ANALYSIS OF THE EFFECTIVENESS OF THE MONITORING PROGRAM IN THE CHEMISTRY COURSE: AN EVOLUTIONARY PERSPECTIVE

ANÁLISE DA EFETIVIDADE DO PROGRAMA DE MONITORIA NO CURSO DE QUÍMICA: UMA PERSPECTIVA EVOLUTIVA

ANÁLISIS DE LA EFECTIVIDAD DEL PROGRAMA DE MONITORÍA EN EL CURSO DE QUÍMICA: UNA PERSPECTIVA EVOLUTIVA

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Neusa Nogueira Fialho[1]

ABSTRACT

This study presents an analysis of the tutoring (monitoring) program in the Chemistry Teacher Education (Licentiate) course at a large university in the city of Curitiba, PR. The research was guided by the following question: how does the tutoring program in the Chemistry Teacher Education course, in the distance education (EAD) modality, contribute to improving students' academic performance and optimizing the support provided for their questions and pedagogical needs? The objective is to analyze the effectiveness of the tutoring program in distance Chemistry Teacher Education courses at the university. The tutoring program in this institution, recently implemented in this modality, aims to promote greater student engagement and enhance the training process. The theoretical framework is based on authors such as Cunha Júnior (2015), Demelash, Andargie and Belachew (2024), Lima and Sousa (2023), Pereira (2023), Sousa et al. (2019), and Zingra et al. (2018). This is a qualitative study, using a methodological procedure of the experience report type. The analysis was based on final reports from the years 2024 and 2025, each year involving a different tutor. The criteria for analysis focused on the organization and evolution of tutoring practices, student performance, and the reduction of inquiries via the "Contact Us" channel. The results indicate that tutoring in the distance Chemistry Teacher Education course has not only been consolidated as a positive and indispensable practice in the teaching and learning process, but has also shown significant progress in its effectiveness.

Keywords: Academic Tutoring. Chemistry Teacher Education. Distance Education. Teaching and Learning.

RESUMO

Este trabalho apresenta uma análise do programa de monitoria no curso de Licenciatura em Química de uma universidade de grande porte da cidade de Curitiba-Pr. O estudo partiu do seguinte problema de pesquisa: como o programa de monitoria no curso de Licenciatura em Química, na modalidade de educação a distância (EAD) contribui para a melhoria do desempenho acadêmico dos estudantes e para a otimização do atendimento às suas dúvidas e necessidades pedagógicas? O objetivo é analisar a efetividade do programa de

[1] Dr. in Education. Pontifícia Universidade Católica do Paraná. E-mail: nogueira.neusa@pucpr.br

monitoria nos cursos EAD de Licenciatura em Química na universidade. A monitoria nesta instituição, implementada recentemente nesta modalidade, busca promover maior engajamento dos estudantes e qualificar o processo formativo. A fundamentação teórica apoia-se em autores como Cunha Júnior (2015), Demelash, Andargie e Belachew (2024), Lima e Sousa (2023), Pereira (2023), Sousa et al. (2019) e Zingra et al. (2018). Trata-se de uma pesquisa qualitativa, com procedimento metodológico do tipo relato de experiência. A análise apresentada tomou por base os relatórios finais dos anos de 2024 e 2025, sendo cada ano com a atuação de uma monitora diferente. Os critérios de análise foram focados na organização e evolução das práticas da monitoria, no desempenho dos estudantes, na redução das consultas via canal "Fale com a Gente". Os resultados apresentados indicam que a monitoria no curso de Licenciatura em Química na educação a distância não só se consolidou como uma prática positiva e indispensável ao processo de ensino e aprendizagem, como também evidenciou um progresso significativo em sua eficácia.

Palavras-chave: Monitoria Acadêmica. Licenciatura em Química. Educação a Distância. Ensino e Aprendizagem.

RESUMEN

Este trabajo presenta un análisis del programa de monitoría en el curso de Licenciatura en Química de una universidad de gran tamaño en la ciudad de Curitiba, PR. El estudio partió del siguiente problema de investigación: ¿cómo el programa de monitoría en el curso de Licenciatura en Química, en la modalidad de educación a distancia (EAD), contribuye a la mejora del desempeño académico de los estudiantes y a la optimización de la atención a sus dudas y necesidades pedagógicas? El objetivo es analizar la efectividad del programa de monitoría en los cursos EAD de Licenciatura en Química en la universidad. La monitoría en esta institución, implementada recientemente en esta modalidad, busca promover un mayor compromiso de los estudiantes y cualificar el proceso formativo. El marco teórico se apoya en autores como Cunha Júnior (2015), Demelash, Andargie y Belachew (2024), Lima y Sousa (2023), Pereira (2023), Sousa et al. (2019) y Zingra et al. (2018). Se trata de una investigación cualitativa, con un procedimiento metodológico del tipo relato de experiencia. El análisis presentado se basó en los informes finales de los años 2024 y 2025, siendo cada año con la actuación de una monitora diferente. Los criterios de análisis se centraron en la organización y evolución de las prácticas de monitoría, en el desempeño de los estudiantes y en la reducción de consultas a través del canal “Hable con nosotros”. Los resultados indican que la monitoría en el curso de Licenciatura en Química en la educación a distancia no solo se ha consolidado como una práctica positiva e indispensable para el proceso de enseñanza y aprendizaje, sino que también ha evidenciado un progreso significativo en su eficacia.

Palabras clave: Monitoría Académica. Licenciatura en Química. Educación a Distancia. Enseñanza y Aprendizaje.

1 INTRODUCTION

Distance education (EAD) has been consolidated as a strategic modality in the Brazilian higher education scenario, especially because it expands access to academic training and enables flexible learning. However, this modality also presents specific challenges, such as the difficulty of continuous interaction between students and teachers, the dispersion in the monitoring of activities and the need for greater autonomy on the part of students. In this context, it is essential to implement support strategies that promote student engagement and the effectiveness of the educational process. Academic monitoring is one of these strategies, working as a link between students, professors, coordination, and the institution.

Monitoring plays a crucial role in the teaching and learning process both in the face-to-face modality and in distance education, functioning as an essential link between the didactic content and the effective understanding of students. In a virtual environment, where face-to-face interaction is limited, the monitor becomes a learning facilitator, helping to solve complex doubts, explain abstract concepts, and provide guidance for carrying out practical and theoretical activities.

In the Chemistry Degree course at the institution in question, the monitoring program was introduced as a recent initiative in distance courses, with the objective of improving academic performance, helping to overcome pedagogical difficulties and stimulating more collaborative and participatory learning practices. Monitoring is thus presented as a concrete response to the needs of pedagogical support in distance learning, especially in courses with a high degree of theoretical and practical complexity, as is the case of Chemistry.

The introduction of monitoring in the institution's Teaching Degree in Chemistry was driven by systematic observations carried out by the teacher-tutor throughout her experience in the disciplines offered. Such observations subsidized the elaboration of a project that outlined the main challenges foreseen for the execution of monitoring, including the need to improve student engagement, the sense of belonging, interactivity and the habit of studying.

Monitoring plays a crucial role in the teaching-learning process, both in the face-to-face modality and in distance education (EAD). In virtual contexts, where face-to-face interaction is inherently limited, the monitor emerges as an essential facilitator of learning. Its performance ranges from helping to resolve complex doubts and explaining abstract concepts to guiding the execution of practical and theoretical activities, establishing a vital link between the didactic content and the effective understanding of students.

In the Distance Learning Chemistry Degree of the institution in question, the monitoring program was recently implemented, aiming to optimize academic performance, overcome

pedagogical difficulties and encourage collaborative and participatory learning practices. In this way, monitoring is configured as a strategic response to the demands for pedagogical support in distance learning environments, particularly in courses characterized by a high degree of theoretical and practical complexity, as is the case of Chemistry.

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The pedagogical difficulties to be faced by the students were identified and presented in the project with an emphasis on chemical and mathematical calculations, in addition to chemical reactions, themes that permeate the disciplines covered by the monitoring. The central proposal was that the monitoring offer a differentiated support, through synchronous and interactive moments with the purpose of supporting students not only in the specific difficulties of the disciplines, but also in the organization of studies and in the punctual delivery of evaluation activities.

In addition, the observations made by the teacher-tutor evidenced the need to expand communication between peers, in order to favor the timely clarification of doubts and, thus, enable the adequate performance of the evaluations. It was also verified the relevance of intensifying the engagement and interactivity between students, the teacher-tutor and the educational institution, as well as improving student participation in synchronous meetings, considered strategic for strengthening the training process.

These aspects were duly contemplated in the monitoring project, which began to guide the structuring of synchronous moments with an emphasis on promoting interactivity, stimulating critical-reflective thinking and encouraging students' intellectual autonomy. The proposal seeks, therefore, not only immediate support for academic activities, but also the consolidation of practices that contribute to the integral formation of students, both personally and professionally.

Thus, monitoring began to play a strategic role in the educational process, configuring itself as a pedagogical action that responds to the emerging demands of the distance learning modality, especially in courses that require a high degree of abstraction and logical reasoning, such as the Degree in Chemistry.

The justification of this study lies in the importance of evaluating in depth the effects of this action within the context of distance education, understanding to what extent monitoring contributes to student learning, to the optimization of institutional support and to the

development of teacher training for monitors. Considering the current scenario of expansion of distance learning courses and the growing demand for effective pedagogical mediation strategies, it is essential to analyze practices such as monitoring in a systematic and reasoned way.

The present investigation is characterized as a qualitative research, of the experience report type, an approach that focuses on the description, reflection and critical analysis of practices experienced in specific educational contexts. This type of research does not seek the generalization of results, but rather the in-depth understanding of a concrete reality, valuing practical experience as a legitimate source of knowledge. By reporting and examining the actions developed by the monitors in the years 2024 and 2025, the study takes a reflective perspective, highlighting both the challenges faced and the advances observed, contributing to the improvement of support programs in distance higher education.

Thus, this work aims to analyze the effectiveness of the monitoring program in the distance learning course of Chemistry of a large institution in Curitiba, based on the performance developed in two distinct cycles.

The analysis considers the impact of monitoring on the academic performance of students, the reduction in the demand for assistance via institutional channels, the evolution of the pedagogical strategies adopted and the development of the teaching skills of the monitors. By exploring this practice from an evolutionary and experiential perspective, it is intended to contribute to the strengthening of innovative and effective pedagogical actions in the context of distance education.

2 DEVELOPMENT

Monitoring is a pedagogical practice that goes beyond simple academic support, it represents a bridge between the faculty and students, promoting the strengthening of the teaching-learning process. By acting as mediators, monitors contribute to the construction of a more collaborative, accessible, and dynamic environment, where knowledge is shared in a meaningful way. Cunha Júnior (2018) highlights that monitoring, when well guided, contributes to the formation of bonds between students and strengthens learning through the exchange of knowledge between peers. Academic monitoring is recognized as an essential pedagogical support service that promotes theoretical deepening and the development of technical skills in students, contributing to their overall improvement (Zingra et al, 2018; Pereira, 2023).

In the general context of teaching, monitoring favors the development of students' autonomy, stimulates academic responsibility and provides monitors with a rich formative

experience, often being the first contact with teaching practice. Both monitors and students benefit from monitoring: the former develop teaching skills and a sense of responsibility, while the latter find a more accessible environment to answer questions and organize their studies (Zingra et al, 2018; Pereira, 2023).

In chemical education, monitoring takes on an even more strategic role. As it is a discipline that involves abstract concepts, symbolic language and laboratory practices, the support of monitors can be decisive for the understanding of the contents. They assist in solving exercises, preparing for evaluations and, especially, in monitoring practical activities, where they reinforce safety standards, guide procedures and help consolidate the relationship between theory and practice. Thus, the performance of the student-monitor favors the construction of a more dynamic and participatory learning environment, allowing the exchange of experiences between students and teachers, and stimulating student protagonism through active methodologies (Lima and Sousa, 2023; Sousa et al, 2019).

Monitoring in Chemistry can contribute to the development of active methodologies, such as study groups, experimental workshops, and peer tutorials, making learning more attractive and contextualized. This action also favors the formation of a scientific culture among students, encouraging critical thinking and investigative curiosity.

Thus, academic monitoring is understood as an activity that goes beyond technical support, being an opportunity for teacher training and deepening the knowledge acquired throughout the undergraduate course, while contributing to the teaching-learning process of colleagues (Lima and Sousa, 2023; Sousa et al, 2019). Therefore, monitoring not only complements the teaching work, but also enriches the training of those involved, promoting a more inclusive, participatory and effective education — especially in challenging areas such as Chemistry.

2.1 ORGANIZATION OF MONITORING WORK: STRATEGIES AND EVOLUTION

In the two years evaluated, the monitoring organization demonstrated careful planning and continuous adaptation to the needs of students in the distance learning modality. Initially, in mid-2024, the first weeks were dedicated to the organization of materials and methodological planning. A key strategy was to send a form to students to identify their availability and preference for active participation in online meetings. Based on this, fixed schedules were defined for monitoring, for example, in the months of August to October, in 2024 the monitoring worked on Monday nights and Wednesday afternoons; Similarly, in the period from March to May 2025, the meetings took place weekly on Mondays, in the evening.

Dissemination and engagement were priorities in both cycles. In 2024, informative

folders were used, such as the example presented in Image 1, and were widely disseminated in the course's WhatsApp groups, in the Chemistry community, and in the Virtual Learning Environment (VLE). This dissemination was complemented by inviting videos recorded by the monitor. In the subsequent cycle, this practice was maintained because it proved to be efficient in the monitoring work.

A central and highly relevant element in both periods was the creation of specific *WhatsApp* groups for monitoring. These groups functioned as private channels for students to share doubts and difficulties, in addition to being used to send links to access the meetings and to provide support and recorded materials. The practicality and agility of communication via *WhatsApp* were highlighted as very positive points, allowing effective interaction between students, monitor, teacher-tutor and course coordination.

Faced with the challenge of students' unavailability to participate in synchronous moments, which is common in the distance learning modality, the monitoring demonstrated the ability to adapt. Thus, one of the initiatives was to create a *YouTube* channel to store the recordings of the meetings, making the links available via *WhatsApp*. This strategy allowed students to access the material at a flexible time, without the need for active participation in synchronous time. Another initiative was to record the synchronous meetings and make the videos available in the VLE, within the specific disciplines.

The production of diversified and innovative teaching materials was a constant, among them we mention: videos explaining practices within the institution's virtual laboratory, videos with experiments using low-cost materials, quizzes, games using the *Wordwall website,* PowerPoint *presentations*, *podcasts* and *cards*, as shown in the example presented in Figure 1.

Figure 1

Invitation to monitoring

Source: The authors (2025).

The presence of monitors in learning environments that use innovative methodologies favors collaborative learning and the development of students' autonomy in the study of Chemistry (Demelash, Andargie and Belachew, 2024).

The monitor also created forms for content suggestions and podcasts about the National Student Performance Exam - ENADE. There was a significant focus on explanatory videos and recorded resolution of exercises, especially for more complex content, such as Chemical Kinetics. This adaptation was even a direct response to requests from students to help understand complex calculations.

Collaboration with the teacher-tutors and coordination was another pillar of the organization, with emphasis on the holding of regular meetings between the monitor and the teacher-tutor to clarify doubts, administrative assistance, discuss methodologies and engagement strategies. The course coordination also offered continuous support in the dissemination of materials, in addition to exchanging ideas to favor student engagement. These partnerships were crucial for the adaptation and improvement of the monitoring work.

2.2 EFFECTIVENESS OF MONITORING PRACTICES: STUDENT PERFORMANCE

The monitoring demonstrated a positive and quantifiable impact on the students' academic performance, overcoming challenges such as chemical and mathematical calculations, and chemical reactions. The performance of academic monitors, according to Pereira (2023), is associated with a positive impact on student performance, especially when monitoring is integrated with collaborative practices and self-regulation strategies for learning. Comparing the years 2023 and 2024, there was an improvement in the final averages in the subjects attended: in the Professional Practice discipline: Organic Chemistry Laboratory, the percentage of students with a final average above 7.0 increased from 44.44% in 2023 to 50% in 2024; in the discipline of Organic Chemistry, the improvement was even more significant, with the percentage of students with a final average above 7.0 jumping from 57.14% in 2023 to 80% in 2024.

The data collected for 2024 and 2025 showed an even more significant growth in the approval rate in the disciplines listed for monitoring: in the discipline of Chemical Kinetics, the number of approved students (final average > 7.0) increased from 50% in 2024 to 75% in 2025, while the number of failed students decreased from 33.3% to 12.5%; in the discipline of Professional Practice: Physical Chemistry Laboratory, the improvement was remarkable, with the percentage of students with a final average above 7.0 rising from 42.9% in 2024 to 100% in 2025, and the number of failures completely zero.

These data prove that monitoring is, in fact, fundamental in the teaching and learning

process of students, contributing to gains and significant improvement in performance. Zingra et al. (2018) highlight that the presence of monitors in the educational environment contributes to overcoming academic difficulties, being perceived by teachers and students as a factor that favors school performance.

2.3 EFFECTIVENESS OF MONITORING PRACTICES: REDUCTION OF MESSAGES IN "TALK TO US"

Another robust indication of the effectiveness of monitoring is the significant decrease in messages sent to the institution's official "Talk to Us" channel to clarify doubts related to content. This channel, sometimes overloaded, received many specific doubts. Comparing the years 2023 and 2024, it was noted that: the Inorganic Chemistry discipline saw a reduction from 11 messages in 2023 to 9 in 2024, although most were still about summative activities; the disciplines of Organic Chemistry and Professional Practice: Preparation of Didactic Materials for the Teaching of Chemistry zeroed out the messages in 2024 (there were 2 and 11, respectively, in 2023).

In 2025, the improvement was even more significant: there was a 100% improvement in messages about content via "Talk to Us" in 2025 compared to 2024. In 2025, there were no messages from students with doubts about the content of the subjects, only doubts related to the structuring of the evaluation activities. This significant reduction in the flow of messages evidences the commitment and effectiveness of the monitor in her work, minimizing the difficulties of the students and facilitating the work of the teacher-tutor. The monitoring redirected support, becoming the main point of contact for content questions.

2. 4 EVOLUTION AND COMPREHENSIVE IMPACT OF THE MONITORING WORK

The comparison between the periods mentioned reveals a consistent evolution and continuous improvement in the monitoring program. Initially, the monitoring focused on establishing its presence in a recent distance learning context, with strategies for dissemination and organization of schedules. Adapting to the unavailability of students led to the creation of asynchronous resources, such as the *YouTube* channel, for example. This flexibility was consolidated with the availability of materials recorded directly in the VLE, and the monitor's proactivity in creating specific videos requested by students for complex calculations, showing a more refined response capacity.

Student engagement, initially a timid challenge, demonstrated progress, with positive comments in the *WhatsApp group* and direct praise in the satisfaction survey, such as a student's testimony to the monitor.

In addition to the academic gains for students, monitoring also proved to be a fundamental space for the personal and professional growth of the monitors. The remarkable development of the monitor who worked in this action in 2024 stands out, showing significant improvement in academic writing, in the production of relevant teaching materials, compatible with active and dynamic methodologies, including the production of articles for presentation at events, and a scientific article entitled: University/school interconnection and digital technologies in the context of chemistry teaching, published in the journal *Contribuciones a Las Ciencias Sociales*, in the same year of operation. Regarding the monitor of the year 2025, we emphasize skills such as organization, active listening, patience, group management and clear communication, essential for future teaching, especially in virtual environments.

For future cycles, the analyses point to the continuity of the concern with the synchronous engagement of students, with proposals for the creation of Instagram and study groups, and study agendas, in addition to greater diversification of materials, focus on videos and commented exercises, more interactive online meetings and the use of practical resources, such as online simulations. The use of simulations in the teaching of Chemistry, when accompanied by trained monitors, contributes to the understanding of abstract concepts and increases student engagement in the proposed activities (Demelash, Andargie and Belachew, 2024). In addition, plans to expand the offer of schedules and introduce differentiated activities demonstrate the commitment to continuous improvement.

3 FINAL CONSIDERATIONS

The data presented show that monitoring in the Chemistry Degree course in the distance learning modality was not only established as a positive and essential action for the teaching and learning process, but also demonstrated a remarkable evolution in its effectiveness. Through a flexible organization and adaptive strategies, such as the intensive use of digital platforms (*WhatsApp*, *YouTube*, VLE, *Microsoft Teams*) and the production of varied teaching materials, the monitoring was able to significantly improve the academic performance of students and reduce the demand for support in official channels, optimizing the work of the teacher-tutors.

The constant search for feedback and the ability to integrate new approaches, combined with the professional development of the monitors, solidify monitoring as a fundamental pillar for the success and quality of distance education in the institution. The mediation carried out by the monitors adds value and brings together students, monitoring, teachers-tutors, coordination and the university.

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