

## Informed Consent Form (ICF)

This document, entitled **Informed Consent Form (ICF)**, is intended to ensure your rights as a participant and will be provided in printed form. Please read it carefully and calmly, making sure you fully understand the research proposal.

**Research Title:** *RiskGuard: A Serious Game for Education on Security Patterns and Software Vulnerabilities in Web Systems*

**Sponsoring Institution and Research Location:** Federal University of Ceará (UFC), Itapajé Campus

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## INFORMATION FOR THE PARTICIPANT

### 1) Presentation of the Research

You are invited to participate in a scientific research study entitled “**RiskGuard: A Serious Game for Education on Security Patterns and Software Vulnerabilities in Web Systems.**” This research is conducted by Tauã da Silva (tauadasilva@alu.ufc.br), Anderson

Uchôa (andersonuchoa@ufc.br), and Artur Franco (arturfranco@ufc.br), researchers affiliated with the Federal University of Ceará (UFC), Itapajé Campus.

This document is entitled **Informed Consent Form (ICF)**. It contains the main information about the research. To ensure your rights regarding participation in the study, it is important and necessary that you keep a copy of this form for your records; this also applies to the other questionnaires used in the research. Therefore, we advise that, after reading and completing the forms and questionnaires presented to you, you download or print the document/web page (for example, using the Ctrl+P shortcut, selecting -- if possible -- the option to display page numbers, headers, and footers).

**Research Context and Rationale:** Despite the importance of software security, higher education students (including graduates) often demonstrate knowledge gaps and inadequate practices regarding topics in this area (such as security patterns and software vulnerabilities). This situation leads to problems for both students and the software industry, which consequently demands improved education in software security from academia. This research is justified by this context and demand, and it aims to support and enhance the teaching of software security.

## 2) Research Objectives

The objective of this research is to evaluate a serious game called *RiskGuard* as a teaching and learning tool for security patterns and software vulnerabilities in web systems, with regard to its impact on students' motivation and learning.

## 3) Participation in the Research

Your participation in this research is voluntary (with no payment or rewards) and not mandatory. You have full freedom to decide whether or not to participate, and you will not suffer any kind of penalty if you choose not to participate.

The research method used is known as a **controlled experiment**. Thus, students who agree to participate will be randomly assigned to two groups (referred to as the control group and the experimental group), balanced in terms of the number of participants and their Academic Performance Index (API – *Índice de Rendimento Acadêmico*). Both groups will complete questionnaires and take part in a traditional teaching and learning session on the topic of “security patterns and software vulnerabilities in web systems.” However, only the experimental group will use the *RiskGuard* serious game.

The experiment will be conducted in Computer Laboratory 03 and at the Innovation and Technology Transfer Center (NITT). If you agree to collaborate with this research, your participation will consist of carrying out the following activities:

- **First Session:** You will attend a traditional lecture on security patterns and software vulnerabilities in web systems (45 minutes). After that, you will be asked to complete an online retrospective questionnaire (3 open-ended questions in which you will report how satisfied you were with the traditional approach, whether the approach maintained your interest, and whether the concepts taught are applied in real-world scenarios). Next, you will complete an online questionnaire about your motivation

regarding the approach (rating 30 statements on a scale from 1 to 7; 10 minutes) and an online questionnaire to assess your knowledge of the content taught after being exposed to the approach (10 multiple-choice questions; 30 minutes).

- **Second Session:** After the researchers divide the participants into two groups (10 minutes) -- control group and experimental group -- the activity will proceed as follows: (1) If you are assigned to the control group, you may remain in the laboratory with the other classmates; (2) If you are assigned to the experimental group, you will take part in the second phase of the experiment, which consists of using the *RiskGuard* serious game for teaching security patterns and software vulnerabilities, carried out after the traditional lecture. This activity will take place in the NITT room, located in Block 2. At this stage, the experimental group will play *RiskGuard* in four rounds, totaling 45 minutes. Afterward, you will be asked to complete an online retrospective questionnaire (6 open-ended questions in which you will report how satisfied you were with *RiskGuard* as a teaching tool, whether the game maintained your interest, whether the concepts taught are applied in real-world scenarios, whether you found the game complex to use, whether a digital version would be more appropriate, and which aspects of the game you would change and why). Then, you will complete an online questionnaire about your motivation regarding the approach (rating 30 statements on a scale from 1 to 7; 10 minutes) and an online questionnaire to assess your knowledge of the content taught after being exposed to the approach (10 multiple-choice questions; 30 minutes).

#### 4) Confidentiality

Throughout all phases of this research, the confidentiality, secrecy, and privacy of your data will be ensured, in compliance with ethical standards and the Brazilian General Data Protection Law (*Lei Geral de Proteção de Dados – LGPD*, Law No. 13,709/2018). Any information that could allow your identification will be omitted from the disclosure of results. In addition, in analyses and publications, you will be represented by a code (such as "Participant 1") instead of personal data.

The data collected will be used exclusively for the purposes of this research and will be kept in a secure location, whether in physical or digital form, under the custody and responsibility of the researchers, for a period of five years after the completion of the study.

#### 5) Risks and Benefits

##### a) Risks:

During the research, there may be moments when you will need to interact with other participants and with the researchers, such as when sharing your opinion about the correct answer to an exercise or when completing online knowledge tests. A possible identified risk is discomfort or embarrassment during these interactions and activities, especially due to factors such as shyness or nervousness. To minimize this risk, we emphasize that your participation takes place in a learning environment, where mistakes are natural and expected, as they are part of the knowledge development process. In addition, interactions among participants are intended to be collaborative rather than competitive, with a focus on mutual learning. The knowledge tests aim to evaluate the approach applied in the study and not your individual performance; therefore, there is no reason for concern or embarrassment.

regarding your answers. If you feel the need, you are free to talk to the researchers, who will be available to provide the necessary support.

Furthermore, as some stages of the study will be conducted online, this research is subject to risks inherent to the use of electronic media, such as potential data or confidentiality breaches. To minimize these risks, the following measures will be adopted: (a) the use of a secure, widely known, and commonly used data collection tool, Google Forms; (b) for consent registration, you will be instructed to sign the printed consent form; and (c) once data collection is completed, the researchers will store the data on a local electronic device, and any data that could identify participants will be removed from virtual platforms, shared environments, or cloud-based services.

**b) Benefits:**

The benefits related to your collaboration in this research include: (a) for you, as a participant: you will receive, free of charge, explanations and training on security patterns and software vulnerabilities in web systems; (b) for science: by participating, you will support research that contributes to the body of studies aimed at improving the teaching and learning of software security; and (c) for society: by contributing to this study, you may help in the education of more motivated and better-qualified professionals in the field, as well as support the strengthening of higher-quality software solutions and products for society.

**6) Inclusion and Exclusion Criteria**

**a) Inclusion**

To participate in this research, you must meet the following criteria:

- Be a student currently enrolled in, or have completed at least one of the following courses according to your undergraduate program:
  - **Information Systems Program:** Systems Development and/or Principles of Information Security;
  - **Systems Analysis and Development Program:** Web Programming and/or Introduction to Information Security.
- Be legally capable and at least 18 years of age.

**b) Exclusion**

Not applicable.

**7) Reimbursement and Compensation**

You are guaranteed the right to reimbursement in the event of expenses demonstrably related to your participation in the study. You will also be guaranteed, in accordance with the law, the right to assistance and compensation in the event of any damages resulting from the research.

**8) Dissemination and Access to Research Results**

The results of this research will be disseminated through scientific events and/or publications, including an undergraduate thesis (*final course project*), which will be made

available in a public repository of the Federal University of Ceará (UFC). In all publications, the confidentiality of participants' personal data will be ensured.

In addition, participants have the right to access the research results. If you are interested in receiving them, please indicate the corresponding option:

( ) I would like to receive the research results (email address for delivery):

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( ) I do not wish to receive the research results

### **9) Consent Process**

To provide consent for the research, that is, to agree to participate in it, you must sign this **Informed Consent Form (ICF)** below:

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Participant's name (in block letters)

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Participant's signature

\_\_\_\_\_, \_\_\_\_\_ of \_\_\_\_\_, 20 \_\_\_\_ .

After completing the consent process, you should wait for the researchers' instructions to begin your participation in the study, if you have agreed to take part. The instructions will be provided verbally by the researchers after the end of the time agreed upon in the classroom for reading this form and providing consent