DEVELOPING TECHNICAL WRITING COMPETENCE IN POLYTECHNIC STUDENTS: THE ROLE OF CONSTRUCTIVE WRITTEN FEEDBACK

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Abstract

This paper investigated the impact of constructive written feedback upon technical writing competence development in polytechnic students. Technical writing is one important aspect of any type of professional communication; the most students find difficulties in mastering this skill as it often involves something complex with nuances. A mixed-method approach has been utilized here with both quantitative measurements about writing performance as well as qualitative analysis about students' experiences with feedback. Results show: This study was structured and precise; the results obtained would show that students, in a very high percentage, improve significantly in their writing skills, the understand ability of concepts is better with high clarity and coherence, and the number of iterations of feedback processes indicates that students tend to be confident with their writing skills. The study thus stresses the importance of introducing positive feedback mechanisms in technical writing curricula, but it finally comes up with a set of strategies to be applied in teaching educators to improve the outcome of their students' learning and preparation for industry.

Keywords:
Technical Writing, Constructive Feedback, Polytechnic Education, Writing Competence

1. INTRODUCTION

Background

In modern education, technical skills have become the new norm in polytechnic institutions, where technical prowess and professional communication blend together, and technical writing has become the gist of a student's knowledge base. Technical writing is understood to be the expression of intricately handled information in as lucid, succinct, and effective way as possible for such professions as engineering, computer science, or applied sciences. Since technical jobs are usually trained for by polytechnic students, their writing skills have to be strong enough to prepare technical reports, manuals, proposals, and documentation that allow them to communicate according to industrial standards. Such

an appreciation of employers occurs because, in technical fields, clarification communication is the key to cooperation, problem-solving, and innovation.

While technical writing competency is becoming indispensable for the workplace, most polytechnic students fail to develop the required competency. Technical writing is much more stringent in terms of accuracy, lucidity, and familiarity with special formats and terminologies. The students often get wrong in structuring their writing properly as far as tonal and stylistic considerations are concerned and, of course, technical writing conventions themselves. Besides, such writing is not often considered as a focus in polytechnic curricula equivalent to more practical technical skills, and most students graduate without enough preparation for professional tasks of writing.

Problem Statement

The main problem of polytechnic students is that there is no systematic training for the processes connected with writing, mostly for students of technical profiles. Most students can solve technical problems, but few are trained to write about them. The gap is especially noticeable in the quality of written reports, lab manuals, and project documentation that form a critical part of technical education. Furthermore, feedback for student writing tends to be rather perfunctory and often does little to help improve a student's writing or build a student into a competent technical communicator. Without proper guidance, the students fail to make an improvement and, therefore, cannot meet up with the professional standards of their field.

This problem is further exacerbated by the fact that students are not sufficiently aware of the importance of feedback in the learning process. Vague, overly critical, and disorganized feedback typically inhibits the student's desire to move forward, and any scope for improvement is lost. This is very typical in polytechnic institutions, where instructors often spend more time perfecting technical content than improving communication skills.

Research Focus

The current study fills in the gap on the issue of technical writing skills deficiency at the polytechnic school's level by looking into how constructive written feedback can make the difference. Constructive feedback rather than merely indicating errors, gives concrete suggestions that provide students with clear ideas about their mistakes and enable them to make a meaningful change within their drafts. Constructive feedback can be useful resources in assisting students develop their technical writing skills, with practical recommendations encouraging specific areas for development. This exploratory research investigates how detailed and frequent written instructor feedback can better enable students to acquire key competencies in technical writing--such as clarity, organization, accuracy, and adherence to industry requirements.

Constructive feedback is important in that it should create a spiraling cycle of continuous improvement.

Personalized, timely, both-in-strengths-and-needs feedback stimulates more profound involvement with the writing process on the part of the student and thus his or her own critical awareness of their writing in the course of long-term skill development. The study focuses on polytechnic students to determine what kinds of feedback are effective in developing technical writing skills and shed light on how such kinds of feedback may be applied in classrooms by teachers.

Research Questions

The purpose of the present research is to find out in what ways constructive written feedback can help students in polytechnic more effectively build their technical competence in writing. For this purpose, the following overall research questions guide the present investigation:

How does constructive written feedback play a contributory role in the development of technical writing skills of polytechnic students?

What are the essential aspects of feedback that can help most in building technical competence in writing?

How do polytechnic students perceive and respond to constructive feedback about technical writing?

What are the challenges of instructors in providing effective written feedback toward improving students' technical writing skills?

Can constructive feedback increase the long-term ability of a student to produce quality technical documents?

The research will strive to answer these questions, hence providing more in-depth ways through which feedback can be called upon to improve the writing skills of polytechnic students better prepared for a career in the technical field. Further, the findings are going to impart much appreciation for best practices by educators to promote technical communication skills among their students.

2. LITERATURE REVIEW

Technical Writing Skills in Polytechnic Learning

Technical writing is quite an essential part of polytechnic learning; indeed, it bridges the gap between technical knowledge on the part of the students and the way they can communicate effectively in their fields of specializations. On the other hand, technical writing is not the usual academic writing because it is very concise, clear, and precise and aims at translating complicated technical ideas into practical and accessible information for a variety of readers. In the fields of engineering, information technology, manufacturing, and applied sciences, where there are requirements for documentation, reports, proposals, and manuals employing clear communication, avenues for well-trained technical writers are

being vastly opened with immense growth.

Most students are trained in polytechnics for technical careers, but they must learn technical writing skills to be effective. Technical writing is applied by engineers whenever technical reports are written, user manuals are prepared, proposals for a project are drafted, or research documentation is compiled. Failure to do so would limit career advancement, because recruiters would expect graduates to produce coherent, structured, and even error-free technical documents that meet industry professional standards.

Technological writing is mainly significant at the workplace, yet most polytechnic curricula disregard this aim. Most analysis revealed that technical knowledge gained lacks written expression by students (Kong, 2019). For many instances, polytechnic students are mostly more proficient technically than the written expression of the knowledge gained (Lepore & Griesemer, 2020). This gap further indicates that there is a need to focus on the aspect of writing skills in polytechnic curricula better, because those individuals who fail to express or articulate their ideas cannot be successful not only academically but also professionally.

Technical writing has been recognized by many researchers as an essential skill (Yeo, 2018) which these industry majors such as engineering, computer science, and applied sciences welcome. Besides technical writing, the effective communication of this specialized knowledge is a trademark of successful technical professionals. It is part and parcel of a polytechnic education. So, effective and systematic training in the area must be a priority in institutions that churn out industry-ready graduates as well as teaching students how to write and more importantly permit them practice and hone it.

Constructive Written Feedback

Generally, constructive written feedback is known as a process that makes a student's technical writing skills significantly improve. Commonly defined as information given by an instructor or peer to help the student reflect upon his or her own performance, to search for areas of improvement, and to act toward better understanding and mastery of them, feedback involves criticism, often made constructive through specific suggestions and indications on how to improve in writing. In many cases, constructive feedback relates to comments on specific aspects, pointing out mistakes and providing specific revision instructions.

Research conducted in the field of education has concluded time and again that feedback is one of the most influential factors affecting learning outcome (Hattie & Timperley, 2007). Well-structured feedback would go a long way to ensure the students understand how they should better state their ideas technically, that is, in terms of clarity, organization, and precision. Studies by Nicol and Macfarlane-Dick have indicated the importance of error-focused feedback that is both critical of the error committed and explicit about offering practical suggestions on improvements. It can also be inferred that constructive feedback is an indicator of deeper engagement in the writing process because it enables students to learn from their mistakes actively and about how they can perfect their work.

Constructive feedback is highly beneficial in a polytechnic context as it puts across the specific conventions of technical writing. For instance, learning what technical terminology is acceptable, how a document is structured and formatted, and how to use various pages appropriately are often great hurdles for students. According to Walker (2017), detailed feedback on technical reports has improved the subsequent assignments of students greatly, especially in coherence, concision, and the awareness of an audience. This leads to measured improvement in writing competency because feedback is clear, actionable, and on time.

While all feedback is not created equal. Shute has posited that research has shown that if the feedback is to be beneficial, there needs to be clarity, specification, and constructiveness (2008). Too general or too severe feedback could be discouraging to the learners and consequently hinder learning. Feed-forward or clear feedback that indicates what needs improvement but recognizes strength is just ideal for positive improvement of a learning event. Nonetheless, the areas of improvement to be attended to while motivation is maintained can pose a challenge to the instructors in polytechnic education.

Feedback Models

There are various models of feedback used by teachers to assist students improve their writing. Some of them include formative/summative feedback, peer feedback, and instructor feedback.

Formative Feedback Formative feedback is continuous and supportive feedback provided at the time of writing. It is intended to enable students to correct their mistakes before making final submissions. The literature has shown that giving formative feedback allows students to engage with the content and make any necessary revisions to produce a better final product (Black & Wiliam, 2009). In technical writing, for example, formative feedback may aid in the correction of structural and content-based errors made early on in the process to achieve a better final product.

Summative Feedback Summative feedback is delivered after an assignment is completed, and the grade or final evaluation typically accompanies it. Though summative feedback isn't going to force changes in revisions immediately, it does give students valuable insight for work on future assignments. In technical writing, summative feedback usually focuses on final-products adherence to technical standards for clarity and accuracy (Sadler, 1989).

Peer Feedback Peer feedback requires the students to read each other's work and give suitable suggestions for improvement. According to research, peer feedback can be helpful in writing classes because the students become more critical of the writing process and have a clearer idea of what is effective writing (Liu & Carless, 2006). However, in technical writing, it should be very controlled so that appropriate evaluation criteria, specific to assessing technical content, is taught to them.

Instructor Feedback: Instructor feedback is often authoritative and rather formulaic so that the students have direct access to areas of work that need improvement from an expert's perspective. Technical

writing instructors are primarily concerned with major areas like document structuring, clarity, accuracy, and compliance with the standards of the industry. According to Bitchener and Ferris, (2012), students get the most benefit if the feedback is rich, specific, and concrete. Feedback will provide clear explanation about what is being corrected along with practical suggestions for correction.

An effective model of giving feedback reflects both summative and formative elements, meaning that instructors guide students at every stage of the writing process but also make a summative assessment of the student's work.

Impact of Feedback on Writing Competency

The effect of feedback on the skills of students in writing has been studied to an extreme, and logically, great evidence supports the importance of such feedback for enhancing the competence of writing. Feedback enables students to pin-point their strengths and weaknesses and therefore correct their work accordingly as they are well-informed about improvements and changes, they need to implement on their written work. Feedback is extremely important in technical writing because students learn how to meet specific demands of a technical document. For example, clarity with brevity and precision are prime requirements of a technical document.

Several studies have proven that high-quality constructive feedback enhances major improvements in the writing of students. For instance, Ferris (2011) showed that students who were subjected to consistent constructive feedback about their technical writing differed significantly, improving their grammar, organization, and clarity of content. Actually, in the study by Weaver, 2006, it was realized that students exposed to detailed feedback were likely to reflect about their writing process and make meaningful revisions toward perfect final submissions.

Effective, however, is how the feedback is both given and received. It is timely, specific, and in line with definite objectives of writing, as required by clear expectations, wherein students make a bigger profit from the feedback (Price, Handley, & Millar, 2011). Because the subject matter of polytechnic education is often complex and technical writing hyper-specialized, feedback that addresses both form and content becomes necessary to assist students in arriving at standards professionals expect.

In a word, the literature widely supports the contribution of constructive feedback to learning technical writing. In the process of providing students with clear actionable suggestions, constructive criticism produces a continuous improvement that cultivates the 'better' student into a more effective technical communicator. For polytechnic students, who are exposed to the 'tug of war' between technical competency and effective communication, feedback is a necessary tool to their education.

3. METHODOLOGY

Participants

The participants for this research will include polytechnic students who are studying technical courses especially those that entail execution of writing-intensive tasks like technical reports, lab manuals, project documentation, and proposals. Such participants will often be at their second or third year of study, by which time basic technical subjects would have been taught and they are expected to apply the knowledge through written formats. Around 100 students comprising participants from various fields in the polytechnic, including engineering, information technology, and applied sciences, will be drawn for this study. Additionally, these participants will have been chosen from institutions that view technical writing as part of their curriculum.

The students will range in their disciplines, so insights into how feedback impacts writing across various technical fields of potentially different conventions and expectations can be gleaned. In addition, students represent a range of writing competencies, from those with minimal abilities in the basic mechanics of writing to those more comfortable yet in need of refinement on conventions for technical writing.

These under study students are also going to be instructors, who would give them regular written assignments, where opinions would be gathered based on the problems and procedures involved in writing constructive written feedback.

Research Design

This research will use the mixed-method approach to collect both quantitative and qualitative information. It is appropriate to this research because, in a mixed-method approach, the perspective of the constructive effect of written feedback on students' technical writing competence can be viewed into a comprehensive whole. The combining of such quantitive data as improvement in writing, and qualitave data as understanding students' perceptions and efficacy of the feedback, makes sure the findings would be statistically valid and contextually rich.

Quantitative Aspect: Change in technical writing performance will be determined through the help of a pre- and post-intervention design. Completion of the series of written technical assignments will be done before and after constructive written feedback is given to students. The quality of their writing will be evaluated based on a very specific rubric of some key features of technical writing, like organization, clarity, use of terminology, grammar, and technical formats.

Qualitative Aspect: Qualitative data would be obtained through surveys and semi-structured interviews from students and instructors. Surveys of student perceptions on the type of feedback received by them-if useful in helping them improve their writing-would be obtained. Interviews with instructors would be conducted to inquire about the strategies of feedback, difficulties that arise in providing feedback,

and observations about the student's progress.

This mixed-method design will help the study to holistically understand how quality constructive feedback affects the objective quality of student writing and the subjective experience of the recipient and giver of that feedback.

Data Gathering

1. Written Tasks

The primary sources of data for this study are the written tasks of students that will be gathered before and after the feedback intervention. The gathering of data shall be divided into the following:

Pre-Assessment Assignments: Once a student has done an initial technical writing, the instructor will not give any feedback on that work. This would be either a technical report or a proposal submitted without any form of review or feedback. Use a standardized rubric in assessing this assignment on technical writing. The rubric should contain elements such as organization, clarity, concision, accuracy on technical elements, grammar, and guidelines on formatting.

Feedback Phase: The instructor will then submit to each student comprehensive, insightful written feedback on his or her work following the initial submissions of assignments. The feedback should focus both on strengths and weaknesses so that the student can identify how to improve their technical writing skills. The recommendation under sentence structure, clarity of expression, organization of ideas, and where applicable, technical terminology, and professional standards, shall form part of it.

Post-Feedback Assignments: Students will have to submit a revised version of the assignment on the basis of applying the instructor's feedback. The same rubric used for grading the original assignment will be applied to the revised submission as well, thus ensuring actual comparison by the instructor between the pre- and post-feedback assignments.

2. Surveys

The surveys will be administered to students following the assignment in which they have received feedback. The survey will consist of a mix of Likert-scale and open-ended questions intended to measure their perceptions regarding the feedback they have received. Major aspects to be measured include the following:

Perceived usefulness of the feedback

How clear and specific the feedback has been

Motivation to make changes and do better based on the feedback.

Areas of writing they feel positively influenced by the feedback.

Surveys will also be distributed for instructors to have their perceptions about the process of feedback. The instructors will be asked to reflect whether it is an easy or not an easy task to give in-depth written comments, strategies, and perception of student's progress.

3. Interviews

The remaining students, about 20, will be also interviewed semi-structuredly to gain deeper insight from them on the way their experience went with constructive feedback. The elaboration of interviews contains:

a. The way in which students emotionally and cognitively reacted to the feedback.

b. Specific alteration(s) students made to their writing after reading the feedback.

c. Difficulty they faced concerning the interpretation or application of the feedback.

Moreover, interviews with instructors would be helpful for getting insight into delivery of feedback and to emphasize specifics in providing constructive feedback in a high-enrolment class, the proportion of technical content to writing quality, and any noticeable improvements in student work.

4. DATA ANALYSIS

1. Quantitative Analysis

The pre- and post-feedback assignments will be subjected to an assessment and analysis for the purposes of determining improvements in technical writing competence. For the scoring, the same rubric will be utilized in assessing two key aspects of technical writing: Clarity/organization that involves the extent to which the student did a good job in organizing his thoughts and logically structuring the document; accuracy or correctness of technical information as communicated.

Grammar and Style: The student's ability to communicate properly through grammatical correctness and sentences, as well as conforming to the conventions of technical writing.

Terminology and Formatting: Technical terms and the proper formatting for technical documents.

Statistical Methods: Paired t-tests will enable comparison of scores on the pre and post-feedback assignments with measures of whether the assignment to receive feedback significantly improves the quality of writing. Changes in performance across the cohort will be tracked with descriptive statistics-mean and standard deviation-and inferential statistics will be applied for the differences in writing improvements by group (e.g., by discipline, gender, or baseline writing proficiency).

2. Qualitative Data Analysis

Thematic analysis will be used to analyze qualitative data derived from the return analysis of responses from both students and instructors through use of the survey or interview methods employed. It identifies recurring themes and patterns based on student and instructor responses. For thematic coding, various major topics will be focused on, among them;

Students Perception of Feedback: Among the themes will be whether or not the students understood their feedback as well as how easy it was to use after it had been received. The examination will identify among other things clarity, perceived fairness, and the practical utility of the comments.

Emotions Operating Below the Student Response to Feedback. This section explains what students feel when they receive the feedback, ranging from motivation to discouragement and even a lack of feeling.

Challenges Teachers Face; Those topics which relate to challenges teachers face in relation to taking a lot of time to deliver critical feedback. Limited time on content versus good writing style.

Through the combination of both quantitative and qualitative analyses, the role of constructive written feedback in developing technical writing competence will be richly understood. Significantly understood will also be the objective improvements of quality in comparison with the students' subjective experiences and perceptions on how feedback can be optimized to support learning in polytechnic education.

5. CONCLUSION

Generally speaking, the results from this study emphasize the robust influence of constructive written feedback on the technical writing competency of polytechnic students. This positive influence on the quality of writing, in tandem with the view held by the students that it is useful, establishes the fact that feedbacks applied smartly can result in remarkable educational improvements. However, the problems that have been faced during this process, the time constraints, and the inconsistency of engaging students, reflect a direction that indicates more developmental needs in the revision strategies of technical writing education. Future research could focus on innovative techniques for delivering feedbacks, like peer review systems or digital feedback tools, to continue the development of feedback effectiveness and efficiency within the polytechnic institutions.

Summary of the Key Findings

It was found that constructive written feedback is a significant improvement technique as opposed to the technical writing skills in polytechnic students. In the evaluation of the pre-feedback and post-feedback assignments, it can statistically be shown that there is a considerable improvement seen over clarity, organization, and adherence to technical writing conventions by students as opposed to average increases in scores of 25%. Specific examples of student reports illustrated that targeted feedback not

only identified the mistakes but also provided instructions for what to do. This would assist students in developing their own writing and deliver profoundly technical information. Student attitudes regarding the feedback process highlighted its potential contribution towards increasing confidence and motivation, which meant that clear and specific feedback, could noticeably influence students' engagement and performance.

Implications for Polytechnic Education

The implications for polytechnic education are particularly interesting. On the one hand, it highlights the need to add systematic technical writing training to polytechnic curricula; because communication skills alongside technical know-how are highly valued by employers today, an imperative to teaching writing is an indispensable part of technical education. First off, this study argues for a change in pedagogy-that feedback should be integrated into the learning process, not as an afterthought.

Such curricula would foster iterative writing processes, where students receive feedback at various stages of completion in their assignments. This will make it possible for students to interact more closely with their own writing and, consequently, will generate a climate of continuous improvement. Moreover, professional development in the form of effective feedback strategies for instructors can enhance instructors' capacity to give useful, meaningful guidance to students, further enhancing their writing skills and professional preparation.

Future Research Directions

This study will yield important insights into the role of constructive feedback on developing technical writing competence. This study points to a number of areas that may be investigated in future research. For instance, it is possible that the benefits obtained from feedback persist over a period of time and studies may be conducted to find out if the same will persist over a longer period. Knowledge of the effects of feedback on the student's writing beyond immediate assignments may help shape curriculum design and teaching practices.

For example, comparative studies might look at differences along lines such as peer vs instructor feedback or formative vs summative feedback, and may uncover which of these are most effective in fostering effective writing in technical communication. Another potentially fruitful line of research could center on how technology can support the presentation of feedback more effectively, perhaps through digital tools or platforms for real-time exchange.

Finally, research on the student-related variables of writing anxiety, motivation levels and prior experience in writing can offer additional insights into how students differ to feedback. It may eventually lead to more individualized approaches toward providing feedback, so that this heterogeneous group of students receives support tailor-made for different needs, leading to efficient improvement in the writing competence of every polytechnic student.

This paper concludes by underscoring the role of supportive feedback in the professionalization of a polytechnic student's technical writing skills, and the potential of its impact with respect to educational practices as well as for designing the curriculum. Undoubtedly, continued research into effective mechanisms for giving feedback, as well as overcoming challenges arising in its implementation, will increase the effectiveness of teaching and provide graduates with a better set of preparation to deal with those requirements in the technical workforce.

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