Use of Google Forms for Ludic Learning The Experience in the Computer Science Fundamentals Course

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Abstract:- We present the experience and main results obtained in the implementation of the Google Forms tool, as a support mechanism for the learning of programming fundamentals in C++, in the introductory course Computer Fundamentals, in the Information Systems Engineering degree of the National University.

Keywords:- Google Forms; Ludic Learning; Gamification; Programming.

I.   INTRODUCCIÓN

In the new university framework, there has been a shift from learning based on teaching to base on learning itself, centered on the student, favoring his or her involvement, activity and protagonism and evaluating his or her efforts more effectively. Precisely one of the advantages of digital devices is that they facilitate the possibility of active-collaborative work, interactive participation and the development of motivating strategies for students in the classroom. TIC as a support to active-collaborative techniques are educational tools that, regardless of the educational context where they are applied, allow the transmission, acquisition and evaluation of skills, knowledge and competences of students in an objective and global way [1].

E-learning provides immediate, convenient, flexible and long-distance learning to individuals, however the key to success lies in its continued intention to thrive alongside the development of digital technology [2].

For homework assignments, teachers may also choose to provide students with instant feedback. However, this option is only accurate with closed-ended tests or spelling tests. The settings are almost identical to those used for grading after a test, but teachers must select from the advanced options, the option to enable self-grading. At this point, teachers select the grading scales, choose the answer key, and finalize the mail settings. Once this is completed, the students can receive immediate feedback in their email once the test is completed, allowing students to examine their mistakes while maintaining the commitment [3].

Through numerous universities and introductory programming courses, students seriously completed both readings and interactive web material assignments. Keys to such completion are likely to include the allocation of an appropriate number of points, the use of properly designed content, and the assignment of a reasonable amount of work [4].

During the last few years, we have seen the significant advance of ICTs; these provide tools that facilitate the teaching-learning process, due to which pedagogy has been forced to make changes, implementing the tools offered by ICTs in its teaching. In this way, the student is encouraged to learn using increasingly efficient strategies, and the teacher is encouraged to design more meaningful teaching methodologies [5].

On the other hand, according to [6] "…within a career oriented to Systems Engineering, it is considered fundamental from the beginning to work on the development of logic and the solution of algorithms. The definition is one of the most important logical operations of the way of thinking, since it sets the basis for more complex operations. Although work in the school area begins in primary education, the results achieved are still insufficient and are more notable when young people enter university education".

However, we must realize that students have different levels of logical reasoning where they have different abilities to use various thought patterns to understand programming, analysis and specification problems. Some studies have stated that students need to acquire logic and reasoning as well as analytical thinking in the development of problem solving. These differences in cognitive characteristics among students explained why some of the students were successful in programming courses and some of them did not complete the course successfully [7].

It is also found that gamification is the application of the mechanics and dynamics of the play in areas that are not normally playful. It can get people involved, motivate, concentrate and make an effort to participate in activities that before it could be classified as boring and with that gamification it can become creative and innovative [8].

Due to the above considerations, we developed an initiative to involve new teaching elements such as online forms to motivate the development of the logic of the solution algorithms in the programming languages, in this case the C++ language. In this way, the present work proposes the technological resource of online forms to motivate the students of the course.

This document shows the previous research of four tools that allow the generation of online forms, the selection of the tool, the creation of the questions, as well as their grouping, the population in which it was put into practice and the design of the form, originating that the students can interact with these forms and learn the topics of the course in a playful way.

The research is of an exploratory nature and aims to provide an initial perspective on the subject, which will enable more rigorous research to be conducted in the future.

II. METHODOLOGY

➢ Investigate and compare some of the tools for the creation of online forms, among which the following were investigated: Google Forms, TypeForm, SurveyMonkey, Eval & Go: It was considered of great value to analyze each of these tools in three important aspects which are: design, response management, analysis. Below is a comparative table for each of the selected aspects:

Tool Comparison			
Google Forms	**TypeForm**	**SurveyMonkey**	**Eval & Go**
-19 different types of questions (text, multiple choice, etc.) -Available up to 25 default templates. -Customization options (logos, colors) -Allows you to add images or videos from Youtube. -Responsive.	17 different question types (closed-ended, rating, opinion scale, multiple choice, etc.). -Intuitive design with a "Drag & Drop" interface -Customization options per question (images, colors, fonts) -Default templates available. - Responsive.	-15 different question types (multiple choice, text boxes, comparisons, etc.) -Option to choose questions written by survey experts -Customization options (themes, logos, thank you pages) -Responsive.	-More than 20 different question types (multiple choice, text, etc.) Intuitive "Drag & Drop" design. -Allows you to add images and videos. Customization options (brand colors, logo). -Advanced timer options, scoring, multi-language option, quotas. -Responsive.
Share surveys through a web link, email or social networks. Option to collect email addresses for a newsletter. Option to receive email notifications when new responses are received.	Share surveys through a web link or social networks. Option to receive notifications by electronic mail when new answers are received. Send the participant a personalized e-mail. Send the received data to a URL.	Share surveys through a web link or social networks. Option to incorporate an email collector. Add a built-in or pop-up collectors to any website.	Share surveys through a web link, QR code or social networks. Send the participant a personalized e-mail.
Collection of responses automatically and sorted by form. Generation of graphics and data of the answers in real time. Option to examine the data in spreadsheets Export of data in csv format No filters.	Variety of monitors (visits, responses, percentage of completion, average time) per device (pc/laptops, smartphones, tablets, others). View results in real time and download them in .xls format Option to add Google Analytics. Generation of reports/graphs.	Filter and compare results. Data export in a variety of formats (xls, pdf, spss, ppt). Custom filters to create multiple views of the data Convert data into graphs.	Real-time statistics analysis. Data export in xls and csv formats. Automatic customized reports in various formats (online, Word, PDF, Excel, Power Point). Data filtering.

Table 1:- Comparison in Design.
Source: Own Design

Due to the diversity of the question types that the Google Forms tool has and the management of their answers, it was decided to use a questionnaire and self-assessment tool to perform a set of exercises in the C++ programming language, allowing the student to have an additional element to practice during the course and improve the development of logic in the problem-solving process in the areas of sequential structures, cyclical, unidimensional and bidimensional arrangements.

➢ *Design of the exercises*

The exercises were selected and analyzed in their writing, then three different questionnaires were designed, which include the three main topics of the course: sequential structures, cyclical structures and unidimensional and bidimensional arrangements.

Each questionnaire consists of 20 questions of unique selection. They were presented to the students with 4 possible options. In this way the student selects the answer he or she considers correct and at the end of the questionnaire he or she indicates the number of answers he or she got right and those he or she did not get right.

Each one of the forms allows you to have a different user role: manage, edit and view. And in each of the forms, different questions, are presented to be analyzed by the student who is just entering a career related to technologies. Below is a picture of the question in the topic of cyclical structure:

What is the screen output after the next cycle is executed for? *

```
for(int i = 1; i < 3; i = i*2){
    for(int j = 0; j < 3; j++){
        cout<<i+j<<" ";
    }
}
```

◯ 0 1 2 3 4 5

◯ Queda en un ciclo infinito

◯ 2 4 6 1 2 3

◯ 1 2 3 2 3 4

The variables int n and c are declared with the following values: n=10, c=2 What is the output per screen after the following cycles are executed r?

```
do{
    r = n % 10;
    n = n/10;
    cout<<r<<"-";
}while(n > 0);
```

◯ 4-16-0-

◯ 0-8-2-

◯ 0-16-4-

◯ none

Fig 1:- Example of questions

In this design, we first determined the errors that occur in the students in this course: cycle initialization, cycle ranges, use of logical operators among others. Then, three forms were created for each of the topics and the corresponding questions and answers were entered. The questions were written as closed and have four possible answers, of which only one is correct. The challenge was to gradually place each of the exercises so that each student would be motivated to do them and the dynamic would not be counterproductive.

On the other hand, the option was implemented so that the student could see the questions and answers that he or she had incorrectly at the end of the questionnaire. And to avoid any doubt, in case of having incorrect answers, the student would be able to observe the correct answers.

III. EXPERIENCE DEVELOPMENT

This experience took place during the course Computer Science Fundamentals in the second semester of 2017. This first test was carried out in only one group of the course, in which all the students participated, of which 5 were women and 15 were men, with an average age of 19 years old. This population used on average each of the forms about 2 times each. These practices with Google Forms, were presented as training activities to reinforce concepts that were explained in class.

At the end of each topic, the teacher placed the forms with the exercises in the virtual classroom platform of the course so that the students could access them as many times as they considered necessary, so it was decided to leave the form open to several answers from the students (users) of the application.

➢ *Development of a survey for the evaluation of the tool:*

Student's Name
Gender
Did you already know about online surveys?
Have you used these tools for any subject?

Did you like using this tool?
Do you think the exercises were of an adequate level? Please justify your answer.
Regarding the questions on the forms:
They reflect the content studied in class
They help me to understand better the issues
I have the knowledge to be able to accomplish them
They have a level of difficulty appropriate to the course
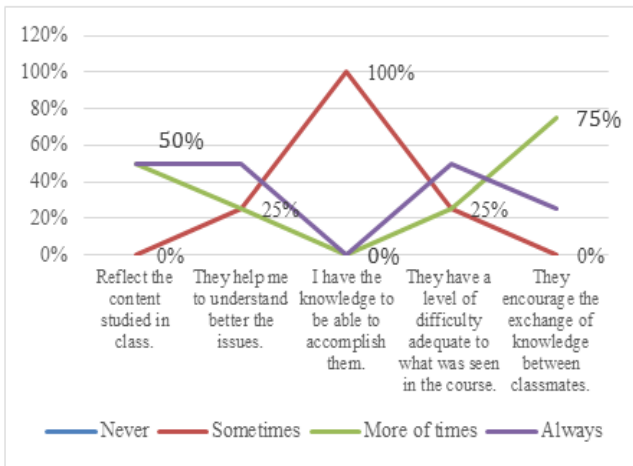They encourage the exchange of knowledge between classmates.
Was the activity helpful in improving your knowledge of the course topics?
Why do you think it is important to have these technologies available for students to study?
Would you recommend this tool to other classmates in other groups?
What recommendation would you give your teacher to provide other ideas to motivate the student in class?
What would you like to see incorporated into this tool?

Fig 2:- Questionnaire applied

IV. RESULTS

The following are the results obtained in each one of the questions:

1. ¿ Did you already know about online surveys?
   100% of the participants mentioned that they did.
2. Have you used these tools for any subject? 50% mentioned that they had not used it.
3. Did you like using the tool? 100% said yes.
4. Do you think the exercises were at an adequate level? Yes.
5. Regarding the questions on the forms:

Graph 1:- Percentage of the use of the forms

6. Did you find the activity useful in improving your knowledge of the course topics? 100% answered yes.
7. Why you think it is important to have these technologies available for the students to study?

Answers
More work in class
It is a very easy and entertaining way to study and it can be done at any time, from home and even in a bus.
Because it's dynamic and simple, it's better this than doing a project
It's more practical

Table 2:- Open answers on the importance of the scope of technologies.
Source: Own.

8. Would you recommend this tool to other classmates in other groups? 100% answered yes.
9. What recommendation would you give your teacher to provide other ideas to motivate the student in class? 100% answered yes.
10. What you would like to see incorporated into this tool? 98% responded that this is fine and the other 2% mentioned that it would be very useful to have a rating.

➤ *Useful results for the educator:*
   This tool is very useful for the teacher because when he or she logs in with his or her email account, he or she can see the results obtained by the students. For example, the following image is shown below:
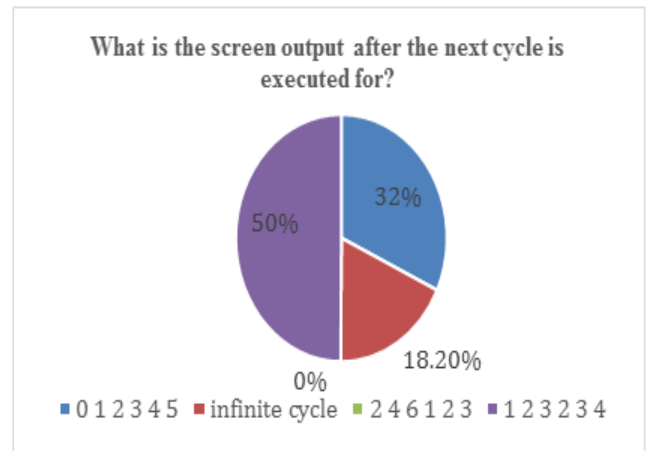
Graph 2:- Example of student's response
Source: Own

For this case the correct answer was option #4 which appears in green. As can be seen in the illustration, no. 3, half of the students corresponding to 50% answered incorrectly. With 50% wrong answers, it allows the teacher to reanalyze it's class this kind of results and to be able to resume the exercise in class. In this way the student can already understand the justification of the correct answer.

In addition, the teacher can view whether students are using the tool and monitor access from the Google Forms tool.

V. DISCUSSIÓN

100% of students who used Google Forms found it useful in applying knowledge.

The assessment made by the students at a general level is considered that it favored them in their studies.

All students would recommend the tool to their classmates.

All students find it easy to access the technology, as they can easily access the form from their phone.

As presented in the section "useful results for the teacher", reference is made to what is called "formative evaluation", meaning the teacher receives feedback on the students learning process and can thus adjust his or her teaching practices.

VI.   CONCLUSIONS

The use of technological tools for learning are highly motivating for students, as most of them are very used to using the computer or cell phone daily.

The Google Forms application allows each student to use it to check whether their answers are correct or not. In case not all the answers are correct, the application tells you what the correct answer is and you can later in class go deeper into the subject with your teacher.

The tool is very useful for the teacher, because he or she can have a very quick analysis of the response frequencies of his or her students and see if there is any subject that is not very clear, and with enough time in advance it can be expanded during the classes.

Search for technological tools that allow students to learn while playing by answering questions, generating in them a more pleasant environment to learn.

VII.   RECOMENDATIONS

It is recommended that the teacher who wishes to apply it, separate the topics of the course in advance, classify them and ask multiple choice questions so that they can later be incorporated into the Google Forms platform.

To continuously improve the exercises after this first experience, in order to refine them as the most frequent errors or comprehension problems faced by the students every time, they practice with the forms are identified.

Ask students which topics they would reinforce, which they would like more or less practice in, or which aspects they would change to the questions.

It is considered essential to pre-test before sharing the link with students. This allows you to avoid any mistakes when entering the information.

It is important to carry out a first exercise with the students during the class to make a previous dynamic and then they can apply the questionnaire when they wish.

New studies are recommended that compare a student group that uses Google Forms for support versus a group that does not, in terms of performance on short tests or exams.

For the future, it is intended to address metacognitive aspects, that is, how students generate knowledge about their own ways of learning. The use of online forms can encourage this skill.

It is important to generate spaces for focus groups or interviews, how these exercises help or do not help students to improve their learning strategies. In this way we can improve the exercises in class.

To emphasize the importance that this experience could have not only for the students, but also for the continuous improvement of the teaching by the teacher. In this sense, the concept of "formative evaluation" noted above, and the role of improvement from one course to another, can be integrated. In other words, the teacher can detect gaps in the knowledge, frequent errors, as well as process difficulties (the metacognitive aspects mentioned above are integrated into this), in order to adapt his or her teaching strategies in an attempt to improve students' understanding.

This type of tool is perfectly suited to any discipline, only the topics that are most suitable for the teacher should be chosen in order to carry out a questionnaire and answers as complete as possible.

Afterwards, the intention is to incorporate the entire questionnaire into an app so that the student can install it directly from his or her phone without having to open any additional links.

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