

# Analysing the efficacy of UML in explaining object-oriented concepts to undergraduate computer science students

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**Abstract**—This study used the undergraduate course Object-Oriented Analysis and Design as a case study to assess how the depth of knowledge of object-oriented concepts was developed in preparation for learning the Unified Modeling Language (UML). Two surveys were conducted to assess student learning. The first survey identified the concepts of object orientation that students should be aware of while taking object-oriented courses. The second survey examined the depth of knowledge gained from learning UML. The results show that teaching UML significantly increases students' knowledge of UML compared to just learning it in object-oriented courses. This study concluded with reflections on the effectiveness of UML as an approach to developing the concept when taught at the undergraduate level.

**Index Terms**—Object-oriented concept, UML, Statistical data, Qualitative analysis

## I. INTRODUCTION

UML stands for Unified Modeling Language and is very popular for modeling business systems and helps in the analysis, design, and implementation of any system. It combines the best diagramming practices used by software developers or analysts. It gives the software developer the freedom to design the system according to his own preferences and techniques while ensuring that he understands the requirements properly. Object-oriented programming is a challenging task for undergraduate programs, as it extends to all tertiary educational institutions. Several courses are offered in undergraduate computer science programs that cover OOP concepts as well as languages such as Java, and C++ [1], [2]. In the undergraduate

computer science curriculum, UML is taught in the Object-Oriented Analysis and Design (OOAD) course [3]. Philip and Bruhn explained the effectiveness of UML in teaching the OOAD course. By using UML, students are actively engaged in the learning process, and it increases their interest in creating a more complete picture of a problem through diagrams [4], [5].

As in other universities, the undergraduate computer science program (CS) of American International University-Bangladesh (AIUB) covers both UML and object-oriented concepts. Students in the undergraduate CS program take several courses based on the object-oriented concept. In the Department of Computer Science curriculum, there is a course titled “Object-Oriented Analysis and Design” that covers details of UML [3]. In this research, we aimed to find out if the use of UML has an impact on the understanding of the object-oriented concept. Therefore, this work mainly focuses on the understanding of the object-oriented concept among undergraduate students who use UML.

In this article we evaluated how UML improves the understanding of the object-oriented concept. The empirical study addresses the following research questions:

- 1) RQ1: Do students who do not know UML have a good understanding of object orientation?
- 2) RQ2: Does knowledge of UML have an impact on understanding of object-oriented language?