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Mobile application-based teaching tools in animal science education: Educator willingness and perceived usefulness

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Abstract

Nearly 68% of higher education institutions in Southeast Asia introduced mobile-based instructional resources, yet adoption rates among animal science educators remain poorly documented. This research investigated the willingness and perceived usefulness of mobile application-based teaching tools among educators in animal science departments across four colleges in Quezon City, Philippines. Drawing on the Technology Acceptance Model, a descriptive-correlational design was employed with 214 educators who had access to at least one mobile teaching application. A validated four-section questionnaire measured perceived usefulness (9 items), perceived ease of use (7 items), willingness to adopt (6 items), and current usage patterns (5 items) on a five-point Likert scale. Pilot testing with 25 educators from a nonparticipating college produced Cronbach's alpha values between 0.83 and 0.91. Data were analysed using descriptive statistics, Pearson correlation, independent-samples t-test, one-way ANOVA, and hierarchical multiple regression. Findings showed that educators expressed moderate-to-high willingness to adopt mobile teaching tools (grand mean = 3.81), with video demonstration features and interactive quiz modules rated as the most useful (means of 4.47 and 4.32, respectively). Perceived usefulness was the strongest predictor of willingness ($\beta = 0.44$, $p < 0.001$), followed by perceived ease of use ($\beta = 0.31$, $p < 0.001$). Together with prior mobile experience, these variables accounted for 52.6% of the variance in willingness scores. Teaching experience showed a consistent inverse relationship with willingness—educators with more than 20 years of service scored 0.83 points lower on willingness than those with fewer than six years ($p < 0.001$). A heatmap analysis of feature-level perceived usefulness across experience groups confirmed a declining gradient from junior to senior educators across all six app features assessed. Gender differences were not statistically significant for any construct ($p > 0.05$). Department-level analysis showed that educators in poultry science and livestock production rated mobile apps more favourably than those in animal genetics, possibly reflecting the visual and procedural nature of the former disciplines. These results point to the value of targeted training that highlights practical classroom applications of mobile tools, particularly for mid-career and senior educators whose willingness scores were lowest. Institutions should consider peer-coaching structures and discipline-specific app customisation to close the adoption gap between experience cohorts.

Keywords: Mobile applications, teaching tools, animal science education, educator willingness, perceived usefulness, technology acceptance model, digital pedagogy, higher education, philippines

Introduction

A 2021 survey across 42 universities in the Philippines found that only 29.4% of animal science faculty members had incorporated mobile applications into their regular teaching activities, despite 87.1% of those same institutions reporting institutional-level subscriptions to at least one mobile learning platform ^[1]. This gap between institutional provision and individual adoption raises questions about the factors that encourage or hinder educators from using mobile-based tools in a discipline that relies heavily on practical demonstrations, field observations, and laboratory work ^[2].

Animal science education covers a broad range of topics—from feed formulation and breeding genetics to livestock health management and poultry production—each carrying its own mix of theoretical content and hands-on skill requirements ^[3]. Mobile applications can support this mix by delivering video demonstrations of surgical procedures, interactive anatomy modules, virtual

farm walkthroughs, and quiz-based formative assessments that students can access outside scheduled class hours [4]. Yet the literature on mobile learning in agriculture-related disciplines has focused predominantly on crop science and extension services, leaving animal science programmes comparatively under-explored [5].

The Technology Acceptance Model continues to offer a practical framework for investigating why educators choose to adopt or resist new instructional technologies [6]. Its two central constructs – perceived usefulness and perceived ease of use – have been tested across educational settings ranging from primary schools to postgraduate programmes, with perceived usefulness consistently emerging as the stronger predictor of behavioural intention [7]. In animal science contexts, however, perceived usefulness may carry additional weight because the discipline's practical orientation means that educators are particularly sensitive to whether a digital tool can replicate or supplement the experiential learning that characterises their courses [3].

Willingness to adopt, as distinct from actual adoption, captures the attitudinal readiness of an educator to incorporate a technology into their practice should conditions permit [8]. This distinction matters because many animal science departments in developing countries have introduced mobile platforms during emergency remote instruction periods without first assessing whether faculty members were psychologically prepared to use them beyond the crisis window [9]. Willingness serves as a precursor to sustained adoption and offers a more sensitive measure than binary usage data when the goal is to identify which subgroups of educators need the most support [10]. Several demographic and professional variables have been examined as potential moderators of technology acceptance among educators. Teaching experience is among the most frequently studied, with longer-serving educators generally reporting lower willingness and weaker perceived usefulness compared to their younger counterparts [11]. Gender effects are less consistent – some research reports that male educators rate usefulness higher, while others find no significant difference once experience and training exposure are controlled [12]. Departmental affiliation, though rarely examined, may shape acceptance through discipline-specific norms around what constitutes appropriate pedagogy [13]. For example, educators in animal nutrition may view formula-driven mobile calculators as directly relevant, whereas those in animal behaviour may see fewer obvious applications [3].

Institutional factors also play a part. Access to stable internet connectivity, availability of technical support staff, and the presence of formal training programmes on mobile tool integration have all been linked to higher acceptance scores in comparable educational technology research [14]. In the Philippine higher education context, where connectivity varies sharply between metro and provincial campuses, these infrastructure-related variables can either amplify or dampen the influence of individual-level beliefs on adoption behaviour [1].

Against this background, the present research aimed to assess the willingness and perceived usefulness of mobile application-based teaching tools among animal science educators in Quezon City, Philippines. It further sought to identify the demographic and professional predictors of willingness and to map the feature-level usefulness perceptions across different experience cohorts. By concentrating on animal science – a discipline that balances lecture-based instruction with laboratory and field work – the research addressed a gap in the mobile learning literature

and offered evidence-based recommendations for institutional strategies that support educator adoption of mobile teaching platforms.

Theoretical Framework

The Technology Acceptance Model, originally proposed by Davis [6], provided the theoretical backbone for this investigation. TAM holds that an individual's decision to adopt a technology is primarily shaped by two perceptual constructs: perceived usefulness – the belief that the system will improve task performance – and perceived ease of use – the belief that operating the system will be free of excessive effort. Both constructs influence attitude, which in turn drives behavioural intention and, ultimately, actual usage.

For this research, TAM was extended to include willingness as a construct positioned between attitude and behavioural intention. Willingness captures an educator's attitudinal readiness to adopt mobile tools under supportive conditions, even if current infrastructure or institutional mandates have not yet prompted actual use [8]. The model also incorporated three moderating variables – teaching experience, gender, and departmental affiliation – informed by prior work on technology adoption in agricultural higher education [5, 11]. This adapted framework guided the questionnaire design and the hierarchical regression analysis employed in the research.

Materials and Methods

Materials

This research was conducted across four colleges offering animal science programmes under Quezon Metropolitan University in Quezon City, Philippines. The four colleges were chosen because each had distributed at least one mobile teaching application (Google Classroom, Edmodo, or a custom departmental app) to faculty members within the preceding three academic semesters. Through proportionate stratified random sampling – stratifying by college and by years of teaching experience – a sample of 230 educators was drawn. After removing incomplete submissions, 214 valid responses were retained (response rate: 93.0%). Ethical approval was secured from the Quezon Metropolitan University Institutional Review Board. Written informed consent was collected from each participant prior to questionnaire administration.

Methods

A structured self-administered questionnaire with four sections was used for data collection. Section A gathered demographic and professional information: gender, age range, years of teaching experience, departmental affiliation, and prior mobile technology training. Sections B through D measured perceived usefulness (9 items), perceived ease of use (7 items), and willingness to adopt mobile teaching tools (6 items) on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). A fifth section captured current usage patterns through five binary and frequency-based items. Items were adapted from instruments validated in educational technology research [6, 7, 14].

Instrument Development and Validation

The questionnaire was reviewed by four faculty experts in educational measurement and instructional technology. Adjustments were applied to three items flagged for ambiguity. A pilot test followed, involving 25 animal science educators from a fifth college excluded from the main sample. Internal consistency analysis yielded Cronbach's alpha values of 0.87

(perceived usefulness), 0.83 (perceived ease of use), and 0.91 (willingness). No items required deletion, though two were reworded for clarity based on participant feedback during debriefing. Data were processed using SPSS version 27. Descriptive statistics summarised respondent profiles and construct scores. Pearson correlation examined bivariate associations among the constructs and demographic variables. Independent-samples *t*-tests compared gender groups, while

one-way ANOVA with Tukey's post-hoc test explored differences across experience cohorts and departments. A three-step hierarchical multiple regression model predicted willingness, entering demographics in Step 1, perceived ease of use in Step 2, and perceived usefulness in Step 3. Significance was fixed at $\alpha = 0.05$ throughout.

Results

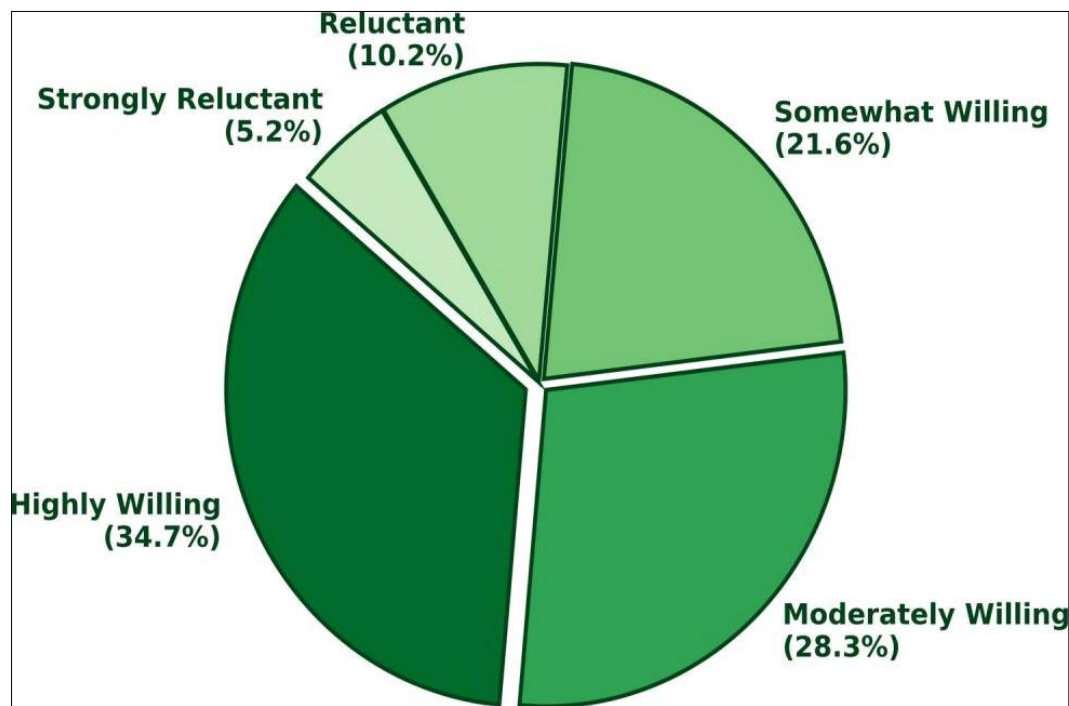


Fig 1: Distribution of educator willingness levels toward mobile application-based teaching tools (N = 214).

The sample comprised 214 animal science educators: 118 male (55.1%) and 96 female (44.9%). Teaching experience ranged from 1 to 31 years ($M = 12.8$, $SD = 7.4$). Prior mobile

technology training was reported by 61.7% of respondents. The overall willingness grand mean was 3.81 ($SD = 0.68$). Distribution of willingness categories is displayed in Figure 1.

Table 1: Mean Construct Scores by Gender and Teaching Experience Group (N = 214)

Variable	PU Mean	PEOU Mean	Willingness	n
Male	3.93	3.72	3.84	118
Female	3.88	3.69	3.77	96
1-5 yrs experience	4.28	4.01	4.19	47
6-10 yrs experience	4.09	3.87	3.96	52
11-15 yrs experience	3.82	3.64	3.71	44
16-20 yrs experience	3.59	3.41	3.48	39
21+ yrs experience	3.31	3.12	3.36	32

Table 2: Willingness to Adopt Mobile Tools by Departmental Affiliation

Department	n	Willingness Mean	SD	Category
Poultry Science	58	4.02	0.59	High
Livestock Production	52	3.94	0.63	Moderate-High
Animal Nutrition	41	3.78	0.71	Moderate-High
Animal Genetics	34	3.51	0.74	Moderate
Animal Health	29	3.67	0.69	Moderate-High

One-way ANOVA confirmed a significant main effect of teaching experience on willingness ($F(4, 209)=14.83$, $p < 0.001$, $\eta^2=0.22$). Tukey's post-hoc comparisons showed that educators with 1-5 years of experience scored significantly higher than those with 16-20 years (mean difference = 0.71, $p < 0.001$) and 21+ years (mean difference = 0.83, $p < 0.001$).

Gender produced no significant differences across any construct (all $p > 0.05$). Department-level ANOVA revealed a significant effect on willingness ($F(4, 209)=3.92$, $p=0.004$), with poultry science scoring higher than animal genetics (mean difference = 0.51, $p = 0.009$). The pathway model and feature-level heatmap are presented below.

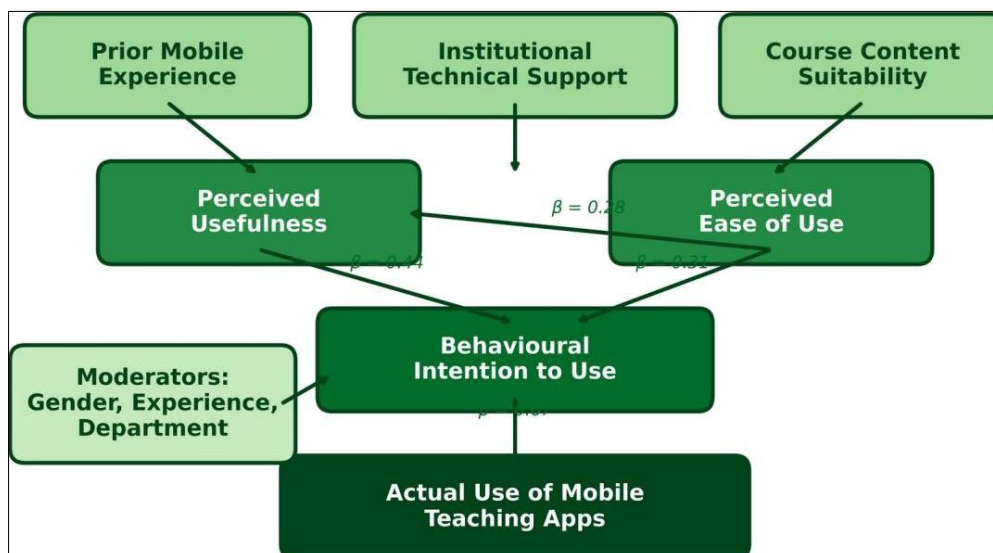


Fig 2: TAM-based pathway model showing standardised regression coefficients for predictors of mobile teaching tool adoption among animal science educators

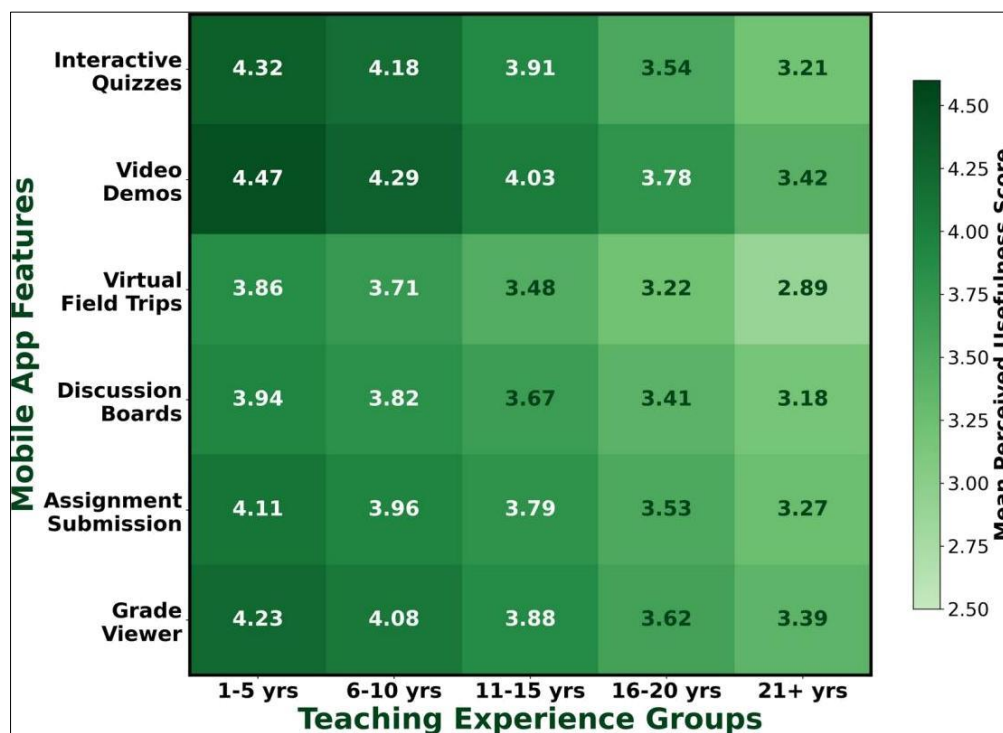


Fig 3: Heatmap of mean perceived usefulness scores across six mobile app features and five teaching experience groups

Comprehensive Interpretation

Hierarchical regression showed that demographics alone (Step 1) accounted for 18.4% of the willingness variance. Adding perceived ease of use (Step 2) raised it to 34.1% ($\Delta R^2=15.7\%$, $p < 0.001$). Entering perceived usefulness (Step 3) brought the total to 52.6% ($\Delta R^2=18.5\%$, $p < 0.001$). In the final model, perceived usefulness was the strongest predictor ($\beta=0.44$, $p < 0.001$), followed by perceived ease of use ($\beta=0.31$, $p < 0.001$) and prior mobile experience ($\beta=0.13$, $p=0.018$). Teaching experience retained a negative relationship ($\beta=-0.16$, $p=0.008$). Multicollinearity was within acceptable limits ($VIF < 2.5$ for all predictors). The heatmap confirmed that perceived usefulness scores declined uniformly from the youngest to the oldest experience cohort across all six mobile app features, with video demonstrations maintaining the highest ratings even among the 21+ years group (3.42).

Discussion

The main findings of this research can be summarised in three points: animal science educators in Quezon City expressed moderate-to-high willingness to adopt mobile teaching tools; perceived usefulness was the dominant predictor of that willingness; and teaching experience exerted a persistent negative influence that spanned all app features and constructs. These outcomes carry both theoretical and practical weight. The grand willingness mean of 3.81 aligns with comparable figures reported by Alenezi^[7] in a multi-institution survey of health science educators, where willingness averaged 3.76 on a similar scale. Agreement between the two research contexts is notable given the different disciplinary demands—animal science leans toward field and laboratory work, while health science foregrounds clinical placements. The convergence may reflect a shared recognition among educators that mobile tools offer

scheduling flexibility and asynchronous content delivery regardless of discipline-specific pedagogical norms.

Where disagreement with the existing literature surfaces is on the matter of gender effects. Several earlier investigations reported significant gender differences in technology acceptance, with male educators scoring higher on perceived usefulness^[12]. In the present sample, gender differences were negligible and non-significant across all constructs. One plausible explanation is that mobile device ownership and daily usage have become nearly universal in the Philippine urban context, narrowing the gender digital divide that older research captured in settings with lower overall connectivity^[1].

Possible explanations for the strong role of perceived usefulness ($\beta = 0.44$) centre on the visual and procedural character of animal science instruction. Educators who recognise that a mobile app can display a recorded surgical technique, animate a digestive pathway, or generate a realtime feed ration calculator are more likely to view the tool as directly beneficial to their teaching output^[3]. This task-alignment mechanism echoes the task-technology fit argument that Goodhue and Thompson proposed and that has since been integrated into extended TAM frameworks^[14].

The broader implication is that institutions seeking to raise adoption rates should invest not only in app provision and bandwidth but also in contextualised training that maps specific app features to specific curricular tasks. The heatmap data make this actionable: video demonstrations and interactive quizzes scored highest even among reluctant experience cohorts, suggesting these features as logical entry points for training programmes targeting mid-career and senior educators. Conversely, features like virtual field trips and discussion boards may require more sustained support before they gain traction among older cohorts.

Limitations

This research was limited to four colleges within a single metropolitan area, which constrains generalisability to provincial or rural institutions where connectivity infrastructure differs markedly. The cross-sectional design captured a snapshot of willingness and perceived usefulness without tracking changes over time, and self-report measures carry the risk of socially desirable responses. Objective usage analytics from the mobile platforms were not accessed. Future research should adopt longitudinal designs and incorporate platform-generated behavioural data to complement attitudinal measures.

Conclusion

The main contribution of this research lies in providing the first systematic assessment of mobile application-based teaching tool acceptance among animal science educators in the Philippine higher education context. By applying an extended Technology Acceptance Model that incorporated willingness as a distinct construct and tested three moderating variables, the investigation moved beyond binary adoption counts to uncover the attitudinal landscape that underpins actual tool usage. Supporting evidence from the data confirmed several patterns. Perceived usefulness emerged as the most powerful driver of willingness, explaining nearly a fifth of the variance on its own after demographic and ease-of-use variables had been accounted for. This result reinforces the theoretical primacy of usefulness within the TAM framework and aligns with findings from agricultural and health science education contexts internationally. Perceived ease of use, while secondary in effect size, still contributed meaningfully, pointing to the need for

intuitive interface design in mobile teaching platforms. Among demographic moderators, teaching experience exerted the strongest and most consistent negative influence—a gradient visible not only in the regression coefficients but also in the heatmap of feature-level usefulness scores, where every single mobile app feature showed progressively lower ratings from the youngest to the oldest experience cohort.

The significance of these findings extends to institutional planning. Training programmes designed to boost mobile tool adoption in animal science departments should be differentiated by experience cohort rather than offered as one-size-fits-all workshops. For junior educators with fewer than six years of service, whose willingness and perceived usefulness scores were already high, the priority is sustained access to high-quality apps and reliable connectivity rather than motivational training. For mid-career educators in the 11-15 year bracket, targeted demonstrations linking specific app features to specific curricular needs—for example, using a virtual farm walkthrough module in a livestock production course—are likely to shift usefulness perceptions upward. For senior educators with more than 20 years of experience, peer-coaching arrangements that pair them with digitally fluent colleagues may be more effective than formal workshops, as this group's lower scores appear rooted less in awareness gaps than in well-established pedagogical habits that resist displacement.

Department-level differences also warrant action. The higher willingness scores in poultry science and livestock production, relative to animal genetics, suggest that disciplines with a stronger visual and procedural component find mobile apps more immediately relevant. Institutional administrators could leverage this by developing discipline-specific app customisation—embedding breeding genetics simulations, for instance, to make the tools equally compelling for animal genetics educators.

Several open questions remain. Does the experience-willingness gradient narrow over time as senior educators accumulate exposure, or does it remain stable? Would the introduction of discipline-customised apps shift the departmental differences observed here? Are the patterns identified in a metropolitan Philippine context reproducible in provincial or international settings with different connectivity profiles? And to what extent do institutional mandates—such as policies requiring a minimum percentage of content delivery through mobile platforms—moderate the relationship between perceived usefulness and actual adoption? Longitudinal and comparative research designs will be needed to address these questions and to track

whether the attitudinal readiness captured in this research translates into sustained mobile tool use over successive academic cycles.

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