean Traditional Universities (Cruch). To preserve anonymity, in this study, teacher participants are named 2019-CCP1, 2019-CBP2, 2020-CCP1, 2020-CCP2, and 2020-CBP3. Fields from STEM+ disciplines correspond to marine biology, phonoaudiology, and nutrition. Moreover, student-participants are 117 and the majority are students of phonoaudiology. Student participants were previously arranged, and the groups correspond to intact classes from the two final years of the university major of each teacher; nevertheless, not all the students from each class delivered both products; hence, some products were not able

to be analyzed. Moreover, data were collected in 2019 and 2020 in a broader investigation, two of the teachers correspond to 2019 data and 3 to 2020. Additionally, to preserve anonymity, teachers' names are not mentioned; rather, they are labeled with SPSS codes.

### Data Collection

Data was collected in a natural environment and it was part of Tapia-Ladino, De La Ho and Sáez-Carrillo's (2020) previous study. Nevertheless, in the previous study, investigators studied three fields, engineering, humanities, and sciences. For this study, the study field chosen was sciences (STEM+/ life sciences). Teacher participants voluntarily delivered all the data. Data chosen correspond to 47 authentic texts from 5 different teachers, 971 feedback comments written in 2019 and 2020, in some cases rubrics, and each student's final grade graded by their teachers; however, 2020-CBP3's texts were not graded; consequently, they were not included in the final analysis.

### Procedure

The task students had to accomplish was to write a piece of paper in which genres were previously selected by the teacher and communicated to the students (*e. g.* report). Later, the text was read by the teacher who provided written feedback comments, then, students had to modify the text according to the comments; additionally, they received a grade that follows the Chilean grading system, in which 7 is the maximum number.

Therefore, from the decisions made by students in their texts, actions were classified based on the author's previous classification (Tapia-Ladino, De La Ho & Sáez-Carrillo, 2020) based on Faigley and Witte's taxonomy (1981): adopted, not adopted and deleted. However, in this study, categories were modified and divided into five: adopted, not adopted, partially adopted, not found, and does not apply. Moreover, students' actions were specifically categorized to clearly show students' decisions about feedback. This classification was previously used, modified, and simplified by Tapia-Ladino,

De La Ho and Sáez-Carrillo (2020) and they support its productivity. That is to say, Faigley and Witte's (1981) taxonomy classification of actions remains divided into surface and meaning. Subcategories are also present in this study. Surface changes were categorized in spelling; tense, number, and modality; abbreviations; punctuation; and format, and meaning changes were categorized in additions; deletions; substitutions; permutations; distributions, and consolidations (Table 3). After the categorization, grades obtained by students were correlated to study the impact of actions on students' grades.

■ Table 3. Taxonomy Used

| Categories | Subcategories | Specific Categories |
|---|---|---|
| 1. Adopted<br>2. Not adopted<br>3. Partially Adopted<br>4. Not found<br>5. Does not apply | 1. Surface<br>2. Meaning | 111. spelling<br>112. tense, number, and modality<br>113. abbreviations<br>114. punctuation<br>115. format<br>1. additions<br>2. deletions<br>3. substitutions<br>4. permutations<br>5. distributions<br>6. consolidations |

Source: own elaboration.

## Analysis

For statistical analysis, an Excel spreadsheet database was created. It incorporated data related to the actions implemented regarding written feedback and the grades obtained in the task. The following table presents examples of the data used and the structure used. Moreover, a section example of the matrix used can be found in Table 4. Finally, the final grades obtained by students were compared according to their actions.

■ Table 4. Matrix Example

| Text 1 | WFC | Text 2 | 1: Adopted<br>2: Not adopted<br>3: Partially Adopted<br>4: Not found | 1: Surface<br>2: Meaning | 111: Spelling<br>112: Tense, number and modality<br>113: Abbreviations<br>114: Punctuation<br>115: Format<br>1: Additions<br>2: Deletions<br>3: Substitutions<br>4: Permutations<br>5: Distributions<br>6: Consolidations | Grade |
|---|---|---|---|---|---|---|
| **"caso N°55"** | **El caso es el n° 4** | **"Caso N° 4"** | **1** | **2** | **1** | **62** |
| Diagnóstico médico: Reflujo gastroesofágico | Este es un dg perinatal (rescatado de sus antecedentes anamnésicos: el niño no tiene actualmente RGE. Entonces no colocar | Diagnóstico médico: Sin diagnóstico médico. | 1 | 2 | 1 | |

Source: own elaboration.

The data were analyzed with SAS statistical software version 9.0. The correlation analysis was carried out using the Pearson correlation coefficient with 0.5. Specifically, for the action analysis, the previous and final version of each text was compared, based on the teacher's comments. Hence, according to the students' decisions, actions were classified using an Excel matrix to organize the material and to facilitate the quantification. As stated, the categorization follows a modified version of Tapia-Ladino, De La Ho and Sáez-Carrillo's (2020) categorization of actions, based on Faigley and Witte's taxonomy (1981) and their specific sub-categorization. Specifically, the matrix included the WFC year, the discipline of study, the professor code, the student code, the WFC code, the students' first text, WFC, the Students' final text, and three different analysis categories previously shown in Table 4 and the final grade obtained by the students.

### Validity

The validity process was carried out with a triangulation, using Cohen's (1960) kappa test to assess agreement between the two researchers who analyzed the same 32 actions performed by students on their writing drafts and final products based on comments made by their biology teacher from 2019 with the same categories and procedures used in this study, which is based on Faigley and Witte's (1981) taxonomy and the results of the analysis obtained by researchers were compared. Indeed, each action category from the independent variable was analyzed by a statistician, and the values obtained demonstrate that there is an agreement between both researchers' analyses; that is to say, the two analyses are similar enough to be considered valid. The first two classifications were substantially similar and the specific categorization was moderately similar. These values correspond to Landis and Koch (1977).

## RESULTS

Firstly, students' possible actions were classified based on Faigley and Witte's taxonomy (1981) as shown in Table 5. Adoption means students changed the text; not adopted means that no changes were made; partially adopted corresponds to changes that did not fulfill the entire suggestion; not found are entire paragraphs or sections that disappear from the text; and does not apply are comments that do not imply changes, such as congratulations.

■ Table 5. Classification of actions

| Categories | Number of actions taken by students | Percentage |
|---|---|---|
| Adopted | 515 | 76.75% |
| Not adopted | 36 | 5.37% |
| Partially adopted | 16 | 2.38% |
| Not Found | 36 | 5.37% |
| Does not apply | 68 | 10.13% |

Source: own elaboration.

Results indicate the majority of actions were adopted; hence, students, most of the time, modify their texts. In fact, from a total of 671 feedback comments provided by teachers, the majority were adopted by students (76.75%); these findings are similar to Tapia-Ladino, De La Ho and Sáez-Carrillo's findings (2020), in which more than 90% of actions were adopted in each case studied.

■ Table 6. Surface and Meaning changes

| Changes | Number of changes | percentage |
|---|---|---|
| Surface | 55 | 8.2% |
| Meaning | 476 | 70.94% |
| Does not apply | 140 | 20.86% |
| Total | 671 | 100% |

Source: own elaboration.

After actions were classified, changes were classified into Faigley and Witte's (1981) taxonomy: surface, meaning, and does not apply categories were added. Specifically, surface changes do not modify relevant information from the text; they mostly modify the text's structure. On the contrary, meaning changes alter the meaning of the text. Does not apply from the first categorization of actions, changes were not contemplated. Moreover, these categories are divided into specific subcategories which are covered in Table 6.

Results show that most of the changes made were meaning or content-related changes. Table 7 presents detailed information about the subcategories.

■ Table 7. Subcategories

| Categories | Subcategories | Number | Percentage | Total |
|---|---|---|---|---|
| Surface | Spelling | 15 | 1.9% | 8.5% |
| | Punctuation | 7 | 0.89% | |
| | Format | 45 | 5.71% | |

| Categories | Subcategories | Number | Percentage | Total |
|---|---|---|---|---|
| Meaning | Additions | 504 | 63.96% | 91.5% |
| | Deletions | 169 | 21.45% | |
| | Substitutions | 34 | 4.31% | |
| | Permutations | 2 | 0.25% | |
| | Distributions | 12 | 1.52% | |

Source: own elaboration.

Secondly, surface changes are divided into spelling; tense, number modality; abbreviations; punctuation; and format. Secondly, meaning changes are divided into addition; deletion; substitution; permutation; distribution; and consolidation. In the case of addition changes, these correspond to the expansion or clarification of an idea or text. Contrastingly, deletion changes remove information. Moreover, substitution changes correspond to replacing text with alternative words or phrases with the same meaning or paraphrasing. The following subcategories are more related to the structure of the text. Permutation is the rearrangement of words or phrases that retain their original meaning, for example, explaining the same as the first product with a different subject. In the case of distribution, authors split or separate elements from one text segment into two, ending with two sentences instead of one. On the other hand, in consolidation changes, authors combine elements from two text segments into one, ending with one sentence instead of two.

Related to students' grades, the maximum number of final grades obtained by students corresponds to the Chilean grading system, 7. According to students' grades results, the average number is 4.9, the maximum 6.3, and the minimum 3.1. That is to say, the majority of students approved; indeed, 11.1% of grades were failing grades; hence, 88.89% approved. It is important to mention that teacher 2020-CBP3 did not include grades; hence, one field was not part of the analysis. Additionally, the level of adoption of teachers' feedback comments was compared with final students' grades to investigate possible relationships between the level of adoption, surface and meaning, and student grades, a Pearson correlation co-

efficient was used. The results show that statistically significant relationships between the level of adoption acquired by the students and the grades exist (r=.249; p<.05). Thus, students' actions affect students' grades, the more they adopt WFC, the higher is going to be the grade obtained. And inversely between the grades and surface and meaning (r=-.251; p< .05). In the same way, statistically significant relationships were found between the level of adoption and the surface and meaning (r=-.859; p<.05). Being the correlation significant at the 0.01 level (2 tails). Hence, results demonstrate that students who made more changes obtained a higher score than students who made fewer changes. This answers the objective's question of this study, to determine the relationship between the types of executions or actions undertaken by university students in the area of science (STEM+) and the grade obtained in the final work.

■ Table 8. Genres used by teachers

| Teachers participants | Task | Genres |
|---|---|---|
| 2019-CCP1 | Technical Report | Essay |
| 2019-CBP2 | Phonoaudiological Intervention Plan | Methodology recount |
| 2020-CCP1 | Essay | Essay |
| 2020-CCP2 | Intervention Plan | Methodology recount |
| 2020-CBP3 | Phonoaudiological Assessment Plan | Methodology recount |

Source: own elaboration.

Finally, about Gardner and Nesi's (2012) genres theory, the two genres found in this study were consistent with their findings, being these methodology recount and essay. Specifically, Gardner and Nesi (2012) found that methodology recount was 22% of the total number of genres in life sciences, followed by essays with 18%. Genres found in life sciences are methodology recount, essays, and critiques. In this case, teachers named their tasks as technical reports, essays, intervention plans, or phono-audiological plans. Based on these authors' definitions, most products were phono-audiological plans, which corresponds to methodology recounts, because they aim at demonstrating disciplinary procedures for experimental find-

ings. Moreover, the second type of genre found was essay, as shown in Table 8.

To sum up, results indicate that the majority of students adopt feedback; specifically, most students add new information to their texts. Moreover, findings demonstrate that grades are affected by changes students make to their writing based on the feedback comments provided by teachers. That is to say, students who perform better adopt most of the feedback comments. Considering that most changes were specifically adding or deleting information for students to make meaningful changes. Faigley and Witte's (1981) findings show that, about surface changes, most changes were deletions and substitutions; whereas meaning changes were mostly additions. Indeed, additional changes were the most relevant in meaning changes about inexperienced, advanced, and expert writer participants. Moreover, the authors' results indicate that 24% of changes in advanced writers (similar to this study) were meaning changes; that is to say, Faigley and Witte's (1981) results are considerably similar to this study; however, in this study, 91.5% of changes were meaning changes, which are notably more changes.

Furthermore, Tapia-Ladino, De La Ho and Sáez-Carrillo's (2020) previous study modified Faigley and Witte's (1981) taxonomy and stated that it was a productive classification, explaining that students mostly adopted written feedback comments received; in this study, the author's classification was modified to add more specifications and it was highly effective. Hence, about the methodology used in the analyses of this study, categories could be modified according to the type of data collected. As stated before, the categorization used in this study was highly useful; however, if authors modify previous categorizations, this can also be changed if needed.

Additionally, Sologuren and Morgado (2023) conducted a study during the Covid-19 pandemic, aiming to describe online feedback efficacy by understanding the perception of remote feedback on writing practices that 353 graduate students received from teachers during the elaboration of their qualitative research project in doctoral education programs from a Chilean public university in science and engineering majors. During the procedure, teachers provided group and individual feedback to students on writing practice

projects in three evaluative instances, graded by rubrics. Therefore, a descriptive quantitative analysis was conducted, in addition to a qualitative analysis of the feedback comments which included an analysis of teacher surveys to track their perceptions. In their study, quantitative results indicate the evaluation averages are higher as the generic evaluation chain develops. Thus, the authors highlight the importance of studying the online feedback process, since the results indicate that it improves the quality of student learning.

Similarly, Sologuren and Morgado's (2023) results indicate that online feedback chain evaluation progress is effective because students' grades improved; that is to say, their results evidence students acted based on the feedback provided by their teachers which positively influences their qualifications. Additionally, results can be compared to González-Lillo and Jarpa-Azagra's (2023) study in which participants who made more changes improved their grades. Secondly, Gardner and Nesi's (2012) genres theory mostly methodology recount, essays, and explanations were found by authors in life sciences; in this study, the two genres found were methodology recount and essay, similar to their findings.

## LIMITATIONS

One of the limitations presented in this study was related to the impossibility of communicating with teachers since the data was collected before, in a previous study, two years ago. Additionally, difficulties finding information about previous studies that followed the same or similar methodology arose. Another element that could have had an impact on the process was that this study was mostly done during the Covid-19 pandemic. Moreover, ten 2020-CBP3 products of the final analyses were omitted because they were not graded, corresponding to 300 comments, which had an impact on the final number of comments; yet, it was used in analyses that did not deal with grades. Additionally, because of the number of participants, this study cannot be generalized. The fact that student participants of this study are in 5 intact classes makes this study non-experimental research.

## CONCLUSIONS

Feedback in context can be understood as a process in which Chilean STEM+ students make use of digitally written information related to their writing performance provided by teachers to promote their learning and, in this case, evidence changes in their grades. In this case, feedback works as assessment and correction. The main objective of this study was to determine the relationship between the types of executions or actions undertaken by university students in the area of science (STEM+) and the grades obtained in the final work. Results demonstrated that students use feedback by adopting teachers' suggestions and those changes directly impact their grades. Therefore, this study proved that teachers provide effective feedback to students about grades.

Thus, answering the study questions: What do students do with written feedback comments provided by teachers in documents from STEM+ disciplines? Students mostly use feedback by adding or deleting information relevant to the content. Moreover, answering to: How do students' actions impact their final result? it can be concluded that grades are directly affected by students' actions, the more actions performed, the higher the score. Furthermore, in the question: What are the differences between STEM+ disciplines in genres? regarding Gardner and Nesi's (2012) genres classification, the two main life sciences genres found in their study were present in the tasks of this study, methodology recount in 60%, and essays in 40%. Gardner and Nesi (2012) found that methodology recount was 22% of the total number of genres in life sciences, followed by essays with 18%.

Hence, based on the methodology and results of this study, we can conclude that the hypothesis: most students use feedback, was correct for this study. Moreover, grades are directly affected by students' actions and several actions. That is to say, feedback is a useful tool because it can be studied concretely, not only students' perceptions, and results demonstrate that students apply changes in their drafts. Nevertheless, the results of this study cannot be generalized since the sample is limited. Considering that this study methodology proved to be effective, it is advisable to replicate the study.

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