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Agrotechnology Students' Acceptance on Agriculture Drones Spraying as Practical Tool in Class using the Knowledge, Attitude and Practice (KAP) Model

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Agriculture drones are currently becoming a major mechanization for the agricultural industry. Drones have been specifically utilized to improve agricultural activities and hence require a specific skill set to operate effectively and efficiently in the field. Therefore, the future workforce in the agriculture industry is required to learn and accept this new technology. Nonetheless, integrating drone technology into the classroom presents obstacles for students and lecturers as well. Therefore, gaining a deeper comprehension of the numerous facets of drone technology integration in higher education, especially courses related to agrotechnology programs is critical. This quantitative survey used the Knowledge, Attitude and Practice (KAP) paradigm to investigate agrotechnology students' acceptance of agriculture drones while reducing ambiguity using statistical analysis SPSS 26.0 and employed both descriptive and inferential analysis techniques. The KAP model was employed in a recent survey to ascertain the student's perspective regarding drones within their practical class. In order to gain a deeper understanding of students' knowledge, attitudes and risk perceptions regarding agriculture drone applications, a closed-ended structured survey was designed. The survey was disseminated to selected University Malaysia Kelantan students specifically those furthering study in agrotechnology, and intensive training on handling and practical skill-set of agriculture drone spraying was provided to them. The response from the survey obtained showed that students had a good level of knowledge about the application of agriculture drones (mean score of 4.43), attitude toward the drone application (mean score of 4.56) and practice level of the students showed a mean score of 4.57. The findings from the study revealed that the practical lesson involving agriculture drone spraying had a positive benefit on the agrotechnology student's skills for their future career endeavor.

Keywords:
Agriculture student; mechanization; drone spraying; KAP model; future workforce

1. Introduction

Drone technology, originally developed for military applications has undergone significant evolution and is now finding extensive use across various sectors, particularly in agriculture [1].

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Governments, agricultural organizations and individual farmers have increasingly adopted drones to revolutionize agriculture practices. Drones, with their advanced capabilities and aerial perspective, are proving to be invaluable tools in enhancing agricultural productivity and sustainability. In recent years, the agricultural sector has recognized the potential of drones to promote precision agriculture and improve crop management practices. The utilization of drones has surged in Malaysia, particularly within the realm of precision agriculture, over the past decade. Since around 2014, the adoption of drones for agricultural purposes, including both first person-view and commercial drones, has seen a notable uptick [2]. It appears that Malaysia is steadfast in accelerating its advancement in drone technology. As reported by the Malaysian Research Accelerator for Technology and Innovation, Malaysia's Drone Readiness Index (DRI) has surged from 31 - 60 % in 2022. Furthermore, Malaysia has claimed the top position in the DRI for 2023, climbing from 30th place in 2021 to 21st [3]. These developments indicate a promising trajectory for Malaysia's drone industry, with projections suggesting a substantial boost to the GDP, potentially adding RM50.71 billion and creating 100,000 jobs by 2030 [4]. Hence, numerous foreign drone company and local small companies had recently offered various services related to drone-based application and inspections for various agriculture sectors in Malaysia especially for rice farmers, oil-palm plantation and pineapple farming. However, the reliance on foreign companies poses potential risks to national security, as it involves the exposure of not only aircraft debris but also sensitive geographical data of the country. Hence, there is a pressing need for Malaysia to cultivate local expertise in the field of drone technology especially for agricultural mechanization to effectively address national demands, particularly in precision agriculture applications.

Educational institutions and agricultural practitioners alike are exploring the integration of drone technology into agricultural education and training programs [5]. Despite this growing interest, the utilization of drones in agricultural education is still in its infancy, with limited research addressing its implementation and the training needs by the students especially young generation. It is imperative to place a heightened emphasis on the role of drones in precision agriculture and aimed at enhancing the knowledge, awareness, attitudes and practice of drones, particularly among the younger generation. As drones become increasingly accessible to the general public, there is a growing interest among younger individuals, particularly in utilizing drones for aerial photography and filming and perhaps within the agriculture industry as next generation of pilot drone [6]. Despite the widespread ownership and application of drone in the country, there remains a noticeable dearth of research on the perceptions and acceptance of drone technology as next generation of training tools for agricultural students [7]. Therefore, it is crucial to gain insights into the perspectives of the younger generation. Understanding their comprehension and attitudes towards drones can profoundly impact the adoption, advancement and regulation of this technology, particularly in the context of precision agriculture. This study aims to assess the KAP model of agricultural students for incorporating drone technology into their practical learning session. By identifying students' training needs and exploring effective strategies for integrating drones into agricultural education, this research seeks to facilitate the broader adoption of drone technology in agricultural teaching and learning environments.

2. Methodology

2.1 Study Population and Sampling Technique

The target population for this study comprises undergraduate students currently enrolled in agricultural-based technology courses at Universiti Malaysia Kelantan, Campus Jeli, Malaysia. A total of 60 respondents participated, selected through a stratified random sampling method. These

respondents all underwent comprehensive technology knowledge transfer sessions and know-how training conducted by an expert in piloting drone spraying. Training sessions included both face-to-face interactions in open fields and classroom-based theoretical instruction.

2.2 Questionnaire Design and Pre-Survey Feedback

A self-administered closed-questionnaire survey was distributed among students. The questionnaire, structured in four sections, aimed to gather demographic information, assess general knowledge of drone spraying applications, explore perceptions of drone technology in agriculture, and gauge attitudes towards its adoption in agriculture activities. The questionnaire comprised four sections: (1) Demographic information, (2) General knowledge of drone spraying applications in agriculture, (3) Perception of drone spraying applications in agriculture and (4) Attitudes towards drone spraying applications in agriculture. The demographic section contained 13 questions covering gender, age, ethnicity, academic qualifications, agriculture experience, family background, address and other relevant factors. Sections 1 to 3 each contained ten questions, aimed at gauging knowledge, perception and acceptance levels aligned with the study objectives. Responses were recorded on a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). Before the actual study, a pre-survey was conducted with a small group of students (minimum 10 respondents) to gather feedback and refine the questionnaire to better suit the target population.

2.3 Data Collection

The primary mode of data collection was face-to-face sessions to facilitate a deeper understanding of information exchange through verbal and non-verbal communication cues [8]. Consequently, the survey was conducted in June 2023. The study aimed to explore the current perceptions, acceptance, understanding and knowledge of drone spraying applications among students for adoption in crop planting systems, particularly those with an agriculture background. In terms of data collection, a self-administered closed-questionnaire survey was distributed. Students were identified and invited to participate in knowledge transfer sessions and interviews conducted face-to-face. The interview questionnaire consisted of structured close-ended questions, totalling forty-seven, designed to probe students' knowledge, acceptance and perception of drone spraying technology for agriculture.

2.4 Data Analysis

Data obtained from the surveys were analyzed using SPSS version 26. Descriptive and inferential statistical techniques were applied, including calculating percentages, means and standard deviations for Likert-scale responses. Knowledge and perception levels were categorized into five classifications, while acceptance levels were determined by the mean Likert-scale scores.

2.5 Reliability Test and Spearman Correlation Coefficient

In the study, Table 1 showed that the Cronbach’s Alpha has been utilized to assess data reliability, consistency and validity. By following this structured approach, the study aimed to comprehensively assess the knowledge, perception and acceptance levels of undergraduate students regarding drone spraying technology in agriculture practices. It is acceptable to have an acceptable value of 0.7, but

it is desirable to have an acceptable value of 0.8 [9]. The following Table 1 summarises Cronbach's Alpha reliability.

Table 1
Reliability test on questionnaire set

Section	Questionnaire	No. of items	Pilot Study (Cronbach Alpha)
1	Knowledge of agrotechnology student towards using drones as mechanization for agriculture and practical tool in class	10	0.895
2	Practice of agrotechnology student towards using drones as mechanization for agriculture and practical tool in class	10	0.875
3	Acceptance and attitude of agrotechnology student towards using drones as mechanization for agriculture and practical tool in class	10	0.886

Whilst the Spearman correlation analysis was used to compute the statistical significance of the cross-tabulation table. In this study, the Spearman correlation coefficient was used (Table 2) to analyses the relationship related to the third objective, which was to identify the relationship between knowledge, attitude and practices toward the acceptance of drones spraying for agriculture and practical tools for learning during the practical class.

Table 2
Guidelines for interpreting the magnitude of a correlation coefficient as outlined by [10]

Size of Correlation (%)	Interpretation
0.90 to 1.00 (-0.9 to -1.00)	Very high positive (negative) correlation
0.70 to 0.90 (-0.70 to -0.90)	High positive (negative) correlation
0.50 to 0.70 (-0.50 to 0.70)	Moderate positive (negative) correlation
0.30 to 0.50 (-0.30 to -0.50)	Low positive (negative) correlation
0.00 to 0.30 (0.00% to -0.30)	Negligible correlation

3. Results

3.1 Social Demographic Profile of Agrotechnology Students

In recent years, significant technological advancements have been observed in the agriculture industry, exemplified by drone technology, which plays a pivotal role in simplifying planting activities and crop monitoring. The demographic profile of the respondents was delineated in Table 3. A total of 60 students participated, all of whom completed the survey. The sample was evenly divided between male (55 %) and female (45 %) respondents. The majority of participants were Malay students (81.7 %), followed by Bumiputera from Sabah and Sarawak (10 %), Indian (3.3 %) and Chinese students (5 %). Concerning the students' parents, over half of them (53.3 %) had no experience working in or with the agricultural sector. As depicted in Table 1, the largest proportion of students (41.7 %) had less than one year of agriculture experience, followed by those with one to three years of experience (26.7 %), four to seven years (15 %) and surprisingly, approximately 16.7 % had more than seven years of agriculture experience. This phenomenon could be attributed to familial involvement in agriculture, passing down knowledge and skills, or could be simply a matter of chance. Despite research indicating diminishing interest among younger generations in agricultural careers due to perceptions and limited social mobility, this study's findings diverge, with half of the students continuing their studies because of their prior agriculture experience and awareness of the sector's potential [11]. Additionally, 65 % of respondents reported having family farms with less than an acre of land, followed by 13.3 % with farms between one and three acres, 8.3 % with farms

between four and seven acres and another 13.3 % with farms between seven and ten acres. Vegetables (33.66 %) were the most commonly grown crop among the students, followed by oil palm (13.86 %), pineapple (11.88), corn (10.89 %), paddy (9.90 %), rubber (7.92 %) and durian (5.94 %).

Table 3
Socio-demographic profiles of agrotechnology students

Profile	Frequency (n)	Percentage (%)
Gender		
Male	33	55.0
Female	27	45.0
Race		
Malay	49	81.7
Chinese	3	5.0
Indian	2	3.3
Bumiputera Sabah & Sarawak	6	10.0
Parents work in agriculture sector		
Yes	28	46.7
No	32	53.3
Student agriculture experiences		
Below 1 year	25	41.7
1 – 3 years	16	26.7
4 – 7 years	9	15.0
7 – 10 years	4	6.7
> 10 years	6	10.0
Family farm size (acre)		
Below 1	39	65.0
1 – 3	8	13.3
4 – 7	5	8.3
7 – 10	8	13.3
> 10	0	0
Major crop cultivated		
Paddy	18	9.90
Oil palm	27	13.86
Pineapple	20	11.88
Rubber	13	7.92
Durian	12	5.94
Corn	25	10.89
Vegetables	53	33.66

Note: n = 60

3.2 Agrotechnology Students' Awareness on the Drone Technology for Agriculture

In our survey interviews, a series of questions were directed towards students to assess their familiarity with the emerging trend of drone spraying technology within the agricultural domain. The outcomes of these inquiries were outlined in Table 4. Predominantly, respondents indicated a budget range of RM 15,000 to RM 20,000 as their preferred expenditure for acquiring drone spraying technology for agriculture purposes. Merely 8.3 % of students expressed willingness to allocate funds below RM 15,000 for such a purchase, while the remaining cohort showed readiness to invest between RM 20,000 to RM 25,000 (20.0 % of students), RM 25,000 to RM 30,000 (18.3 % of students), with a notable subset of respondents (approximately 9) prepared to spend upwards of RM 30,000.

These statistics underscore the importance of pricing drone spraying technology competitively to enable broader integration into routine agriculture practices.

Moreover, a majority of respondents (40 students) deemed an expenditure range of RM 26 to RM 50 as the most suitable and affordable for utilizing drone services in agriculture. Conversely, 10.0 % of students opined that service charges below RM 25 would constitute the optimal price bracket for their adoption of drone services. The remaining respondents indicated varying willingness to spend, with segments willing to allocate between RM 51 to RM 75 (13.3 % of students), RM 76 to RM 99 (16.7 % of students), and a contingent of 20.0 % expressing readiness to invest over RM 100 for leveraging drone services to streamline agricultural operations.

Furthermore, an overwhelming majority of respondents (95.0 %) expressed eagerness to embrace and deploy drone spraying technology in their agricultural endeavours. Similarly, a significant proportion (98.3 %) indicated a keenness to enrol in forthcoming courses related to drone spraying for agricultural purposes. Moreover, 95.0 % of students expressed interest in pursuing drone piloting post-graduation, provided they are afforded opportunities to acquire and utilize this technology within agricultural contexts. These findings underscore the imperative of prioritizing the integration of cutting-edge technologies, such as drone spraying and other contemporary agro-technologies synonymous with the Fourth Industrial Revolution (IR4.0), within the agricultural landscape.

When queried about the prevailing drone brands popular in Malaysia's agricultural sector, respondents overwhelmingly favoured DJI (88.3 %), followed by Aonic (6.7 %), Advansia (5.0 %), with no respondents endorsing XDR drone. The majority of these brands offer comprehensive drone spraying services and products tailored to the Malaysian agriculture industry, enjoying widespread acceptance among farmers, agribusinesses and even students enrolled in agriculture-focused programmes.

Table 4
Agrotechnology students' awareness on drone technology for agriculture

Profile	Frequency (n)	Percentage (%)
Willingness to pay for a maximum cost to use drone for agriculture		
< RM 15,000	5	8.3
RM 15,000 – RM 20,000	23	38.3
RM 20,000 – RM 25,000	12	20.0
RM 25,000 – RM 30,000	11	18.3
> RM 30,000	9	15.0
Willingness to pay for drone service fee		
< RM25	6	10.0
RM 26 – RM 50	24	40.0
RM 51 – RM 75	8	13.3
RM 76 – RM 99	10	16.7
> RM 100	12	20.0
Will use drone to ease agriculture activity?		
Yes	57	95.0
No	3	5.0
Interested to join any course related to drone for agriculture?		
Yes	59	98.3
No	1	1.7
Interested to become a drone pilot?		
Yes	57	95.0
No	3	5.0
Type of drone brand that you know available in the market?		
DJI	53	88.3

Aonic	4	6.7
XDR drone	0	0
Advansia	3	5.0

Note: n = 60

Figure 1 presents the diverse array of information sources utilized by students studying agrotechnology to stay update on emerging trends, such as drone technology in agriculture. A notable proportion of students (29 %) turn to social media as their primary resource for learning about drone technologies. In today's digital age, social media platforms serve as dynamic channels for information dissemination, offering real-time updates, discussions and access to global experts. Reflecting this trend, most Gen Z individuals spend an average of approximately 2 hours and 35 minutes per day on the internet and social media via their smartphones. Remarkably, Malaysians rank 9th globally for daily smartphone usage, spending around 4 hours and 49 minutes per day [12]. Furthermore, 17 % of students rely on television as a key source of information, underscoring the enduring significance of traditional media, especially for students from remote areas with limited internet access. This connectivity challenge remains pervasive in Malaysia, compounded by issues such as slow bandwidth and internet speeds, potentially impeding the full integration of drone technology in agriculture [13,14].

Approximately 14 % of students have conducted self-observational research on drone technology, gaining first-hand experience with its applications. Additionally, 13 % of information sources emphasise the value of peer networks, with students and their close friends exchanging insights verbally. Surprisingly, students also acquire knowledge about drone applications within their local communities (11 %), indicating the embrace of technology by some rural farmers who then disseminate this information to their communities. Moreover, advertisements from drone companies play a significant role in disseminating the latest information on drone usage and applications for agriculture, with approximately 12 % of respondents citing them as information sources. A smaller percentage (4 %) of students rely on their university instructors for drone-related knowledge. Given the pivotal role of educational institutions in preparing students for future career roles, there is a growing need for academic curricula to incorporate drone technology as a practical tool. The analysis of data highlights the diversity of information that sources agrotechnology students utilise to stay updated on the drone trends that shaping the industry currently.

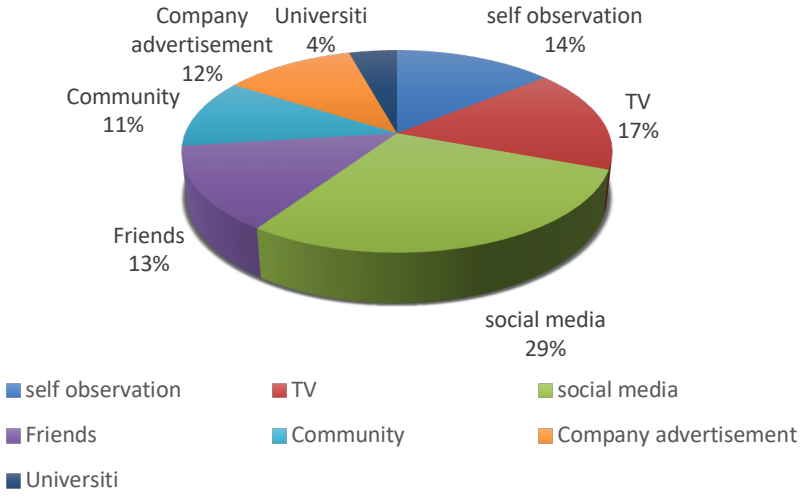

Fig. 1. Sources from which the agrotechnology students acquired information about drone technology

3.3 Agrotechnology Students' Knowledge on the use of Drone Technology for Agriculture

Table 5 illustrates the students' comprehensive grasp of drone spraying technology and its significance in modern agricultural practices. A significant proportion of students (45.0 %) agree and a similar percentage (43.3 %) strongly agree, that drones represent a novel technology introduced by both government agencies and commercial enterprises to streamline agriculture tasks. Consequently, the majority of students also perceive drones as capable of uniformly monitoring and providing inputs to trees in the field (mean score 4.61), as well as saving time, increasing speed and reducing labour during planting, fertilizing and spraying activities (mean score 4.72). Furthermore, drones are seen as a viable alternative for monitoring crop growth across larger areas (mean score 4.67). Consequently, most students feel that the current cost of drone services is prohibitive and should be made more affordable to facilitate wider adoption among farmers, indicating a keen awareness of the benefits and demands of drone technology compared to traditional methods.

A substantial majority of students (66.7 %) agree (mean score of 2.23) that proper installation and guidance from qualified operators or expert authorities are crucial for realizing the full potential of drone technology. They also emphasize the importance of accurate input dosage for crop application using drones to prevent crop losses due to pest and disease attacks (70.0 % agreement). Despite acknowledging the risks associated with drone use, such as system or drone failures due to electrical circuit malfunctions, a majority of students (65.0 %) still believe that drones can enhance agricultural productivity. However, they are cognizant of the challenges associated with deploying drones in open fields, including increased costs and limited access to maintenance and after-service providers, which reflects a nuanced understanding of the drawbacks of drone adoption. According to Livingstone [15], younger generations exhibit superior digital skills and technological proficiency compared to previous cohorts. This presents an optimistic outlook for integrating advanced technology education into agricultural curricula at secondary schools and universities, preparing future generations of agriculturalists for the evolving technological landscape.

Table 5
Agrotechnology students' knowledge on the drone technology for agriculture

Questions	Mean ± SD	Percentage of Response (%)				
		Strongly disagree	Disagree	Slightly agree	Agree	Strongly Agree
Drone is a new technology introduced by private companies & government agencies to help ease the agriculture activity	4.32 ± 0.68	0	0	43.3	45.0	43.3
Drone service fees is currently too expensive	4.77 ± 0.46	0	0	3.3	31.7	65.0
Drone technology ease work in the field such as monitoring tree growth and helping to spray inputs faster to plants	4.61 ± 0.56	0	0	1.7	20.0	78.3
The use of drone can increase crop yield.	4.33 ± 0.77	0	0	3.3	31.7	65.0
I acknowledge the risks associated with drone operation, including system breakdowns, drone failures, and the potential for crop losses in the field.	5.48 ± 0.52	1.7	0	8.3	43.3	46.7
Utilizing drones can help to save time, accelerate processes, and	4.72 ± 0.49	0	0	1.7	31.7	66.6

reduce labor when undertaking planting, fertilizing, and spraying activities.						
I believe that using drones provides an effective alternative for monitoring crop growth across wider areas.	4.67 ± 0.54	0	0	1.7	25.0	73.3
It is crucial to adhere to recommended input doses, including pesticides and herbicides, to effectively utilize drones and mitigate disease outbreaks, wastage, and losses.	4.6 ± 0.62	0	0	3.3	26.7	70.0
Operating drone technology requires qualifications, skills, and expertise.	2.23 ± 0.65	0	0	6.7	26.7	66.7
Drone application in open cultivation is not suitable due to the need for proper protection procedures. Additionally, drone service providers have limited coverage in cultivation areas, often leaving portions uncovered.	4.6 ± 0.56	10.0	58.3	30.0	1.7	0
Average	4.43 ± 0.59					

3.4 Agrotechnology Students' Practical Knowledge on the use of Drone Technology for Agriculture

The incorporation of drone technology into agriculture holds immense promise for revolutionizing the sector, fostering enhanced efficiency and sustainability. However, the realization of this potential pivot relies heavily on the readiness and attitudes of future agricultural professionals, particularly the younger generation. Table 6 showed the findings of a study aimed at assessing students' practical knowledge and attitudes towards the utilization of drone technology in agriculture. The results indicate a clear preference among students for drone technology over outdated methodologies, with an average score of 4.45 (SD = 0.65). An overwhelming majority (91.6 %) of respondents expressed agreement or strong agreement with this sentiment, underscoring a favourable attitude towards drone implementation and a marked preference for it over obsolete techniques. The simplicity of drone management and its long-term cost-effectiveness resonated with a significant majority (71.7 %) of students, who indicated a preference for drones (M = 4.08, SD = 0.81).

Furthermore, the availability of diverse drone service providers and affordable costs emerged as pivotal factors influencing students' propensity to adopt drone technology in the long term, with nearly 96.7 % of respondents expressing agreement on this matter. Students displayed awareness of the potential benefits of drone technology, recognizing its cost-effectiveness and exhibiting considerable interest in its deployment. Regarding adherence to expert guidance, all students expressed an intention to seek advice from agricultural officers, accredited agencies or trained experts for technical assistance and funding related to drone technology use. A substantial majority (90.1 %) of respondents expressed confidence in utilizing drone technology and valued the technical guidance provided by agricultural agencies and drone companies themselves (M = 4.58, SD = 0.56). This readiness to seek expert advice and confidence in technical guidance underscores students' rationale and trust in utilizing drones for agricultural activities.

Moreover, students' openness to education and their desire for dedicated courses on drone technology demonstrate a willingness to invest in enhancing their knowledge. Nearly all students (98.3 %) concurred on the necessity to expand exposure programs and technology courses, such as drone training, to attract the younger generation to agriculture. This underscores the importance of educational initiatives in sustaining food security and shaping the future of the nation's agriculture industry. Additionally, students advocated for government subsidies (98.3 %) to alleviate farmers' costs and promote the use of drone technology services in addressing labour shortages. They also emphasized the importance of expanding training programs for young entrepreneurs (100 %) and increasing government assistance for start-up companies related to drone technology for agriculture (M = 4.7, SD = 0.46). Government support, through subsidies and assistance for start-up companies and entrepreneurs, is deemed essential for fostering the adoption of drone technology and driving innovation in agriculture, aligning with students' aspirations for a supportive ecosystem.

In alignment with these sentiments, the Malaysian government has launched the Malaysia Drone Technology Action Plan (MDTAP) 2022 – 2030, aimed at enhancing the drone industry in the country to generate 100,000 job opportunities and contribute nearly RM 50.7 billion to the country's Gross Domestic Product (GDP) by 2030 [16]. These findings reflect positive attitudes and a willingness to learn among students, boding well for the adoption of drone technology in the agriculture industry's future.

Table 6
Agrotechnology students' practical knowledge on the use of drone technology for agriculture and practical skills

Questions	Mean + SD	Percentage of Response (%)				
		Strongly disagree	Disagree	Slightly agree	Agree	Strongly Agree
I propose transitioning to drone technology rather than adhering to outdated methods.	4.45 ± 0.65	0	0	8.3	38.3	53.3
I prefer drones due to their user-friendly nature and cost-effectiveness over time.	4.08 ± 0.81	0	0	28.3	35.0	36.7
I will use the drone service if there are many drone service providers in the cultivation area and the cost of use is reasonable.	4.52 ± 0.57	0	0	3.3	41.7	55.0
I plan to consult agricultural experts and seek guidance from knowledgeable individuals regarding the integration of drones into my agricultural practices.	4.62 ± 0.49	0	0	0	38.3	61.7
I am more confident in utilizing drones, particularly with the guidance provided by agricultural experts and technology firms.	4.58 ± 0.56	0	0	3.3	35.0	61.7
Given the opportunity, I would enroll in a practical course focused on agricultural drone usage to enhance my skills and knowledge.	4.57 ± 0.56	0	0	3.3	36.7	60.0
It is imperative to raise awareness among young individuals about the benefits of drone technology in agriculture, potentially fostering	4.68 ± 0.50	0	0	1.7	28.3	70.0

interest and employment opportunities.						
Government subsidies for drone services could significantly alleviate financial burdens on farmers and encourage wider adoption of this technology.	4.68 ± 0.50	0	0	1.7	28.3	70.0
There is a critical need to expand training programs for entrepreneurs interested in drone technology, particularly in rural areas where agriculture is a primary economic activity.	4.7 ± 0.49	0	0	1.7	26.7	71.7
Increased government support for start-up companies involved in drone technology could stimulate innovation and growth within the agricultural sector.	4.7 ± 0.46	0	0	0	30.0	70.0
Average	4.56 ± 0.56					

3.5 Level of Acceptance and Attitude of Agrotechnology Students on the Learning of Drone Technology as Part of Practical Skills for Agricultural Operation

Table 7 highlights key aspects of students' acceptance and attitudes towards the use of drone technology in agriculture. Firstly, students displayed a strong optimism and acceptance of drone technology, particularly in its potential to enhance efficiency and reduce resource inputs. They expressed confidence in the technology's ability to save time, increase crop yields and reduce labour costs in the long term (M = 4.58, SD = 0.56). An overwhelming 96.7 % of respondents agreed with these sentiments, indicating a widespread belief in the technology's benefits. Their confidence reflects a deep understanding of its potential advantages. Additionally, a significant majority (88.3 %) of students expressed a preference for utilizing drone technology as a precise agricultural method and recognized the importance of drone piloting as a valuable skill for future job opportunities (M = 4.35, SD = 0.79). Drone pilot as a career has boosting recently and becoming a game-changing in the agricultural mechanization industry especially with the issues of lack of farm worker in the country due to travel restriction enacted during last Covid-19 pandemic in 2020 [17,18]. Similarly, 86.7 % of students indicated their willingness to learn and use drone technology to reduce inputs required for cultivation, such as soil, water, fertilizers and pesticides during planting. Moreover, 95 % of students were confident that learning drone technology could optimize spray inputs and ensure uniform distribution during planting (M = 4.58, SD = 0.59), with a majority students (100 %) recognizing its potential to enhance safety by proper chemical handling and spray material distribution (M = 4.70, SD = 0.46).

A substantial portion of students (98.3 %) stressed the importance of entrusting drone technology usage to skilled individuals to prevent losses (M = 4.73, SD = 0.48). Additionally, a majority (83.3 %) believed that practical classes teaching comprehensive drone piloting skills could enhance their employability after graduation (M = 4.58, SD = 0.59), underscoring the value they place on acquiring this skill set for future career growth. Despite perceiving drone technology as complex and requiring high skills and knowledge (95 %), a significant majority (98.3 %) expressed willingness to learn and maintain drones if given the opportunity (M = 4.68, SD = 0.50). This willingness to adapt and learn demonstrates students' readiness to embrace drone technology within their agricultural skill sets, despite initial concerns about its complexity. Despite controlling drone is complex and required

skilled, more youth interested in becoming drone pilot and work in the tech sector compared to the traditional job role like their parents especially after the Covid-19 pandemic that shifting the mindset of young people on the world of [19,20].

Furthermore, students unanimously recognized the vast potential for innovation in drone technology within agriculture, with 100 % agreeing on its further development (M = 4.77, SD = 0.43). Their acceptance and positive attitudes towards drone technology signal a promising future for agriculture, indicating that the next generation of agriculturists is poised to leverage its potential within agricultural operations.

Table 7
Agrotechnology students' acceptance and attitude on the learning of drone technology as part of practical skills for agricultural operation

Questions	Mean + SD	Percentage of Response (%)				
		Strongly disagree	Disagree	Slightly agree	Agree	Strongly Agree
I have confidence that learning drone technology can streamline operations, potentially boosting crop yields and reducing labor costs over the long haul.	4.58 ± 0.56	0	0	3.3	35.0	61.7
I hold confidence in the efficacy of drone technology as a precision agriculture method, foreseeing potential practical skills in the future	4.35 ± 0.79	1.7	0	10.0	38.3	50.0
I am of the belief that learning drone technology can help to minimize input requirements for cultivation, including soil, water, fertilizers, and pesticides, particularly during planting.	4.37 ± 0.71	0	0	13.3	36.7	50.0
I place my trust solely in skilled drone pilots when employing drone technology in my cultivation area, aiming to increase farm productivity	4.73 ± 0.48	0	0	1.7	23.3	75.0
I will exclusively consider drone technology recommended by agricultural agencies and reputable drone companies to ensure proper handling of chemicals, pesticides, and fertilizers, thereby minimizing risks to humans and crops.	4.7 ± 0.46	0	0	0	30.0	70.0
I hold the belief that learning drone technology can accurately determine optimal spray input amounts and ensure uniform application across the field.	4.58 ± 0.59	0	0	5.0	31.7	63.3
I am believed that learning drone technology during practical class can increase my employability chances after graduated	4.38 ± 0.78	0	3.3	8.3	35.0	53.3

I perceive drone technology as sophisticated and requiring advanced skills and knowledge for proficient use, especially for farm operation	4.52 ± 0.65	0	1.7	3.3	36.7	58.3
I am eager to learn how to operate and maintain drone technology if provided with the opportunity.	4.68 ± 0.50	0	0	1.7	28.3	70.0
I recognize the immense innovation potential of drone technology, particularly in advancing agricultural activities in Malaysia.	4.77 ± 0.43	0	0	0	23.3	76.7
Average	4.57 ± 0.60					

4. Conclusions

The data indicates that agrotechnology students hold a generally positive view of using drone technology in agriculture. They widely agree on its potential benefits, including increased crop yield, time and labour savings, enhanced efficiency and reduced labour-intensive tasks. Consequently, these students recognize the importance of incorporating drone technology into their practical classes to enhance their skills and career prospects after graduation. This study's insights can inform industry initiatives and higher education programs to integrate drone technology courses into existing agricultural curricula. Overall, the findings shed light on students' attitudes, knowledge and practical experiences with drone technology in agriculture, suggesting optimism and a willingness to learn. This bodes well for the future of Malaysian agriculture, indicating the potential for growth and development of drone technology in modern agricultural practices.

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