Understanding the Lecturers' Perception About a Programming Learning Prototype

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Keywords: Programming Learning Prototype, Novice Programming, Prototype Utility.

Abstract: The problem of programming learning is a universal phenomenon, which poses enormous challenges in the initial phase of learning, with countless reports of difficulties and poor performance among students, which has often resulted in dropouts. In order to minimize this problem, a prototype was created for initial programming learning inspired by the Mozambican reality, using a visual and storytelling approach, incorporating culturally relevant narratives and interactive elements that reflect students' daily context. In this qualitative case study work we intend to understand the lecturers' perception regarding the usefulness of the current prototype and the possible adjustments necessary to fit well the Mozambican reality, serving as a tool to support initial programming learning. In the data collection process, semi-structured interviews were conducted with 7 lecturers from two Mozambican Universities. The content analysis technique was applied for data analysis. The results show a positive perception of lecturers regarding the usefulness, clarity and level of organization of the prototype's content as a learning tool for initial programming learning.

1 INTRODUCTION

The problem of programming learning is a universal phenomenon (Cheah, 2020; Francisco et al., 2016; Gomes & Mendes, 2007), which poses enormous challenges in the initial learning phase with numerous reports of difficulty and poor student performance, which has often resulted in dropouts (Tan et al., 2009; Kaya 2018; Kazimoglu 2012). In this sense, the concern with finding a learning environment that is favorable for programming learning is something that has been around for a while.

In 1994, the authors Brusilovsky et al. (1994), after an in-depth analysis based on an empirical approach, came up with 3 guidelines for teaching programming to beginners. They recommend that programming teaching be done in a simple and incremental way using a simple language that progresses step by step to avoid overloading the student, establishing a visual approach for better visualizing the semantics of the teaching content. Reinforce the need for visual metaphors that simplify student learning to achieve visible results. Finally, they emphasize the importance of using visual metaphors to simplify learning for students and help them achieve clear and tangible results.

Studies published between 2005 and 2011 corroborate the idea of using visualization or simulation of concepts to improve programming learning and provide greater interactivity Mohd et al. (2013).

From the perspective of Savidis (2022), to achieve interactivity in visual programming environments, it is necessary to consider four essential elements: the appropriate element metaphor, configurable level of detail, interactive level of detail, and annotations of extensible code. Appropriate element metaphor corresponds to the graphical component of the interface that seeks to establish an analogy with real-world components. A configurable level of detail refers to the ability to manage visual elements as the complexity or size of the code increases. The

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Nhadumbuque, G. C., Gomes, A. and Marcelino, M. J.
Understanding the Lecturers' Perception About a Programming Learning Prototype.
DOI: 10.5220/0013288600003932

In *Proceedings of the 17th International Conference on Computer Supported Education (CSEDU 2025) - Volume 1*, pages 400-410
ISBN: 978-989-758-746-7; ISSN: 2184-5026

interactive level of detail allows to define code components that should remain visible during editing. Finally, code notes are details that allow the user experience to be directed. The authors Gomes & Mendes. 2007) in their studies on "An environment to improve programming education" defined certain important characteristics to ensure effective learning: inclusion of teaching content taking into account students' learning styles (Cegielski et al., 2011; Maia et al., 2017), the inclusion of standards that help students learn, monitoring the student's level of knowledge, the inclusion of games, inclusion of a development environment based on algorithms. Based on this logic, several tools were developed with different characteristics but with a single purpose: to provide a learning experience closer to students' needs. We find various tools based on different approaches, for example, Blocks approach Price & Barnes (2015), storytelling approach Suh et al. (2021), augmented reality perspective Kao & Ruan (2022), Games approach Barnes et al. (2007), and others with a hybrid environment that include several approaches (Chen & Chuang, 2021). There are also specific proposals made exclusively for mobile environments.

Block-based tools were developed based on Blockly[1], a Google library created with a visual programming environment in mind for beginners. Programming tools like Scratch[2], Code.org[3], CS First[4] or App Inventor[5] were developed using this library.

In a systematic study by Coelho et al. (2023), corresponding to the period from 2011 to 2022 on, about mobile tools for learning mobile programming in higher education, they highlight 12 important tools for initial programming learning with a positive impact on the teaching and learning process, providing greater motivation and improved performance.

Despite the existence of several studies addressing the issue of programming learning, for the African context and specifically for the Mozambique context, there are not many cases in the literature that highlight this problem.

To understand the particularities of the Mozambican context, we want to characterize the learning preferences of Mozambican students. Therefore, in a first phase, the index of learning style (Referece), was validated, and predominant learning styles were identified. We verified that most students do not have a marked learning style and are placed in the mild preference with a slight visual, sensing, sequential, and active tendency.

Next, we sought to understand the panorama of initial programming learning in Mozambique through the perception of lecturers and students about learning difficulties, learning strategies, assessment mechanisms, barriers, and tools used. Several factors g were identified. The lack of prior knowledge about technology is referred to as an influencing aspect, as in this context, most students only establish their first contact with programming and computers in higher education (Reference). In a context where Portuguese is the official language, the language barrier was another important consideration because the syntax of programming languages is based on the English language.

Furthermore, initial programming learning has been based on textual programming environments such as Turbo C and Dev Cpp as preferred environments (References). However, these environments were not developed with initial programming pedagogical considerations in mind but rather for professional program development. However, the transition to development environments needs to be properly monitored to ensure effective learning, initially adopting more effective learning tools (Cheah, 2020; Gomes & Mendes, 2007; Mohd et al., 2013).

Several programming learning environments have been created and adopted as precursors and facilitators of the initial programming learning process, thus presenting integrated environments essentially based on visual resources. Visual tools have been seen as alternatives to provide more student engagement. Among the visual tools widely used in different contexts, the following stand out: Scratch (Wilson & Moffat, 2010), Appinventor, code org. However, the environments provided have the disadvantage of being in blocks and in the perspective of several authors, these environments are widely used in contexts where students learn programming at secondary level and the resources presented have a childish tendency (Good, 2018; Nhadumbuque et al., 2024; Saito et al., 2017). Due to limited technological infrastructure, in the Mozambican context most students establish their first contact with the computer and with the initial learning content of programming in higher education

In addition, the textual environments widely used in this context for initial learning phase do not seem to be suitable for most students due to the prevalence

[1] https://developers.google.com/blockly
[2] https://www.scratchjr.org/
[3] https://code.org/
[4] https://csfirst.withgoogle.com/s/en/home
[5] https://appinventor.mit.edu/

of failures in several computer science courses and related areas, and due to the lack of interactivity, negatively affecting the level of student motivation (Wilson & Moffat, 2010).

Based on all these considerations, we defined a prototype to help learn initial programming, through metaphors that reflect the cultural context and the specific needs of Mozambican students. The present work is a continuation of a previous one related to the Perception of Lecturers and Students about an Initial Programming prototype, in which the usefulness of the present prototype as a programming learning tool was studied, having obtained a positive perception regarding its usefulness as a programming learning tool. However, certain suggestions were made mainly in the way the system is presented. .

Regarding the content, the previous study only covered concepts of variables from creation, assignment, and accumulation. In this version, there were improvements and inclusion of new scenarios related to the decision, repetition structures and exercises. This work seeks to answer 2 research questions:

- R1: What is the lecturers' perception of the prototype regarding the usefulness, complexity, and level of organization of the learning content?
- R2: How can the narratives and scenarios of the prototype be adjusted to better reflect the reality of students and increase its effectiveness in teaching and learning?

This paper has three main parts, of which the introduction provides a brief contextualization of the work and presents the main contributions in terms of literature, followed by the methodology section that seeks to explain the steps to carry out this work, the description of the prototype, the main results, then the main results discussion are presented and finally the main conclusions.

2 METHODOLOGY

This study has a qualitative nature with an emphasis on a case study. Seven higher education lecturers from two universities with 7 to 16 years of experience participated in this study. As illustrated in Table 1, regarding the level of lecturers, two have PhD level, 4 with master's degrees, and one is graduated.

In the data collection process, semi-structured interviews were used. As mentioned by Sönmez (2013), this type of technique has the advantage of allowing open and closed questions with the possibility of adapting the questions depending on the lecturers' responses, obtaining from this form relevant information. The interviews lasted a minimum of 60 minutes and a maximum of 120 minutes. After the collection process, lecturers were asked to review the interview transcripts to validate the information provided and ensure greater reliability, as mentioned by (Creswell, 2009).

Table 1: Lecturers profile.

Lecturer	Gender	Years of experience	Field area	Academic Level
L1	Male	7	Informatic	Graduated
L2	Male	16	Informatic	PhD
L3	Male	13	Informatic /Multmedia design	Master
L4	Male	15	Informatic	PhD
L5	Male	14	Informatic	Master
L6	Famele	14	Multmedia design	Master
L7	Male	11	Informatic	Master

The closed questions are based on the Likert scale and seek to respond to 3 main aspects: usefulness, clarity and level of organization. As illustrated in table 2, the usefulness of the prototype is based on question Q1, with response options varying from very useful (5), useful (4), more or less (3), less useful (2) to not useful (1). To verify the clarity of the prototype, question Q2 was used, with response options very clear (5), clear (4), more or less (3), less clear (2), and not clear. Regarding the level of organization, the prototype is based on question Q3, with response options very well organized (5), well organized (4), more or less (3), less organized (2) and disorganized.

Table 2: Closed questions.

Q1	How do you assess the usefulness of the content presented in the context of the concept presented?
Q2	Does the prototype provide enough clarity to facilitate learning of the concept?
Q3	Is the scenario presented well-organized and accessible for students to understand the concepts?

As illustrated in table 3 the open questions, were guided by questions G1 and G2 illustrated in table 3, and as the conversation flowed naturally and dynamically, other questions were formulated with the aim of deepening the perception of these concepts.

Table 3: Open questions.

G1	The prototype's narratives and scenarios are able to create a realistic connection with the students' reality, especially in the Mozambican context?
G2	What would you recommend to make the prototype more accessible or effective as a tool to support the teaching and learning process?

2.1 Ethical Considerations

To safeguard ethical aspects, this work was carried out respecting the ethical principles established in Marczyk et al. (2005): respect for the interviewees expressing the right to participate freely without coercion, being intended for a beneficial action, being based on the principle of fairness in choosing participants. To preserve these principles, all participants freely expressed their desire to participate in the study, mainly because it addressed a problem that also concerns them. The selection of lecturers to participate in the study was randomly chosen based on their experience in teaching programming subjects. They participated freely in the study and signed the free and informed consent form.

2.2 Data Analysis

In the data analysis process, the content analysis technique was used. As mentioned Kothari (2004), content analysis consists of carrying out an analysis of information obtained from various verbal textual sources to understand its meaning. From the perspective of Giannantonio (2010), this method presents specific characteristics: it requires an exhaustive reading of the amount of text under analysis, articulation, or interpretation of the text in other narratives adjusted to the context under study that corresponds to the social hermeneutic circle. Following this approach, the recorded interviews were transcribed, and the text was organized to compare differences and similarities. Afterward, the interviewed teachers were engaged to evaluate how closely the written content aligns with their perceptions. The prototype is based on a story that mirrors the reality of the village of Quissico. The complete story is described in (Reference). This Village is located in the southern region of Mozambique, which was initially a prosperous region, but after a civil war and being devastated by floods ended up being affected by a cycle of poverty that forced the community to find a way out. The community decided to create a community safe where members decided to make contributions to the community, and the ruler was the person responsible for collecting the amounts. The prototype based on a web platform was designed taking into account this story using a storytelling approach to explain several initial programming learning concepts. It also integrates a visual environment. Content is presented in the form of episodes (Table 4).

Table 4: Overview of scenarios.

Units	Episodes/Cenarios
Information tips	Constant Variable creation Assignment of value Visualization of information Accumulation of quantities Exercises
Control structure	Selection structure Repetition structure for and while

Figure 1: Overview of scenarios.

2.3 Description of Scenarios

The scenarios were divided, considering the types of information and the main control structures.

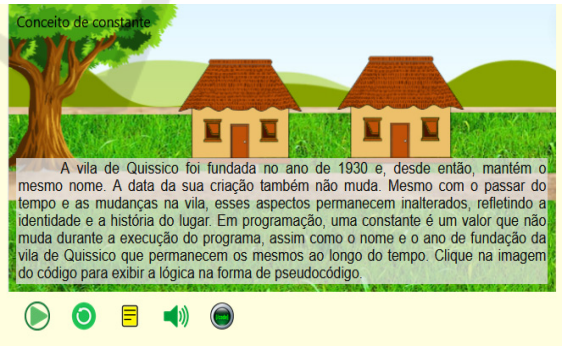

Figure 2: Constant concept.

In Figure 2, the concepts are illustrated, based on the village of Quissico, and a description of those concepts relating to the history of the village explained. Then, when clicking on the code button, a summary in the form of a pseudocode can be viewed (See figure 3).

Figure 3: Pseudocode representation.

Figure 4: Pseudocode completion exercise

2.3.1 Information Tips

Regarding the notion of variable, several scenarios are simulated that reflect the creation, assignment of a value, visualization of value for the purpose, assignment of value, and accumulation of quantities and exercises.

- Constant - it is highlighted that throughout a program, it never changes, just like the village name and the year of foundation, which remain the same over time.
- Variable creation - the chief (Ruler) carries the safe to the designated location, thus creating a specific location to store contributions. The variable name is savings.
- Assignment of value - The Ruler goes to the house, collects the first contribution and deposits it in the safe. In other words, it assigned an initial value to it. Now, the safe has a defined starting value and is ready to receive additional resident contributions.
- Visualization - the current value of the "savings" variable is displayed on the vault display so that everyone in the village knows how much money has already been raised, thus serving as a reminder of the progress of the village's savings and encouraging residents to continue to contribute.
- Accumulation of amounts - The Ruler continues his journey of collecting contributions, and this time he collects the amount in another house. Assuming that the previous deposit has already been made, the value of the safe will be updated.
- Exercises – The prototype includes multiple choice exercises and exercises to complete the missing code or instruction. Figure 4 presents an exercise on value assignment, where the student is required to complete the corresponding pseudocode to assist the Ruler in collecting the contribution and depositing it in the safe.

2.3.2 Control Structures

- Selection structure - After collecting contributions, it is decided to check the available financial capacity to make different decisions respecting the logic of the selection structures. It was decided that if the remaining value is less than 5, hoes are acquired; if less than 10, machetes; if less than 20, shovels; and, if larger than 20 saws are acquired.
- Repetition structure - the logic used is summarized in a while and for repetition structure. In the first repetition structure, the Ruler does not know how many times the cycle will be repeated, i.e. how many houses he will collect contributions, while in the for repetition structure he already knows in advance how many houses he will collect contributions, i.e. the number of times to collect contributions.

Figure 5: Repetition scenario.

3 RESULTS

Questions Q1, Q2 and Q3 served as a basis for assessing the usefulness, clarity, and organization of the prototype content respectively. The results are presented below.

3.1 Lecturers' Perception

3.1.1 Lecturers' Perception

Regarding the trend of responses in these aspects, there is a positive and very positive perception, and the responses vary from very useful/ very clear/ very well organized to useful/ clear/ well organized, except in one case of a lecturer (L2) who responded more or less useful in the concept of information visualization. From this lecturer's perspective, instead of viewing the total value available in the safe, it should be possible to view the content inserted in the safe. The perception of lectures regarding usefulness, clarity, level of organization and general perception of the prototype is described below.

3.1.2 Utility

In relation to the concepts of constant, value accumulation, variable creation, selection structure, most lecturers reported that there is a positive perception, 3 responded very useful, and 4 responded useful. Regarding the creation of variables, the attribution of value, repetition structure while and for, there was also a positive perception, 4 lecturers responded very useful and 3 responded useful. Regarding the concept of information visualization, there is also a positive perception, and 3 lecturers responded that the content is well organized; 3 reported that it is very well organized, except for one lecturer who said that the content is not well organized. In relation to the concepts of repetition and the exercises presented, the majority have a very positive perception, with 5 lecturers mentioning that the content is very well organized and 2 mentioned that it is well organized.

3.1.3 Clarity

Regarding the response trend about the clarity of the prototype in the different concepts presented, there was a positive perception, and the responses ranged from very clear to clear, except for one case of a lecturer who responded more or less clearly in the concept of information visualization. Regarding the perception of the concept of constant, creation of variables, decision structure, selection structure, while repetition structure and formulated exercises, the majority agree that the prototype presents the contents clearly; 3 responded very clear, and 4 clear. Regarding the concept of value assignment and repetition structure, the majority agreed that the content is very clear, with 5 responding that the content is very clear and 2 that it is clear. Regarding the concepts of information visualization and accumulation of values, there is also a positive perception, with 3 agreeing that there is a lot of clarity in the presentation of this content, three agreeing that the concept is clear and 1 stating that the concepts are more or less clear.

3.1.4 Organization

Regarding the trend of responses on the level of organization of the teaching and learning content presented, it can be seen that most lecturers have a positive perception regarding the organization of constant content, creation of variables and selection structure. The majority responded that the teaching content is well organized, of which 3 lecturers responded that the teaching content is very well organized and the rest said that it is well organized. Regarding the concepts of value assignment, accumulation of values, and repetition structure, most lecturers responded that the content is very well organized, with 4 lecturers sharing this opinion and 3 with a view that the content is well organized.

Can the Prototype's Narratives and Scenarios Create a Realistic Connection with the Students' Reality, Especially in the Mozambican Context?

In relation to the prototype's connection with the Mozambican reality, several aspects were considered, which reveal a positive perception of the use of the prototype as a learning tool.

L2 lecturer stated that "it is a very simple way of motivating students to learn "using examples inspired by the student's reality. Therefore, the prototype is considered valuable and allows the students to fit better into their learning context. Lecturer L5 reinforces this idea, considering that the visual representation of the prototype directs the student's perception; images are more explicit than text. From L5's perspective, using Portuguese in the prototype greatly enhances student learning, as it aligns with the language they are most familiar with.

Lecturers L1 and L2 cited the need to promote greater transparency in the management of values arising from contributions, and encourage finding ways to show the community what value is actually available in the safe. From this perspective, lecturer L1 suggests the inclusion of a transparent safe as a strategy to achieve this requirement in order to allow visualization of the entered value.

Lecturer L3, in turn, refers the need to clarify that showing the value of contributions on the screen is the same thing as showing the value to the community for accountability, and would be relevant to

demystify the concept of screen taking into account the context of the village as an essential element to simplify students' perception.

L2 and L5 lecturers consider the tool useful and that it can be a vehicle for learning various initial programming learning concepts.

Regarding the concept of variable, L2 lecturer recommends the inclusion of more examples in order to allow for a better elucidation. For example, considering that they can vary from 2 to 3 scenarios simulating the same concept, he even gave an example of using a scenario that explored the collection of amounts to support donations for flood victims. Regarding this aspect, lecturer L5 also mentioned the need to include another example that explores the concept of constant.

This is a valuable teaching innovation, which should be widely disseminated so that everyone can have access, stated L6.

What Improvements Are Recommended to Make the Prototype an Excellent Tool to Support the Teaching and Learning Process?

Several improvements were suggested by the lecturers to make the prototype an effective tool in the teaching and learning process. An essential aspect of programming learning is the notion of variables and their types. In the scenario about creating variables, this notion is not mentioned. Hence, lecturers L1, L6 and L7 recommend the inclusion of data types that consider numerical and literal data. As lecturer L6 points out, this characteristic is essential to ensure alignment with the programming languages used, such as C, which already incorporate this characteristic.

Lecturer L1 highlighted that the concept of a constant is well contextualized, mentioning that "new paintings can be done or new houses built, but the name of the village continues Quissico, and the year of the foundation remains the same".

Regarding the value accumulation scenario, lecturer L1 also suggests placing the instruction savings + 10 for savings + increase, and in the perspectives of L1 and L4, the placement savings = savings + 10 needs to be clearly explained as it may be difficult to understand for those who are just starting.

Lecturers L2 and L4 recommend modifying the scenario about value accumulation to position contributions in the 2nd house, as the lecturers' perception is that it is the same house contribution.

Lecturer L2 emphasized the importance of incorporating feedback into the exercises, suggesting that students be directed to revisit specific chapters or scenarios for improvement if they make mistakes during problem-solving. He also highlighted the need to diversify the proposed exercises and include an exercise on differentiating the concepts of constant and variables. Lecturer L4 emphasized the need to include more examples to better clarify the concept of variables, providing the possibility of creating more variables in addition to savings, as long as they are aligned with the context of the history of the village of Quissico. To improve clarification, the lecturer suggested creating variables such as family number, amount collected, and the name of the ruler since only one example would not explain everything properly. Lecturer L4 pointed out a limitation in the space available to display the code in the scenario. He noted that, as new scenarios are created, the space at the bottom becomes insufficient. Therefore, he recommended exploring the space at the top of the houses to place the code, allowing it to expand as the content develops.

Furthermore, lecturer L4 observed that when the contribution value is entered, it appears as $10, but the visualization shows the value as $10. From the lecturer's perspective, since this is a visualization scenario, it is necessary to find a way to harmonize the visualization of the value in the same way as it appears in the scenario.

Regarding the code visualization scenario, the lecturer points out the need to replace the command "escreva" (write) with the command "imprimir" (print). He stated that students may create confusion in this process by doubting whether it is an action to be performed by the computer or by the student. The term "imprimir" seems to be the most appropriate because it dispels doubts and clarifies the action to be performed by the computer.

Regarding the accumulation scenario, lecturer L5 states that an instruction such as savings = savings1 + savings2 could be used, where savings1 represents the value of the first collection and savings2 the value of the second collection. The logic of the "while" loop structure could be adjusted so that the ruler continues to make contributions as long as there are remaining contributions, or collects values until reaching a predefined goal, such as acquiring irrigation equipment

For proposed exercises, the lecturers consider them to be interactive, and the sections where the student can complete the missing pseudocode are especially important for learning.

Regarding the scenario on the selection structure, lecturer L5 points out that in the initial phase, the use of "else" could be omitted, giving priority to the

simple selection structure, in which the value stops being displayed only when the option is true.

Lecturer L6 suggested intensifying the exercises on editing pseudocode and pointed out the importance of clearly specifying the content of the contributions to be stored in the safe.

He also highlighted the importance of indicating moments in which the variable is created, but without assigning an initial value, and suggested that "contribution" could be considered a variable, since each contribution will have a different value.

Lecturer L7 recommended a change in the sequence of the content presented, suggesting that the concept of variable be addressed before the concept of constant.

In addition, the exercises could be interactive, requiring the editing of pseudocode as a condition for advancing to subsequent scenarios.

Lecturer L7 also agrees that the prototype is useful as a teaching and learning tool. However, the inclusion of an introductory chapter that addresses content such as operators and rules for creating identifiers would further simplify perception for students.

3.2 Discussion

The perception of lecturers about the prototype is positive and lecturers highlighted that the prototype is useful, with properly organized scenarios providing clarity as an initial support tool for initial programming learning.

The need to include literal and numerical data types referred to by teachers L1, L6 and L7 to ensure alignment with the programming languages used in the initial phase, can be achieved by adding new scenarios that explore these concepts. The notion of numerical data can be easily achieved by clarifying that the savings variable is similar to a numerical variable that stores the contributions' values. For the literal variable, you can use the name of the region, clarifying that this variable assumes the name of the region and if the village residents name a new region, the variable name will assume the name of the new region.

The addition of a literal variable can be used using the name of the ruler, noting that when changing the ruler, the content of the variable name will also change.

There is a positive perception regarding the use of the prototype as a teaching/learning tool, indicating a convergence with the results achieved by Yamashita et al. (2017) about code visualization and memory images with a positive effect on simplifying programming concepts and especially the content of pointers that constitute one of the student's learning difficulties.

When L2 stated that the use of scenarios that explore the student's reality is a very simple way of motivating students to learn, he agrees with the perspective of Savidis (2022), who considers the Appropriate Element metaphor related to the graphical component of the interface that seeks to establish an analogy with real-world components. Teacher L3 reiterates this aspect when he refers to the need to clarify that showing the value of contributions on the screen is the same thing as showing the value to the community for accountability. This aspect is essential to fit the metaphors with the projected reality.

Lecturer L3, in turn, refers to the need to clarify that showing the value of contributions on the screen is the same thing as showing the value to the community for accountability and would be relevant to demystify the concept of the screen taking into account the context of the village as an essential element to simplify students' perception.

L2 and L5 lecturers consider the tool useful and can be a vehicle for learning various initial programming learning concepts. For example, regarding the concept of variables, L2 lecturer recommends the inclusion of more examples in order to allow a better elucidation. As for the number of scenarios, he considers 2 scenarios that portray the same concept enough. For example, considering that they can vary from 2 to 3 scenarios simulating the same concept, he even gave an example of using a scenario that explored the collection of amounts to support donations for flood victims. Regarding this aspect, lecturer L5 also mentioned the need to include another example that explores the concept of constant.

It is an aspect to take into account although it is subjective because in the same way that the L7 teacher suggests learning the concept of variable be addressed before the concept of constant, the reverse process can apply since the concept of constant is simpler than that of variable. As mentioned Brusilovsky et al. (1994), one of the guidelines for teaching programming is that the concepts are conveyed in a simple and incremental way, progressing step by step to avoid overloading the student. This aspect is framed insofar as the placement of concepts in the scenarios is done progressively from simple to more complex concepts.

Regarding the inclusion of the transparent safe mentioned by lecturer L1, it is practically possible to integrate this aspect, and it would make the

interaction more interesting but it does not influence the perception of the logic of attributing the value of the concept that is intended to be transmitted. Furthermore, this simulation only serves as an analogy to illustrate the attribution process and the visualization of the assigned value is covered in another episode, a reference to the most important thing in this aspect is the visualization of the value that is intended to be transmitted.

This positive perception converges with the findings in Akhuseyinoglu et al. (2024), that linking exercises solved explicitly has beneficial effects on student learning, contributing to increased levels of achievement.

The need to include more stories to explain certain scenarios may be related to the need to consolidate knowledge. This can also be achieved using consolidation exercises that make the student reflect on the learning content and as mentioned in Ocares-Cunyarachi & Andrade-Arenas (2022), the exercise has a beneficial effect, thus contributing to increasing the level of student knowledge.

There is a positive perception in the use of exercises and scenarios that reflect the student's reality, converging with the perception of Tan et al. (2009), who consider the use of exercises and examples with illustrations as important elements in student learning. Furthermore, programming skills do not appear naturally, they need to be trained, and exercises play a fundamental role in this perspective (Cachero et al., 2020). However, it would be beneficial to include more exercises that explore different learning domains considering the levels of the bloom taxonomy proposed in Shargabi et al. (2016) which are related to the development of understanding, comparison, analysis, application and creation skills.

This positive perception increasingly reinforces the use of the prototype to support the teaching and learning process.

4 CONCLUSION AND FUTURE WORK

Taking into account the teachers' perceptions regarding the prototype, the tool appears to be relevant and promising as a resource for initial learning of the basic concepts of programming learning. Teachers highlighted the inclusion of narratives and scenarios that reflect the local reality of the student's village of Quissico as important elements to create the necessary motivation for students' engagement in the teaching and learning process. The use of the Portuguese language is also seen as an element that facilitates learning, as it is a language with which students are familiar.

The use of visual metaphors based on the students' context are also seen as elements that can provide greater interactivity. However, for a better adaptation to the context, teachers highlighted the need to include data typification, readjustments in control structure concepts, and inclusion of feedback in exercises as elements that can improve students' learning experience.

The study only presents results related to lecturers' perception of the system. Although this is a positive perception, further studies are needed to obtain feedback from students and advance to the experimental phase through an observational study to measure the prototype's performance in the teaching and learning process.

ACKNOWLEDGMENTS

This work is financed through national funds by FCT-Fundação para a Ciência e a Tecnologia, I.P., in the framework of the Project 10.54499/PRT/BD/152690/2022 and UIDP/00326/2025

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