

Original article



Completion studies by portfolio: methodological proposal for Bachelor Degree in Chemical Education

**Culminación de estudios por portafolio: propuesta metodológica para
Licenciatura en Educación Química**

**Conclusão dos estudos por meio de portfólio: uma proposta metodológica
para a Licenciatura em Educação Química**

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ABSTRACT

The portfolio emerges as an innovative modality for completing studies in higher education, aligned with trends in formative and integrative assessment. This research aimed to design and validate a methodology for completing studies through a portfolio in the Bachelor's Degree in Chemical Education at the University of Holguín. Action research was conducted, using document review, expert judgment, and a case study with a high-achieving student. Data were analyzed qualitatively and through simple percentages. A methodology and didactic structure for using portfolios as a graduation option in pedagogical programs were proposed. Validation by specialists showed high

relevance and scientific rigor, although feasibility presented more diverse assessments. The proposal was viable and positively evaluated, enriching the methodological work of the program and offering a formative alternative that stimulates student autonomy, critical reflection, and comprehensiveness. Its controlled generalization in pedagogical programs is recommended.

Keywords: completion of studies; higher education; formative assessment; methodology; portfolio.

RESUMEN

El portafolio emerge como una modalidad innovadora de culminación de estudios en la educación superior, alineada con las tendencias de evaluación formativa e integradora. La presente investigación tuvo como propósito diseñar y validar una metodología para la culminación de estudios mediante portafolio en la carrera de Licenciatura en Educación Química de la Universidad de Holguín. Se realizó una investigación-acción, empleando revisión documental, criterio de especialistas y un estudio de caso con una estudiante de alto rendimiento. Los datos se analizaron cualitativamente y mediante porcentajes simples. Se propone una metodología y estructura didáctica que facilita la implementación del portafolio como vía de titulación en carreras pedagógicas. La validación por especialistas mostró alta pertinencia y rigor científico, aunque la factibilidad presentó valoraciones más diversas. La propuesta fue viable y valorada positivamente, enriqueciendo el trabajo metodológico de la carrera y ofreciendo una alternativa formativa que estimula la autonomía, la reflexión crítica y la integralidad del estudiante. Se recomienda su generalización controlada en carreras pedagógicas.

Palabras clave: culminación de estudios; educación superior; evaluación formativa; metodología; portafolio.

RESUMO

O portfólio emergiu como uma modalidade inovadora para a conclusão de estudos no ensino superior, alinhada às tendências da avaliação formativa e integrativa. Esta pesquisa teve como objetivo desenvolver e validar uma metodologia para a conclusão de estudos por meio de um portfólio no curso de Licenciatura em Educação Química da Universidade de Holguín. Foi utilizada uma abordagem de pesquisa-ação, empregando revisão documental, opinião de especialistas e um estudo de caso

com um aluno de alto desempenho. Os dados foram analisados qualitativamente e por meio de percentagens simples. Propõe-se uma metodologia e uma estrutura didática que facilitem a implementação do portfólio como opção de conclusão de curso em programas de formação de professores. A validação por especialistas demonstrou alta relevância e rigor científico, embora as avaliações de viabilidade tenham sido mais diversas. A proposta mostrou-se viável e foi avaliada positivamente, enriquecendo o trabalho metodológico do programa e oferecendo uma alternativa formativa que estimula a autonomia, a reflexão crítica e o desenvolvimento holístico do aluno. Recomenda-se a sua generalização controlada em programas de formação de professores.

Palavras-chave: conclusão de estudos; ensino superior; avaliação formativa; metodologia; portfólio.

INTRODUCTION

Over the past decade, Cuban universities have prioritized integration and innovation through their core processes: education, research, and outreach (Salfrán Vergara & Figueredo Salfrán, 2023). This integration contributes to fulfilling the university's social purpose: the comprehensive training of competent professionals committed to the country's needs.

In this context, diversifying the ways in which studies can be completed is a way to stimulate the curriculum's formative and research aspects. Resolution 47/2022 of the Cuban Ministry of Higher Education (MES, 2022), in its article 321.3, establishes modalities such as professional practice, projects, portfolios, and the presentation of scientific articles.

The theoretical review established the trends and conceptualizations related to the new portfolio-based study completion modality, according to several researchers. García Segura *et al.* (2019) present the usefulness of the portfolio method as a means of developing one of the subjects in the curriculum: orientation, training, and socio-labor integration, allowing students self-knowledge, the design of a professional project, and knowledge of the work environment.

On the other hand, competency-based training is a trend that is gaining increasing prominence in the academic environment due to its usefulness and impact on the comprehensive training of graduates as a means of disseminating new knowledge in novel ways, coinciding in this aspect with del Valle Llufrío *et al.* (2023), Escobar Yéndez *et al.* (2022) and Olivares García *et al.* (2020), who

argue that this approach would reinforce not only the knowledge acquired, but also the development of specific professional skills for their performance once they graduate from university.

Some researchers such as Dino Morales and Tobón (2017), identify the notion of the portfolio of evidence from a socio-formative approach as a process that articulates teaching with assessment and focuses on talent development through the continuous improvement of evidence. For Barragán (2005), the portfolio is a technique for gathering, compiling, and collecting evidence and professional competencies that empowers an individual for successful professional development; this approach was applied in the development of the Educational Technology course. Meanwhile, Arraiz *et al.* (2013) state that the portfolio consists of a collection of work produced by students throughout their educational cycle, reflecting their academic progress and educational achievements.

According to Vázquez Abella *et al.* (2022), the portfolio constitutes a novel tool for evaluating learning from a new perspective, since it is more than just a collection of learning evidence, where the student must reflect on their own learning and skills acquired during the development of said work.

It is currently trending to view this format as a way to assess the knowledge accumulated by students during their training. The portfolio represents a learning and assessment system that allows for the collection of evidence of the learning process and what has been learned, as a result of the activities carried out by the student during their university studies.

In this integrated university process, the development of research skills acquired by students during their training takes on particular interest and relevance. According to Reyes Labori *et al.* (2025), research constitutes a fundamental pillar in the development of knowledge and professional practice in any discipline or career, as it establishes essential skills that allow individuals not only to generate, but also to interpret and apply knowledge effectively.

Thus, it is important to highlight this aspect within the portfolio's structure as evidence of the student's successful and comprehensive progress during their university studies.

The authors' review of the literature revealed that the main shortcoming of previous research was the lack of an effective methodological approach adaptable to the curricular requirements for completing teacher training programs at Cuban universities. Therefore, the following problem was identified: how to organize the portfolio-based graduation process? Consequently, the objective was

to establish the methodology and structure to be followed in the portfolio-based graduation process for the Bachelor of Science in Chemistry Education program at the University of Holguín, thereby improving and enriching this process.

MATERIALS AND METHODS

The study was conducted according to the qualitative paradigm, under the action research typology, and assumed the following research methods, both theoretical and empirical: analysis, synthesis, bibliographic review, expert opinion, discussion table, case study, among others.

Participants:

Population: faculty of the Bachelor of Science in Chemical Education program (N=20).

Validation sample: ten (10) specialists intentionally selected for their experience in didactics, evaluation, or research methodology. The group consisted of four PhDs in Pedagogical Sciences, five Masters of Science, and one specialist in the area of knowledge.

The student selected to complete her studies through the portfolio modality belonging to the 20/21 cohort, corresponding to the period 2020-2024, was selected as a unique case study in the course of this research, based on the following criteria:

- Academic index ≥ 4.5
- Relevant investigative evidence
- Outstanding career
- Informed consent

Techniques and instruments:

1. Documentary review: of regulations (Res. 47/2022 MES), scientific literature and curricular documents of the career.
2. Design of the methodological proposal: result of the documentary analysis and reflection of the research collective.
3. Expert criteria: a survey with a rating scale (Excellent, Very Good, Good, Fair, Poor) was used to evaluate the indicators of relevance, feasibility and scientific rigor of the proposal.

4. In-depth interview: applied to the student in the case to find out her opinion on the satisfaction, feasibility, skills development and rigor of the process.
5. Discussion table: with the methodological collective of the integrative discipline and the career committee, to debate controversial aspects of the proposal.

Ethical considerations: Institutional research ethics guidelines were respected. Confidentiality was guaranteed. and informed consent was obtained from the participant and the specialists.

The designed methodology comprised the following elements:

1. Identification of professional skills.
2. Selection of relevant evidence for each dimension of the curriculum: academic, work, research and extension.
3. Temporary organization by years of study using digital folders.
4. Standardized structure of the digital portfolio.
5. Defense before an academic tribunal.

Procedures:

1. Preliminary design of the methodology
2. Expert review
3. Student Selection
4. Methodological orientation
5. Building a digital portfolio
6. Evaluation by 10 specialists
7. Information processing
8. Public defense

The steps in the adopted methodology are specified in:

1. Request to the career committee, by the tutor, given the characteristics of his student, to complete by portfolio.
2. Portfolio structure using digital folders.
3. Defense of the portfolio before the culmination tribunal of the studies of the degree.

In this way, the first step of the methodology established the requirements to be considered when selecting and proposing the student who would complete their degree through this modality. The second step proposes the portfolio structure from a technical and methodological perspective. The third step was controversial, as there were differing opinions regarding whether a final presentation should be required and whether the final project should be evaluated as such.

RESULTS

The following details the different aspects that the authors considered in each part of the methodology adopted as action research:

Application and access requirements for the modality

The requirements that must be met by the student aspiring to this modality were established, in accordance with the trends in the Educational Teaching field of evaluation, these being:

- Student trajectory maintained throughout all years of study.
- Academic results achieved above 4.5 points, during the degree.
- Research results that demonstrate the student's positive progress.
- Level of comprehensiveness achieved throughout the period.
- Mark of 4 points in the Term Paper defense exercise of the subject Research Methodology (II) in the 3rd year.

Once this form of culmination of studies has been established for the selected student, the student must show evidence of the development achieved in the different dimensions of the curriculum, and at the request of the student and the proposal of their tutor, present the documentation corresponding to said activity to the evaluation committee within the time established according to the course schedule for this type of modality.

Portfolio structure using digital folders

The portfolio was structured in digital folders organized by academic year and included:

- Cover page: general information about the institution (name of the institution, specialty, name of the student, name of the tutor, place, date).

- Student's autobiography.
- General student information: tutor's opinion.
- Rationale for choosing the portfolio modality as the culmination of studies with its academic index
- Evidence: folders are organized by academic year, which must take into account as component elements the substantive processes or dimensions of the Cuban university curriculum: academic, work, research and extension, coinciding with Salfrán Vergara and Figueredo Salfrán (2023); fairly valuing in an integral way the balance between the elements contributed in each of them, hence the following are proposed as aspects to include in each folder of the portfolio year:
 - Award exams
 - Activities as a student assistant
 - Activities as high-achieving students
 - Activities as a member of the Student Scientific Group
 - Papers presented at events at different levels
 - Participation in research projects
 - Participation in research or exchange networks with other universities
 - Articles written and published in high-impact journals
 - Results achieved in the cultural and sporting movement
 - Results of coursework
 - Awards and places achieved in all participating activities

Note: Verifiable evidence will be in the form of videos, interviews, experiments, research work carried out on one's own initiative, assessments made by other people (teachers, directors, students, tutors) that support the proposal, articles, participation in events at different levels, accreditation certificates, among others, which support a comprehensive assessment of the student in question.

In the implementation, the student organized her results clearly, incorporating digital materials such as infographics, photographs, documents, and audiovisuals, resulting in the following:

- Results and evidence in folders by academic year.
- List of evidence, in each academic year, according to the substantive processes of the curriculum: academic, work, research and extension.
- Format variations:

- Digital: any Microsoft Word tool, digital tools (Photoshop, Movie Maker, others).
- Paper: accompanied by photographs, scanned images, diagrams, models.

Defense of the portfolio before the degree completion tribunal

The disagreement regarding this component of the methodology was submitted to criteria, both from specialists in the discussion table, as well as from the methodological collective of the integrating discipline and the career collective, considering, with great weight, the criterion of the student herself, which was the case taken for the execution of the work.

Presentation

The student chooses whether it is more comfortable to present her results by academic year or by substantive curriculum processes, emphasizing her line of research and results.

Assessment

The tribunal, as regulated in the MES documents, may or may not exempt candidates from the defense stage before the tribunal. Should the presentation take place, and based on the provisions of the MES Methodological Regulations (Res 47/2022), the following evaluation scale was proposed:

- 5 points: when the evidence is complete, accurate, and the content is clear and well-integrated. Opinions are clearly supported by referenced facts. Event results show first-place finishes or awards achieved.
- 4 points: when the evidence is complete, accurate, and the content is clearly understood and integrated. The samples presented demonstrate depth, but lack sufficient comprehensiveness, and do not include first-place finishes or awards at participating events.
- 3 points: when the evidence is sufficient, accurate and without errors in understanding, but does not show sufficient comprehensiveness, does not present depth in the samples presented for each dimension of the curriculum, etc.
- 2 points: when the evidence is weak, inaccurate, lacks understanding and insufficient justification.

If the evaluation tribunal deems it necessary to clarify any of the elements presented or to engage in scientific exchange (opposition) on a topic addressed, it must inform the student 15 business days

before the date established for the defense of the exercises, as established, as opposition, in the defense of the diploma.

The proposal was validated through the following methods: expert criteria and, in its action-research typology, the personal opinion of the student selected as a case study.

For the expert opinion, 10 professors from the faculty of the program were consulted, including: four Doctors of Education, five Masters of Science and one specialist in the area of knowledge, using the indicators of relevance, feasibility and scientific rigor under the criteria of Excellent (E), Very Good (MB), Good (B), Fair (R) and Poor (M) (Table 1).

Table 1. Expert criteria (n=10)

Indicator	Evaluation Criteria				
	E (%)	MB (%)	B (%)	R (%)	M (%)
Relevance	30	70			
Feasibility	40	20	30	10	
Scientific Rigor	60	40			

Source: Own elaboration

DISCUSSION

As can be seen, both the relevance and scientific rigor indicators of the proposal showed very favorable results in the opinion of the specialists who rated them between E and MB. This confirms that the proposal responds to a real need in the Cuban pedagogical context (Salfrán Vergara & Figueredo Salfrán, 2023) and is theoretically sound, aligning with current conceptions of the portfolio as an integrative tool (Dino Morales & Tobón, 2017; del Valle Llufrío *et al.*, 2023).

This result allows us to establish the novelty of the proposal based on the alignment between the Cuban Ministry of Higher Education policy and the potential of well-rounded students to achieve satisfactory results that are recognized and endorsed during their university period, which enhances and motivates them to improve their training and recognize their well-roundedness.

Regarding the feasibility indicator for implementing this form of graduation, various criteria were generated, distributed as follows: 60% rated it as E or MB, 30% as Good, and 10% as Fair. This latter rating is influenced by the cumbersome nature of compiling information and evidence for students using this modality, as well as their ability to synthesize, sequence, and present their work coherently. The comments associated with these assessments point to two practical challenges already identified in the literature on portfolios (Barragán Sánchez, 2005): the administrative and organizational burden for the student, and the need for the student to possess strong synthesis, self-reflection, and coherent presentation skills. This does not invalidate the proposal, but rather limits its optimal applicability to well-rounded students with a high-achieving profile, as established in the requirements of phase 1.

Its feasibility may be limited by the required documentation load and the need for synthesis and organizational skills.

The methodological proposal constitutes a novel contribution for Cuban universities, as no similar precedents were found in the national literature consulted.

For her part, the personal opinion of the student who completed this modality was evaluated through an interview, considering the indicators: satisfaction, feasibility, development of skills, scientific rigor and any other aspect that was of interest to her.

The student generally expressed personal satisfaction upon completing the program through this modality. She stated that undertaking this approach required her to organize her work across all dimensions of her training, which enabled her to develop intellectual, professional, and research skills. In the process of creating and organizing her portfolio, she was able to identify her strengths, weaknesses, and the evolution of her own learning, focusing on continuous improvement. This organizational method proved highly effective for compiling her application for the student researcher category.

All of this contributed to his recognition at the faculty level as an outstanding student and at the University level with the Scientific Merit Award.

In agreement with the specialists, the student found the viability indicator to be more cumbersome, as it required not only organizing the work and synthesizing the results, but also finding supporting documentation to verify the existence and quality of the work completed during the four years of her

degree. She notes that the most significant aspect was recognizing, year after year, the progressive advancement in her development. This finding reinforces the formative nature of the portfolio, beyond its final evaluative function, promoting student autonomy and metacognition.

The research group took on the challenge of establishing and validating a novel proposal unprecedented in this area, both in the documentary research carried out and in the methodological records of the degree, which opens a new path to the improvement of the traditional study completion modalities for the personal components in the management process of Cuban universities.

The result obtained from the implementation of the methodology and structure of the portfolio-based study completion modality, in the career that is the subject of this research, allowed:

For teachers and the career:

- To enrich the methodological work of the process of culminating studies in the Bachelor's Degree in Chemical Education at the University of Holguín.
- To have a methodology and didactic structure of this type of modality for the completion of studies, which serves as methodological didactic material in other school courses.
- To evaluate the student's progress throughout the course, as well as the tangible product of their work.

For the student:

- Satisfaction and positive feedback, based on the proposed plan, in their academic, professional, scientific and cultural development in general.
- It is a product that is built throughout the course of the race; this reduces the concentration of effort at the end.
- It stimulates critical thinking and reflection, as well as autonomy in decision-making: what to include and how to present it. Furthermore, it fosters an integrated understanding of knowledge and skills from various subjects within the degree program, providing a holistic view of the subject matter.
- Personological approach by focusing the student's interest on a professional area.

The proposal was positively validated by specialists, although its feasibility depends on the student's profile and requires considerable organizational effort. The case study demonstrated its viability and educational value.

Limitations and perspectives: The study focused on one career and one case, which limits immediate generalizability.

Recommendations:

1. To socialize and apply the methodology in a controlled manner in other pedagogical careers at the university.
2. Develop workshops for tutors and students on the creation and evaluation of portfolios.
3. Conduct future research that measures the impact of this modality on the subsequent professional performance of graduates.

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Conflict of interest

Authors declare no conflict of interests.

Authors' contribution

The authors participated in the design and writing of the article, in the search and analysis of the information contained in the consulted bibliography.



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