

# Learning Effectiveness of Natural Science Education in the Context of Social Networks: A Case Study of Plant Identification Application

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**Abstract.** This study aims to investigate the application of plant identification apps in high school natural science education, focusing on their impact on social learning environments. Through classroom experiments and surveys among a group of high school students, we analyze the effectiveness of plant identification apps on students' botanical learning and the influence of social networks on their learning outcomes. The study finds that plant identification apps have potential applications in natural science education, enhancing students' interest and engagement in learning. Additionally, social networks play a significant role in students' learning outcomes, as the social learning environment facilitates cooperation and information sharing among students, thereby improving learning effectiveness. The findings of this study are essential for understanding the educational effects of plant identification apps within social learning environments and provide valuable insights for future research in this area.

**Keywords:** Plant Identification Applications, Natural Science Education, Social Learning Environment, Social Network Analysis

## 1 Introduction

With the advancement of technology, plant identification apps have gained attention as emerging educational tools in recent years. Botany is an essential field in high school natural science curriculum, yet traditional teaching methods often need help to engage students effectively. Therefore, this study aims to explore the application of plant identification apps in this curriculum, focusing on their role within social learning environments.

The impact of social networks on student learning has been widely recognized in recent years. In social learning environments, student interactions and collaborations facilitate knowledge sharing and exchange, enhancing learning outcomes. Thus, we will investigate the influence of social networks on students' botanical learning, particularly the potential social learning effects brought by plant identification apps in this process.

This study aims to understand further the impact of plant identification apps within social learning environments on high school students' natural science education. Through observation and analysis of teaching practices, we aim to identify the application value of plant identification apps in education and provide theoretical and practical foundations for improving relevant teaching methods in the future.

The main research questions of this study are as follows:

- (1) The impact of plant identification app interface design on learning effectiveness
- (2) The influence of social networks on collaborative learning behaviors

## 2 Literature Review

### 2.1 Plant Recognition Applications and Artificial Intelligence

With the widespread use of smartphones and mobile technology, plant identification apps have attracted considerable attention in education. Researchers have begun to explore the potential applications of these apps in teaching and their impact on student learning outcomes. Buck et al. (2019) investigated the application of plant identification apps in education and found that they could stimulate students' interest in natural science and provide an interactive learning experience [4]. In addition, Catal & Tekinerdogan (2019) conducted a study that showed how augmented reality-related programs could enhance learners' learning outcomes [5]. Mech et al. (2022) indicated that integrating plant identification apps into science education could promote students' active learning and inquiry spirit, which includes increasing learning interest and curiosity [10]. Boho et al. (2020) found that as plant image digitization becomes increasingly important, given a large number of images, deep learning algorithms can be trained to identify plants and automatically provide educational institutions with more resources [3]. Furthermore, attention to design and aesthetics in applications also affects learning effectiveness. Ruf et al. (2022) found that aesthetic design positively impacts students' learning. With the development of artificial intelligence, the emergence of A.I. recognition technology has brought new possibilities for plant identification [13]. Traditional applications mainly rely on users manually taking plant photos for comparison. At the same time, AI recognition technology can achieve faster and more accurate identification by analyzing image features and comparing them with large databases. For example, studies have found that a deep learning-based plant identification system significantly improves recognition accuracy and speed, enhancing learners' learning effectiveness [15] [14]. Compared to traditional plant identification apps, A.I. recognition technology offers higher accuracy and efficiency, which is crucial for student learning. Firstly, A.I. recognition technology can provide more accurate plant identification results, helping students recognize and understand the characteristics of different plants, thereby deepening their understanding of plant diversity and ecosystems [6].

Overall, plant identification apps demonstrate many potential educational advantages, including stimulating student interest, enhancing learning effectiveness, promoting active learning, and providing field experiences.

## 2.2 The application and impact of collaborative learning

Social learning-related applications are increasingly crucial in natural science education, attracting extensive attention from researchers and educators. Mondahl & Razmerita (2014) pointed out that students can collaborate, interact, and share knowledge through social media and various social learning platforms, enhancing their learning experience [11]. Research by Qureshi et al. (2023) further explored the impact of collaborative learning applications on student classroom participation, finding that these applications could increase student engagement and enthusiasm [12]. In addition, studies have revealed the effectiveness of social learning applications in education, but specific conditions are required to achieve this [8].

In summary, social learning-related applications can improve student learning outcomes and participation in natural science education. However, further research and practice are needed to overcome existing challenges and maximize the advantages of these applications.

## 2.3 Social Networks

The application of social networks in digital learning has become a significant focus in education. This application includes various online platforms and tools, such as social media, discussion forums, and collaboration tools, primarily aimed at facilitating student communication, collaboration, and learning. Through these social network platforms, students can share ideas, discuss issues, and interact with peers or experts worldwide [2]. Social network platforms also provide educators a convenient way to share teaching resources, design courses, and communicate with students. Educators can maintain close contact with students through these platforms, providing timely guidance and support to facilitate learning. Ahmed & Opoku (2022) found that during the COVID-19 pandemic, technology-assisted educational methods could provide rich multimedia teaching resources, such as instructional videos, online exercises, and interactive simulations, to help students vividly understand and master knowledge [1]. Additionally, research suggests that future applications in education will be more personalized [9]. With the advancement of artificial intelligence, these applications will be more personalized and enhance learning functionality.

In conclusion, using social networks in digital learning provides students and educators many opportunities and challenges. Further research and practice are needed to maximize the potential of social network platforms in digital learning while addressing related issues and challenges, thereby promoting the development and progress of education.

### 3 Methodology

Through focus group interviews, this study invited 40 high school students from different grades and backgrounds to participate, to gain insights into their views and experiences regarding using learning apps for education. To ensure the effectiveness and objectivity of the research, we divided the participants into four different cohorts, labeled as A.B.C.D., each consisting of 10 participants, and conducted focus group interviews. In each cohort's focus group interview, we adhered to relevant norms of focus group interviews to ensure the validity and reliability of the research. These norms included ensuring voluntary participation, establishing an open, trusting, and respectful interview atmosphere, and encouraging participants to share their thoughts and feelings. During the interviews, researchers encouraged participants to engage in free discussion and communication while maintaining a neutral and objective attitude, avoiding subjective evaluations of participants' viewpoints.

Through these four cohorts of focus group interviews, we collected rich data, gaining in-depth insights into high school students' views and experiences regarding using learning apps. This data will help us further understand students' learning needs and expectations and propose corresponding improvements and suggestions to enhance student's learning effectiveness and satisfaction.

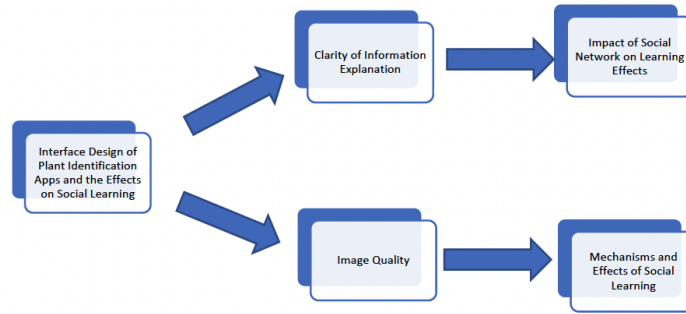


Fig. 1. Research Framework

## 4 Findings and Results

### 4.1 Positive Impact of Plant Identification App Interface Design on Learning Effectiveness

Through focus group interviews, we found that the interface design of plant identification apps positively impacts learning effectiveness. Participants unanimously agreed that excellent interface design can enhance learning efficiency

and satisfaction, making it easier for students to understand and apply learning content. The following are opinions from three interviewees, demonstrating this result:

The interface design of this plant identification app is intuitive and user-friendly. I can easily find the functions I need and quickly identify plants. This makes my learning process more efficient, as I can focus more on the learning content rather than wasting time on interface operations." (Focus group interviewee A-8)

"The interface design of this app is very aesthetically pleasing and friendly. It uses rich images and visual elements, making learning more vivid and interesting. When I use this app, I feel like I'm in an interactive library where I can easily explore information about various plants. This makes me passionate about learning. (Focus group interviewee C-3)

"The interface design of this plant identification app considers the needs of different age groups and learning styles. It provides various learning modes and interactive methods, allowing students to learn according to their preferences and abilities. Such design helps increase student engagement and initiative, enhancing learning effectiveness." (Focus group interviewee D-9)

These opinions from the interviewees demonstrate the positive impact of plant identification app interface design on improving learning effectiveness. They unanimously believe that excellent interface design can enhance students' learning experience, efficiency, and satisfaction, thereby promoting the understanding and application of knowledge.

#### **4.2 Positive Influence of Social Networks on Collaborative Behaviors**

Through focus group interviews, this study also found that the social networks within plant identification apps positively influence collaborative behaviors. Participants unanimously agreed that interactions among students increased during the use of this app, which facilitated collaborative learning and knowledge sharing, thereby improving learning outcomes. The following are insights from the participants, further demonstrating this research finding:

"Using this plant identification app, I found that interactions with my classmates increased significantly. We discuss using the app to identify plants and share our experiences and discoveries. This interaction makes learning more interesting and helps us better understand and remember learning content." (Focus group interviewee B-10)

"During the use of this app, my classmates and I have established a supportive learning community where we help and support each other.

We encourage each other and share resources to solve problems and challenges together. This makes me feel less lonely, and learning becomes more motivating and effective." (Focus group interviewee D-5)

The social networks within plant identification apps positively impact students' collaborative behaviors. Through communication and interaction with peers and teachers, students can explore and learn together, deepening their understanding and application of learning content. This helps establish learning communities and enhance students' learning effectiveness. (Focus group interviewee C-2)

These insights from the participants indicate that the social networks within plant identification apps positively influence collaborative behaviors. They unanimously believe that interaction and communication with peers and teachers contribute to deeper learning and improved effectiveness. Therefore, establishing and developing social networks play a positive role in students' learning effectiveness and outcomes when using plant identification apps.

## 5 Discussion and Conclusion

In this study, we investigated the application of plant identification apps in natural science education and conducted in-depth research on the impact of their interface design and social networks. Based on our research findings, we draw the following two conclusions:

Firstly, the interface design of plant identification apps significantly impacts the effectiveness of natural science education. This study found that interface design quality directly affects students' learning outcomes. In particular, the quality of images and clarity of information descriptions are vital factors influencing students' learning effectiveness. When images are clear and information descriptions concise, students find it easier to understand and identify plants, improving learning efficiency and outcomes.

Secondly, social networks play an essential role in plant identification apps. This study found that within plant identification apps, students' information interaction increased, which promoted cooperation and discussion among students. Through social learning, students can quickly share observations and experiences, deepening their understanding and memory of botany. Therefore, the social learning effect in plant identification apps can play a mechanism and role, positively impacting students' botanical learning.

In summary, the results of this study emphasize the importance of plant identification apps in natural science education and highlight the impact of interface design and social networks on students' learning outcomes. We recommend that educators and developers focus on interface design quality and establishing social learning mechanisms to enhance the educational effectiveness of plant identification apps and students' learning experiences. Future research can explore interface design and social learning mechanisms within plant identification apps and their long-term effects on students' learning outcomes.

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