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*Artículos científicos*

# Desarrollo del pensamiento computacional en niñas y niños usando actividades desconectadas y conectadas de computadora

***Development thinking computing to children use of unplugged and plugged computing***

***Desenvolvimento do pensamento computacional em meninas e meninos usando atividades de computador desconectadas e conectadas***

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**Resumen**

Actualmente, una de las competencias que más debe ser desarrollada desde edades tempranas es el pensamiento computacional, el cual procura resolver problemas por medio de la computadora, de ahí que demande la maduración de diversas habilidades cognitivas. Por tanto, el objetivo de este trabajo fue mostrar datos cuantitativos de la aplicación de un taller de programación en bloques con la finalidad de incorporar las habilidades básicas del pensamiento computacional en una muestra de alumnos de la escuela primaria rural Bartolomé Vargas Lugo, del municipio de Acatlán, Hidalgo. La pregunta que guio el presente estudio fue la siguiente: ¿cuál es la el grado de aceptación de un curso de programación en bloques combinando computación conectada y desconectada? El diseño de la investigación fue mixto y la metodología cuantitativa, mientras que el enfoque del estudio fue exploratorio y descriptivo. El referente tomado para el desarrollo de las competencias del pensamiento computacional en los participantes del taller fue la filosofía constructivista, mediante el uso de recursos didácticos usados para fortalecer los nuevos conocimientos en el área de la programación de computadoras. Como resultados se identifica la aceptación del uso de la plataforma, de las actividades previas para adoptar conocimientos nuevos en el desarrollo de un programa de computadoras y de la búsqueda de información con respecto al tema. Con base en los resultados de las encuestas aplicadas, se puede indicar que se observaron algunas diferencias en cuanto al género, pues las niñas tienen más curiosidad de aprendizaje sobre la herramienta de programación y visualizan sus beneficios. También se observa en los resultados que los niños y niñas muestran una poca o nula resistencia en la adquisición de los conocimientos experimentados en el taller de programación y establecen mecanismos de confianza en la resolución de problemas basados en computadora, o bien en la interpretación y uso de estructuras de control. Por ello, para futuros trabajos se puede aplicar este tipo de actividades en escuelas distantes de la zona urbana con la finalidad de establecer comparativos.

**Palabras clave:** educación básica, habilidades, informática educativa, lenguaje de programación, programación informática, técnicas didácticas.

## Abstract

The objective of this work was to show quantitative data from the application of a block-based computer programming workshop in order to incorporate the basic skills of computational thinking in a sample of Bartolomé Vargas Lugo rural elementary school students from the municipality of Acatlán, Hidalgo where there is a number to consider of participating students who do not have computer equipment at home to solve this characteristic, the course was developed in the following two hours after their normal departure from classes. The question that guided the present study was the following: what is the degree of acceptance of this course combining connected and disconnected computing? The research design was mixed, and the methodology used was quantitative, while the focus of the study was descriptive and exploratory. The reference that is taken for the development of computational thinking competencies in the workshop participants is the constructivist philosophy through the use of didactic resources in connected and disconnected computer programming. As results, acceptance is identified both in the use of the platform, the activities prior to the use of the computer, the understanding of the activities prior to the development of a computer program and a relevant point the search for information regarding programming. These data can be seen reflected in a questionnaire with a Likert scale. In addition, there are some differences in this workshop course in the stages of development of programs at the gender level where girls are more curious about learning in the programming tool, they visualize the benefits of learning programming among some others. As observed in the results, the boys and girls show little or no resistance in acquiring the knowledge experienced in the developed workshop, such as establishing trust mechanisms in some future that are presented again with concepts such as problem-solving based in computer or in the interpretation and use of control structures. Within the previous works it is intended to carry out this concept of disconnected activities for the acquisition of computational thinking in remote schools from the urban area in order to establish a comparison in the knowledge of the same.

**Keywords:** Basic education, skills, educational informatics, programming language, programming informatics, didactic techniques.

## Resumo

Atualmente, uma das competências que mais se deve desenvolver desde cedo é o pensamento computacional, que busca resolver problemas por meio do computador, portanto exige o amadurecimento de várias habilidades cognitivas. Portanto, o objetivo deste trabalho foi mostrar dados quantitativos da aplicação de uma oficina de programação em blocos para incorporar as habilidades básicas de pensamento computacional em uma amostra de alunos da escola primária rural Bartolomé Vargas Lugo, do município de Acatlán, Hidalgo. A questão que norteou o presente estudo foi a seguinte: qual o grau de aceitação de um curso de programação em bloco combinando computação conectada e desconectada? O desenho da pesquisa foi misto e a metodologia quantitativa, enquanto o foco do estudo foi exploratório e descritivo. A referência assumida para o desenvolvimento das habilidades de pensamento computacional nos participantes das oficinas foi a filosofia construtivista, por meio da utilização de recursos didáticos utilizados para fortalecer os novos conhecimentos na área de programação de computadores. Os resultados são a aceitação do uso da plataforma, as atividades anteriores de adoção de novos conhecimentos no desenvolvimento de um programa de computador e a busca por informações sobre o assunto. Com base nos resultados das pesquisas aplicadas, pode-se indicar que algumas diferenças foram observadas em relação ao gênero, uma vez que as meninas têm mais curiosidade em aprender sobre a ferramenta de programação e visualizar seus benefícios. Observa-se também nos resultados que meninos e meninas apresentam pouca ou nenhuma resistência na aquisição dos conhecimentos vivenciados na oficina de programação e estabelecem mecanismos de confiança na resolução de problemas informatizados, ou na interpretação e utilização de estruturas de controle. . Portanto, para trabalhos futuros, este tipo de atividades pode ser aplicado em escolas distantes da zona urbana para estabelecer comparações.



**Palavras-chave:** educação básica, habilidades, computação educacional, linguagem de programação, programação de computadores, técnicas de ensino.

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# Introduction

It is evident that today's society is immersed in a changing technological era, which has forced the creation of teaching schemes that promote the development of skills that adjust to current demands. For this reason, as Espino and González (2015) point out, children should be guided to cultivate certain essential digital skills for daily and work life.

In this sense, according to a study carried out by Salesforce Economy, for the year 2024 an annual increase of 44% in specialized positions of artificial intelligence and 38% in jobs related to the Internet of Things is estimated (Gantz, 2019), concepts innovative in the technological area. For this reason, it is vital to incorporate the use and development of technology at an early age, as is the case in various nations (eg, such as the United States, United Kingdom, New Zealand, South Korea and Israel), where they have included within its educational programs the teaching of computer programming (Mannila et al., 2014).

Among the competencies that children must acquire in the proliferation of information and communication technologies (ICT) are the analysis of information, its representation through abstractions (such as models and simulations), the automation of solutions using algorithmic thinking; and generalization and transfer of the problem-solving process using a computer. These competencies are encompassed within what Wing (2006) calls computational thinking (PC). Its development not only reduces costs and its effects are more durable than those initiated in late stages, but also help to overcome many obstacles when entering a specific field of work (González-González, 2019).

In the present work, therefore, various didactic techniques are used in a computer programming workshop to foster climates of trust and creativity where the participants acquire the contents of the PC from a constructionist role. In this regard, it should be noted that constructionism understands technology and particularly the computer as ideal structures where the child can genuinely build his knowledge from "a sense of mastery over an element of modern technology and the deepest ideas of the science, mathematics and the art of building intellectual models ”(Papert, 1987, pp. 17-18). This reference to the constructivist philosophy is made to address the development of computational thinking using didactic resources in connected and disconnected computer programming in basic education students.

## Related jobs

The PC is being widely studied due to the current trend that advocates the inclusion of computer science in earlier and earlier stages of formal education. To do this, researchers and teachers are using programming exercises from a computer (that is, connected activities), as well as teaching strategies that allow understanding concepts from the computer science environment without the need to use a computer (that is, disconnected activities). The use of disconnected activities as a didactic resource to transmit the concepts of PC is justified to have significant learning through kinesthetic experiences, which has a lower cost and benefits children who lack computer equipment (Huang and Looi, 2021; Venkatesh, Das and Das, 2021). This, according to Papert (1980), can be applied through the use of certain games.

Another precursor of disconnected programming (PD) is Tim Bell (Bell, Alexander, Freeman and Grimley 2009), who explains that this type of learning not only simulates the processes carried out by a computer, but also provides students with the possibility to explore the fundamental ideas of CS. Consistent with this idea, the University of Canterbury (February 25, 2020) promotes a constructivist environment where participants are challenged based on simple rules that allow them to discover powerful CS ideas on their own. In short, it is not only another form of meaningful learning, it also empowers them to realize that these are ideas that are within their grasp.

Likewise, researchers in the field of CP teaching affirm that the use of PD facilitates the learning of concepts related to CS, as indicated by Hufad, Faturrohman and Rusdiyani (2021), who worked with children between 5 and 6 years of age. age in problem solving using PD exercises. In their research, they identified that problem-solving skills improve if activities are playful, as this keeps children motivated. Logically, each strategy varies depending on its nature. For example, Threekunprapa and Yasri (2021) used augmented reality to teach flowcharts to a group of young people from a high school.

Another of the study factors of PD is to identify the variables that influence the learning of PC skills, as explained by Hsu, Chang and Hung (2018), who measured participation by gender in the implementation of a programming workshop, because — according to Dagiene, Pelikis and Stupurienė (2015) - there are differences between men and women to develop the ability to solve a problem through the aforementioned technological resources. In fact, the work by Torres-Torres, Román-González and Pérez-

González (2019) describes some non-disconnected activities used with a group of women not only to bring them closer to science, technology, engineering and mathematics issues, but also in order that they could create more complex codes than those made by men. Motivation, therefore, is another study factor for the achievement of the acquisition of CP skills when DP activities are used. (Brackmann *et al*., 2017; Del Olmo, Cózar-Gutierrez y González-Calero, 2020).

## Method

A block programming workshop was held. For this, the Scratch programming language was used (Fagerlund, Häkkinen, Vesisenaho and Viiri, 2021) and didactic resources applied to connected and disconnected programming were used with a group of 22 sixth grade students of basic education (11 girls and 11 kids).

Likewise, a mixed experimental design was used to identify the acceptance and use of block programming and to determine the degree of acquisition of concepts and computational thinking skills.

To record the final activities carried out by the students, video recordings were used (Imler and Eichelberger, 2011), which facilitates the observation of the development of the practices, especially in everything related to the correct use of control structures, processes such as definition of variables, data entry elements and visualization of the results.

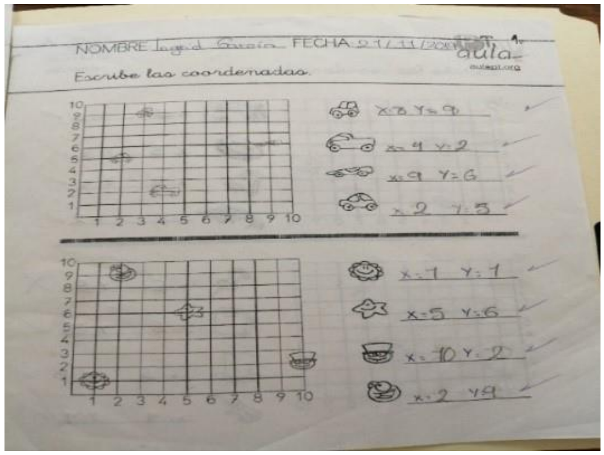
As a starting point, a survey was applied to identify the use of computer equipment at home. The results show that 73.68% of the participants in the workshop lack computer equipment. Therefore, it was decided to hold a workshop for 10 weeks (two hours per session) after study hours. In order to carry out this workshop at said time, the parents' authorization was requested.

The planning of the activities had the following structure: objective to be met in each session, breakdown of topics, materials and strategies for the development of connected and disconnected activities, which are described below.

First session. The concepts of computer algorithm, instruction, steps or activities were explained to the participants. In this way, the child could identify the construction of these and describe a daily event through the use of this tool. Then, the work team was in charge of playing with the algorithm together with the children.

Second session. The students began with the interaction of the programming tool. This allows knowing some elementary sentences to move objects in the Scratch programming environment. Previous work was done with activities disconnected from the computer to acquire or reinforce the coordinate concept by means of elements to locate in a quadrant (figure 1).

**Figura 1.** Trabajo de coordenadas para ubicar objetos en un plano




Fuente: Elaboración propia

Subsequently, the Scratch work environment was used, and through programming an object was moved through different points, which allowed the use of connected programming to be involved. Environmental instructions were taught to move images using small codes in order to explain basic elements that could be used during the course.

Third session. Disconnected activities, such as the game of dice, were again presented to explain the summation process. Through this activity, the knowledge of the cycle concept began in a connected activity where the students identified the instructions and learned to construct repetition sentences.

Fourth session. The variable concept was worked on in the disconnected activity. For this, paper bags were used to represent the phases of creation of one of them, that is, naming and initialization, depending on the content of the bag (cookies or sweets) (figure 2).

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**Figura 2.** Aprender el concepto *variable*

Fuente: Elaboración propia

Once the phases of the creation of the variables were identified, the programming platform was switched to implement the following steps for the use of variables from the tool.

Fifth session. Connected activities were used to publicize the if-then block concept, through a program proposed by the instructor where the student replicates the instruction mechanism (figure 3).

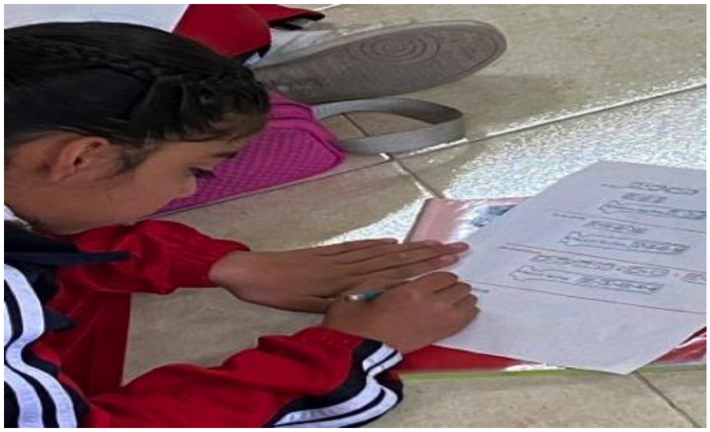
**Figura 3.** Actividad conectada mostrando el uso de sentencia *si-entonces*

Fuente: Elaboración propia

Sixth session. Disconnected activities were used to explain the composition of basic arithmetic expressions, which the children themselves began to construct using arithmetic operators (figure 4).

On the other hand, the platform was used to identify the section where the arithmetic operators were located, and it was explained how the construction of some expressions learned in the PD should be carried out.

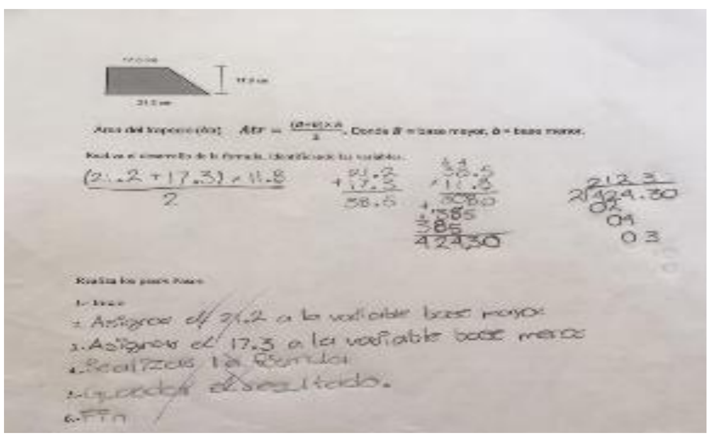
**Figura 4.** Alumna desarrollando expresiones aritméticas en el leguaje por bloques



Fuente: Elaboración propia

Seventh session. In this, the knowledge acquired in the activities seen began to be combined to introduce them to the concept of pseudocode and construction of the solution in the Scratch environment. In addition, the verification and validation process was started as part of the software development (Figure 5).

**Figura 5.** Desarrollo de primer pseudocódigo en fase de evaluación del taller




Fuente: Elaboración propia

The previous activities reinforced the concepts of computational thinking from the competences of abstraction, algorithmic thinking and verification, through the strategies that were explained through blocks in the programming platform.

The following section describes the findings gathered throughout the programming workshop.

# Results

As part of the study of the results, a questionnaire was developed to evaluate the degree of acceptance of the connected and disconnected activities developed (Table 1).

**Tabla 1.** Resultado de aplicación de cuestionario

| # | Pregunta | Totalmente en desacuerdo | En desacuerdo | Ni de acuerdo ni en desacuerdo | De acuerdo | Totalmente de acuerdo |
|---|---|---|---|---|---|---|
| 1 | Aprendo varios conceptos nuevos de programación en cada sesión que tenemos. | 4.55 % | 0.00 | 4.55 % | 64 % | 27.26 % |
| 2 | Aprendo en este curso de Scratch por qué me puede servir en el futuro | 0.00 | 4.55 % | 0.00 | 3 % | 81.82 % |
| 3 | Entiendo los pasos que debemos usar para hacer un programa en Scratch | 4.55 % | 0 % | 9.08 % | 54.55 % | 31.82 % |
| 4 | Si hay algo que no comprendo durante el curso, lo pregunto a mis amigos | 9.09 % | 4.55 % | 22.73 % | 18.18 % | 40.91 % |
| 5 | Prefiero que los profesores me expliquen todo lo relacionado a la actividad | 9.09 % | 0.00 % | 18.18 % | 18.18 % | 54.55 % |
| 6 | Podría realizar yo solo, sin ayuda de los demás, un programa en Scratch | 4.55 % | 4.55 % | 22.73 % | 54.55 % | 13.64 % |
| 7 | Encuentro relación de las actividades previas con lo que hicimos en la computadora | 9.09 % | 0.00 % | 4.55 % | 59.09 % | 27.27 % |
| 8 | Me gustan las actividades previas al uso de la computadora en el curso | 0.00 % | 0.00 % | 0.00 % | 18.18 % | 59.09 % |
| 9 | Se me hacen aburridas las actividades previas al uso de la computadora | 36.36 % | 0.00 % | 9.09 % | 31.82 % | 18.18 % |
| 10 | Se me hace difícil el desarrollar un programa en Scratch | 18.18 % | 0.00 % | 9.09 % | 31.82 % | 22.73 % |

| # | Pregunta | Totalmente en desacuerdo | En desacuerdo | Ni de acuerdo ni en desacuerdo | De acuerdo | Totalmente de acuerdo |
|---|---|---|---|---|---|---|
| 11 | Me gusta buscar información de Scratch | 0.00 % | 0.00 % | 4.55 % | 18.18 % | 54.55 % |
| 12 | Me gusta aprender programación con Scratch | 0.00 % | 0.00 % | 0.00 % | 9.09 % | 86.36 % |
| 13 | Me interesa aprender más sobre el tema de Scratch | 0.00 % | 0.00 % | 0.00 % | 13.64 % | 72.73 % |
| 14 | Quiero seguir aprendiendo más del tema de programación de computadoras | 0.00 % | 0.00 % | 4.55 % | 13.64 % | 81.82 % |
| 15 | Me agradaría estudiar una carrera en sistemas computacionales | 13.64 % | 0.00 % | 9.09 % | 31.82 % | 45.45 % |

Fuente: Elaboración propia

As a validation element of the measurement instrument, Cronbach's alpha of 0.717 was calculated, a result that was obtained with the SPSS software. To make a better reading of the results, the segments were proposed (see table 2) to group the questions.

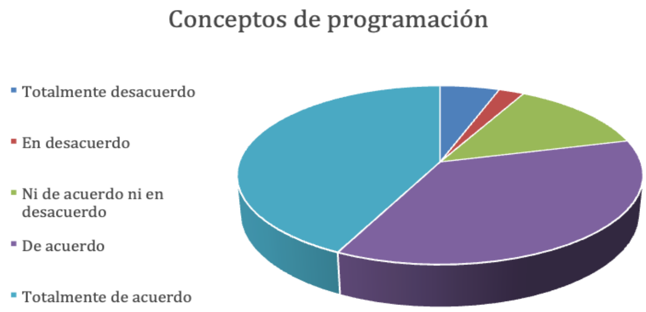
**Tabla 2.** Segmento de preguntas.

| Segmento | Pregunta |
|---|---|
| I | 1, 2, 3, 4, 5 y 6 |
| II | 7, 8 y 9 |
| III | 10, 11, 12, 13 |
| IV | 14 y 15 |

Fuente: Elaboración propia

In segment 1, questions 1, 2, 3, 4, 5 and 6 were grouped, which refer to the learning and development of PC concepts. Figure 6 shows that most of the participants agree or totally agree, which allows establishing the existence of concepts of this type of thinking in the course participants.

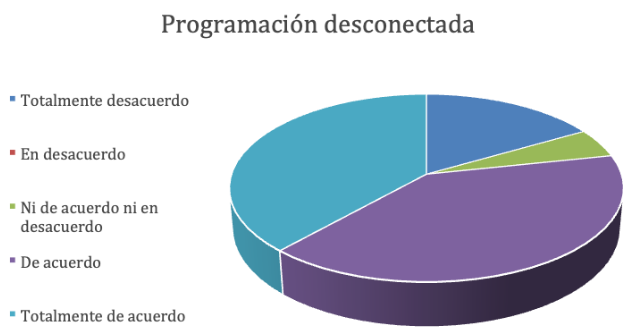
**Figura 6.** Segmento relacionado al aprendizaje de conceptos de PC




Fuente: Elaboración propia

In the questions in segment 2 - regarding disconnected programming - only a small percentage still totally disagree with its use to acquire PC concepts (figure 7).

**Figura 7.** Gráfica del segundo segmento referente al uso de actividades previas




Fuente: Elaboración propia

The third refers to the activities that were carried out in the connected programming phase, as can be seen in figure 8. Where the interest in using the platform is observed and also causes them curiosity, which they resolve by inquiring more about it.

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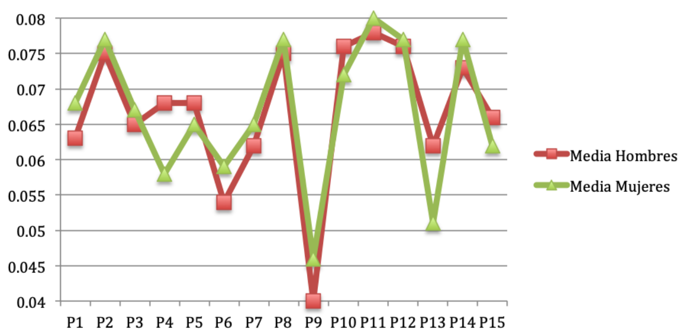
**Figura 8.** Gráfica del tercer segmento referente a las actividades conectadas.


Fuente: Elaboración propia

On the other hand, the analysis of the information by gender is shown in figure 9. See the acceptance of the workshop by the girls.

**Figura 9.** Resultados por género




Fuente: Elaboración propia

The workshop participants show independence in the management of PC concepts, as well as autonomy in the creation of programs on the platform. In fact, they present themselves with greater confidence, independently elaborating the disconnected activities, as well as greater acceptance compared to men.

In the programming workshop, exercises of various types were used with animations (eg, movements of objects randomly and others controlled by the user). In addition, programs that allow interaction between the user and the computer through data entry and visualization of the results of a process.

To evaluate the achievement of the expected competencies in the programming workshop, the SOLO (Structure of the Observed Learning Outcome) taxonomy was used, that is, the structure of the observed learning outcome (Biggs and Collis, 1982). The taxonomy hierarchically defines the categories of learning, that is, it classifies the results of computer programming in prestructural, unistructural, multistructural, relational and abstract, which allows to analyze the quality of learning from the most concrete to the most abstract and complex levels.

The SOLO levels are adapted to give a contextualization of the items evaluated in each of the activities carried out in the final phase of the workshop as follows.

Prestructural (N1). The programs contain only a few blocks and the student does not understand their meaning.

Unistructural (N2). Programs have action sequences in a simple way. No relationships are found between the control structures.

Multistructural (N3). The program meets all the given requirements and includes a variety of different types of blocks. The code may have been reorganized to make a more integrated solution.

Relational (N4). A well structured program is provided that eliminates all redundancy and has a clear and logical structure.

Abstract (N5). The program uses concepts and blocks beyond the exercises to provide improvements to the solution.

In the block programming workshop there are a total of 11 Scripts (how a program is known in the Scratch environment) with an average of 14.09 blocks per project, that is, programming sentences that are used to achieve of a target. The 16 blocks with the highest frequency of use by participants in connected programming are shown in table 3.

**Tabla 3.** Bloques usados en el taller de programación

| Bloque | Número de ocasiones | Porcentaje de todos los bloques usados |
|---|---|---|
| cambiar y en _ | 20 | 12.90 % |
| cambiar x en _ | 15 | 9.68 % |
| decir_ por _ seg. | 15 | 9.68 % |
| si _ entonces | 15 | 9.68 % |
| mover _ pasos | 13 | 8.39 % |
| por siempre | 12 | 7.74 % |
| ir a x_ y_ | 10 | 6.45 % |
| rebotar si toca un borde | 10 | 6.45 % |
| Variable | 10 | 6.45 % |
| al presionar | 7 | 4.52 % |
| preguntar _ y esperar | 5 | 3.23 % |
| Respuesta | 5 | 3.23 % |
| repetir _ | 5 | 3.23 % |
| operadores | 5 | 3.23 % |
| fijar estilo de rotación | 4 | 2.58 % |
| al presionar la tecla | 4 | 2.58 % |

Fuente: Elaboración propia

With this information, it is possible to obtain the frequency of occasions that the categories of instructions are used (table 4). The information shows that students focus their interest more on the movement of objects and apply the construction of arithmetic expressions sporadically.

**Tabla 4.** Concentrado de uso de categorías

| Categoría | Frecuencia | Porcentaje |
|---|---|---|
| Movimiento | 72 | 46.45 % |
| Control | 32 | 20.64 % |
| Apariencia | 15 | 9.67 % |
| Eventos | 11 | 7.09 % |
| Sensores | 10 | 6.45 % |
| Variables | 10 | 6.45 % |
| Operadores | 5 | 3.22 % |

Fuente: Elaboración propia

On the other hand, to further identify the behavior of each of the participants, some activities were recorded according to these three categories: a) programming concepts, b) operability and c) levels of understanding (Funke, Geldreich y Hubwieser, 2017).

a. Programming concepts. All students participated in the development of activities with different degrees of complexity. Some of them carried out activities different from those expected by the instructor, that is, there was an autonomy and curiosity to involve blocks, mainly movement.

   Regarding the use of variables, the majority followed the indicated process of declaring, initializing and displaying the value of the variables. Thus, 17% of the participants implemented some concept seen in the workshop in their final activities.

b. Operability. 85% of the students completed activities where the user had to enter data through the keyboard. Most identified the process for their program to allow data entry and display a result.

c. Comprehension level. To evaluate this level, the SOLO taxonomy classification was used. Table 5 identifies the percentages of the participants' learning levels.

**Tabla 5.** Concentrado de niveles de aprendizaje SOLO

| Nivel | Porcentaje |
|---|---|
| N1: Preestructural | 25 % |
| N2: Uniestructural | 35 % |
| N3: Multiestructural | 21 % |
| N4: Relacional | 8 % |
| N5: Abstracto | 11 % |

Fuente: Elaboración propia

In the classification it is observed that 25% of the participants must integrate more elements so that they understand the meaning of the blocks and develop a PC in a way that allows them to develop greater capacities.

Regarding the following levels, 35% of the students incorporate sequences of simple instructions; This means that more work must be done on decision and repetition control structures.

On the last two levels, it is identified that students acquire skills in the PC, such as abstraction and algorithmic thinking.

## Discussion

This first approach to the development of PC skills is encouraging, although some activities that allow increasing the level of learning in the programming workshop remain to be detailed. Also, because students prefer the use of move instructions, the abstraction part should be emphasized more. Likewise, based on this knowledge that block programming students acquire, work elements can be incorporated into the textual code construction paradigm. That is, new ways of applying control structures from known perspectives and then make a natural migration to other programming environments

Likewise, there is a clear participation and pleasure on the part of children in this type of learning. This data is very important and can be used to promote a culture of technological creation, and not just consumer of it.

However, to achieve this purpose, strategies must be established at a global level, such as those exposed by the Secretariat of Public Education of the Government of Mexico, through the General Coordination @ prende.mx, and its Digital Inclusion Program (PID). In this way, the PC reference framework for basic education can be strengthened, whose main objective is to cultivate the knowledge associated with the digital world in the Mexican educational community.

## Conclusion

As a conclusion, it can be indicated that students can actively participate in the implementation of computational thinking projects through various pedagogical strategies in the so-called connected and disconnected computing. In fact, it can be ensured that the use of both variants provides diverse learning through a dynamic that differs from traditional workshops.

In addition, the development of the PC is not only related to programming in an environment like Scratch, but involves a series of thought mechanisms, such as abstract-mathematical and pragmatic-engineering, which are applied throughout life.

Likewise, it is found that computational thinking can be developed using a pencil and a paper, with dynamic didactics as an alternative element for the transfer of the competences of this type of thinking. In addition, the concept of disconnected programming becomes a key element when there are shortages in computer equipment.

In short, the results show little or no resistance in acquiring the knowledge experienced in the workshop. Therefore, they establish trust mechanisms for solving problems based on the computer or on the interpretation and use of control structures.

## Future lines of research

Despite the fact that this was a first approach, considerable progress is perceived in the development of materials for the follow-up of the delivery of workshops. However, these must be adapted to a new reality that combines the virtual and the face-to-face.

Likewise, other strategies different from those used in this work can be implemented to increase computational thinking skills and to achieve a higher percentage at the relational and abstract levels.

On the other hand, it is necessary to develop lines of action so that all basic education students have access to subjects that include computer programming.

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