Didactic Use of the Publisher Processor to Enhance Meaningful Learning in Peruvian Secondary School Students

Sara Esther Liza Ordoñez[1,*], Silvia Georgina Aguinaga Doig[2], Osmer A. Campos-Ugaz[2], Ronald M. Hernández[3], Yen Marvin Bravo Larrea[4], Silvia Josefina Aguinaga Vasquez[5] & Carlos Luy-Montejo[6]

[1]I.E. 10042-Monseñor Juan Tomis Stack, Chiclayo, Perú

[2]Universidad Católica Santo Toribio de Mogrovejo, Chiclayo, Perú

[3]Universidad Privada Norbert Wiener, Lima, Perú

[4]Universidad Tecnológica del Perú, Chiclayo, Perú

[5]Universidad Nacional Pedro Ruiz Gallo, Lambayeque, Perú

[6]Universidad Privada del Norte, Lima, Perú

*Correspondence: I.E. 10042-Monseñor Juan Tomis Stack, Chiclayo, Perú

Received: January 10, 2024 Accepted: January 31, 2024 Online Published: February 15, 2024

doi:10.5430/jct.v13n1p298 URL: https://doi.org/10.5430/jct.v13n1p298

Abstract

The coronavirus pandemic has changed the course of education from face-to-face to remote. In response to this context, we investigated the positive effect of the didactic use of the Publisher processor to enhance meaningful learning in the competence "explain the physical world based on scientific knowledge about matter and energy, biodiversity, earth and universe" of the science and technology area in fifth grade students of secondary education of a Public Educational Institution of Chiclayo (Peru). For this purpose, a pre-experimental design with pre- and post-test was used with a sample of 102 students selected in a non-probabilistic way. A program based on activities incorporated in learning experiences proposed by the Ministry of Education (Peru) was applied. As a result, 72% of the students increased their academic performance after the application of the program, improving up to five (5) points compared to the initial test. Thus, the development of didactic material using the Publisher processor strengthens learning, which highlights the importance of information technologies in the achievement of active learning and the need to use them in the processes of mediation, reinforcement and teacher feedback in virtual and/or face-to-face scenarios.

Keywords: education, science and technology, active learning, didactic material, information technology

1. Introduction

Meaningful learning allows scientific-technological literacy by promoting the achievement of competencies that meet the demands of real and everyday situations, integrating more and more skills, abilities and strategies to respond to a problem and strengthening critical and creative thinking that mobilizes very high level cognitive skills in order to respond appropriately to the constant changes of the XXI century. Therefore, the peculiarities of education must be significant, in this sense, the teacher's role is to adapt the necessary elements for the student to be the actor, not only of his own learning, but also to be able to relate to his peers in his educational task; for this, it is required that the educational process be intensive, planned, systematic, considering individualities, interests and problematic situations of each student (Changoluisa, 2021).

The coronavirus pandemic situation worldwide has had an impact on education, transforming it from face-to-face to virtual education, which teachers and students, who are directly involved, must assume as a challenge of the 21st century. One of the ways to respond to this context is with the use of Information and Communication Technologies (ICT), which, in its eagerness to face the challenge, favors communication between people, allows knowledge to be transferred quickly to any place in the world in record time; it also impacts on society, human activity and, above all, on education.

In this line, teachers are called to use different strategies that respond to the demands of a virtual education, with the

use of technological resources that allow the achievement of learning; however, most of them are not sufficiently prepared to provide a remote education according to the student's learning style and pace, which leads to the development of prioritized competencies. It should be noted that there are limiting factors in families: low educational level and precarious economic conditions.

The results of the national assessment ECE 2019, implemented by the Ministry of Education (MINEDU, 2019) are not encouraging, for the second grade of secondary school they show as an average measure 567 in reading and mathematics, 501 in science and technology, demonstrating beginning level in learning achievement; in the Lambayeque Region, 564 correspond to reading, mathematics 562 and 496 science and technology, reaching beginning level of achievement. On the other hand, at the national level, students in reading are located as follows: Prior to beginning 17.7%, beginning 42.0%, process 25.8% and satisfactory 14.55%. The Lambayeque Region in reading reaches 17.45% prior to start, start 44.6%, process 25.4% and satisfactory 12.6%; in mathematics 33.6% prior to start, start 34.8%, process 35.4% and satisfactory 8.0% (Ministry of Education, 2020).

In general, education is being increasingly affected by the health emergency; among the main causes are the limited connection to the Learn at Home strategy, scarce accompaniment, feedback and reinforcement by teachers, since most of them are not prepared to face the distance and/or remote modality, characterized by being deferred in time and space between educational actors. On the other hand, the scarce access of students to digital and technological means results in low learning levels in most curricular areas, particularly in science and technology.

In coherence with the problem regarding virtual competencies in teachers and in order to respond to the demands of the context, the research question was: How to enhance meaningful learning in the competency "explain the physical world based on knowledge about living beings, matter and energy, biodiversity, earth and universe", in the area of science and technology in fifth grade high school students?

The purpose of this problem was to demonstrate the effect of the didactic use of the Publisher processor to enhance meaningful learning in the aforementioned competency. In this line and with the purpose of reaching the expected and/or outstanding achievement level in said competency, the study addressed three specific objectives: (1) To identify the current level of learning achievement in the competency under investigation (2) To determine the characteristics of the use of the Publisher processor to enhance meaningful learning in the competency under study and (3) To establish a comparison of pre-test and post-test results to determine the effectiveness of the use of the Publisher Processor in the achievement of the competency under investigation, after using educational material elaborated with the Publisher Processor.

In this sense, it is recommended to incorporate ICT as a pedagogical value in times of crisis, in the teaching process to achieve lasting learning, since the pedagogical value in the use of ICT is shown as a key factor for the introduction of remote teaching and an advance in learning processes mediated by technologies (Avendaño et al. 2021). Therefore, these and other references motivated the use of the Publisher processor in the elaboration of didactic material to develop the learning experiences proposed by MINEDU, and thus, strengthen teaching strategies and reach the expected and/or outstanding achievement level of students (Torres, 2019).

This pre-experimental study responds to the positivist paradigm and quantitative approach, the methodological strategy was based on the design of a single group with pre-test and post-test, the data obtained in this research were subject to description, analysis and interpretation, in order to focus on the objectives and finalize with a clear communication of the study. The scientific observation allowed to know the level of achievement of learning in the competence "explain the physical world based on knowledge about living beings, matter and energy, biodiversity, earth and universe of the science and technology area" in students of fifth grade of secondary education of an Educational Institution of the city of Chiclayo, in the academic period 2021. A structured pre-test was applied to 102 students selected in a non-probabilistic way, the questions to the students were directed to the achievement of the competence under study; thus, a program based on activities incorporated in learning experiences proposed by MINEDU's strategy Aprendo en casa (I learn at home) was proposed.

From what has been said above, the contribution provided by this research is very valuable and significant, in terms of the response that teachers must give in a remote education context, the strategies to be applied and the didactic material to be used by students according to their different learning styles and rhythms. Likewise, the design and elaboration of triptychs, bulletins, posters, among others, using the Publisher processor, has allowed obtaining quality and impact didactic material in an easily accessible format (JPG) that has been shared, observed and used directly by the student through the virtual tools WhatsApp and Telegram both in synchronous and asynchronous meetings; in such a way that the student has obtained the expected and outstanding level of achievement in the prioritized competence, reaching lasting learning for problem solving.

Finally, with the research conducted, in addition to benefiting the school population that received the program, it will also have a positive social and educational impact on their immediate environment; at the same time, it will be a precedent to be used by teachers in other areas of Regular Basic Education (RBE).

1.1 Theoretical Basis

1.1.1 Ausubel's Significant Learning Theory

The center of attention is the student or learner, who learns, to the extent of what he/she knows or the set of concepts he/she has prior to the new knowledge and how these are related. Therefore, according to him, priority should be given to knowing the cognitive structure of the student, in order to give the appropriate orientation to the new knowledge (information). In this sense, quality teaching will aim to build knowledge, elicit conceptual change and provide meaningful learning (Chiguala, 2019).

1.1.2 Siemens' Theory of Connectivism

Connectivism is a learning theory for the digital era, integrating various principles that have been studied by theories such as chaos, networks, complexity and self-organization theory. In this sense, it states that learning is the sum of what happens within situations with changing elements that are not always monitored by individuals. Similarly, he states that learning, considered as knowledge that can be applied, can reside outside the individual or be found within an organization or a database, oriented to linking specialized information. Thus, connections are more important than our current state of knowledge, when they allow us to learn more. In addition, he explains that connectivism is based on principles that change rapidly, because new information is being obtained at an accelerated rate. Consequently, it is vital to know how to differentiate between important and unimportant information, as well as to recognize whether the new information alters decisions taken previously (Gargicevich, 2020).

1.1.3 Significant Learning

In this regard, Ausubel states that learning will be meaningful to the extent that the contents are related to the student's previous knowledge and not in an arbitrary manner. In this sense, a substantial and non-arbitrary relationship must be understood as the relationship of the idea or concept with relevant aspects found in the student's cognitive structure (Trujillo, 2020).

Likewise, the most important characteristics, requirements, factors, among others, necessary for meaningful learning in order to achieve the assimilation of information in the cognitive structure; that is, the student must be able to develop his or her own skills and abilities. In this sense, the teacher must know the different learning styles, preferences and needs in order to program activities and/or sessions that connect the cognitive structure of the new knowledge with the previous one, since no learning starts from zero. The new meaning can be understood as a process through which the new information or new knowledge is related in a non-arbitrary and substantive way, that is, in a non-literal way with the cognitive structure of the learning subject (Garcés et al., 2018).

Meaningful learning occurs when learners are located at the appropriate levels of cognitive development that correspond to them, without forcing mental processes to the competencies and/or capacities that the teacher thinks the students can develop; then, the influence of the stimuli received from the environment is of vital importance; therefore, it is worth specifying that instructional strategies are those that the teacher elaborates and uses to improve the teaching-learning process. Along these lines, the author considers that the theory of meaningful learning is a cognitive theory of restructuring, a psychological theory that is built from the organicist approach of the subject, focused on learning created in a school environment. Clearly, it is a constructivist theory, since it is the individual-organism-subject itself that generates and constructs its learning (Salgado, 2022).

1.1.4 Strategies to Promote Meaningful Learning

Among the strategies that make it possible to generate significant learning are the different types of evaluation such as summative, formative and diagnostic, where the rubric assumes capital importance as a tool to support the learning process; in this line, the authors consider formative evaluation as valuable, because it allows gathering information as the processes are being developed, with the purpose of improving them; likewise, they mention that, according to Carlessi, evaluation should contribute effectively to the improvement of learning, who, in addition, suggests three basic principles: The first, to evaluate tasks, it is necessary to design them as a stimulus for peer learning practices; in this sense, aligning objectives, contents and evaluation tasks will allow active learning and achieve the goals. Second, students should be directly involved in the evaluation through quality criteria on their own performance and that of their peers; to that extent, participation in self-evaluation, peer evaluation and peer feedback leads to a better understanding of the learning objectives. Third, the teacher will provide timely feedback in order to

strengthen current and future learning; thus, adequate and relevant feedback engages the student in the learning process (Quiroga et al., 2021).

This means that among the indispensable strategies for meaningful learning are the evaluations, especially the formative evaluation that is generated by developing activities that constitute a process evaluation, which allows the teacher to provide timely reinforcement and feedback.

1.1.5 Meaningful Learning and Its Benefits in Pedagogical Practice

Meaningful learning is one of the most interesting practices today that enhances school development, since it awakens interest and builds knowledge with teacher guidance and student participation, based on previous knowledge expanded with the teacher's guidance. Hence, students feel motivated to complement what they already know, considering their needs and interests. As a result, learning is meaningful and lasting. In this sense, it will be convenient to make use of daily learning situations to give it greater significance, even more, if it is done in teams of students where different appreciations enrich the practice, highlighting the value of what has been learned (Gómez et al. 2019).

In the pedagogical practice, several strategies are applied, such as the elaboration of concept maps in the teaching process, as referred to in the research of quantitative approach, of experimental type, with a quasi-experimental design and a sample of 66 students whose results determined that most of the students of the experimental group developed their intellectual capacities, explored their knowledge and finally, reached competences in a good and significant level after the application of concept maps in the teaching process. (Beker, M. Zevallos, L. 2022).

1.1.6 Significant Learning and ICT

ICT currently provide a number of virtual and digital tools that favor teaching strategies in their quest to achieve active learning in students. In this sense, research has been carried out that results in the permanent need to update teachers in the use of ICT, in order to apply innovative resources to improve the strategies they use to generate new knowledge, develop communicative and collaborative skills, making use of technological and digital resources in the path of a more active teaching (Changoluisa, 2021).

In a case study referring to practical work in a professorship in which the mediation of Information and Communication Technology was incorporated to meaningful learning, it is concluded that learning activities begin to show different ways of acquiring meaning, self-organizing, organizing, processing and sharing information, favoring other ways of learning; However, the teacher must promote substantial pedagogical proposals mediated by technology, in order to develop autonomous learning, transfer through cognitive, metacognitive, reflective, critical and self-regulatory skills. In this sense, autonomy implies that the student makes decisions on how to learn, reflects on the tools to use, the appropriate time to work and solve problems consciously to achieve their goals (Gilardoni, 2021).

1.1.7 Educational Use of Publisher

Information and communication technologies in the teaching-learning process. Making use of information technologies involves identifying innovation processes in different environments that allow the construction of interactive and dynamic learning spaces. As an example, they mention the changes generated referring to the traditional form of learning centered on the teacher; however, it should be focused on the student; likewise, they point out that, currently, communication is often influenced by information technology; then, it is possible to make use of media or instruments that serve as a link for the exchange of opinions (Carrera and Villegas, 2020).

ICT positively affects the planning of the teaching-learning process, since it is necessary to take into account the interests, needs and characteristics of the student, as well as the subject, methodology and strategies. Using these technologies we change to a new didactic model constituted by networking, thus, the initiative of the formative process is strengthened to the student, who will work cooperatively in order to access information presented in various formats, such as audio, video, text, etc. In this change, the teacher assumes new roles in which he/she must prioritize the technological benefits and provide spaces to establish interaction among students. Likewise, they consider that the use of general software such as word processors (e.g. Publisher), databases, spreadsheets, among others, are of great help in various aspects to facilitate the development and presentation of tasks, organize information, manage teaching materials that favor the academic part of the students and are able to perform better in an increasingly competitive environment.

1.1.8 Impact of ICT on Learning

The traditional educational environment has been transformed by the incorporation of ICT, with the interest of

promoting teamwork aimed at creating symbolic environments, representing, processing and disseminating information; in this way, innovation and creativity of both students and teachers is motivated. In this sense, the great challenge of current education for teachers is to value the pedagogical potential of ICTs and integrate them into teaching strategies in order to achieve meaningful learning. In this line, the function of information and communication technologies is to mediate learning, since they change the technological context of traditional education, generating more exploratory, flexible and cooperative learning processes. However, the use of ICTs in education requires standards that optimize learning environments; one of them is creativity and innovation that promote creative thinking and the development of innovative processes and products. On the other hand, communication and collaboration strengthen the ability to work and learn cooperatively; as well as critical thinking and decision making regain great importance in problem solving (Aparicio, 2018).

With these standards and indicators, the school must carry out a diagnosis of its particular educational context in order to establish lines of action aimed at achieving significant learning.

1.1.9 Word Processors

Word processors are applications that provide us with formats for writing documents. To that extent, we use them to create simple or complex documents, including images, graphics and even forms to complement the completion of a work. These virtual tools allow us to creatively elaborate the didactic material that will serve as input in learning activities considering the diverse rhythms and styles that students have to learn (Rivadeneira and Villegas, 2018).

1.1.10 Publisher Processor

This processor corresponds to an application whose purpose is to provide functions to create, design and publish works with the purpose of a better communication of messages and ideas. It has templates that facilitate the design of monographs, envelopes, invitations, newsletters, brochures, among others. In this processor it is possible to insert autonomous text boxes, images, figures, the same that have the possibility of being customized, in addition to creating colored designs and / or used from templates (Rivadeneira and Villegas, 2018).

In this sense, the Publisher Processor as a program allows us to make calendars, brochures, advertisements, flyers, letters, it also provides opportunities for easy design and creation of school magazines, as well as various types of documents (posters, banners, invitations); likewise, when carrying out a project, several areas of knowledge can be involved to work together. There is also the possibility of converting the magazine into a web format and publishing it. The Publisher processor is characterized by templates located on the program's home page, whose purpose is to help users create different types of advertisements. On the other hand, they allow the manipulation of various formats, enable several options such as WordArt that facilitates the arrangement of words, design of phrases and/or complete titles in a creative way and elaboration of logos, among others.

The Publisher processor is a good element for education, since it has several attributes. It is useful for teachers and students; for teachers it gives them ideas on how to have a didactic material that benefits the student's learning; while, in the case of students, they have the opportunity to make works in different formats (leaflets, brochures, newsletters, etc.); in this sense, the only thing the student has to do is to edit a design suggested by the program, thus achieving a good and simple work.

2. Method

With regard to methodology, in an effort to promote the development of research skills, significant methods such as inverted classroom, workshops, problem-based learning (PBL), case method, interspersed questions, exposition-dialogue, autonomous learning, collaborative work were used. There is no doubt that, in a transversal way, the use of ICT resources, as a set of digital tools, fulfilled its function through the WhatsApp and Telegram applications, used by the students' situation in terms of type of connectivity. On the other hand, the various teaching strategies in the processes of mediation, reinforcement and feedback, as well as the didactic material that was developed in JPG format (image), allowed in non-face-to-face scenarios not only the development of the area, but also, the conduct of student research in the application phase or field work, for example, in the design of instruments to be applied synchronously and asynchronously (observation guides-observation of videos; questionnaires, Google forms, interviews-via WhatsApp and Telegram, and/or via telephone). For the research process, in order to respond to the stated objectives and considering its purpose, a pre-experimental type study was selected, supported by the positivist paradigm and with a quantitative approach according to Hernández and Mendoza (2018). In such reason, the strategy employed was, the design of a single group with pre-test and post-test.

The sample population consisted of five groups of students in the fifth grade of secondary school. Specifically, the

ages of the students evaluated ranged between 16-20 years old, belonging to both sexes, students who developed the area of science and technology in an educational institution in Chiclayo, Peru. The basic characteristics of the population in the research selected by non-probabilistic method with intentional character as manifested by Sánchez et al. (2018), are shown below.

Table 1. Sample Population of Fifth Grade Students, Secondary Level

Groups	Students		Total
	Men	Women	
A	13	10	23
B	07	16	23
C	09	09	18
D	12	06	18
E	11	09	20
Total	52	50	102

Table 1 shows that the population under study consisted of 5 groups that incorporated 102 students, thus, groups A and B are made up of 23 students each; groups C and D are made up of 18 students each; while group E has 20 students.

Like Gómez et al. (2016), selection criteria such as homogeneity, accessibility and representativeness of the subjects under evaluation were mainly considered. These criteria are linked to age, gender and learning achievement level in the competency "explain the physical world based on knowledge about matter and energy, biodiversity, earth and universe". It is necessary to emphasize that, since the population is made up of school-age subjects, it was convenient to have the informed consent of the parent and/or guardian in order to be able to participate in the study. Thus, the sample population complies with minimum and sufficient criteria, which merited the execution of the field work in coherence with the needs and assuming the generalization of the results, a primordial characteristic of quantitative research.

In addition to the total number of students, we also identified the way in which the groups were formed, considering gender, in order to show the selection criteria of the subjects under evaluation; in the research, students of both sexes were considered, identifying 52 males and 50 females in total.

Regarding data collection techniques and instruments, one of the most feasible resources available to the teacher to evaluate and collect relevant information in a group or personal manner, in the classroom or outside it, is the psychometric technique, which was used with the instrument, meaningful learning test of the competence "explain the physical world based on knowledge about living beings, matter and energy, biodiversity, earth and universe", constituting a virtual support used in the context experienced due to the effect of the coronavirus pandemic.

The test contains 16 questions aimed at measuring significant learning in the competency under study, which was subjected to validity and reliability processes.

The first step was to obtain the content validity, for this, a guide was used that verifies aspects of clarity, coherence and relevance of the items quantified by the Aiken V, "since it is a coefficient of easy calculation and guarantees results supported by statistical techniques that contribute to provide quality of measurement instruments for research purposes" (Pastor, 2018, p. 193). In this regard, five judges with 10 or more years of experience in teaching and research from public and private universities in Peru, specialists in the area of science and technology with master's and doctoral degrees, who voluntarily accepted to participate, were considered, resulting in very high values with a score of 95% for the tool in question. The exclusion criteria used were revocation of informed consent and failure to deliver the evaluated material within the established deadline.

The items were evaluated using the Expert Judgment template, whose rating establishes 4 levels: 1, does not meet the criterion; 2, Low level; 3, Moderate; 4 and High level, based on the characteristics to be evaluated: sufficiency, clarity, coherence, relevance and pertinence, also considering the qualitative observations of the experts, for each of the items. Finally, each of the experts signed a validation certificate, where they evaluated the assessments related to the original instrument.

The second step, following Mayorga et al. (2020), as part of the methodological framework, the pilot test was installed in order to ensure the validity of the measurement procedure and determine the reliability of the instrument; likewise, the suitability of the guide used for data collection was evaluated. The instrument applied preliminarily was

submitted to reliability mechanisms, through the KR20 coefficient, after a pilot test was applied to fourteen students of similar characteristics, but of different identity than the ordinary sample, obtaining as a result the value of 0.884, a very high magnitude range.

Regarding the method used, Manterola et al. (2018) point out that in research, reliability encompasses precision, consistency and reproducibility and that it corresponds to a psychometric property that guarantees the absence of error in the measurement; therefore, it should be selected considering the particularities. To this effect, the Kuder Richardson coefficient was used in order to be consistent with the dichotomous organization of the responses.

Another important point is the research methods, a combination of them were used, using theoretical procedures such as the inductive-deductive used throughout the research, mainly to establish how the program design corresponds to the results found; analytical-synthetic for the analysis and theoretical foundations; mathematical methods to deal with the variable under study and empirical methods, with the use of the instrument mentioned above (Burgo et al., 2019). Thus, a combination of methods allows the study conducted to acquire effectiveness.

From the procedures used to strengthen the research work, initially, the target population was chosen and contact was established for which the necessary arrangements were made with the authorities of the educational institution. Then, the information gathering instrument was designed to undergo validity and reliability processes, so that it was possible to apply it in order to obtain information.

As for the fieldwork, concrete processes were considered. First, the objectives of the study were clearly defined. Then, the population or sample of participating students was selected. Subsequently, the technique and instrument were designed and applied. Then, the indicated population was contacted, complying with scientific rigor in each step. Also, the activities that were part of the learning experiences proposed in the strategy Aprendo en casa of the Ministry of Education for the research "didactic use of the Publisher Processor to enhance meaningful learning in the competence explains the physical world" were submitted to the judgment of experts. In this regard, it is worth mentioning that other elementary processes were taken into account, such as the elaboration of the final theoretical framework of the research, data processing and analysis, whose results allowed the development of theoretical-empirical discussion. Finally, the final report was written with all the elements contemplated in the university's protocol guide.

Regarding the information processing plan, the data were organized in the EXCEL statistical program, considering variables and dimensions that order the data resulting from the research. As a tool for processing, the same resource was used, thus achieving the systematization of the results through tables and graphs that express the level of learning achievement of the students under study with the criteria previously defined for that purpose. Thus, in the consistency matrix, the methodological elements present in the study are consolidated, since they fulfill the function of supporting the research carried out.

It is worth mentioning that some ethical considerations were taken into account, such as the presentation of a premise in the initial part of the meaningful learning test that circulated virtually in a Google form, in order to develop the informed consent of the participants. This voluntary authorization regulated both the participation and the disclosure of results but taking into account the maintenance of anonymity and the use of codes for the examinees. Likewise, the veracity during the circulation of the guidelines to validate first the questionnaire and then the program, documents delivered to experts, is emphasized. Regarding the use of data, these were treated in a way that was faithful to the reality with which they were collected. Similarly, the quality of the instrument stands out, assessed with the reliability method based on the data obtained in the pilot test, for which the starting point was also the acceptance and permissions of the people evaluated, thus constituting an enriching and collaborative group at all times of the study.

2.1 Reflection and Evaluation

Once the actions have been developed, it is necessary to evaluate and reflect on the results obtained. Regarding the evaluation of the program, this was materialized in three modalities, diagnostic (rubric), formative (through an estimation scale) and summative (rubric), considering the instrument proposed by the authors Aliaga et al. (2021), who, in their research, present a socio-formative analytical rubric that allows establishing the level of mastery of research skills, abilities and capacities. After the methodological stages, they ensure that the instrument has content validity, in addition to being understandable for the target population and reliable. The program was validated by means of the expert judgment method, obtaining an average score of 96.6 points. This result allows us to validate characteristics such as pertinence, relevance, originality, feasibility of the proposal, verified throughout the process of its execution. The learning activities included in the proposal have guaranteed the achievement of the competence

under study. Likewise, the technical quality, methodology, extension, the explicitness of the objectives and the easy materialization of the evaluation indicate that the proposal has managed to promote significant learning in the mentioned competence.

On the other hand, it is worth mentioning that the positive impact of the program has been proven, since it was shared with science and technology teachers working in the Lambayeque Region and other regions of Peru, who have seen its effectiveness in the meaningful learning of students.

The program is structured in 10 learning experiences:

Quadre 1. Learning Activities

Activity	Name	Objetivo
Learning Activity 1	"We understand traditional medicine in the light of science."	Use scientific knowledge to explain how traditional how traditional medicine works.
Learning Activity 2	"Understanding the properties of matter allows us to take advantage of them to preserve health."	Analyze aspects related to the study of active principles to understand the structure of matter.
Learning Activity 3	"We explain the contributions of science to the preservation of health"	Recognize the progress of science and technology in contributions to the preservation of health.
Learning Activity 4	"We analyzed and explained the results of the Human Genome Project"	Reflect on the results of the Human Genome Project, valuing respect and good coexistence.
Learning Activity 5	"We explained the physical-chemical properties for the responsible use of plastic."	Explain the chemical composition of plastic and its impact on the environment and health.
Learning Activity 6	"We explained the origin of water and its distribution in various sources".	Identify the origin of water and its distribution in different sources in the country.
Learning Activity 7	"We identify technologies for sustainable water acquisition, care and maintenance."	Identify ancestral and contemporary technologies that guarantee the sustainable care of water.
Learning Activity 8	"We understand the effect of solid waste on health."	Understand the effect of waste on health based on scientific support.
Learning Activity 9	"We develop proposals for the good management of organic and inorganic solid waste"	Develop proposals for the management of organic and inorganic solid waste.
Learning Activity 10	"We explain the alterations in the functions of some human systems in the face of acts of citizen insecurity."	To learn how the brain and various neurotransmitters function in the face of dangerous situations.

3. Results

In line with the stated objectives, the section develops the presentation of the main findings of the study. It explains the current level of learning achievement in the competency "explains the physical world based on knowledge about living beings, matter and energy, biodiversity, earth and universe", of the science and technology area in fifth grade high school students.

Table 2 indicates that, of the total number of students evaluated, 95.17% are at the beginning level and in process. These data are corroborated with the result of the statistic, which indicates an arithmetic mean equivalent to 10.69 points, being the homogeneous group with a CV=16.78%. The most frequently repeated score is 10, finding at the same time that 50% of those evaluated have scores lower than 10 and the percentage difference is higher than the indicated value.

Table 2. Level of Achievement Obtained in the Competence Explaining the Physical World (Pretest)

Achievement level	Score	Frequency	Percentage
At startup	0-10	52	50.98 %
In Process	11-13	46	45.09 %
Expected accomplishment	14-17	4	3.92 %
Featured	18-20	0	0.00 %

According to Table 3, of the total number of students evaluated, 71.56% are located in the expected and outstanding achievement levels. These data are corroborated with the statistic, which identifies an arithmetic mean equivalent to 15.39 points, being the homogeneous group with a CV=18.89%. The most frequently repeated score is 14, finding at the same time that 50% of those evaluated have scores lower than 15 and the percentage difference higher than the indicated value.

Regarding the comparison of pre-test and post-test results to determine the effectiveness of the use of the Publisher Processor in the meaningful learning of the competency explains the physical world, first, the result of the post-test applied to the students is detailed to then compare with the preliminary findings through the use of statisticians.

Table 3. Level of Achievement Obtained in the Competence to Explain the Physical World (Post-test.)

Achievement level	Score	Frequency	Percentage
At startup	0-10	4	3.92 %
In Process	11-13	25	24.50 %
Expected accomplishment	14-17	42	41.17 %
Featured	18-20	31	30.39 %

Table 4, which summarizes the statistical processing of data, indicates that the differences between the pre-test and post-test in the learning achievement of the competency under study are marked; thus, the minimum score in the pre-test is 8, while in the post-test it is 11; the maximum score in the pre-test is 15, while in the post-test it is 20. These values prove the effectiveness of the program since the coefficient of variability indicates that the level of learning achievement has been exceeded by about 5 points (4.80).

Table 4. Comparison of Results Obtained When Applying the Pre-Test and Post-Test

Statisticians	Pre test	Post test
Media	10.59	15.39
Median	10	15
Fashion	10	14
Standard Deviation	1.59	2.91
Range	7	9
Minimum	8	11
Maximum	15	20
Sum	1080	1570
Account	102	102
Coefficient of variability	14.99	18.889

4. Discussion

In the present context, the Ministry of Education (MINEDU, 2019), in its national evaluations of learning achievement, reports that more than 81% of the students evaluated in our Lambayeque region are in pre-starting, starting and in process achievement levels; therefore, they present difficulties to achieve the students' exit profile considering the inquiry and scientific and technological literacy approach. This situation justifies the use of the Publisher processor as a strategy for the elaboration of didactic material that responds to the learning needs in order to achieve significant learning.

In this regard, Lema and Meza (2021) report that 80% of students consider that the use of technological equipment

and information technologies in the classroom benefits their learning and strengthens their communication skills; likewise, a large percentage of teachers believe that technology contributes to the increase of significant knowledge. According to Espinoza et al. (2018), ICT resources used in class with RBE students, such as word processors are widely used by teachers for the introduction and development of content in learning sessions; however, this same resource, on the part of students, is oriented mainly for the completion of tasks and extra-class work (Parra Bernal & Rengifo Rodríguez, 2021).

The statistics used showed that the program administered in the corresponding group was effective, since it achieved the results expected in the study, surpassing the initial test by 4.80 points. All this indicates that the aforementioned academic strategy is rigorously adjusted to a concrete and contextualized reality. A study related to the present one, is the one conducted by Rivadeneira and Villegas (2018), on the use of Microsoft Office in the learning of first grade high school students, who managed to demonstrate, with 38%, that maintaining interactive environments that motivate students, helps good communication in the learning of a subject, achieving motivation and interest in learning in a meaningful way (Martin, 2017).

In summary, the hypothesis is proven: The didactic use of the Publisher processor enhances meaningful learning in the competency "explains the physical world based on knowledge about living beings, matter and energy, biodiversity, earth and universe"; a situation that merits that the study continues to be applied in other areas and thus contributes to achieve the competencies required by the regular elementary education student of our region and country (Castillo, 2008). As a consequence, we must be aware that the culture surrounding learning becomes an inherent element of the teaching and learning process (Fajardo, 2016). Virtual resources facilitate education in formal and non-formal environments respecting cultural diversity, in this way the different realities converge for the use of different strategies can plan activities to promote cultural sensitivity, internet accessibility resource, virtual materials, cultural presentation, cultural content research (Fleet, 2006). Finally, the use of the Publisher can be considered a tool capable of encouraging cultural sensitivity, not only as a teaching tool, but also as a teaching objective.

5. Conclusions

In the research conducted, it was identified that students in the fifth grade of secondary school reached the beginning and process level in the competency "explain the physical world, based on knowledge about living beings, matter and energy, biodiversity, earth and universe"; thus, raising the need to enhance scientific literacy, in order to achieve meaningful learning that will allow students to respond correctly to real and everyday situations.

In addition, it was determined that the use of the Publisher processor in the elaboration of didactic material enhances significant learning in the competency "explain the physical world, based on knowledge about living beings, matter and energy, biodiversity, earth and universe"; thus originating the need to use the benefits of formatting, design, use of downloadable templates, create publications in various formats, among others, to facilitate understanding, argumentation and mastery of the competency under study.

The use of the Publisher program in the elaboration of didactic material demonstrated its effectiveness in the achievement of the competency "explains the physical world, based on knowledge about living beings, matter and energy, biodiversity, earth and universe", with notable differences in the results of the pre-test and post-test, thus accepting the hypothesis put forward. It is important to visualize in this way, the need to use information and communication technologies that allow teachers to carry out mediation and feedback processes in virtual and/or face-to-face scenarios.

In the academic field and the preparation of education professionals, programs to promote individual and collective development of learning experiences and/or research projects and pedagogical innovations and improvement of the quality of educational services at school, such as the one developed in this study, constitute actions that promote the achievement of competencies in students to solve problems in their environment. These are the concrete results obtained from the presentation made in the body of the work. They should correspond to the objectives stated in the introduction.

The main advantages are security, access, ease of use and improved collaboration in the organization of a learning session, allowing greater participation and tutoring between teacher and student. Some difficulties that arose in the study are the technical problems derived from the use of ICTs. The problems could be related to the need for students to learn how to handle this application and not lose the sense of collaborative work. Likewise, there is a need to guide students in the proper use, organization and collaborative and communicative possibilities of this tool.

This proposed methodology is intended to be extended to other contexts other than those of the representation used.

The use of Publisher in other educational environments, for example, in the teaching of other academic contexts such as mathematics, natural sciences, biology, plastic arts, seeks the development of new applications of this technology through other sources such as augmented books, the teaching of shapes and their representation in the teaching-learning process.

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Acknowledgments

The authors would like to thank each institution that represents them as an affiliate.

Authors contributions

The authors SELO and SGAD were responsible for the design and review of the study. OACU, RMH and YMBL were in charge of the methodological review and theoretical support. SJAV and CLM wrote the discussion and conclusions of the manuscript. All authors read and approved the final manuscript.

Funding

Not applicable

Competing interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Informed consent

Obtained.

Ethics approval

The Publication Ethics Committee of the Sciedu Press.

The journal's policies adhere to the Core Practices established by the Committee on Publication Ethics (COPE).

Provenance and peer review

Not commissioned; externally double-blind peer reviewed.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.