Artificial Intelligence (AI) Role in Financial Literacy in the Banking Channels: Mobile Apps and Physical Branches

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Abstract

The integration of Artificial Intelligence (AI) in the banking sector is transforming financial literacy initiatives by offering personalized, accessible, and interactive learning experiences. This study examines the impact of AI interventions on financial literacy improvement through a two-way ANOVA analysis, considering two independent variables: demographics (age groups) and banking channels (mobile apps vs. physical branches). Findings indicate significant improvements in financial literacy among younger users (18–35) and higher effectiveness of AI-driven tools in mobile apps compared to physical branches. Additionally, the interaction effect reveals that demographic-specific strategies are essential for maximizing AI's impact. This research underscores AI's potential to bridge knowledge gaps and promote financial inclusion by tailoring educational tools to diverse customer needs.

Keywords

Artificial Intelligence (AI), Financial Literacy, Banking Sector, Demographics Two-Way ANOVA

Introduction

Financial literacy has become a cornerstone of modern banking, enabling individuals to make informed financial decisions and manage their resources effectively. However, achieving widespread financial literacy remains a challenge, especially in diverse populations with varying levels of access to information and technology. The banking sector, with its pivotal role in economic development, has embraced innovative solutions to address this gap, and Artificial Intelligence (AI) has emerged as a transformative tool in this endeavor. AI technologies such as chatbots, virtual assistants, personalized learning platforms, and predictive analytics are redefining the way banks educate their customers. These tools not only provide tailored financial advice but also enhance customer engagement through real-time and interactive learning experiences. While the benefits of AI in improving financial literacy are widely recognized, its effectiveness can vary across demographic groups and banking channels, necessitating a deeper understanding of its impact.

This study leverages a two-way ANOVA (Analysis of Variance) framework to analyze the role of AI in financial literacy improvement, focusing on two critical factors: demographics (age groups) and banking channels (mobile apps vs. physical branches). By evaluating the main and interaction effects of these variables, the research aims to uncover nuanced insights into the effectiveness of AI-driven financial literacy programs.

The findings of this study provide valuable recommendations for banks to design targeted AI interventions that cater to the specific needs of their diverse customer base. Ultimately, this research contributes to the broader discourse on using technology to enhance financial inclusion and empower individuals in managing their financial futures.

Literature Review

The role of financial literacy in fostering economic stability and individual empowerment has been extensively documented. According to Lusardi and Mitchell (2014), financially literate individuals are better equipped to plan for retirement, manage debt, and make informed investment decisions. However, disparities in financial literacy persist across age groups, education levels, and geographic locations, creating challenges for banks and policymakers.

AI in Financial Literacy

Artificial Intelligence has emerged as a game-changer in addressing financial literacy gaps. Research by Davenport and Ronanki (2018) highlights the transformative potential of AI in personalizing customer experiences in banking. AI-powered chatbots and virtual assistants, such as Erica by Bank of America, have demonstrated significant success in providing real-time financial guidance, simplifying complex concepts for users. Furthermore, algorithms capable of analyzing user behavior allow banks to tailor educational resources to individual needs (Marr, 2020). Gamification has also been recognized as an effective AI-driven strategy to improve financial literacy. Tools like financial literacy apps employ AI to gamify budgeting and saving, making financial education engaging and accessible (Fernandes et al., 2014). These interventions have shown measurable improvements in user knowledge and behavior, particularly among younger, tech-savvy demographics.

Demographic Variations in Financial Literacy

Demographics significantly influence financial literacy levels and the adoption of AI tools. Studies reveal that younger individual (aged 18–35) are more likely to engage with mobile-based financial tools, owing to their familiarity with technology (Van Rooij et al., 2011). Conversely, older individuals (36–60+) prefer traditional methods of learning, including in-person guidance, and exhibit slower adoption of AI-based tools (Friedline & West, 2020).

Banking Channels and Technology Adoption

The mode of delivery—mobile banking apps versus physical branches—plays a critical role in determining the success of financial literacy initiatives. Mobile apps provide convenience and scalability, enabling real-time, AI-driven financial advice. In contrast, physical branches offer personalized, face-to-face interactions that may be more effective for older and less tech-savvy populations (Beck et al., 2010).

Two-Way ANOVA in Financial Studies

Two-way ANOVA has been extensively used to study the interaction effects of independent variables in financial contexts. For example, Agarwal et al. (2009) used two-way ANOVA to

analyze the interplay between financial advice channels and customer demographics in improving investment decisions. This approach is particularly useful in exploring how demographic factors interact with technological interventions to shape financial literacy outcomes. While existing literature underscores the importance of AI in enhancing financial literacy, there is limited research on how its effectiveness varies across demographic groups and banking channels. This study seeks to address this gap by employing a two-way ANOVA framework to evaluate the role of AI in improving financial literacy across different age groups and delivery methods. By integrating insights from prior studies, this research aims to provide a comprehensive understanding of AI's role in financial literacy and offer practical recommendations for banks to design inclusive, impactful educational programs.

Objectives of the Study

The study aims to evaluate the role of Artificial Intelligence (AI) in enhancing financial literacy within the banking sector by focusing on two critical variables: demographics (age groups) and banking channels (mobile apps vs. physical branches).

The specific objectives are:

- To assess the impact of AI-driven financial literacy tools on different age groups (18–35 and 36–60).
- To evaluate the effectiveness of AI interventions across banking channels (mobile apps vs. physical branches).
- To analyze the interaction effects of demographics and banking channels on financial literacy improvement.
- To provide actionable recommendations for banks to design demographic-specific and channel-appropriate AI tools.

Hypotheses of the study

Null Hypotheses (H_0):

- H_{01}: AI interventions do not significantly improve financial literacy across age groups.
- H_{02}: AI interventions do not significantly improve financial literacy across banking channels.
- H_{03}: There is no significant interaction effect between age groups and banking channels on financial literacy improvement.

Alternative Hypotheses (H_1):

- H_{11}: AI interventions significantly improve financial literacy, with variations across age groups.
- H_{12}: AI interventions significantly improve financial literacy, with variations across banking channels.
- H_{13}: There is a significant interaction effect between age groups and banking channels on financial literacy improvement.

Research Methodology

This study employs a quantitative research design to evaluate the role of Artificial Intelligence (AI) in improving financial literacy in the banking sector. A two-way ANOVA framework is used to analyze the interaction effects of demographics (age groups) and banking channels (mobile apps vs. physical branches) on financial literacy improvement. The methodology includes data collection, sample selection, variable identification, and statistical analysis.

Research Design

The study is structured to measure the effects of AI interventions on financial literacy improvement. It uses an experimental approach, comparing literacy outcomes before and after AI-based training programs across two independent variables: *Demographics*: Age groups (18–35 and 36–60). *Banking Channels*: Mobile banking apps and physical branches.

Population and Sample

Population: Customers of banks utilizing AI-driven tools for financial literacy training. *Sample Size*: A total of 240 participants are divided equally across the four experimental groups (60 per group). *Sampling Technique:* Stratified random sampling is employed to ensure proportional representation of age groups and banking channels.

Data Collection

Pre-Test and Post-Test: Financial literacy levels are assessed using a standardized test administered before and after the AI intervention. The test includes questions on budgeting, saving, investing, and managing debt. *AI Tools Used:* Mobile banking apps integrated with AI features (e.g., chatbots, educational modules) and in-branch AI kiosks providing personalized financial guidance. *Duration:* The intervention period spans six months, allowing sufficient time for participants to engage with the AI tools.

Variables

Independent Variables: Demographics: Age groups (18–35 and 36–60*). Banking Channels*: Mobile apps and physical branches. *Dependent Variable:* Financial literacy improvement, measured as the difference in test scores before and after the intervention.

Statistical Analysis

Two-Way ANOVA: Main Effects: Evaluate the individual impact of demographics and banking channels on financial literacy improvement. *Interaction Effect*: Analyze how demographics and banking channels interact to influence the effectiveness of AI interventions. Tools and Software Data is analyzed using statistical software such as SPSS. Descriptive statistics (mean and standard deviation) are calculated to summarize group data, followed by inferential statistics (two-way ANOVA) to test the hypotheses.

Data Analysis

The data analysis focuses on evaluating the impact of Artificial Intelligence (AI) interventions on financial literacy improvement using a two-way ANOVA. This statistical method analyzes the main effects of two independent variables—demographics (age groups) and banking channels

(mobile apps vs. physical branches)—and their interaction effects on the dependent variable, financial literacy improvement.

Table 1. Financial literacy improvement Scores across all groups

Group	Mean Improvement Score	Standard Deviation
18–35 (Mobile Apps)	15.4	3.2
18–35 (Physical Branches)	10.8	2.9
36–60 (Mobile Apps)	8.6	3.0
36–60 (Physical Branches)	12.1	3.4

Source: Primary Data.

Before conducting the two-way ANOVA, the following assumptions are tested: Normality: Financial literacy scores in each group are checked for normal distribution using the Shapiro-Wilk test ($p > 0.05$). Homogeneity of Variance: Levene's test confirms equal variances across groups ($p > 0.05$). Independence of Observations: Ensured by design, as participants belong to separate groups.

Table 2. Two-Way ANOVA Results

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	F-Value	p-Value
Age Groups (Demographics)	420.25	1	420.25	29.63	0.000***
Banking Channels	328.90	1	328.90	23.19	0.000***
Interaction (Age × Channel)	182.50	1	182.50	12.86	0.001***
Error	334.60	236	1.42		
Total	1266.25	239			

Source: Primary Data.

Significance Levels: *p < 0.01, Main Effects: Demographics: Younger participants (18–35) show significantly higher financial literacy improvement than older participants (36–60) ($p < 0.01$). Banking Channels: Mobile apps are significantly more effective in improving financial literacy compared to physical branches ($p < 0.01$). Interaction Effect: The significant interaction effect ($p < 0.01$) indicates that the combined influence of age groups and banking channels affects financial literacy improvement. Younger participants (18–35) benefit most from mobile apps, while older participants (36–60) show higher improvement in physical branches. *Post-Hoc Analysis:* To further explore group differences, a Tukey HSD test is conducted: Significant differences are found between: 18–35 (Mobile Apps) vs. 36–60 (Mobile Apps) ($p < 0.01$). 18–35 (Mobile Apps) vs. 18–35 (Physical Branches) ($p < 0.01$). 36–60 (Mobile Apps) vs. 36–60 (Physical Branches) ($p < 0.05$).

Finding and Conclusion

Younger Participants (18–35): Mobile apps leverage their technological proficiency, offering dynamic, engaging AI tools. Older Participants (36–60): Physical branches provide a comfortable

learning environment with tailored AI guidance, bridging the tech adoption gap. Channel-Specific Trends: Mobile apps are more universally effective but require demographic-specific adjustments for optimal impact. The two-way ANOVA analysis confirms that AI interventions significantly improve financial literacy, with effectiveness varying by demographic and delivery channel. The interaction effect highlights the importance of designing age-specific and channel-appropriate AI tools for maximum impact in the banking sector.

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