Assignment 5: Improving the Curriculum Management in your place by using theories

142 302 Curriculum Management

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Direction:

Complete Curriculum Management for your project. (see Assignment #2)

Marks: 5 marks, Length: 3-5 typed, double spaced pages

Due Date: August 18, 2024

Assignment 5: Improving the Curriculum Management in your place by using theories

Research Title: Designing Engaging Lesson Plans for Computer Science Education in Schools

Research Objective:

1) To Understand Student Needs by investigating the diverse backgrounds, motivations, and learning styles of Computer Science students.

2) To Design Engaging Content or lesson plans by using project-based learning, gamification, and unplugged activities.

3) To Scaffold Learning by developing step-by-step instructions and break down complex topics.

4) To Evaluate the effectiveness of lesson plan, students need to be assessed regularly and also proper feedback to be taken to understand the satisfaction of students.

Research Questions:

1) How can lesson plans be tailored to accommodate diverse student backgrounds and motivations?

2) What strategies would effectively integrate gamification and project-based learning into Computer Science curricula?

3) How can unplugged activities enhance understanding of Computer Science concepts?

4) What type of supporting or scaffolding techniques should be considered for skill development?

5) How does computational thinking impact student problem-solving abilities?

Conceptual Framework

This research aims to study the methods for developing an effective lesson plan for computer science students which can make learning programming skills fun and easy for learners. It explores various approaches to curriculum development for computer science students, emphasizing strategies to make programming accessible, fun, and relevant.

The **independent variables** are **teaching methods** or tools incorporated in lesson plan to make learning more engaging and **curriculum design** that is the structure and content of the lesson plans which includes learning objectives, activities and assessments. The **dependent variable** is **student's performance**.

The conceptual framework for developing engaging lesson plans in computer science revolves around three core approaches:

1. **Learner-Centered Approach:** This approach emphasizes the importance of understanding and addressing the needs, interests, and learning styles of students. It involves creating a supportive and inclusive learning environment that encourages active participation and exploration.

2. **Computational Thinking and Problem-Solving:** This approach highlight the development of computational thinking skills, including problem decomposition, pattern recognition, algorithm design, and debugging. It emphasizes the application of these skills to real-world problem-solving.

3. **Motivation and Engagement:** This approach focuses on creating learning experiences that are motivating and enjoyable for students. It involves incorporating elements of

game-based learning, project-based learning, and real-world applications to make programming relevant and engaging.

Key Components

In this conceptual framework, the following components are essential:

- **Learning Objectives:** Clearly defined and measurable learning outcomes that align with curriculum standards and student needs.
- **Engaging Activities:** A variety of activities, including problem-solving challenges, simulations, games, and projects, to cater to different learning styles and interests.
- **Assessment:** Formative and summative assessments to monitor student progress and provide feedback for improvement.
- **Technology Integration:** Effective use of technology tools to enhance learning, such as programming environments, simulations, and online resources.
- **Collaboration and Communication:** Opportunities for students to work collaboratively and communicate their ideas and solutions.

Literature Review

Repenning et al.'s (2015) paper, "Scalable Game Design: A Strategy to Bring Systemic Computer Science Education to Schools through Game Design and Simulation Creation,"

presents a compelling argument for integrating computer science (CS) education into the mainstream curriculum through game design and simulation creation. The authors address a critical gap in traditional education by proposing a scalable model that can be effectively implemented across diverse school settings. The paper introduces the concept of "scalable game design" as a pedagogical approach to introduce CS concepts to students in a motivating and engaging manner. The authors argue that by starting with game design and progressing to simulation creation, students can develop a strong foundation in computational thinking, problem-solving, and creativity. The curriculum is designed to be accessible to students of varying abilities and interests, fostering inclusivity and equity in CS education.

Ryoo et al.'s (2013) paper, "Democratizing computer science knowledge: Transforming the face of computer science through public high school education," presents a critical analysis of the need to broaden access to computer science (CS) education. The authors emphasize the importance of democratizing Computer knowledge to create a more inclusive and equitable educational landscape. The paper underscores the existing disparities in CS education, highlighting the underrepresentation of marginalized groups in the field. The authors argue that by incorporating Computer education into public high school curricula, it is possible to dismantle these barriers and create a more diverse pipeline of Computer talent. They propose a shift in focus from traditional Computer science content to emphasize problem-solving, critical thinking, and creativity, making the subject more accessible to a broader range of students.

Israel et al (2020) paper, "Teaching Elementary Computer Science through Universal Design for Learning," provides a foundational framework for making computer science (CS) education accessible and equitable for all students. The paper introduces the concept of Universal Design for Learning (UDL) as a strategic approach to teaching elementary CS. UDL is a framework that guides the creation of learning environments that can meet the needs of all students by providing multiple means of engagement, representation, and action and expression. The authors argue that by applying UDL principles to CS education, educators can create inclusive classrooms where all students have opportunities to succeed. A key contribution of the paper is its focus on practical implementation strategies into Computer Science teaching.

Dengel et al (2023) introduce the Engaging Computer Science Education Laboratory as an innovative approach to informatics teacher education. Employing a mixed-methods design, the study investigates the creation of a learning environment that fosters effective teaching practices. The laboratory aims to bridge the gap between theoretical knowledge and practical application by providing hands-on experiences. Key findings emphasize the importance of collaborative learning, problem-solving, and technology integration in preparing future CS educators. The study contributes to the field by offering a comprehensive model for designing effective teacher education programs.

Research Methodology

- **Qualitative data** will be collected through interviews, observations, and focus groups with teachers and students to understand their perceptions of engagement.
- **Quantitative data** will be collected through pre- and post-tests to measure student learning outcomes and surveys to assess changes in attitudes towards computer science.
- **Lesson plan analysis** will be conducted to identify effective design principles and practices.

Data Collection and Analysis

- **Pilot testing** of lesson plans will be conducted with a small group of students and teachers to gather initial feedback.
- **Data analysis** will involve analysis of qualitative data and statistical analysis of quantitative data.
- **Iterative design** will be used to refine lesson plans based on findings from data analysis.

Participants

Participants will be secondary students from year level 7 of approximately 32 students aged between 11 to 12 years old. All the students learn computer science as a core subject in their curriculum and have 3 periods of 50 minutes each per week. Participants are learning python programming for the first time and they are just beginners to textual programming concepts.

Data Sources to answer Research Questions

A combination of quantitative and qualitative data sources will likely be necessary to comprehensively address the research questions.

Question 1: How can lesson plans be tailored to accommodate diverse student backgrounds and motivations?

- To accommodate diverse student backgrounds, first of all **student surveys and interviews** are required to be conducted to understand students' backgrounds, interests, and learning styles.

- To understand current practices and challenges in differentiation faced by teachers in the classroom, **teacher interviews and observations** are important to be conducted.
- **Curriculum analysis** needs to be done to identify potential areas for modification and to accommodate diverse learners.

Question 2: What strategies would effectively integrate gamification and project-based learning into Computer Science curricula?

- **Student performance data:** To measure the impact of gamification and project-based learning on student achievement, assessments needs to be conducted and then the pre-test and post-test data can be used as the mode of comparison.
- **Student surveys and interviews:** To assess student engagement and motivation while using different apps.
- **Teacher interviews and observations:** To understand the challenges and successes of implementing these approaches.
- **Game design documents and analysis:** To identify effective gamification elements or apps to be included in the curriculum.

Question 3: How can unplugged activities enhance understanding of Computer Science concepts?

- **Student performance data:** To compare the effectiveness of unplugged activities versus traditional instruction.
- **Student surveys and interviews:** To assess student attitudes and perceptions of unplugged activities. To understand their satisfaction level and their motivation.

- **Teacher interviews and observations:** To understand the implementation of unplugged activities in the curriculum is required or not. Teachers satisfaction is also taken into consideration to implement the activities in curriculum.

Question 4: What type of supporting or scaffolding techniques should be considered for skill development?

- **Student performance data:** To identify areas where students are struggling and need additional support.
- **Student surveys and interviews:** To understand students' perceptions of scaffolding techniques.
- **Teacher interviews and observations:** To identify effective scaffolding strategies which teachers can implement in their lesson plans.

Question 5: How does computational thinking impact student problem-solving abilities?

- **Student performance data:** On problem-solving tasks before and after computational thinking instruction.
- **Student surveys and interviews:** To assess students' perceptions of their problem-solving abilities.
- **Teacher interviews and observations:** To understand how computational thinking is integrated into instruction.

Research Instrument

The research instrument used in the study includes an annual lesson plan, Term wise assessments, resources to be used throughout the session, projects and students' reflection.

1) Annual Lesson plan – The lesson plan is constructed based on International GCSE curriculum by Pearson. The standards to be taught in each year level is taken into consideration and resources and assessments are planned according to that.

The lesson plan is divided into 3 terms and week wise. It also includes weeks when assessment is planned and when students needs to undertake a project.

2) Assessments – The researcher first takes a baseline test which checks the level of understanding of the student for the content which will be taught in a particular year level. After having specific number of classes with students, both formative and summative assessments are conducted which tracks the growth of the students.

3) Resources – While developing the curriculum, various resources are also considered which can help in student engagement and also in doing hands-on activities. This will help students to gain theoretical as well as practical knowledge on the topic and gamification engages students more during the sessions and help them in better understanding of the concepts.

4) Project based learning - Project-based learning is a constructivist pedagogy that intends to bring about deep learning by allowing learner to use an inquiry-based approach to engage with issues and question that are rich, real, and relevant to the topic being studied. Project based learning has roots in constructivist learning and discovery-based methods, both of which rely on the inquiry process and students' ability to devise solutions based on their individual perspective and thinking.

5) Student Reflection – A survey is conducted at the end of each term to understand the satisfaction level of students in understanding the topic. The questionnaire will be consist of questions with a 5–point Likert scale from highest to lowest. The statement from the questionnaire will focus on the participants' satisfaction and feelings towards the activities they had studied. The three experts will check the content validity. The researcher will pilot the students' satisfaction questionnaire before using as the research instrument.

Data Collection

Data collection will be as follows:

1) Prior to instructional period, the participants will be asked to do a pre-test which will include the whole curriculum to be taught during the session year. This test is named as baseline test which gives an understanding how much students already know before starting the year level and how much they have retained from the previous year level.

2) The participants will have 3 classes per week of 50 minutes each. This study will be conducted over a period of one term which is approximately 10 weeks including assessment and remedial week at the end of the term.

3) The participants will be asked to rate their satisfaction on the curriculum after they finish one full term through students' self-reflection form.

4) The participants will take the formative and summative assessment in the week after the instructional period. The total possible score of each test will be 10 points at an average. The scores will be evaluated through growth task which will be a formative assessment to understand

how much students are able to do application based questions and pen and paper test summative assessment to assess their theoretical knowledge.

Data analysis

The data will be analyzed into three parts as follows

1. A survey is conducted before developing the lesson plan to understand the diverse needs of the students since in my school where participants are taken as samples comes from different community and cultural backgrounds. School has mix students from different countries and culture.

2. To analyze the scores from both pre-test and post-test, the scores from pre-test and post-test will be converted into mean scores and standard deviations. Then the mean scores and standard deviations will be calculated to determine whether the mean scores of the pre-test and post-test are significantly different by using Wilcoxon signed ranks test statistics to compare student computing skills as per the year level before and after learning by Lesson plans through engaging classroom resources.

2. To investigate students' satisfaction towards the activities, the results from the 5-point Likert scale will be analyzed by comparing the frequencies and converting them into percentages and mean. Students' self-rating scores from the satisfaction questionnaire will be analyzed and calculated for mean and standard deviation then interpreted into five level as follows:

Score Level

0 - 0.99	=	Highly unsatisfied
1.00 – 1.99	=	Unsatisfied
2.00 – 2.99	=	Average
3.00 – 3.99	=	Satisfied
4.00 – 4.99	=	Very satisficed

References:

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