The Impact of Integrating an Intelligent Personal Assistant (IPA) on Secondary School Physics Students' Scientific Inquiry Skills

Nurfaradilla Mohamad Nasri 🔍 Nurfarahin Nasri, Nur Faraliyana Nasri, and Mohamad Asyraf Abd Talib

Abstract-Intelligent personal assistants (IPAs) carry massive potential in enhancing students' performance through individuadized dynamic scaffolding strategy. Despite IPAs being increasingly recognized among educationists, little is known about their application in the development of students' scientific inquiry skills. particularly in physics. This study integrated the use of Apple's Siriin physics learning and examined the impact on secondary school student's scientific inquiry skills, and how these interactions affect their learning experiences. This mixed-method study conducted two field quasi-experiments (School A: science boarding school; School B: vocational boarding school) and post-experimental focus group discussions. Each school had two classes that were randomly assigned as experimental and control groups. The quantitative data showed that the experimental groups developed significantly higher scientific inquiry skills in comparison to the control groups (School A: p = 0.050; School B: p < 0.001) with moderate (d = 0.62) to large effect size (d = 1.82). The qualitative data further revealed the perceived ability of the IPA to support students' individualized learning by providing timely scaffolding. This study offers substantial empirical data to support the effectiveness of the IPA in increasing secondary school students' achievement in physics and scientific inquiry skills.

Index Terms—Individualized dynamic scaffolding, intelligent personal assistant (IPA), scientific inquiry skills, secondary school physics learning.

I. INTRODUCTION

ODAY, more important than ever, educators carry immense responsibility to prepare a highly competent workforce that is capable of making informed decisions and actions based on critical analysis of scientific-based information. By driving revolutionary innovation and building competitive advantage in a global economy, a focus on nurturing scientific

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This work involved human subjects or animals in its research. The author(s) confirm(s) that all human/animal subject research procedures and postocols are exempt from review board approval.

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inquiry in addition to attaining academic achievement is central in any education plan or policy. At the same time, educators face constant challenges in catching new waves of technological advancement and riding them to diversify existing pedagogical practices. In this context, there is an urgent need to integrate easily available and user-friendly technology to help educators develop scientific inquiry skills among students.

Based on the National Science Education Standards [1], scientific inquiry describes the various methods by which scientists investigate the natural world and develop understandings following the facts gained. Basic principles governing well-grounded scientific inquiry involve hands on research activities, objectivity and rigorous thinking, and most importantly, it undertakes a systematic investigation appearance. Primarily, scientific inquiry entails more than just "doing experiments" as it necessitates a high level of imagination and inventiveness [2]. However, to leverage this concept at a level appropriate for secondary schools, fundamental scientific inquiry skills are outlined as follows:

- identify a problem;
- devise a hypothesis;
- plan procedures;
- 4) carry out a scientific experiment:
- 5) gather, organize, and interpret data;
- 6) employ statistical techniques to support conclusions;
- report findings [3], [4].

A point to note, scientific inquiry varies significantly in the amount of freedom and autonomy given to the students. For this reason, scientific inquiry can be categorized into the following three main approaches:

- structured scientific inquiry, where students conduct the investigation process according to the prescribed procedure.
- guided scientific inquiry, where students investigate collaboratively with teachers;
- open inquiry, where students take responsibility and ownership to independently design the investigation procedures [5], [6].

The first two approaches place great emphasis on external forms of assistance, whereas the third approach views students as the key figure to direct their own learning, resonating valuable virtue of competent learners with high scientific inquiry skills.

In the world of mobile devices, intelligent personal assistants (IPAs) gain strong recognition due to its petential in supporting

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