



Teachers' Familiarity with Machine Learning Concepts and Their Acceptance of Predictive Learning Technologies in a Technical College in Sichuan Province, China

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Abstract: This study investigates the relationship between teachers' familiarity with machine learning (ML) concepts and their acceptance of predictive learning technologies (PLTs) at Sichuan Automotive Vocational and Technical College in China. A descriptive-comparative-correlational research design was employed, collecting data from 350 teachers via a structured questionnaire. Results indicated that teachers possessed only a slight familiarity with core ML concepts and a slightly accepting attitude towards PLTs. A very strong, statistically significant positive correlation was found between ML familiarity and technological acceptance. Furthermore, demographic factors such as education level and years of service significantly influenced both familiarity and acceptance. The findings highlight a critical need for targeted professional development programs that not only build foundational ML literacy but also address practical application and ethical concerns to foster greater adoption and effective use of predictive technologies in the classroom.

Keywords: machine learning, technology attitude, technology cognition, data Literacy

Introduction

The integration of machine learning (ML) into education has created new avenues for predictive learning technologies (PLTs), which assist teachers in personalizing instruction and improving student outcomes. However, the success of these tools hinges largely on teachers' familiarity with ML concepts and their willingness to accept and use such innovations. Recent studies highlight a significant gap between teachers' theoretical understanding of ML and their actual usage of predictive technologies in classrooms (Jeong et al., 2022; Saripah & Kurniawan, 2023). Teachers equipped with foundational ML knowledge tend to exhibit higher confidence and trust in these technologies, which facilitates smoother adoption. Conversely, those lacking such familiarity often perceive predictive tools as opaque or overly complex, which hinders integration efforts (Nakamura & Faisal, 2021).

Emerging research links teachers' familiarity with machine learning and their acceptance of predictive tools to improved student learning outcomes. Yeh and Hsu (2023) found that teachers with a basic understanding of machine learning concepts were better able to interpret analytical data and provide personalized interventions, thereby improving student engagement and academic achievement. Similarly, a longitudinal study by Dinh and Bui (2024) demonstrated that teachers with machine learning literacy were able to effectively use predictive techniques to identify students at risk of academic failure, enabling timely remediation and reducing dropout rates. These findings suggest that machine learning literacy not only empowers teachers to adopt technology but also maximizes its effectiveness in teaching.

Despite the significant advantages of machine learning technology, numerous barriers remain preventing teachers from acquiring machine learning knowledge and embracing AI-driven predictive technologies. Common barriers include limited time, insufficient training resources, and concerns about job loss due to automation (Lim & Tran, 2021; Sutrisno & Yanti, 2023). Cheng and Lam (2022) reported that fear of being replaced by AI systems negatively impacted teachers' motivation to participate in machine learning training. These emotional and psychological barriers must be addressed alongside technical skills development to encourage positive attitudes. Initiatives involving transparent communication about the complementary role of AI, ethical considerations, and collaborative learning communities have proven effective in alleviating resistance (Nguyen & Pham, 2023).

Prior research, such as that by Jeong et al. (2022) in Korea or Nakamura & Faisal (2021) in Malaysia, offers valuable insights but may not account for the unique institutional, cultural, and pedagogical landscape of Chinese technical colleges. There is a lack of empirical studies that quantitatively measure the levels of ML familiarity and PLT acceptance among Chinese vocational instructors and examine the precise correlation between these two variables. This study aims to address this gap by investigating the relationship between teachers' familiarity with ML concepts and their acceptance of PLTs at a technical college in Sichuan Province, China, to provide data-driven insights for crafting effective, context-specific teacher training and technology integration programs.



Literature Review

The convergence of machine learning (ML) and predictive learning technologies (PLT) is reshaping modern education, enabling personalized instruction and early intervention strategies. Teachers' familiarity with core ML concepts significantly influences their acceptance and effective use of these technologies. Understanding teachers' understanding and attitudes toward ML is crucial for the successful implementation of PLT.

Research indicates that teachers' understanding of ML varies widely, largely depending on their access to professional training and institutional support. Schools that invest in professional development in artificial intelligence and data analytics tend to have educators who are more open and confident in using PLT. Without sufficient understanding, teachers may be reluctant to trust and integrate these technologies, reducing their potential impact on student learning (Lim & Quang, 2021). The Technology Acceptance Model (TAM) remains an important framework for examining factors influencing teacher acceptance of PLT. Research by Chua and Setiawan (2023) indicates that perceived usefulness and ease of use are key predictors of adoption. Furthermore, Southeast Asian cultural values, such as an emphasis on group harmony and authority, can moderate teachers' responses to new educational technologies (Sari & Nguyen, 2022).

Several studies have reported concerns about data privacy, algorithmic bias, and transparency (Tanaka & Vu, 2024; Do & Saito, 2023). These ethical issues can impact teachers' confidence in PLTs and their willingness to fully utilize these tools. Addressing these issues through policies and clear communication is crucial for the sustained adoption of PLTs.

A significant portion of educators in the region possess only basic knowledge of machine learning (ML), such as classification algorithms and data interpretation (Koh & Tran, 2023). This limited familiarity hinders their ability to critically evaluate predictive analytics and effectively apply them in teaching. Therefore, there is an urgent need for accessible instructional materials tailored to teachers' needs. Interactive professional development programs that combine theory and practice have proven effective in improving teachers' knowledge of machine learning and their acceptance of programmable logic learning tools (PLTs) (Yeo & Matsumoto, 2022). Workshops simulating classroom scenarios using PLTs allow educators to experience the benefits and challenges of these tools firsthand (Nguyen & Okada, 2021). However, disparities in resource availability limit the scale of such initiatives in some regions.

Statement of problems

This study will determine the teachers' familiarity with machine learning concepts and their acceptance of predictive learning technologies in Sichuan Automotive Vocational and Technical College in Mianyang City, Sichuan Province, China. The results of the study will be used as a basis for an AI and machine learning curriculum integration program. Specifically, the study will answer the following questions:

1. What is the demographic profile of the teacher respondents in terms of:
 - 1.1. sex;
 - 1.2. age;
 - 1.3. educational attainment;
 - 1.4. length of service; and
 - 1.5. number of seminars attended related to the topic?
2. What is the self-assessment of the teacher respondents of their familiarity in machine learning concepts in terms of:
 - 2.1. basic understanding of machine learning;
 - 2.2. knowledge of types of machine learning;
 - 2.3. awareness of common algorithms and techniques;
 - 2.4. application of machine learning in education;
 - 2.5. hands-on experience or exposure;
 - 2.6. confidence in explaining ML concepts; and
 - 2.7. interest in further learning?
3. Is there a significant difference in the self-assessment of the teacher respondents of their familiarity in machine learning concepts when they are grouped according to their profile?
4. What is the self-assessment of the teacher respondents of their acceptance of predictive learning technology in terms of:
 - 4.1. perceived usefulness;
 - 4.2. perceived ease of use;
 - 4.3. attitude toward technology;
 - 4.4. confidence in using predictive learning technology;
 - 4.5. perceived impact on workload;
 - 4.6. trust and reliability; and
 - 4.7. intention to use?
5. Is there a significant difference in the self-assessment of the teacher respondents of their acceptance of predictive learning technology when they are grouped according to their profile?
6. Is there is significant relationship between the teachers' familiarity with machine learning concepts and their acceptance of predictive learning technologies?

Research Design

This study employed a descriptive-comparative-correlational approach, characterized by clear variable identification, rigorous data collection, comprehensive analysis, and a deep understanding of contextual influences. According to Choi

and Lim (2023), descriptive research systematically examines and documents the underlying characteristics, behaviors, and contextual patterns of naturally occurring phenomena. This approach is crucial for accurately and meticulously depicting social realities, thereby laying a solid foundation for further empirical research.

This study aimed to investigate faculty respondents' familiarity with machine learning concepts and their acceptance of predictive learning technologies.

This research approach enabled researchers to conduct numerical, comparative, and correlational analyses of the relationships between the dependent variables involved in the study.

This approach enabled researchers to identify significant differences or correlations between faculty respondents' self-assessed familiarity with machine learning concepts and their demographic characteristics (e.g., age, gender, education, years of service, and number of workshops on related topics). Furthermore, researchers were able to identify significant differences or correlations between faculty respondents' self-assessed acceptance of predictive learning technologies and their demographic characteristics (e.g., age, gender, education, years of service, and number of workshops on related topics). The researchers then correlated the faculty respondents' self-assessed familiarity with machine learning concepts with their acceptance of predictive learning techniques.

Research Location

The study will be done in Sichuan Automotive Vocational and Technical College in Mianyang City, Sichuan Province, China.

Sichuan Automotive Vocational and Technical College is a full-time private general higher vocational college located in Fucheng District, Mianyang City, Sichuan Province. Its predecessor was Sichuan Mianyang Transportation School, established in 1979, and was upgraded to a vocational college in 2012 with the approval of the Sichuan Provincial People's Government.

In terms of teaching staff, the school has 595 full-time teachers, including 145 with senior professional titles and 207 with intermediate professional titles. The proportion of "dual teacher" teachers is 55%, and experts from both inside and outside the province and top skilled talents from enterprises are hired to teach part-time. The school has deepened its cooperation with more than 200 enterprises such as Mercedes Benz, BMW, BYD, and China National Heavy Duty Truck Group to jointly establish "order classes" and implemented a dual education model of "school in factory, factory in school". The employment rate of graduates has remained above 98% for several consecutive years, and the high-quality employment rate has exceeded 80%. In addition, the school provides a pathway for upgrading from vocational to undergraduate programs (connecting with undergraduate institutions such as Southwest University of Science and Technology and Mianyang Normal University), and engages in international exchange and cooperation with universities such as Gangwon University in South Korea and the University of the Arts in Thailand to support students' overseas internships and further studies. It has successively won the honors of "National exemplary organization of Vocational Education", "National Automobile Training Base", and "the first batch of pilot units of modern apprenticeship in Sichuan Province".

Sampling Method

The respondents of the study will be coming from the 595 teachers from Sichuan Automotive Vocational and Technical College in Mianyang City, Sichuan Province, China. In selecting the 234 teacher respondents, stratified random sampling technique will be used among the teacher respondents.

Stratified random sampling is a method of sampling that involves the division of a population into smaller groups known as strata. In stratified purposive sampling, or stratification, the strata are formed based on members' shared attributes or characteristics. For the computed needed respondents, of the 595 teachers, using 5% of margin of error, 234 teachers will be randomly selected as the respondents.

Research Instruments

After collecting the required data, researchers will develop a custom questionnaire to survey faculty respondents about their self-assessment of their familiarity with machine learning concepts and their acceptance of predictive learning technologies.

The questionnaire will be administered face-to-face or on-site.

The questionnaire consists of the following sections:

Part I: This section determines the demographic characteristics of faculty respondents.

Part II: This section determines the faculty respondents' familiarity with machine learning concepts.

Part III: This section determines the faculty respondents' acceptance of predictive learning technologies.

The adapted questionnaire and the researcher-developed questionnaire will undergo content validation by experts in the research field. The experts' suggestions will be incorporated into the questionnaire instrument.

The same questionnaire instrument will be submitted to at least five experts for face-to-face validation. The questionnaire will undergo preliminary testing to assess reliability. Cronbach's alpha will be calculated using the Statistical Package for the Social Sciences (SPSS) software. The researchers welcome suggestions from the experts and will make necessary revisions to ensure the validity of the instrument.

The overall reliability of the questionnaire is Cronbach's alpha = 0.981, indicating high consistency across all items. The reliability test results showed that the research instrument was statistically reliable.

Ethical Considerations

Researchers will constructively consider and diligently adhere to ethical considerations necessary to protect the rights of all respondents. These ethical considerations are as follows:

1. Conflict of Interest

Researchers for this study will ensure that there are no conflicts of interest. Researchers will explain the purpose of this study in detail and clearly to selected respondents. Researchers must also adhere to the purpose of collecting personal information and data. All collected data must not be used for any form of exploitation of respondents. Researchers must adhere to the goals and objectives of the study.

2. Privacy and Confidentiality

Before conducting this study, we assured respondents that all collected information would remain confidential, and the results would not be disclosed to anyone other than the researchers and those completing the questionnaires. Researchers will not mention respondents' names when providing the collected data to protect their privacy. Respondents' identities will remain anonymous, and no clues or suggestions that could lead others to associate or link them to the respondents will be left.

3. Informed Consent Process

Before administering the questionnaire, researchers will obtain an informed consent form confirming that respondents understand the purpose and objectives of the study and agree that the data collected will enhance the researchers' research findings. Researchers will ensure that everything is explained clearly and comprehensively to respondents, without any deception. The researchers will also discuss the process and potential risks of participating in this study.

4. Recruitment

The participants in this study are teachers. Participants have the right to freely consent or withhold consent. Participants will not be forced to participate and have the right to refuse participation at any time.

5. Risks

The researchers will ensure that there are no risks associated with participating in this study. Participants should ensure that any data and information collected will not harm their life or reputation. Participants have the right to stop asking questions at any time if they feel harassed, the questions are too personal, or intrusive.

Results and Discussion

Frequency Distribution of the Teacher Respondents' Profile

Profile	Frequency	Percentage
Age		
More than 18 years old	350	100%
Total	350	100%
Sex		
Male	183	52.30%
Female	167	47.70%
Total	350	100%
Education		
Bachelor's degree w/ Master's units	89	25.40%
Master's degree w/ Doctoral units	40	11.40%
Doctoral degree	131	37.40%
Other (not specified)	44	12.60%
Other (not specified)	46	13.10%
Total	350	100%
Years of Service		
Less than 5 years	135	38.60%
5-10 years	121	34.60%
11-15 years	42	12.00%
16-20 years	30	8.60%

More than 20 years	22	6.30%
Total	350	100%

In terms of age, all three hundred fifty (350) or 100% of the teacher respondents are more than 18 years old. This means that the majority of the teacher respondents are adults legally eligible for employment. This illustrates that the participants in the study possess the minimum age requirement and are likely mature enough to provide credible and responsible insights into the teaching profession.

In terms of sex, one hundred eighty-three (183) or about 52.3% of the teacher respondents are female, while one hundred sixty-seven (167) or about 47.7% are male. This means that the majority of the teacher respondents are female. This illustrates a slightly higher representation of women in the teaching workforce, which aligns with the common trend of female dominance in the education sector.

As for educational attainment, eighty-nine (89) or 25.4% of the teacher respondents hold a bachelor's degree, forty (40) or 11.4% have earned master's units, one hundred thirty-one (131) or 37.4% possess a master's degree, forty-four (44) or 12.6% have earned doctoral units, and forty-six (46) or 13.1% hold a doctoral degree. This means that the majority of the teacher respondents have attained a master's degree. This illustrates that most of the respondents have pursued advanced education, suggesting a commitment to professional development and a strong foundation in their respective teaching fields.

Regarding years of service, one hundred thirty-five (135) or 38.6% of the teacher respondents have less than five years of service, one hundred twenty-one (121) or 34.6% have served for 5 – 10 years, forty-two (42) or 12% have served for 11 – 15 years, thirty (30) or 8.6% for 16 – 20 years, and twenty-two (22) or 6.3% have more than 20 years of teaching experience. This means that the majority of the teacher respondents have less than five years of service.

This illustrates that a significant portion of the teaching workforce is relatively new to the profession, which may have implications for their perspectives, training needs, and professional development priorities.

Self-Assessment of the Teacher Respondents of their Familiarity in Machine Learning Concepts in terms of Basic Understanding of Machine Learning

Item	Mean	SD	Qualitative Description	Interpretation	Rank
1. I understand what machine learning generally refers to.	2.14	1.05	Slightly True of Me	Slightly Familiar	5
2. I can distinguish between machine learning and traditional programming.	2.11	1.1	Slightly True of Me	Slightly Familiar	6
3. I know that data-driven training is involved in ML.	2.17	1.09	Slightly True of Me	Slightly Familiar	2
4. I am aware that ML is a subfield of artificial intelligence.	2.2	1.06	Slightly True of Me	Slightly Familiar	1
5. I understand that ML enables systems to learn without explicit programming.	2.15	1.07	Slightly True of Me	Slightly Familiar	4
6. I can identify real-life examples where machine learning is used.	2.16	1.06	Slightly True of Me	Slightly Familiar	3
Composite Mean	2.15	0.83	Slightly True of Me	Slightly Familiar	

Among the indicators under basic understanding of machine learning, the statement “I am aware that ML is a subfield of artificial intelligence” received the highest mean of 2.20 with a standard deviation of 1.06, interpreted as Slightly True of Me and qualitatively described as Slightly Familiar. This indicates that among the foundational concepts of machine learning, teachers are relatively more familiar with its association with artificial intelligence. This suggests that broader technological themes like AI may have been introduced to them more frequently, contributing to a slightly better grasp of ML's classification within the field.

The lowest-rated statement is “I can distinguish between machine learning and traditional programming”, which obtained a mean of 2.11 and a standard deviation of 1.10, with the same qualitative description of Slightly Familiar. This suggests that teachers are least confident in differentiating ML from conventional

programming paradigms. This may reflect a gap in technical understanding and conceptual clarity, indicating a need for targeted instructional support in fundamental computational distinctions.

The overall composite mean for the teachers' self-assessed basic understanding of machine learning is 2.15, with a standard deviation of 0.83, and is qualitatively described as Slightly True of Me, interpreted as Slightly Familiar. This reflects a generally low but present awareness of basic machine learning concepts among the teacher respondents. The findings imply that while teachers have some limited exposure to ML ideas, their familiarity remains at a superficial level, highlighting the importance of foundational training in this area.

Self-Assessment of the Teacher Respondents of their Acceptance of Predictive Learning Technology in terms of Intention to Use

Item	Mean	SD	Qualitative Description	Interpretation	Rank
1. I plan to continue using predictive learning tools in my teaching.	2.24	1.08	Slightly True of Me	Slightly Accepting	3
2. I intend to explore more features of predictive technology.	2.21	1.07	Slightly True of Me	Slightly Accepting	6
3. I will recommend predictive tools to my colleagues.	2.24	1.04	Slightly True of Me	Slightly Accepting	3
4. I am willing to invest time learning how to use these technologies.	2.28	1.1	Slightly True of Me	Slightly Accepting	1
5. I am likely to integrate predictive tools into future lesson planning.	2.2	1.06	Slightly True of Me	Slightly Accepting	7
6. I want to deepen my knowledge of predictive learning systems.	2.26	1.1	Slightly True of Me	Slightly Accepting	2
7. I am committed to using predictive tools to enhance my instruction.	2.23	1.06	Slightly True of Me	Slightly Accepting	5
Composite Mean	2.24	0.88	Slightly True of Me	Slightly Accepting	

The statement "I am willing to invest time learning how to use these technologies" obtained the highest mean of 2.28, indicating a Slightly Accepting level of intention among teacher respondents. This suggests a mild willingness to develop their skills in using predictive learning tools, showing that professional development and training opportunities could help increase overall adoption and commitment.

The lowest-rated item was "I am likely to integrate predictive tools into future lesson planning", with a mean of 2.20. This indicates that despite some openness, teachers are currently less inclined to actively embed predictive technologies into their teaching practices, possibly due to uncertainty about practical applications or added workload.

The composite mean of 2.24 suggests that the teachers' Intention to Use predictive learning technology is only Slightly Accepting. While there is some initial interest, particularly in learning and recommending the tools, the overall level of commitment remains cautious, highlighting the need for clearer demonstrations of value and usability in real teaching scenarios.

Conclusions

This study concludes that teachers at the technical college exhibit a foundational yet limited familiarity with machine learning concepts and maintain a cautiously optimistic, but not fully committed, attitude towards adopting predictive learning technologies. The overall "slightly familiar" and "slightly accepting" ratings across all dimensions indicate a significant opportunity for growth. The findings reveal that this acceptance is not uniform but is significantly influenced

by key demographic factors, notably higher education levels and greater teaching experience, which correlate with greater familiarity and openness to PLTs. This underscores the need for professional development that is differentiated and tailored to address the specific knowledge gaps and concerns of various educator demographics within the institution. Most critically, the research identified a very strong and significant positive correlation between teachers' familiarity with ML concepts and their acceptance of predictive technologies. This powerful relationship demonstrates that efforts to simply promote the tools themselves will be insufficient. Instead, successful integration is fundamentally dependent on first building a solid foundation of conceptual understanding. Therefore, institutional strategies must prioritize comprehensive ML literacy programs that demystify the technology, address ethical concerns, and showcase practical classroom applications. By investing in building teachers' knowledge and confidence, the college can effectively catalyze a more widespread, confident, and effective adoption of predictive learning technologies, ultimately enhancing personalized instruction and student outcomes.

Recommendations

1. Provide structured professional development courses focused on the practical application of predictive learning tools, including data interpretation, applying insights to instruction, and resolving basic technical issues, to enhance teacher confidence and competency.
2. Implement classroom-based pilot programs to allow teachers to experiment with predictive technologies in a controlled and supportive environment, build familiarity, and demonstrate real-world applications.
3. Encourage the development or selection of predictive tools with user-friendly interfaces and provide ongoing technical support to shorten the learning curve and improve usability.
4. Share case studies or testimonials from teachers who have successfully integrated predictive learning technologies to build trust and demonstrate positive results, including improved student achievement and reduced workload.
5. Embed predictive analytics into platforms already used by teachers (e.g., learning management systems (LMS) or grading systems) to streamline access, reduce perceived workload, and increase the likelihood of adoption.
6. Conduct training on data privacy, algorithm accuracy, and the ethical use of student information to build trust in the reliability and security of predictive technologies.
7. Create a school culture that encourages experimentation with educational technology, recognizes innovation, and supports continuous learning to improve teachers' attitudes towards adopting new tools.

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