

# Quizzes (as a tool for self-regulated learning) in Software Engineering Education

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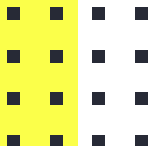
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# Introduction

- Student's way of learning changes with the use of technological tools [1]-[3].
- Using quizzes for learning has been around for many years since it was first discussed [5].





# Education and Quizzes

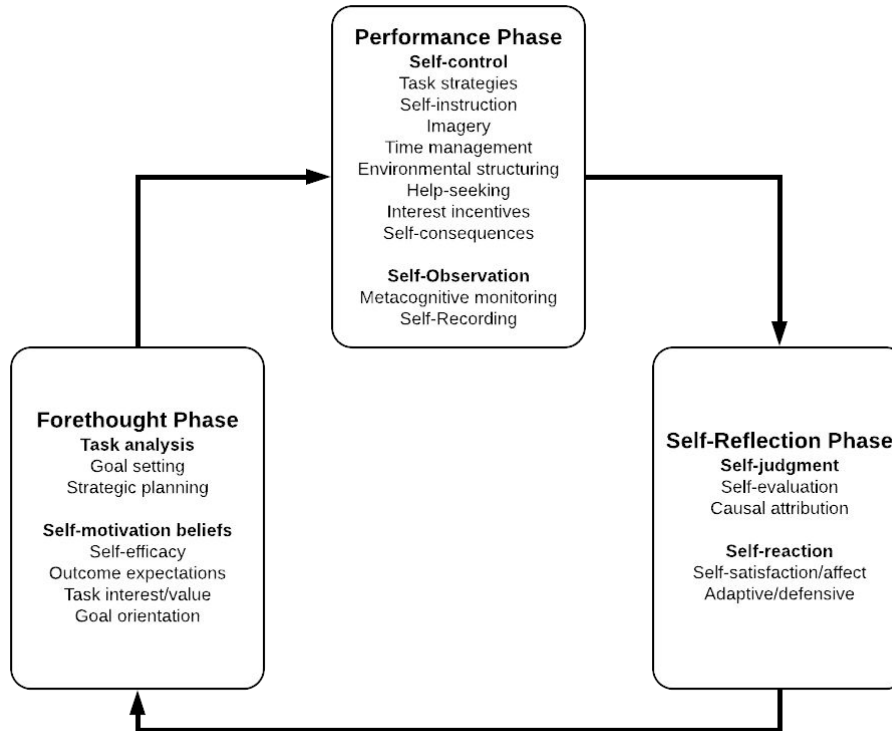
- The inverted classroom is a technology-supported pedagogy. Bishop and Verleger [12] define this type of learning as a direct, computer-based individual instruction outside the classroom.
- By reflecting on their actions and how to find new knowledge, the learner can discover for himself how to overcome his own challenges



**...According to Zimmerman,  
self-regulated learning aims to  
define a student's learning  
process and motivational  
beliefs based on three  
self regulation phases:  
Forethought, Performance and  
Self-Reflection [ 15 ]....**





# Zimmerman Cyclic Model



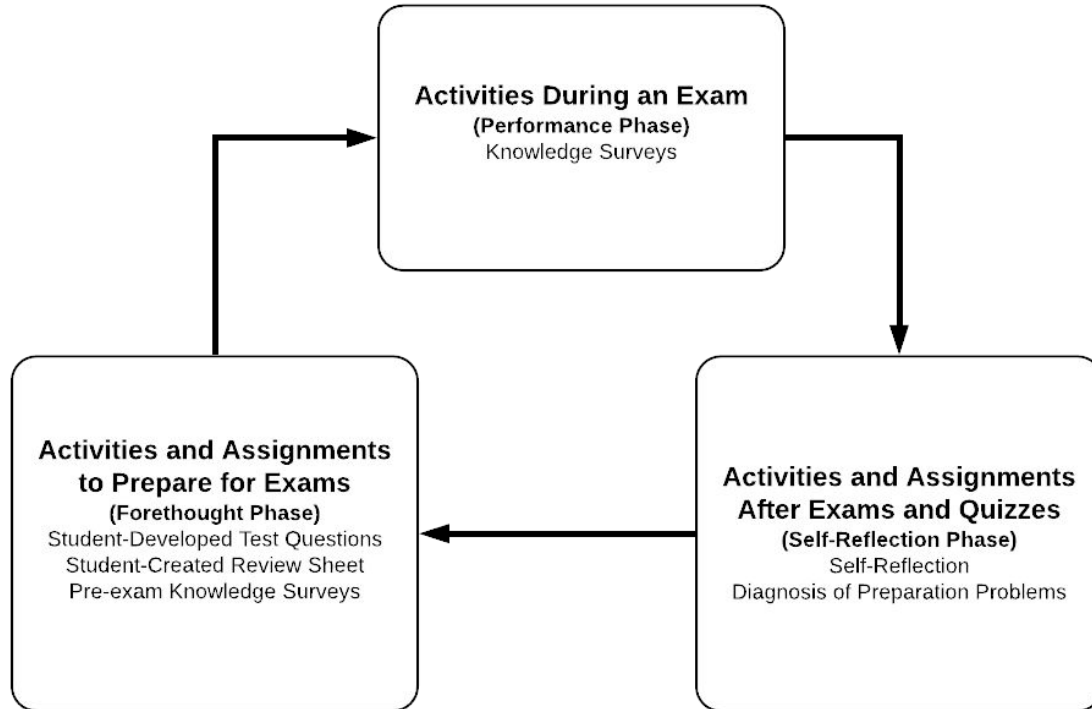


“

...According to Nilson [1],  
quizzes can support  
self-regulated learning by  
providing opportunities for  
several Activities and  
Assignments that help with  
self-regulated learning. [15]....



# Self Regulated Learning Activities Supported by Exams / Quizzes





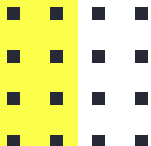
# 1. Methodology

The research process used in this work is based on the systematic review process research in software engineering [21], [22]



# Research Planning

- Objectives
- Population, Intervention, Comparison, Outcome, Contexts
- Research Questions
- Keywords and Synonyms
- Source
- Search String
- Inclusion and Exclusion Criteria
- Quality Assessment Criteria
- Cutoff Score
- Data Extraction Form



# Research Planning

## Objectives

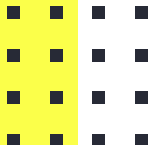
- Analyze scientific publications that address Software Engineering Teaching;
- Analyze scientific publications that study the use of Quizzes in Teaching (and particularly as a self-regulating pedagogical tool);
- Develop a Review and / or Mapping of the literature on “Software Engineering Teaching and Quizzes”;
- Justify / Motivate the creation / implementation of a Software Engineering Shared Quiz repository



# Research Planning

## Research Questions

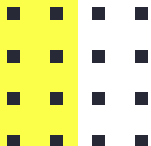
- **RQ1** - Are Quizzes used in Software Engineering Education?
- **RQ2** - How are Quizzes used in Software Engineering Education?
- **RQ3** - Are Quizzes used in Software Engineering Education for the Self-regulation of Learning?
- **RQ4** - How are Quizzes used in Software Engineering Education for the Self Regulation of Learning?
- **RQ5** - How can we improve the use of Quizzes in Software Engineering Education?



# Research Planning

## Data Extraction Form

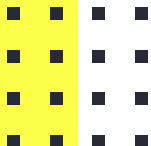
- Type of Application of Quizzes
- Context where Quizzes were applied
- Phases of the Zimmerman Cyclical Model implicitly or explicitly considered
- Types of Activities (Before, During or After Exam/Quiz) implicitly or explicitly considered
- Positive Results from the Application of Quizzes
- Negative Results from the Application of Quizzes



# Methodology

## Conducting the Research/Results

- Search
- Import Studies
- Study Selection
- Quality Assessment
- Data Extraction
- Data Analysis





# 2. Results

Data Extraction

# Results - Data Extraction - Context

Types of Application of Quizzes	Number of Studies	Studies
Quiz Games	4	[27], [30]–[32]
Online Quizzes	4	[8], [23], [24], [29]
Pop-Quizzes	1	[24]
Gamified Quizzes	1	[24]
Quiz Creation	1	[26]
Generic Quizzes	5	[6], [7], [25], [26], [28]

Course Subject	Number of Studies	Studies
Algorithms	2	[23], [26]
Programming	5	[24]–[26], [29], [30]
Software Design	1	[7], [31]
Software Engineering	3	[6], [8]
Software Project Management	2	[27], [32]
Software Security	1	[28]

In-Lecture vs Outside-Lecture	Number of Studies	Studies
In-Lecture Quizzes	6	[7], [25], [27]–[29], [31]
Outside-Lecture Quizzes	7	[6]–[8], [23], [24], [26], [30]

Type of Course	Number of Studies	Studies
Traditional Courses	6	[7], [23], [24], [27], [28], [31]
Online Courses	4	[8], [26], [29], [30]
Hybrid Course	1	[8]
Intelligent Tutor System	2	[7], [25]
Inverted Class Course	3	[6], [23], [26]

# Results - Data Extraction - Zimmerman and Activities

Phase	Number of Studies	Studies
Forethought	6	[6], [23], [24], [29]–[31]
Performance	6	[23], [24], [26], [27], [29], [30]
Self-Reflection	6	[7], [8], [23], [24], [27], [29]

Activity Type	Number of Studies	Studies
Activities Before an Exam	7	[6], [8], [23], [24], [26], [30], [31]
Activities During an Exam	1	[30]
Activities After an Exam	6	[7], [8], [23], [24], [27], [29]



## Results - Data Extraction - Positive Results 1/3

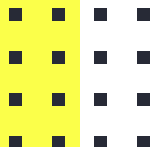
- Quizzes allow better self-assessment [8]
- Pop-Quizzes improve students performance and Gamified Quizzes improve student's engagement [24]
- Quizzes and the creation of quizzes increased Task Performance [26]
- Quiz Games can promote an engaged experience to the players [32]
- Users liked the interactivity provided by online quizzes, [29]
- Quizzes that allow the diagnostic of common errors allow students to improve, and the classification of quiz questions into concepts and cognitive levels allows the course's staff and students to identify problem areas [7]

## Results - Data Extraction - Positive Results 2/3

- Quizzes were effective as a motivator for watching lectures in an inverted classroom [6]
- Quiz Games improved the academic outcomes of students [30]
- In-Lecture Quiz Games made students pay closer attention and had a positive effect on learning [31]
- We found motivational aspects in learning that were applied in some works as a way to improve learning, including active learning, reported by [6],[8],[27],[28],[32].

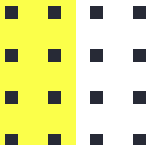
## Results - Data Extraction - Positive Results 3/3

- Generating student feedback [8], [29], [30]
- Improving student involvement, including motivation [6], [23], [24], [29]-[31].
- Improve student attitude [24]
- Improve student experience [24], [32]
- Improve student satisfaction [30]
- Improve student communication [31].



## Results - Data Extraction - Negative Results

- Preparation Quizzes before a class had no benefit [24]
- Weekly graded quizzes can increase student anxiety [6]



# Results - Data analysis 1/3

**RQ1** - Are Quizzes used in Software Engineering Education?

Yes! They are used in Software Engineering Education

**RQ2** - How are Quizzes used in Software Engineering Education?

Type of application:

- Generic Quizzes
- Online Quizzes
- Pop-Quizzes
- Gamified Quizzes
- Quiz Games
- Quiz Creation

Context of application:

- In-Lecture or Outside-Lecture
- Type of course/learning system were they applied on (Traditional, Online, Hybrid or Intelligent Tutor System)
- Course subject where they were applied (Algorithms, Programming, Software Design, Software Engineering, Software Project Management or Software Security)

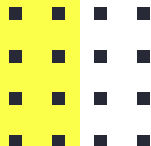
## Results - Data analysis 2/3

**RQ3** - Are Quizzes used in Software Engineering Education for the Self-regulation of Learning?

Yes! Quizzes are used in Software Engineering Education as self-regulated learning. We found examples that approached or focused on each of the different phases of the Zimmerman Cyclical Model and found all the types of self-regulated learning activities that are supported by quizzes. Most of the studies did so implicitly and not explicitly.

**RQ4** - How are Quizzes used in Software Engineering Education for the Self Regulation of Learning?

The extracted data shows that it can be used in order to support different phases of the Zimmerman Cyclical Model, and different types of self-regulated learning Activities. However, as mentioned previously, this was done implicitly in most cases and not explicitly.



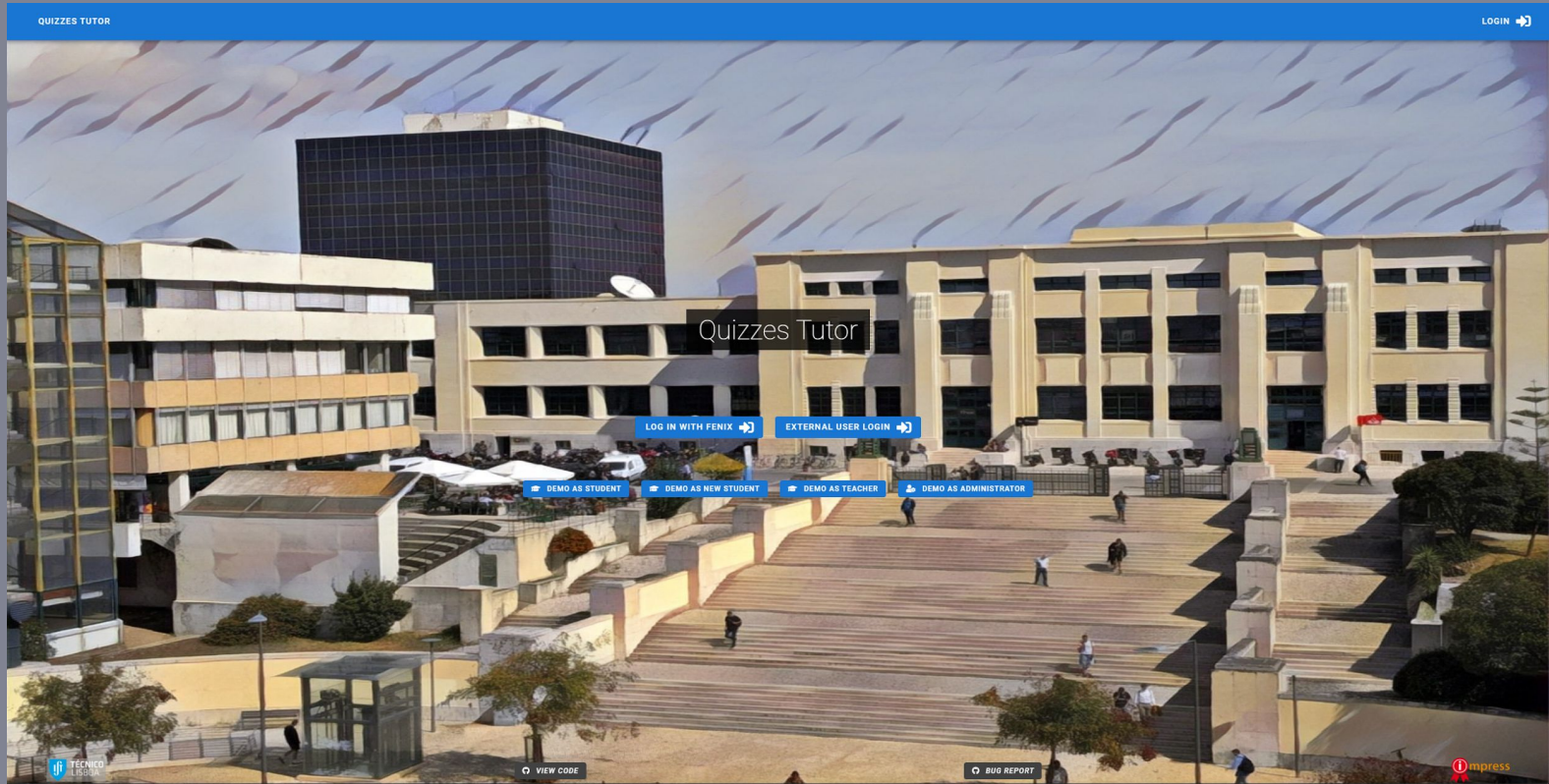
# Results - Data analysis 3/3

**RQ5** - How can we improve the use of Quizzes in Software Engineering Education?

We have found no clear answer to this question. Some suggestions:

- Making sure that the application of Quizzes does not increase student anxiety
- Carefully examining how to apply Preparation Quizzes so that it can produce the adequate benefits
- Considering how to maximize the benefits to the student's performance, engagement, motivation and attitude
- Taking care to maximize the benefits from having a feedback mechanism, and the benefits of using them as a tool for self-assessment and diagnostic
- Approaching the deployment of quizzes with a specific focus on the Zimmermann Cyclical Model and the Activities Supported by Quizzes
- Facilitate the Application of Quizzes to software engineering education through a shared repository of quizzes and the tools required to manage and administer the quizzes that so that they can be easily deployed

# Quizzes Tutor

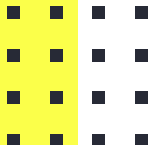


<https://quizzes-tutor.tecnico.ulisboa.pt/>



# Conclusions 1/3

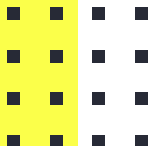
- The results of the analysis showed the potential benefits of using quizzes as a tool for self-regulated learning.
- Thus, we found in these studies common and proposed challenges to address the use of quizzes in the context of software engineering and to improve students self-regulated learning.
- It was also possible to identify failures, mainly related to a correct application of Zimmerman's cyclic model, which provides the basis and process to support self-regulated learning for students.
- This relationship between learning and motivation has a great impact on educational environments, and as a consequence, we can say that quizzes can be used as a way of assessing students, but also to stimulate the participation, motivation and learning of these students



# Conclusions 2/3

We believe that current studies can be better explored and with more research in this field, especially concerning:

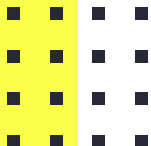
- Self-regulating models, methods and techniques of learning supported by the use of quizzes
- Research relating to the impact, in the form of learning, on software engineering
- Use of quizzes shared among various institutions
- Procedures for assessing the quality and validity of quiz questions based on scientific criteria



# Conclusions 3/3

We argue that a standard body of peer-reviewed questions and answers that can be reused in different faculties can:

- Facilitate the bootstrapping effort required in order to create, review and use quizzes
- Be reused by different Faculties
- Can better reflect the state of the art and current knowledge of the topic being taught
- Can confer the ability to potentially analyze student skills at various universities
- Can enable teachers to better understand the weaknesses of the curriculum and the problem areas that may cause problems for students and provide a better understanding of what those problems are



# Special thanks



## **Tutorial:**

A Gamification Toolset for Improving Engagement of Students in Software Engineering Courses



This work was developed for the IMPRESS project funded by EU Erasmus+Programme, grant nr. 2017-1-NL01-KA203-035259 and by the Fundação para a Ciência e a Tecnologia, under project UIDB/50021/2020.



# Thanks!

## Any questions?

You can find me at:

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